Department of Water Resources
Andhra Pradesh State
Republic of India

Republic of India
Data Collection Survey on Agriculture, Food Processing and Distribution in Andhra Pradesh State

Final Report

Volume I
Main Report

June 2016

Japan International Cooperation Agency (JICA)

Nippon Koei Co., Ltd.

Kaihatsu Management Consulting, Inc.

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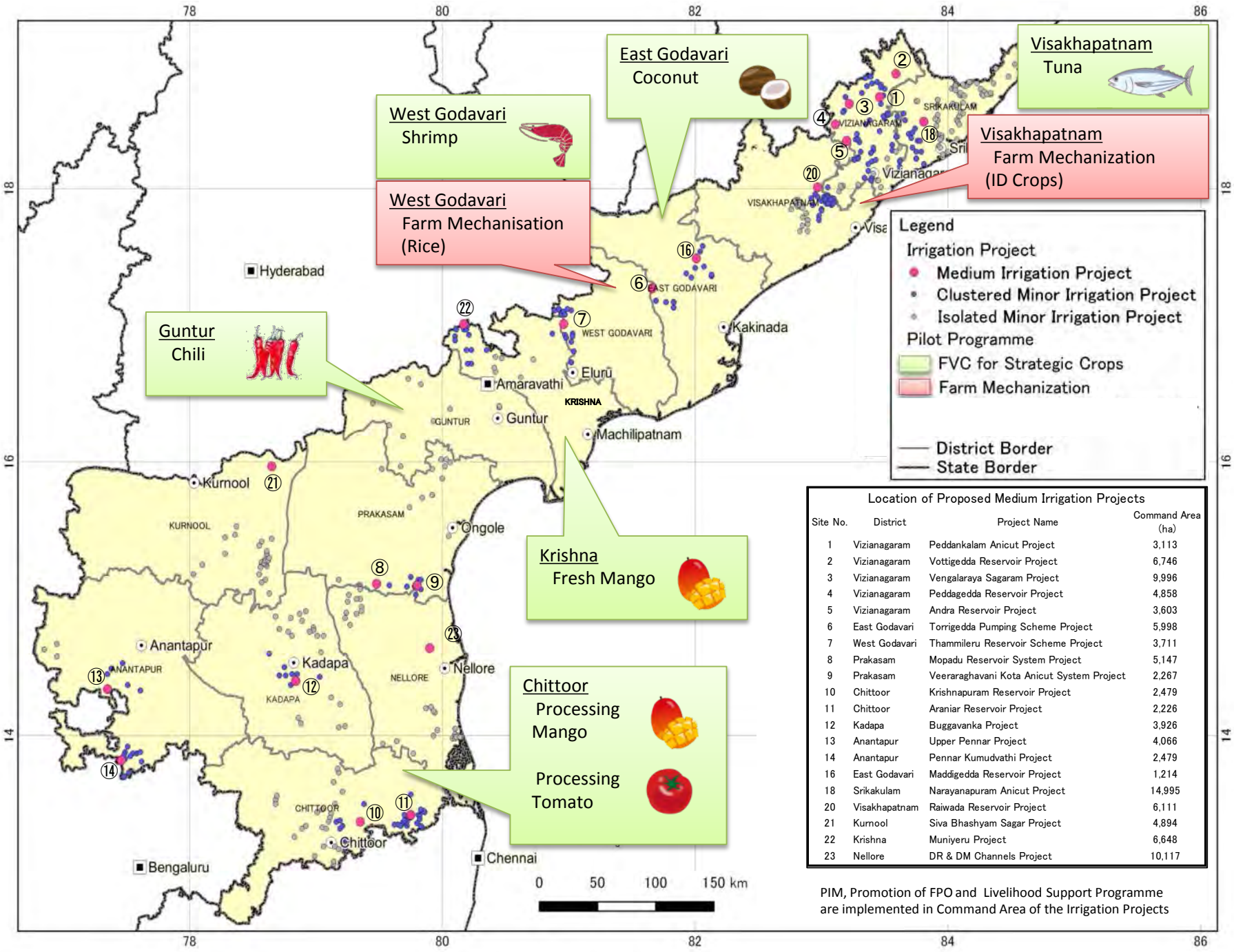
Source: JICA Survey Team

Map of Andhra Pradesh State



Location of Proposed Medium Irrigation Projects

Site No.	District	Project Name	Command Area (ha)
1	Vizianagaram	Peddankalam Anicut Project	3,113
2	Vizianagaram	Vottigedda Reservoir Project	6,746
3	Vizianagaram	Vengalaraya Sagaram Project	9,996
4	Vizianagaram	Peddagedda Reservoir Project	4,858
5	Vizianagaram	Andra Reservoir Project	3,603
6	East Godavari	Torrigedda Pumping Scheme Project	5,998
7	West Godavari	Thammileru Reservoir Scheme Project	3,711
8	Prakasam	Mopadu Reservoir System Project	5,147
9	Prakasam	Veeraraghavani Kota Anicut System Project	2,267
10	Chittoor	Krishnapuram Reservoir Project	2,479
11	Chittoor	Araniar Reservoir Project	2,226
12	Kadapa	Buggavanka Project	3,926
13	Anantapur	Upper Pennar Project	4,066
14	Anantapur	Pennar Kumudvathi Project	2,479
16	East Godavari	Maddigedda Reservoir Project	1,214
18	Srikakulam	Narayanapuram Anicut Project	14,995
20	Visakhapatnam	Raiwada Reservoir Project	6,111
21	Kurnool	Siva Bhashyam Sagar Project	4,894
22	Krishna	Muniyeru Project	6,648
23	Nellore	DR & DM Channels Project	10,117

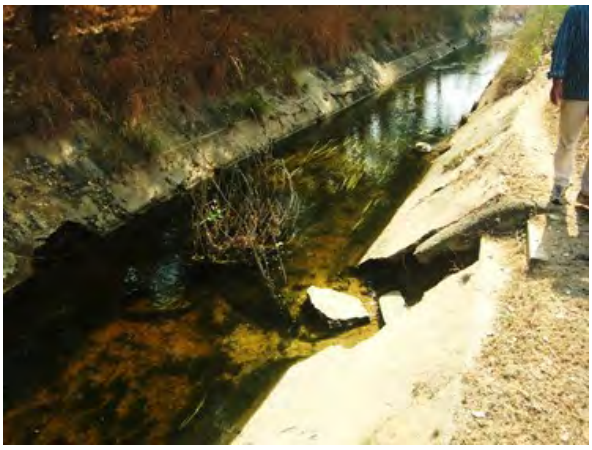
PIM, Promotion of FPO and Livelihood Support Programme are implemented in Command Area of the Irrigation Projects

Source: JICA Survey Team

Project Location Map

Photographs of the Survey (1/4)

Malfunctioned old intake gates shall be replaced with new ones. (West Godavari District)



Concrete lining of main canal shall be partially repaired due to damage. (Chittoor District)

Tank bund is seriously damaged, which shall be improved along with intake structures, spillway and canals. (Vizianagaram District)

The earth canal is not functioned due to sandy soils, which requires concrete lining. (Vizianagaram District)

These paddy fields are well maintained by farmers. Weeds are cut by manual. (Chittoor District)

This is a good groundnut field. Exceptionally farm ditch is constructed and maintained by farmers. (Chittoor District)

Source: JICA Survey Team

Photographs of the Survey (2/4)

Farmers order various types of vegetable seeding from seeding traders. (Chittoor District)

A farmer is very eager to improve his farming practices through extension services. (Guntur District)

A Farmers Producer Organisation (FPO) consisting of 500 farmers in 8 villages cultivates and sells vegetable at a local food mall. (Vizianagaram District)

A livestock farmer milks a cow and sells it about three to five litter at market every day. Milk is sold INR 20 per one litter. (Vizianagaram District)

Fishermen culture fishes in a lake and a medium irrigation tank and sell them at local market. (West Godavari District)

SHG members of livelihood community undertake ornamental fish cultivation and sales business. (Vizianagaram District)

Source: JICA Survey Team

Photographs of the Survey (3/4)

A farmer cultivates Baneshan mango, Tothapuri mango and Rasalu mango. Harvesting period is from April to June. (Krishna District)

Farmers work in field to remove impurities from chilli after sun drying. (Guntur district)

A fisherman holds a yellow fin tuna caught by traditional gill net fishing. Fishing method shall be modernized to improve quality. (East Godavari District)

Vannamei shrimp is widely cultivated in Andhra Pradesh state and shipped at optimal size of around 25g. (West Godavari District)

Rice transplanter is one of components of government subsidy programme. This transplanter is a model of 6 rows riding type. (West Godavari District)

Small tractor is also one of target of government subsidy programme. This tractor is 24 horse-power and 4 wheels manufactured. (Vizianagaram District)

Source: JICA Survey Team

Photographs of the Survey (4/4)

Farmers irrigate field with groundwater pumped up by solar power. (Guntur District)

A farmer uses a rain-gun system as one of the water saving irrigation methods. (Anantapur District)

Japanese delegation members visited Andhra Pradesh state to promote the collaboration between Indian and Japanese food companies in December 2015. (Vijayawada, Krishna District)

Andhra Pradesh state delegation members visited Japan for the business matching and Foodex Japan 2016 to promote collaboration with Japanese food companies. (Makuhari, Japan)

Kick-off Meeting was held on 17th November 2015. (Hyderabad)

Wrap-up Meeting was held on 16th April 2016. (Hyderabad)

Source: JICA Survey Team

Republic of India
Data Collection Survey on Agriculture, Food Processing and Distribution in Andhra Pradesh State

Executive Summary

1. Project Outline

Background of the JICA Survey

The Government of Andhra Pradesh (GoAP) plans to promote food value chain from agriculture production to food processing, distribution and marketing. Meanwhile, the government of Japan intends to support Japanese companies in investment into agriculture and food processing industry of India. Taking the above into account, JICA determined to implement this survey with the following objectives:

(i) to formulate irrigation modernisation projects proposed by the state,

(ii) to establish quality food value chains for strategic produces in the state, and

(iii) to review possible adaptation of advanced Japanese technologies especially for food processing and food park in the state.

Project Development Objectives

The development objective of APILIP-II (Andhra Pradesh Irrigation and Livelihood Improvement Project) is to improve livelihood of farmers in the command areas of old irrigation projects by increasing agriculture productivity and actual irrigated area through;

(i) Modernisation of old irrigation systems for improvement of irrigation efficiency,

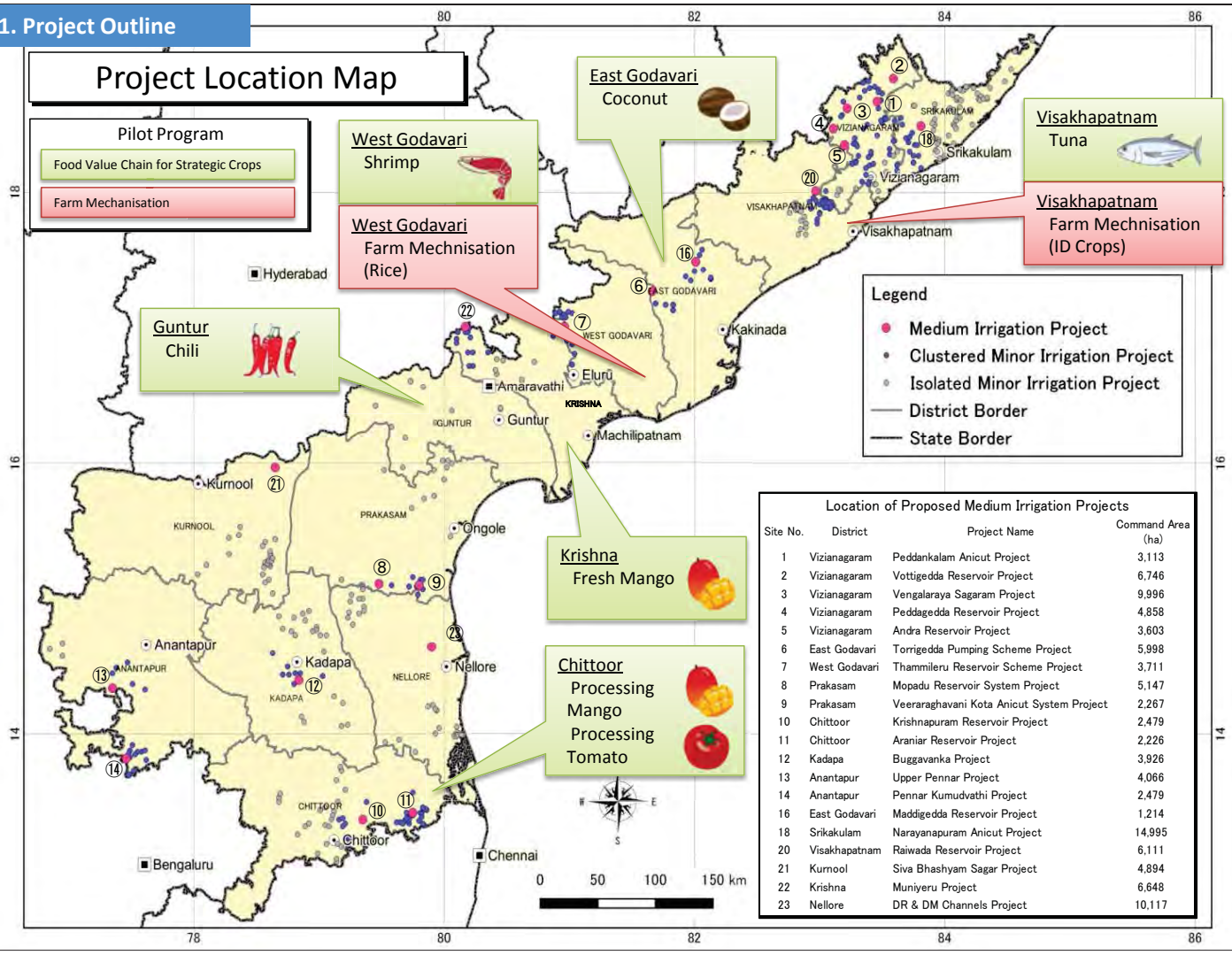
(ii) Participatory irrigation management (PIM),

(iii) Promotion of farmers producer organisations (FPOs), and

(iv) Support for local poor in animal husbandry and fishery communities leading to viable livelihoods.

The challenge toward sector reform in the state focusing on food value chain development for strategic crops through PPP and farm mechanisation on a pilot basis is also objective as well.

Project Location Map



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Andhra Pradesh At A Glance (1/2)

(1) Demography

No.	Item	Unit	Andhra Pradesh	All India
			2011	2011
1	Population	million	49.577	1,210.570
	(a) Male	%	50.08	51.47
	(b) Female	%	49.92	48.53
	(a) Rural	%	70.53	68.85
	(b) Urban	%	29.47	31.15
	(a) Scheduled Caste	%	17.08	16.63
	(b) Scheduled Tribes	%	5.53	8.61
	(a) Hinduism	%	88.5	79.8
	(b) Islam	%	9.6	14.2
	(c) Christianity	%	1.3	2.3
	(d) Others	%	0.4	3.7
	Population Growth Rate	%	9.21	17.69
2	Population Density	persons/ km^2	304	368
3	Literacy Rate	%	67.35	72.99
	(a) Males	%	74.77	80.89
	(b) Females	%	59.96	64.64
4	Number of Households	million	12.719	249.454
	(a) Rural	%	71.27	67.57
	(b) Urban	%	28.73	32.43
5	Workers	million	23.081	481.743
	(a) Agriculture	%	62.36	54.60
	(b) Non-Agriculture	%	37.64	45.40
6	Poverty (No. of BPL)*2	million	7.878	269.783
	(a) BPL Rate in Rural	%	10.96	25.70
	(b) BPL Rate in Urban	%	5.81	13.70

(2) Land Use

No.	Classification		2014-15
1	Geographical Area	Geographical Area	16,276
2	Forest	Forest	3,663
3	Not Available for Cultivation	Area under Non-Agricultural Uses	2,002
		Barren and Un-cultivable Land	1,351
4	Other Cultivable Land excluding Fallow Land	Permanent Pastures and Other Grazing Land	214
		Lands under Misc. Trees and Crops and Groves	160
		Cultivable Wasteland	392
5	Fallow Lands	Fallow Land Other than Current Fallow	858
		Current Fallow	1,401
6	Net Area Sown	Net Area Sown	6,235
7	Total Cropped Area (Gross Cropped Area)	Total Cropped Area (Gross Cropped Area)	7,689
8	Area Sown more than Once	Area Sown more than Once	1,454
9	Cropping Intensity	Cropping Intensity (%)	123.32
10	Net Area Irrigated	Irrigation Potential utilized	2,927
11	Gross Area Irrigated	Area irrigated more than once	3,886

Andhra Pradesh At A Glance (2/2)

(3) Agricultural Land Holdings

Category	No. of Operational Holdings ('000)	Area Operated ('000 ha)	Average Size of Operational Holding (ha)
	Number (A)	ha (B)	(B) / (A)
Marginal (< 1.0 ha)	4,984	2,160	0.43
Small (1.0-2.0 ha)	1,591	2,251	1.41
Semi-Medium (2.0-4.0 ha)	796	2,100	2.64
Medium (4.0-10.0 ha)	230	1,282	5.57
Large (10.0 ha and above)	20	304	15.20
All Holdings	7,621	8,097	1.06

(4) Irrigation Potential Created

No.	Sector	up to Dec. 2015 ('000 ha)	
1	Major Irrigation	2,613	(63%)
2	Medium Irrigation	223	(5%)
3	Minor Irrigation	1,037	(25%)
4	APSIDC	284	(7%)
5	Total	4,157	(100%)

(5) GSDP by Industry Origin at Constant Price 2014-15

Sector	Item	2014-15 (AE)
GSDP	Value (INR Crore)	264,521
	Growth Rate (%)	7.21
Per Capita Income	Value (INR)	44,831
	Growth Rate (%)	6.31
Agriculture	Value (INR Crore)	63,414
	% to GSDP	23.97
	Growth Rate (%)	5.90
Industry	Value (INR Crore)	51,771
	% to GSDP	19.57
	Growth Rate (%)	5.25
Services	Value (INR Crore)	149,336
	% to GSDP	56.46
	Growth Rate (%)	8.48

(6) Major Agriculture and Non-Agriculture Produces

SN.	Crop / Component	Productivity (MT/ha)	Production in Andhra Pradesh (Million MT)	Andhra Pradesh Rank in Entire India*1 (Production)	India Rank in the World*2 (Production)
Agricultural and Horticultural Crops					
1	Mango	9	2.73	1	1
2	Papaya	80	1.55	1	1
3	Lime/Lemon	15	0.35	1	1
4	Palm Oil	12	1.61	1	-
5	Tomato	20	3.36	1	2
6	Chillies	3	0.73	1	1
7	Turmeric	7	0.25	1	-
8	Okra	15	0.67	1	1
9	Cashew	0.68	0.56	2	3
10	Groundnut	0.9	3.0	2	2
11	Paddy	3.3	13.91	2	2
12	Maize	6	5.3	2	-
13	Brinjal (Eggplant)	20	1.16	2	2
14	Millets	0.8	0.5	3	1
15	Coconut (no. of nuts)	15,000	1,829	3	3
16	Banana	35	3.16	3	1
17	Sugarcane	78	1.57	5	2
18	Onion	18	1.0	6	2
Non- Agricultural and Horticultural Crops					
19	Egg (no. of eggs)	-	12,727	1	3
20	Meat	-	0.48	2	-
21	Aqua	-	2.20	2	-
22	Milk	-	9.08	3	1

Necessity and Priority of the Project (1/2)

Component	Necessity and Priority
(1) Consistency with the national plan and development strategy	The National 12th Five-Year Plan emphasises that the growth must not only be rapid but also more inclusive and environmentally sustainable to; (i) reduce poverty, (ii) improve regional equality across states and within states, (iii) improve conditions of SCs, STs, OBCs and minorities, (iv) close the gender gap, (v) generate attractive employment opportunities for the youth, (vi) resource usage efficiency and technology to ensure sustainability of natural resources, and (vii) adaptation to climate change, and improvements in total factor productivity. In addition, farmers and commodity interest groups need to be linked to the global market for "smaller land, short time, more productivity.
(2) Consistency with the state development policy and strategy	The Government of Andhra Pradesh (GoAP) has put top priority on primary sector mission out of seven missions launched as a part of long-term vision. A strategy paper for Mission on Primary Sector - Agriculture Transformation in Andhra Pradesh - published in October 2014 attempts to design a strategy to transform the agriculture and allied sector, and then to operationalise it in a phased manner. As adaptation measures for climate changes, GoAP has initiated various projects and programmes for water conservation and management in the state including modernisation of medium and minor irrigation projects.
(3) Necessity of irrigation modernisation in AP state	The gap ayacut (command area) of the minor irrigation projects is estimated at roughly 40% on average against the irrigation potential created (1.037 million ha) to date. Meanwhile, the same of major and medium irrigation projects is assessed at around 25% on average against the irrigation potential created (2.789 million ha) so far. Accordingly, such irrigation projects need to be improved to reduce the gap ayacut by raising water use efficiency along with institutional development and capacity building of WUAs/farmers.
(4) Necessity of Participatory Irrigation Management	Irrigation schemes have deteriorated due to lack of proper management and ownership. To maximise the benefit of modernisation of the irrigation schemes, capacity development of WUA as well as establishment of supporting system for adequate O&M is crucial. It is a critical time to revive PIM by reformation of WUA and enhancement of capacity of WUAs.
(5) Necessity of promotion of farmers producer organisations	The concept of FPO has been promoted all over the country in recent years. FPO has a potential to improve situation of small and marginal farmers by reducing risk and expenses of farmers and enhancing marketing power through collective practices. The GoAP takes strong initiatives to promote FPOs and has started several programmes. In line with the government policy, it is effective to support their initiatives.

Necessity and Priority of the Project (2/2)

Component	Necessity and Priority
(6) Necessity of livelihood programme in AP state	There are thousands of tanks developed in AP state, providing water to local people not only for domestic and irrigation uses but also for inland fisheries and animal husbandry. Some of the traditional governance systems are still in place to provide governance in agriculture, fisheries and animal husbandry communities at the local level. Those who belong to historically disadvantaged groups are officially designated as scheduled castes (SCs) in India. Some measures have to be taken up for unbenefited local groups living in and around the proposed irrigation projects. Such social consideration shall be built in the project design of APILIP-II.
(7) Necessity of food value chain for strategic crops through PPP in AP state	AP state is one of the leading states in agriculture and horticulture produces and has a good potential to become an agribusiness hub in Southeast India. Among others in AP state, the crops selected by the JICA Survey Team (mango, tomato, chilli, coconut, shrimp and tuna) are the most prospective produces for international market as well as domestic market. However, there is still a big room to improve the total food value chain in AP state, such as enhancement of productivity, food safety and traceability, agribusiness infrastructure and private investment. Thus, development of food value chain coincides with national and state policies and needs to be incorporated into the proposed APILIP-II.
(8) Necessity of farm mechanisation in AP state	There are three major reasons to promote farm mechanisation, (i) severe shortage of agriculture labour in the peak seasons of transplanting/planting and harvesting, (ii) steep rise in labour wages due to increasing migrant workers under MGNREGA, and (iii) aging of farming communities and issues of their successors. To overcome these problems, farm mechanisation attracting the educated youths in farming communities needs to be introduced by the proposed APILIP-II.

Project Components

	Component (by JICA Survey Team)	Name of Component (by JICA Survey Team)	Component (Project Concept Note*)
Core Programme	Component 1	Modernisation of Medium and Minor Irrigation Projects	
	1.1	- Medium Irrigation Projects	Component A
	1.2	- Minor Irrigation Projects	Component A
	Component 2	Participatory Irrigation Management (PIM)	Component B
	Component 3	Promotion of Farmers Producer Organisations (FPOs)	Component C
	Component 4	Livelihood Support Programme	
	4.1	- Animal Husbandry	Component C
	4.2	- Fishery	Component C
Pilot Programme	Component 5	Pilot Programmes	
	5.1	- Food Value Chain for Strategic Crops through PPP	Component C
	5.2	- Farm Mechanisation	Component C
Project Management	Component 6	Project Management	
	6.1	- Support to PMU/DIU	Component D
	6.2	- Capacity Building	Component D
	6.3	- Monitoring and Evaluation	Component D
	6.4	- Thematic Study and Action Research	Component D
	Component 7	Consulting Services	Component D
	GoAP Share	Project Administration, Taxes and Duties, Interest during Construction, Front End Fees	GoAP Share

*Note: *) Project Concept Note for APILIP-II to be funded by JICA under Phase II (2016-17 to 2020-21), DoWR/GoAP*

Project Scope (1/3)

No.	Component	Scope of Works
1	**Modernisation of Medium and Minor Irrigation Projects**	**1. Medium Irrigation Projecst**: 20 Nos., A= 104,594 ha **2. Minor Irrigation Projects**: 449 Nos., A= 56,966 ha
2	**Participatory Irrigation Management (PIM)**	a) Revision of guideline and capacity building of government officers b) Equipping supporting organisations c) Capacity development of WUAs (Minor irrigation projects) d) Capacity development of PCs and WUAs (Medium irrigation projects)
3	**Promotion of Farmers Producer Organisations (FPOs)**	a) Agriculture extension programme b) Preparation for FPO formation c) Support for establishing FPOs
4	**Livelihood Support Programme**	**1. Animal Husbandry** a) Development of livelihood plan b) Enhancing productivity of animals c) Promotion of livestock based income generation activities **2. Fishery** a) Development of livelihood plan b) Support for fish production activities c) Support for marketing activities

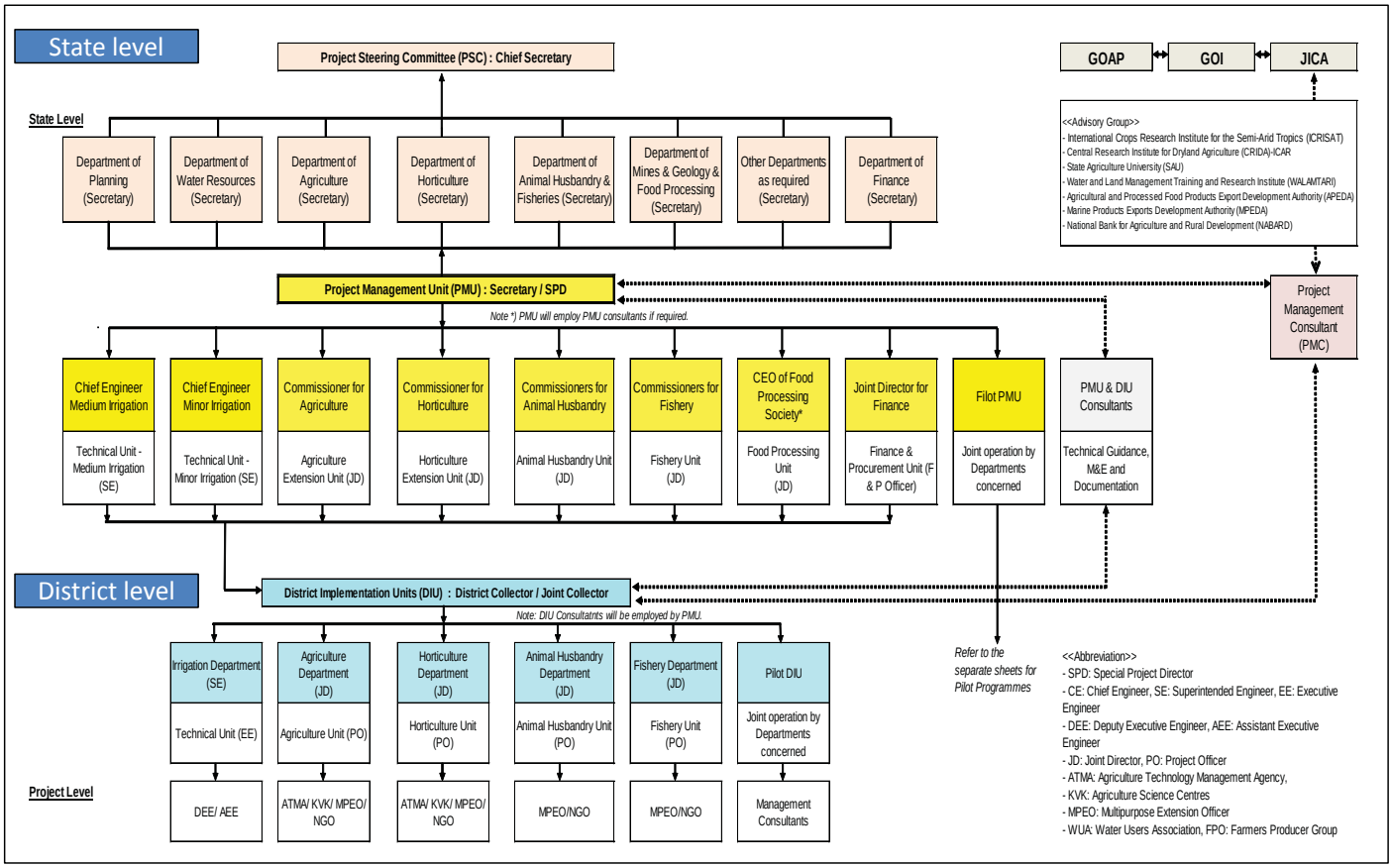
Project Scope (2/3)

No.	Component	Scope of Works
5	**Pilot Programmes**	**1. Food Value Chain for Strategic Crops through PPP** (Mango (fresh & processing), Tomato, Chilli, Coconut, Shrimp and Tuna) a) Develop mechanism to assist entire VC b) Capacity development of government officers, producers, producer groups, and other stakeholders c) Develop and operate commodity-wise marketing strategy <Location> Horticulture - Chittoor (Processing Mango and Tomato) - Krishna (Fresh Mango) - Guntur (Chili) - East Godavari (Coconut) Fishery - West Godavari (Shrimp) - Visakhapatnam (Tuna) **2. Farm Mechanisation** a) Establishment of Agriculture Mechanisation & Training Centre (AMTC): 2 locations b) Establishment of workshop: 10 units c) Training of Custom Service Units (CSUs): 107 CSUs d) Packages of farm machinery for training purpose: 2 units each for rice and ID Crops <Location> - West Godavari (Rice) - Visakhapatnam (ID Crops)

Project Scope (3/3)

No.	Component	Scope of Works
6	**Project Management**	**1. Support to PMU/DIU** a) PSC/PMU advisors, b) PMU/DIU Consultants- Individual, c) PMU/DIU Consulting firms / NGOs, and d) Equipment and furniture **2. Capacity Building** a) Exposure visits and study tours (Domestic), b) Seminars and workshops, c) Publication of information, education and communication materials, d) AP state training and research institute, and e) Multi-purpose WUA office **3. Monitoring and Evaluation** a) Environmental monitoring, b) Benchmark and evaluation survey c) Water benchmarking and water audit, and d) Management information System (MIS) **4. Thematic Study and Action Research** a) Value chain analysis, b) Private sector leadership analysis c) Analysis of storage, transport and other regulations, and procedures for global standards, and d) AP agriculture promotion video film
7	**Consulting Services**	PMC will assist the PMU/DIU in the overall project management as follows.. a) Guide overall project monitoring and management b) Inter-departmental coordination and guidance related matters c) Development and review of annual work plan and monitoring of the work progress at the state level d) Facilitation of convergence among the departments concerned at the state level e) Construction management, technical guidance and monitoring f) Fund management g) Technical support (training and awareness programme, etc.), and h) Liaison between PMU and JICA
-	**GoAP Share**	a) Project administration b) Taxes and duties c) Interest during Construction (2%) d) Front end fees (0.02%), etc.

Overall Organisation Structure



Major Roles and Functions of Project Organisation

Organisation	Members		Major Functions
Project Steering Committee (PSC)	Secretaries to Planning, Water Resources, Agriculture, Horticulture, Animal Husbandry, Fisheries, Mines & Geology and Food Processing, Industries, Finance and others as required.	1	Decision-making Body at State Policy Level
		2	Provide strategic direction and define enabling policy
		3	Approve the annual work plan and fund allocation proposed by PMU
		4	Review the annual work progress
		5	Establish appropriate convergence platforms and institution arrangement
Project Management Unit (PMU)	SE - Water Resources, Joint Directors - Agriculture, Horticulture, Animal Husbandry, Fishery, Finance, CEO-APFPS and others as required.	1	Management Body at State Level
		2	Develop and review the annual work plan, and monitor the work progress at state level
		3	Facilitate convergence among the departments concerned at state level
		4	Provide technical guidance
		5	Fund management
District Implementation Unit (DIU)	SE/EE (Tech unit), JD/DD - Agriculture, Horticulture, Animal Husbandry, Fishery, and others as required.	1	Implementation Body at District Level
		2	Monitor and evaluate the work progress at district level
		3	Trouble shooting
		4	Ensure capacity building support system
		5	Facilitate convergence at filed level

Project Management Consultant

The objective of the consulting services (PMC)

- To assist and advise PMU in overall project management and guide PMU to proper implementation of the APILIP-II.

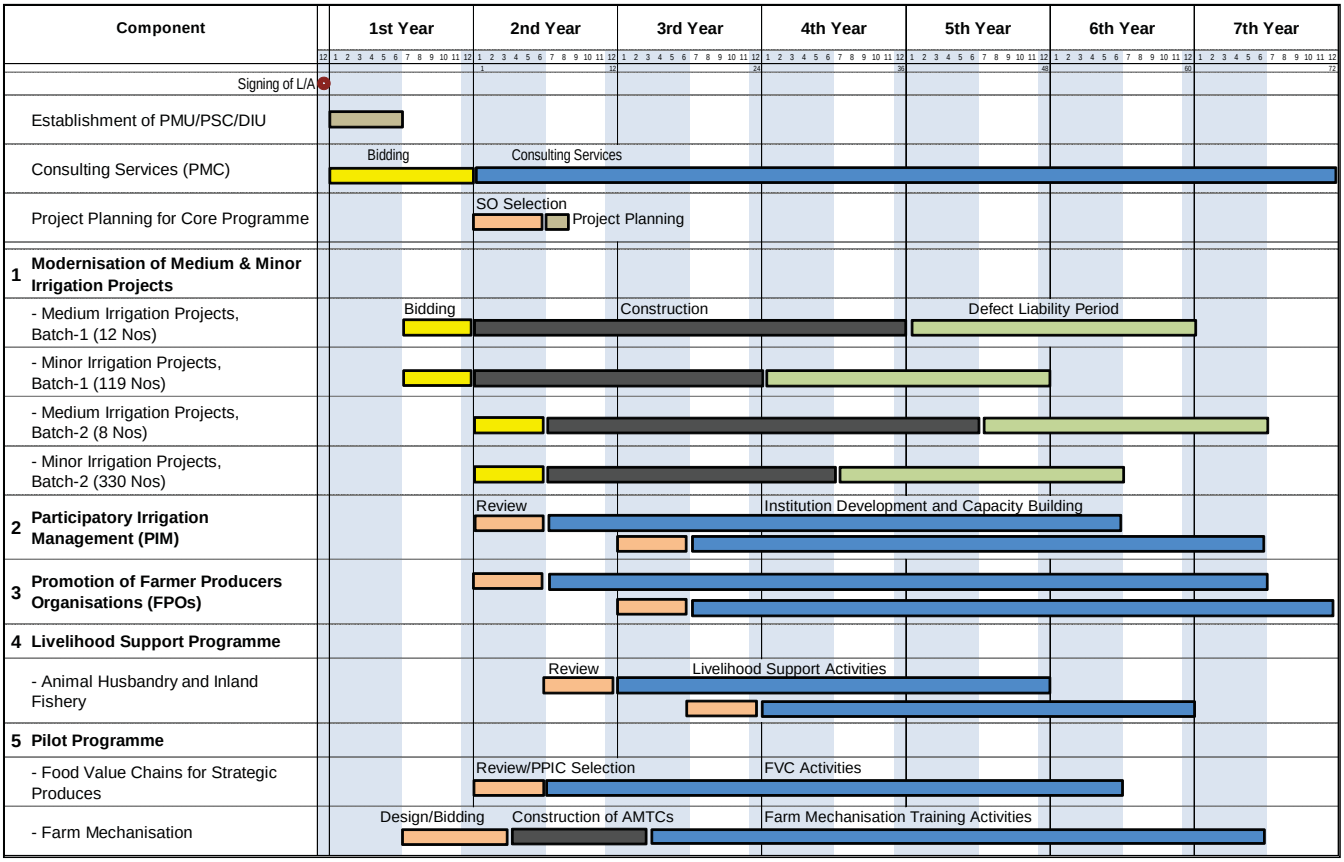
Scope of services of PMC:

(1) Modernisation of irrigation projects
(2) Capacity building programme
(3) Livelihood support programme and
(4) Pilot programme (FVC for strategic crops, farm mechanisation and conjunctive use of surface water and groundwater)
(5) Communicate with JICA for sending information with monitoring report and guidance of JICA for the APILIP-II.

Major activities of PMC:

- Overall project monitoring and management
- Inter-departmental coordination and close communication
- Development and review of the annual work plan and monitor the work progress at state level
- Facilitation of convergence among the departments concerned at state level
- Construction management, technical guidance and monitoring
- Fund management
- Regular meetings on monthly basis
- Technical support (training and awareness programme, etc.)

Overall Implementation Schedule



Note: Quick implementation may be possible by each and every effort of PMU/GoAP.

Project Cost

Item	F/C (Yen mil.)	L/C (INR mil.)	Total Cost (Yen mil.)	Total Cost (INR mil.)	Share
JICA Share					
1. Modernisation of Medium and Minor Irrigation Projects	0	12,077	20,410	12,077	52.6%
2. Participatory Irrigation Management (PIM)	0	615	1,040	615	2.7%
3. Promotion of Farmers Producer Organisations (FPOs)	0	833	1,408	833	3.6%
4. Livelihood Support Programme	0	460	778	460	2.0%
5. Pilot Programmes	0	895	1,513	895	3.9%
6. Project Management	0	853	1,442	853	3.7%
Sub-total of Items 1 to 6	0	15,734	26,591	15,734	68.6%
Price Escalation (Items 1 to 6)	0	2,052	3,468	2,052	
Physical Contingency (Items 1 to 6)	0	889	1,503	889	
7. Consulting Services	1,119	270	1,575	932	4.1%
Sub-total of Items 1 to 7 (Eligible Portion)	1,119	18,945	33,136	19,607	85.4%
State Share					
8. Administration and Other Costs	2,324	1,967	5,648	3,342	14.6%
Grand Total	3,443	20,991	38,784	22,949	100.0%

<Basic Condition for Cost Estimate>
1. Base prices: April 2016.
2. Exchange rate: US$1.0 = Rs.67.0 = JPY 113.1
3. Price escalation: 1.6%/annum for F/C and 3.7%/annum for L/C
4. Physical contingency: 5.0%
5. Project administration: 5.0% of the direct cost
6. Interest during construction: 1.4% for works and similarly 0.01% for the consulting services
7. Front-end fee: 0.2% of the accumulated loan portion

Each Component Cost

Item	Total Cost (INR mil.)
1. Modernisation of Medium and Minor Irrigation Projects	**12,077**
1.1 Medium Irrigation Projects	8,611
1.2 Minor Irrigation Projects	3,466
2. Participatory Irrigation Management (PIM)	**615**
3. Promotion of Farmers Producer Organisations (FPOs)	**833**
4. Livelihood Support Programme	**460**
4.1 Animal Husbandry	242
4.2 Fishery	218
5. Pilot Programmes	**895**
5.1 Food Value Chain for Strategic Crops	589
5.2 Farm Mechanisation	306
6. Project Management	**853**
6.1 Support to PMU	434
6.2 Capacity Building	342
6.3 Monitoring and Evaluation	58
6.4 Thematic Study and Action Research	20
Sub-total of Items 1 to 6	15,734
Price Escalation (Items 1 to 6)	**2,052**
Physical Contingency (Items 1 to 6)	**889**
7. Consulting Services	**932**
7.1 Base Cost	820
7.2 Price Escalation	68
7.3 Physical Contingency	44
Total of Items 1 to 7 (Eligible Portion)	19,607

Economic Evaluation

Project Cost in Financial and Economic Prices

	No. and Name of Project Component	Total (INR mil.) Financial Prices	Economic Prices
1	Modernisation of Medium and Minor Irrigation Projects	12,077	11,714
2	Participatory Irrigation Management (PIM)	615	597
3	Promotion of Farmers Producer Organisation (FPO)	832	807
6	Project Management	853	827
	Sub-total (1,2,3&6)	14,377	13,946
	Price Escalation (for 1,2,3&6)	1,847	0
	Physical Contingency (5%)	811	697
7	Consulting Services (PMC)	820	813
	Price Escalation (for 7)	68	0
	Physical Contingency (5%)	44	41
8	Administration Cost	852	826
	Tax & Duty	3,457	0
	Interest during Construction	1,141	0
	Front End Fee	45	0
	Total	23,462	16,324

Economic Analysis

Net Present Value(NPV) (i=10%)	INR 20,824 mil.
Benefit/Cost Ratio (B/C) (i=10%)	2.57
Economic Internal Rate of Return (EIRR)	23.5%

Sensitivity Analysis

Item		Project Cost		
		Base	10% UP	20% UP
Benefit	Base	23.5%	21.8%	20.4%
	10% DOWN	21.7%	20.1%	18.7%
	20% DOWN	19.8%	18.3%	17.0%

<Basic Assumption for Economic Evaluation>

1. Economic life period: 30 years
2. Discount rate: 10%
3. Economic benefit: Crop production
4. Economic cost: Transfer payments (taxes and subsidies), price escalation and interest are excluded.
5. Standard conversion factor: 0.97
6. Shadow wage rate for agricultural labor: 0.69

Operational Indicators

Operational Indicators for Irrigation Component

Indicator	Unit	Baseline (2016)			Target (2025)*		
		Medium	Minor	Total	Medium	Minor	Total
Beneficiary farmers	('000) Nos	160	93	253	160	93	253
Irrigation potential created*1	('000) ha	69	39	108	104	57	161
Gap ayacut*1	%	33	29	-	0	0	-
Water conveyance efficiency*1	%	35	35	-	60	60	-
Water tax collection*2	%	44	8	-	50	50	-

Note: Target is set on normal rainfall (not droughts and floods) condition.

Operational Indicators for Other Components

Indicator	Unit	Baseline (2016)	Target (2025)	Remarks
WUAs trained	Number	-	604	= Total number of WUA
FPOs established	Number	-	20	= 1 FPO x 20 medium irrigation clusters
Animal husbandry communities trained	Number	-	36	= 4 groups x 9 clusters
Fishery communities trained	Number	-	36	= 4 groups x 9 clusters
Farmers trained for mango (process)	Number	-	1,000	Refer to FVC
Farmers trained for mango (fresh export)	Number	-	100	- ditto -
Farmers trained for tomato	Number	-	500	- ditto -
Farmers trained for chilli	Number	-	2,000	- ditto -
Farmers trained for coconut	Number	-	1,000	- ditto -
Farmers trained for tuna	Number	-	225	- ditto -
Farmers trained for shrimp	Number	-	1,000	- ditto -
Farmers trained for farm mechanisation	Number		1,070	= 107CSUs x 10 persons

Effective Indicators

Indicator	Unit	Present Condition (2016)	Target (2025)
1. Total Cropped Area of Major Crops			
Paddy (Kharif)	ha	25,692	59,477
Paddy (Rabi)		4,622	4,275
ID Crops		77,600	118,102
2. Yield of Major Crops*1			
Paddy (Kharif)	ton/ha	4.8	5.8
Paddy (Rabi)		5.8	6.7
Maize (Kharif)		7.4	8.6
Ground Nut (Rabi)		1.5	2.0
Pulses (Kharif and Rabi)		0.5	0.9
Sugarcane (Kharif to Rabi)		74.1	86.5
3. Gross Annual Average Farm Income			
North Region	INR. / household	8,300	23,800
Central Region		20,800	52,000
South Region		5,900	60,700

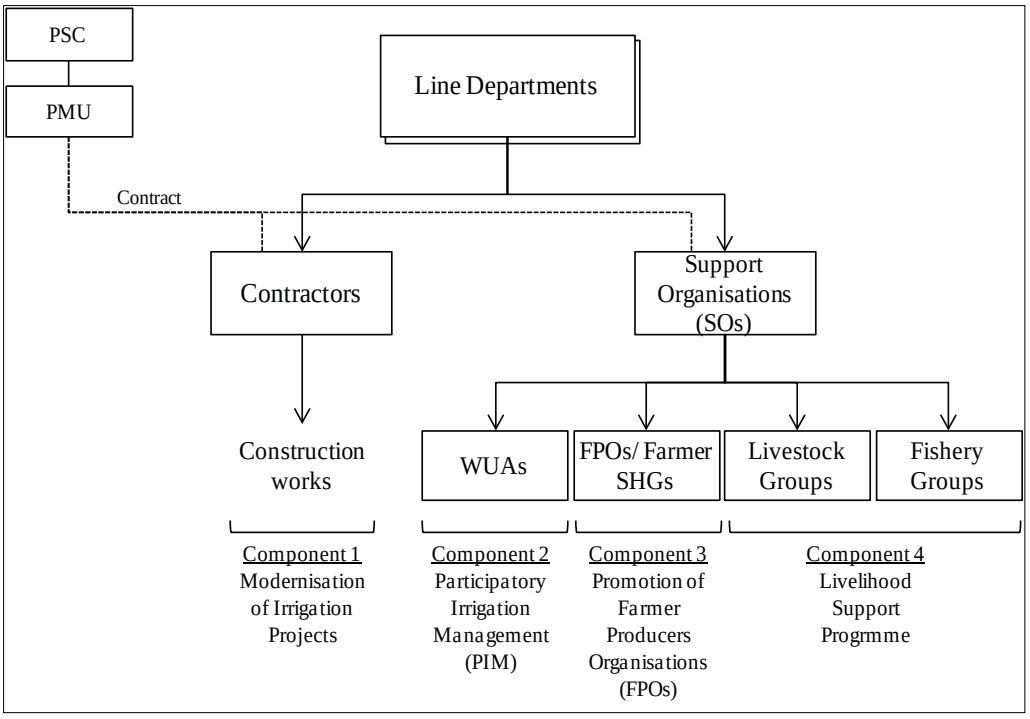
Note: Present and target values for 'Strategic Crops of Food Value Chain' and 'Livelihood Support" will be set based on the baseline survey to be conducted at the beginning of the project period.

Outline of activities and Implementation of the Core Programme

Timeframe	Planning (before commencement)	Implementation (during construction period)	Operation and monitoring (after construction)
Component 1 Modernisation of Irrigation	Each Irrigation command area - Orientation Workshop : Introduction of the project and understanding on issues to be tackled - Baseline survey （Questionnaire survey, Group Discussion, PRA） - Selection of the target groups of the livelihood improvement component	Each Irrigation command area Construction plan and monitoring	Each Irrigation command area O&M plan Monitoring of the irrigation structure
Component 2 Participatory Irrigation Management		WUA Training for planning of water management Implementing agency Support on water management planning	WUA Monitoring of water Water distribution & water tax collection Review of water management plan Implementing agency Support on monitoring by WUA
Component 3 Promotion of Farmer Producers Organisations		FPO Formation of farmers SHGs (groups) and selection of group leaders Crop planning /cultivation plan Implementing agency Orientation for FPO Production plan support Extension plan	FPO Crop planning and review Business planning Marketing research External learning opportunities Monitoring of production activities Implementing agency Review of FPO activity support Review of extension plan Review of cropping plan
Component 4 Livelihood Support Programme		Target village Activity planning Implementing agency Support on activity planning	Target village Trainings, Monitoring of activities Review of the plan Implementing agency Monitoring, Review of the plan

Summary Implementing Structure of the Core Programme

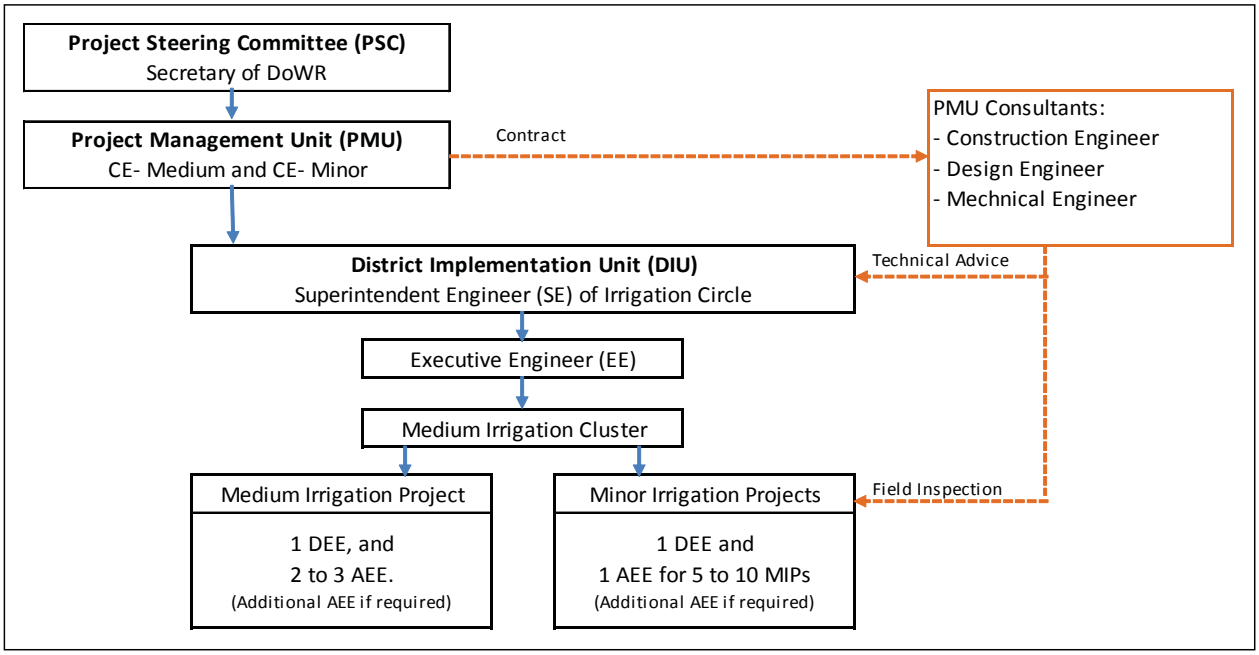
- Activities shall be implemented by the concerned line departments of each component in collaboration with contractors or Supporting organisations (SOs).
- SOs will be the coordinating party in each area, which could handle interdisciplinary activities in their area in charge.



Organisation for Modernisation of Irrigation Projects

<DoWR Staff>
- Construction supervision at the project site,
- Monitoring and evaluation of the work progress, quality control and safety control, and reporting
- Troubleshooting,
- Facilitation of convergence at the field level, and
- Ensuring capacity building support system, etc.

<PMC Consultants>
- Overall progress and quality control,
- Supervision and advice for the works,
- Design change during construction stage, etc.



Implementation Programme for Modernisation of Irrigation Projects

Item	Description
Construction works and procurement	20 medium and 449 minor irrigation projects.
Project Period	7 years from 2017 to 2023
Tendering	The tendering may commence in July 2017, in advance of PMC assignment, because DoWR has much experience on tendering procedures for JICA irrigation projects (75 in APILIP-I). For the medium irrigation projects individual tendering will be made for each project, while tender may put in for a group of several minor irrigation projects in bulk.
Construction in Batch	In order to execute an efficient/smooth implementation of APILIP-II based on APILIP-I experience, it is recommended that construction works should be implemented in two batches as follows. • Batch-1: 12 medium irrigation clusters (12 medium and 119 minor irrigation projects), and • Batch-2: 8 medium irrigation clusters (8 medium and 99 minor irrigation projects) and 231 isolated minor irrigation tanks The construction of Batch-1 is proposed to be commenced in January 2018 and completed in December 2020, and Batch-2 from July 2018 to June 2021, with two years of defect liability period.

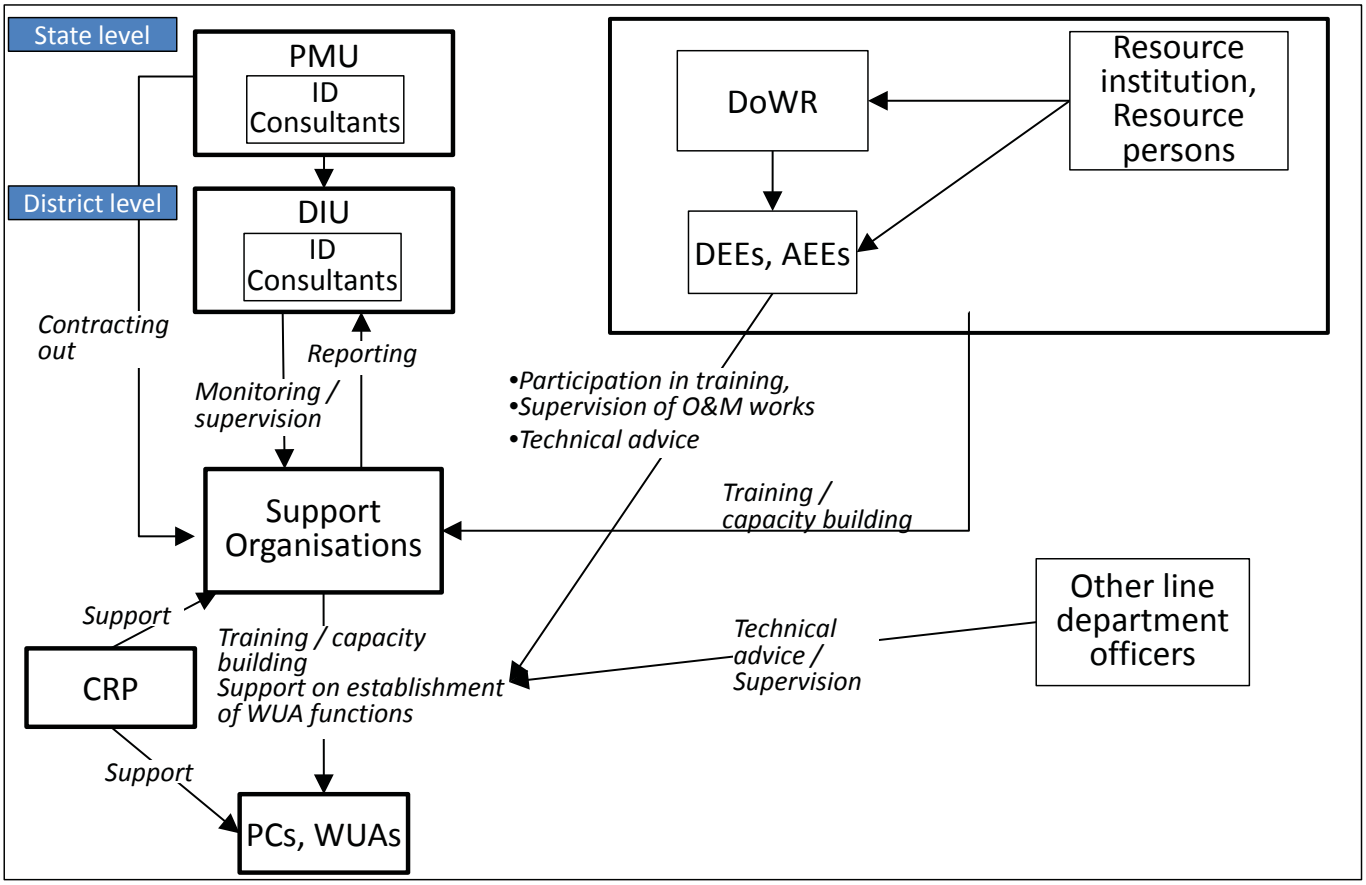
Project List by Construction Batch

Project	Medium Irrigation Project		Minor Irrigation Project			Total	
	Command Area (ha)	Construction Cost (Rs. Million)	Nos.	Command Area (ha)	Construction Cost (Rs. Million)	**Command Area (ha)**	**Construction Cost (Rs. Million)**
Batch-1							
Peddankalam Anicut	3,113	395	8	672	44	**3,785**	**439**
Vottigedda Reservoir	6,746	442	10	1,046	65	**7,792**	**507**
Vengalraya Sagaram	9,996	500	2	509	29	**10,505**	**529**
Torrigedda Pumping Scheme	5,998	312	16	2,515	149	**8,513**	**461**
Thammileru Reservoir	3,711	225	19	2,008	125	**5,719**	**350**
Mopadu Reservoir System	5,147	425	1	186	11	**5,333**	**436**
Krishnapuram Reservoir	2,479	274	9	829	53	**3,308**	**327**
Araniar Reservoir	2,226	367	26	3,132	192	**5,358**	**559**
Upper Pennar	4,066	316	5	391	26	**4,457**	**342**
Pennar Kumudavathi	2,479	155	11	3,287	185	**5,766**	**340**
Muniyeru	6,648	666	12	1,669	100	**8,317**	**767**
DR & DM Channels	10,117	429	0	0	0	**10,117**	**429**
Sub-total	**62,726**	**4,506**	**119**	**16,244**	**979**	**78,970**	**5,486**
Batch-2							
Peddagedda Reservoir	4,858	704	4	299	20	**5,157**	**724**
Andra Reservoir	3,603	345	22	1,710	113	**5,313**	**457**
Veeraraghavani Kota Anicut	2,267	56	7	599	39	**2,866**	**95**
Buggavanka	3,926	667	8	941	58	**4,867**	**725**
Maddigedda Reservoir	1,214	168	9	564	39	**1,778**	**207**
Narayanapuram Anicut	14,995	1138	18	1,919	120	**16,914**	**1,258**
Raiwada Reservoir	6,111	709	31	2,114	143	**8,225**	**853**
Siva Bhashyam Sagar	4,894	318	0	0	0	**4,894**	**318**
Isolated Minor Irrigation Tank	0	0	231	32,576	1,956	**32,576**	**1,956**
Sub-total	**41,868**	**4,105**	**330**	**40,722**	**2,488**	**82,590**	**6,593**
Total	**104,594**	**8,611**	**449**	**56,966**	**3,467**	**161,560**	**12,078**

Flow of Modernisation Works

1. Preparation of Detailed Project Report (DPR)
   - 12 DPRs for medium irrigation projects are completed and 8 DPRs awaited. For minor irrigation projects, 26 DPRs are completed and balance DPRs are awaited.
2. Designs and Construction Drawings
3. Administrative Sanction and Technical Sanction
   - Administrative sanction has to be obtained from the State Project Coordinator (Principal Secretary to Government, DoWR) after preparing cost estimates for individual medium and minor irrigation projects as per the Govt. of AP norms,
   - Technical Sanction for individual irrigation projects should be accorded by the Chief Engineer-Medium Irrigation and Minor Irrigation concerned. The technical matters and cost estimates are reviewed and sanctioned.
4. Tender Works
   - The construction works will be executed by applying tender process for selection of the contractors. The tender procedures for irrigation projects will be executed by applying E-Tender system with the 2-bid format; Technical Bid and Price Bid.
   - The Bid Evaluation Team will be organised in the respective Irrigation Circle Offices. The PMC will assist the tender works.
5. Construction Works: 3 years for medium and 2 years for minor irrigation projects
6. Defect Liability Period: 2 years after physical completion of works

Implementation Structure of PIM and WUA Capacity Building



Roles and Responsibilities of Stakeholders

Stakeholder		Responsibility
Project Implementation Unit (PMU)	State PMU	· Appoint Institutional Development expert as local consultant · Contracting out the works to Resource Institution (RI) and SOs · Contract management of Supporting Organisations (SOs) sub-let works (work assessment based on the State PIU consultants' evaluation and payment)
	District Implementation Unit (DIU)	· Appoint one Institutional Development Expert in each District (DIU) · Monitor and Evaluate the work of SOs and report to PMU
DoWR	State office	· Preparing amendment on APMFIS Act & Issuing necessary government orders · Issuing a Guideline and training module with help of RIs · Organising training for Department officers with help of RIs
	District office	· Major Competent Authority for PIM operation and PCs/WUAs · Monitoring works of SOs and WUAs
	Field officers, DEEs/AEEs	· Major competent Authority in field level being in charge of WUA support · Training farmers as resource person and Providing advice as required · Other routine works defined in the PIM works and APFMIS Act
Other line department	Agriculture Department	· Competent Authority especially in crop budgeting and other agriculture related activities by WUAs
	Revenue Department	· Competent Authority for water tax collection
	Fishery Department	· Competent Authority in optimal tank use especially with regard to use of tanks for fishery activities
Resource Institutions (RIs) / Resource person		· Preparation of Guideline and training modules · Dissemination of contents of the guideline and training modules to relevant government officers · Training of SOs
Institutional Development (ID) Consultants		· Monitoring of overall capacity development programme · Monitoring and assessment of works of RI and SOs · Monitoring the contract and payment procedure from the PMU to SOs
Supporting Organisation (SO)		· Major actor of the WUA support programme · Facilitating and coordinating activities with relevant department · Reporting to works to DIU and relevant department officers
Community Resource Persons		· Supporting implementation of activities by SOs · Coordination and mobilisation in WUA and villages · Facilitation and communication with relevant agencies
PCs / WUAs		· Main actor of the PIM

Outline of Capacity Building Programme for PIM

Activity 1: Revision of guideline and capacity building of government officers

- Review of Guideline and training modules
- Dissemination of the revised guideline and training module to relevant government officers
- Training of relevant Department officers on the revised guideline and training modules
- Technical training for DoWR officers on PIM and O&M

Activity 2: Equipping Supporting Organisations

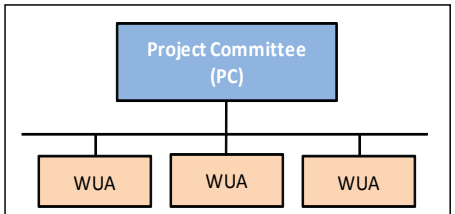
- Selection of optimal organisations and contract management
- Training of SOs staffs on project components and revised guideline and training modules
- Monitoring and evaluation activities by SOs

Activity 3: Capacity Development of WUAs (Minor irrigation)

- Baseline survey
- Organisational development of WUAs
- Fund generation and financial management
- Operation and Maintenance works by WUA
- Water budgeting and crop planning
- Optimal use of tank water (with all the stakeholders such as fishermen)
- Exposure and learning experiences
- Awareness raising and optimal use of government schemes

Activity 4: Capacity Development of PCs and WUAs (Medium irrigation)

- WUAs under medium irrigation scheme
- All the components of the Activity Components 3 for WUAs under medium irrigation schemes
- PCs of the medium irrigation scheme
- Organisation development of PCs
- Project level O&M, water tax collection and water budgeting and crop planning
- Establishment of Social auditing boards
- Exposure and learning experience



Two-Tier Structure for Medium Irrigation Projects

Outline of Promotion of FPO

FPOs Objectives:

The basic objective of forming FPO is to enhance the income and productivity at the same time also reduces risk and expenses of farmers and farming by following climate change resilient sustainable farming production practices. This will also fetch them premium prices for the produce as it will be organic.

FPO Structure:

FPOs will be structured by 3 layers:

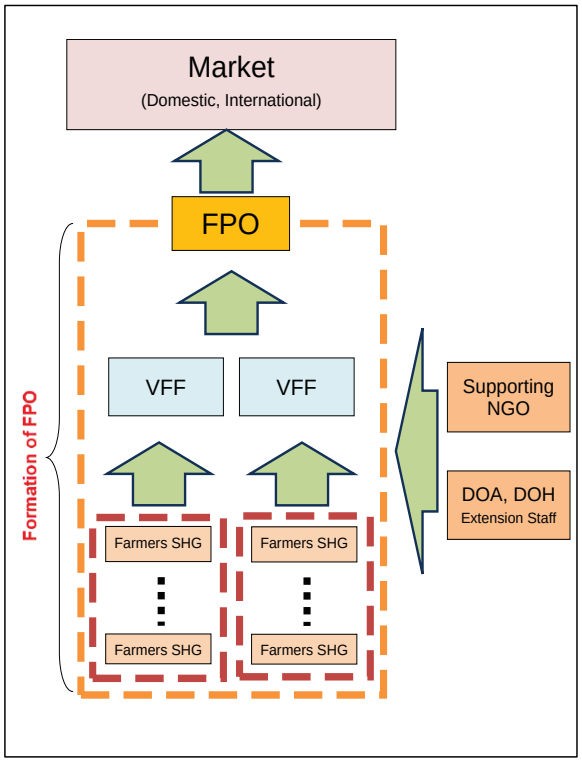
- FPO 1,000-1,5000 members (10 VFFs)
- VFF 100-150 members (10 Farmer SHGs)
- Farmer SHG 10-15 members

Steps for FPO Formation:

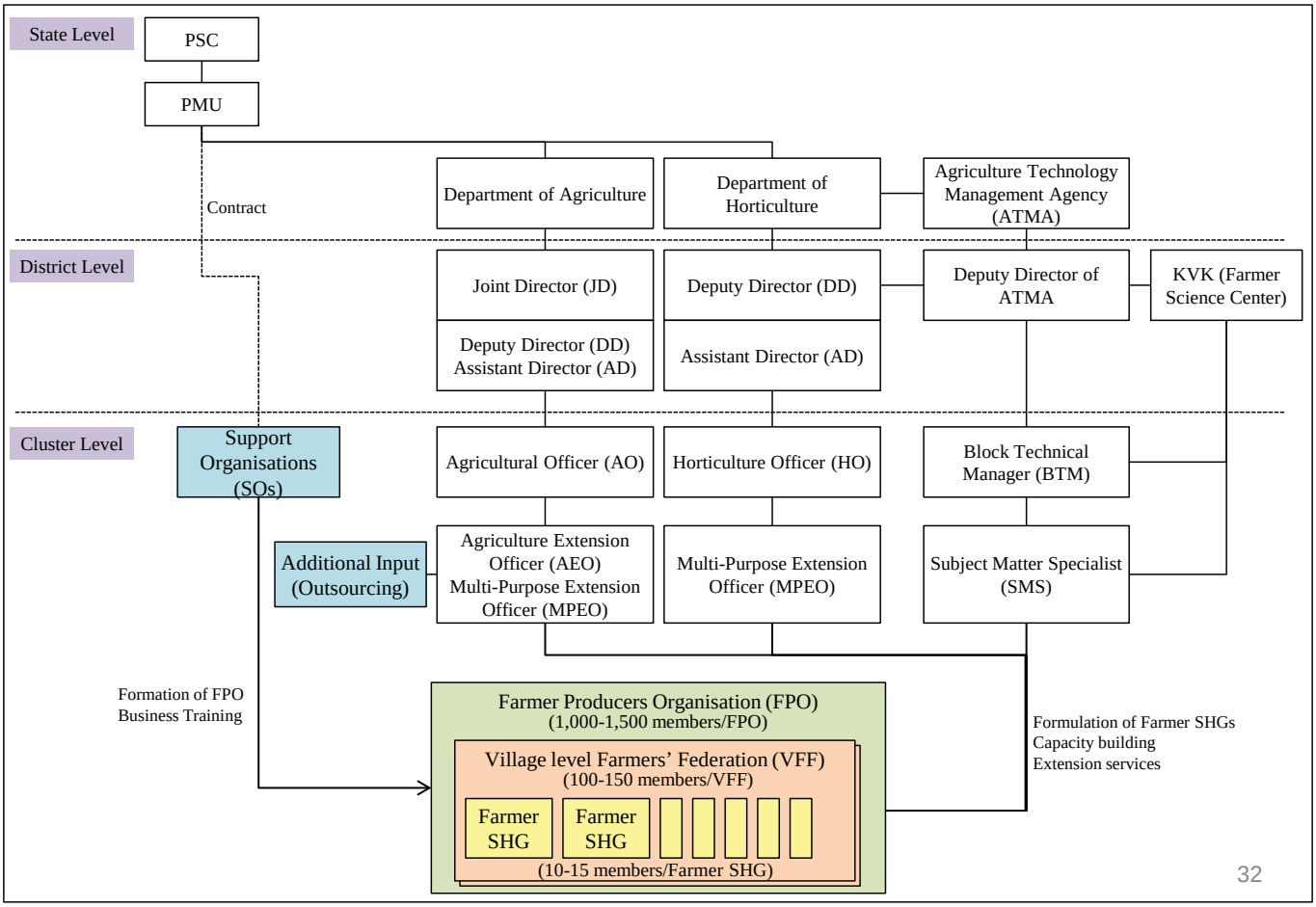
Step 1: The Farmers SHGs (farmer groups) will be formed per 10-15 members. Extension services will be provided by the government based on the demand from farmers.

Step 2: The Village farmer's organisation of farmers SHG called Village level farmers' federation (VFF) will be the main implementation platform of the program at village level.

Step 3: FPOs will be formulated and governed by a Board of Directors elected from among the RMGs and will have a team for delivery of services headed by Chief Executive Officer. FPOs provide a platform for Farmers SHGs to federate into a company or cooperative in order to access market, organic inputs and financial services.



Implementation Structure for Promotion of FPO



Step 1: Agriculture Extension Programmes

Activities	Responsibility	Target	Activity contents
1) Initial awareness and preparatory work	AEO, HO, MPEO	Farmers of each irrigation scheme	Orientation on extension activities Formulation of farmers'' groups and selection of master farmers Capacity building for farmers' groups
2) Farm management (class room training)	AEO, HO, MPEO	Farmers	Training on budgeting / book keeping / monitoring
3) Training on fundamental techniques (class room training)	AEO, HO, MPEO	Farmers	Water use and fertilizer application Rain water harvesting techniques Micro-irrigation Technology (O&M) Promotion of organic farming Promotion of vermi-composting Promotion of GAP Promotion of IPM and INM Seed village programme
4) Demonstration and field school (hands-on training)	AEO, HO, MPEO	Farmers	Demonstration on Rice Demonstration on Upland Crops (Maize, Ground nuts, Pulses, Sugarcane) Demonstration on Upland Crops (fodder crops , others) Demonstration on Vegetables (Chilli / Tomato / Other crops)
5) Exposure and learning experience	AEO, HO, MPEO	Farmers	IPM and Organic Pest Management Successful examples on farming practices Post-harvest techniques
6) Demonstration and exposure visit on farm mechanisation	AEO, HO, MPEO	Farmers	Demonstration of machinery activities in farmers' fields Exposure visit to successful examples

Step 2: Preparation for FPO Formation

Activities	Responsi-bility	Target	Activity contents
1. Preparatory stage			
1.1 Compilation of lessons from the on-going FPO formation	DoA		- Evaluation of the on-going / preceded FPO formation - Compilation of lessons from the preceding programmes - Preparation of strategies based on the lessons
1.2. Formation of farmer groups	AEO, MPEO	Farmers interested in collective practice	- Organising a meeting with farmers - Formation of small groups of farmers for collective practice(15-20 farmers each) for technology dissemination, extension, information sharing - Selection of master trainers from each group
1.3. Periodical monitoring meeting of the groups	AEO, MPEO	Farmer Groups	- Support in organising periodical meeting (e.g. monthly) of the groups - Facilitation in the discussion and providing advice on technical and management issues.
2. Identification of potential area for FPO			
2.1. Survey on potential of forming FPO	AEO, MPEO	Farmer Group	- Identification of active progressive farmers/cluster of organic farming - Analysis on expected benefit by aggregation of the groups - Estimation of expected produce - Identification of potential market
3. Employment of NGO for FPO formation			
3.1 Employment of NGO for FPO formation	DoA, PMU	NGO	- Consensus making among farmers and groups to form FPO in the identified progressive/potential area for FPO formation - Contracting out the works of supporting formation of FPO
3.2. Introductory meeting for NGO	DoA	NGO	- Meeting for explaining the contract administration - Workshop with the selected NGOs on their expected roles, ToR - Training regarding FPO formation and support
4. Formation of FPO			
4.1. Support on aggregation of organic farming group to form FPO	NGO	FPO	The FPO formation support shall be implemented by NGO with consultation with Dept. - Organising meeting to introduce idea of aggregation and formation of FPO - Training on formation of FPO and its basic administration functions

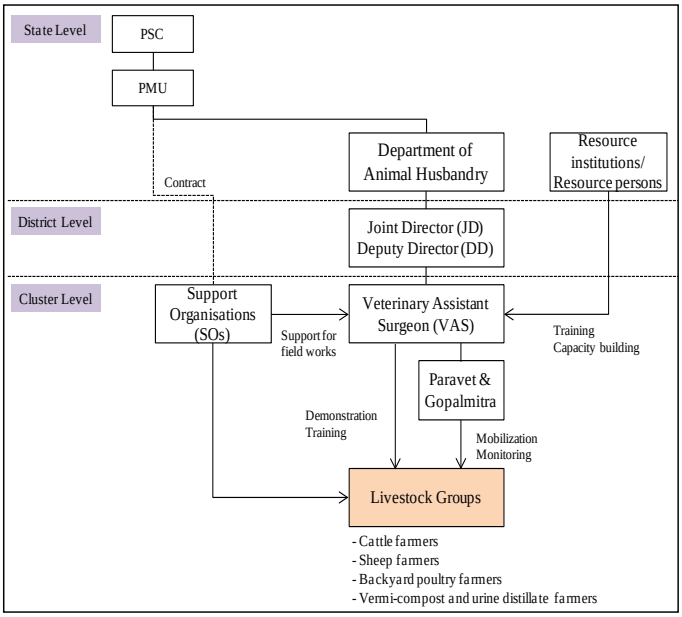
Step 3: Support for Establishing FPOs

Activities	Responsi-bility	Target	Activity contents
5. Support for establishing FPO / business formation			
5.1. Business training	NGO, AEO, MPEO	FPO	Support their business activities of FPO - Business mind setting - Business planning, - Basic budgeting (cost and profit estimation) - Financial and production management - Business management
5.2. Follow-up support on business planning	NGO, AEO, MPEO	FPO	Support actual preparation of; - Business planning, - Financial management, - Production management
5.3. Marketing support	NGO, AEO, MPEO	FPO	Support in promoting marketing - Training on marketing - Identification of market, & linking with buyers - Quality/quantity assurance support
5.4. Production development support	NGO, AEO, MPEO	FPO	Support in production development - Quality improvement, - Post harvest technology, - Processing, packaging, etc
5.5. Minor infrastructure support	NGO, AEO, MPEO	FPO	Support in initial infrastructure support for production and marketing
5.6. Organic certification	NGO, AEO, MPEO	FPO	Support in process of acquiring organic certificate - Procedures and documentation preparation - Conditions and requirement for organic - Quality assurance

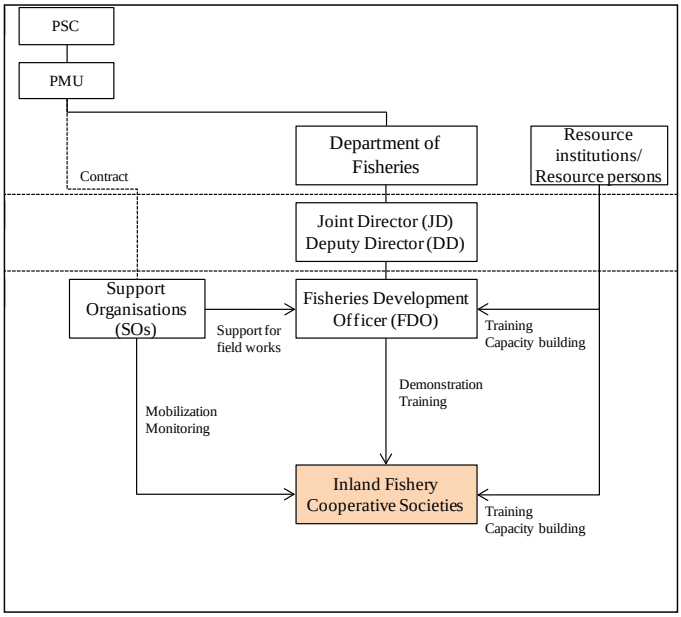
Implementation Structure of Livelihood Support

Implementation Structure

- Implementation: Department of Animal Husbandry and Department of Fisheries
- Technical inputs: ATMA, KVK, state universities etc.
- Mobilisation and facilitation: Support Organisations (SOs)



Implementation Structure for Animal Husbandry Component



Implementation Structure for Fishery Component

Activities for Livelihood Support of Animal Husbandry

3 medium irrigation clusters as 1st batch and additional 6 clusters as 2nd batch, each for 3 years

Output	Responsibility	Target	Activities
1. Development of livelihood plan	Joint Director Veterinary Assistant Surgeon (VAS)	600 farmers	-Staff Training (3 staffs) -Training of Paravet and Gopalmitra (6 staffs) -Developing livelihood plan -Exposure Visits for farmers -Receive Exposure Visits
2. Enhancement of productivity of animals	VAS (SOs)	600 farmers (300 for milk cattle, 300 for sheep)	2.1 Promotion of Fodder Cultivation and Balance Feed -Demonstration of Silage making (3 units) -Demonstration of New variety fodder cultivation -Demonstration of Ration balancing activities (3 units) -Training on Fodder Cultivation -Training on Use of Balance Feed -Training on Productivity
			2.2 Promotion of Sheep Rearing - Training on Good Practices in Sheep Rearing
3. Promotion of livestock based income generation activities	VAS (SOs)	420 farmers (300 for poultry, 120 for compost)	3.1 Promotion of Backyard poultry rearing -Demonstration of Chick hatchery (3 unit) -Training on chick hatchery -Training on rearing of Improved Backyard Poultry -Provision of chicks
			3.2 Promotion of Vermi-compost and Urine distillate -Demonstration of Vermi-compost and Urine distillate -Training on Vermin Composting -Training on Urine distillate -Provision of equipment for Vermi-compost from dunk -Provision of equipment for Urine distillate unit

Activities for Livelihood Support of Fishery

3 medium irrigation clusters as 1st batch and additional 6 clusters as 2nd batch, each for 3 years

Output	Responsibility	Target	Activities
1. Development of livelihood plan	FDO, SO	Leaders of FCSs and women's groups (4 FCSs)	1.1 Staff training 1.2 Developing livelihood plan 1.3 Training on Management of Fishery cooperative society 1.4 Exposure visit for society members 1.5 Receive exposure visits
2. Support for fish production activities	FDO, SO	1 FCS in a medium irrigation (200 fishermen)	2.1 Income generation activities under medium irrigation projects 1) Construction of tanks, landing site and captive nurseries in accordance with the development plan. 2) Trainings for fish production activities.
	FDO, SO	3 FCSs under minor irrigation projects (Total of 600 fishermen)	2.2 Income generation activities under minor irrigation projects 1) Construction of tank within tank, bore well and community hall in accordance with the development plan. 2) Trainings for fish production activities as same as 2.1.
	FDO, SO	One women's group under a FCS (10 members)	2.3 Income generation activities for Women groups Selected women will be trained for small-scale culturing of ornamental fish in their backyard. FCSs will be responsible on selecting members to conduct activities.
3. Support for marketing activities	District Fisheries office	3 women groups under FCSs (Total of 30 members)	3.1 Construction of marketing facilities and provision of marketing equipment
	FDO, SO	3 women groups under FCSs (Total of 30 members)	3.2 Trainings for marketing activities 1) Conducting detailed market survey 2) Harmonizing the harvest with the market demand and the capacity of the member 3) Marketing of ornamental fish

Pilot-1: Food Value Chain for Strategic Crops through PPP

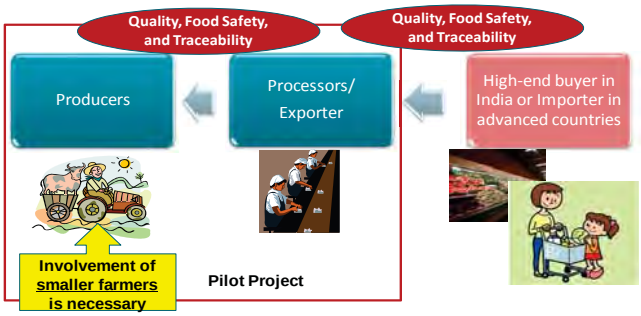
(1) Objective

Increase the competitiveness of food industry in AP by developing AP brand

- Develop a mechanism to assist entire VC
- Capacity development of government officers producers/producer groups, and other stakeholders
- Develop and operate commodity-wise marketing strategy

(2) Project Concept

- Utilize the market force to enhance integration of farmers
- Strengthen PPP to promote target products as a state



Project Concepts for Target Products

Developing **AP fresh mango brand** for export and domestic high value market by improving quality and safety of product

Strengthening competiveness of **mango processing industries** by improving efficiencies in mango production, logistics, and processing

Increasing **export competitiveness** (promoting Guntur chilli brand) by strengthening linkage between farmers and exporters and **upgrading IPM/drying technique**

Enhancing competitiveness and production of **domestic tomato paste** by promoting processing variety and strengthening linkage between farmers, processors and buyers

Developing **community based coconut processing industry** by strengthening capacity of producers to manage VC

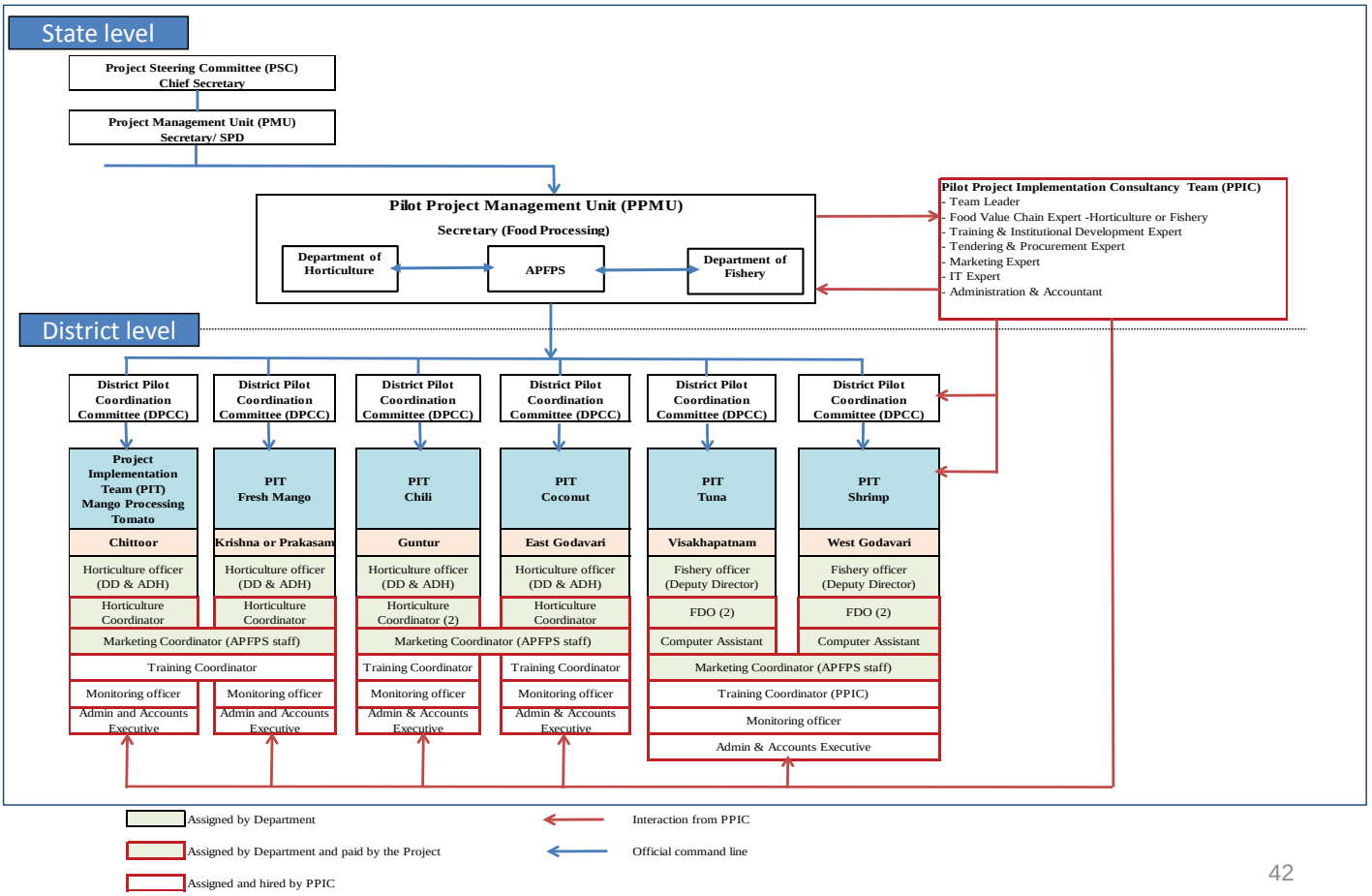
Enhancing **export competitiveness of small shrimp farmers** by improving quality and safety of their products through upgraded aquaculture technique and disease control

Developing **AP tuna brand** by enhancing quality and value addition through upgraded capture, on-board handing and processing techniques

Target Products, Project Period and Scale

Category	Product	District	Survey team proposal		
			Project Period	No. of beneficiary	Target area
Horticulture	Mango (processing)	Chittoor	4 years	1,000 farmers	1,000ha
	Mango (fresh)	Krishna	4 years	100 farmers	100ha
	Chili	Guntur	3 years	2,000 farmers	2,000ha
	Tomato	Chittoor	3 years	500 farmers	500ha
	Coconut	East Godavari	3 years	1,000 farmers	1,000ha
Fishery	Shrimp	West Godavari	3 years	1,000 farmers	1,000ha
	Tuna	Visakhapatnam	4 years	225 fishermen	45 boats

Implementation Structure for FVC for Strategic Crops through PPP



Project Activities for FVC for Strategic Crops through PPP

Output	Activity	By
1. Development of mechanism	• Form a implementation unit • Identify producers/private sector partners • Joint survey and planning • Joint review • Share experiences with others	Line departments in collaboration with APFPS
2. Capacity building	• Training of producers • Training of private sector partners • Training of government officials	Line departments (training for private sector by APFPS)
3. Development of marketing/ brand strategy	• Conduct market survey • Collect information and establish linkage with local resources • Develop guidelines • Support market activities • Develop a platform for stakeholders • Develop brand and marketing strategy	APFPS in collaboration with central agencies such as APEDA/MPEDA and Agriculture Marketing Department

Pilot-2: Farm Mechanisation

(1) Objectives

- Capacity development of farmer operators and local mechanics to ensure effective operation and maintenance of machineries
- Strengthening of functions for training, planning, monitoring and evaluation for farm mechanisation

(2) Concept

Agricultural Mechanisation & Technology Center (AMTC) shall be established at strategic location for promotion and dissemination of agricultural mechanisation and other agricultural technologies.

i) provision of training on machinery's O&M and preparation of business plan for Custom Service Units organised by farmers, cooperateives, and farmers' societies;

ii) distribution of machineries under the current subsidy system;

iii) timely monitoring on farming activities including operational performance and constraints of machineries to be conducted by CSUs and ;

iv) information exchange among DOA, research organisations, manufacturers and dealers to provide timely trouble-shooting actions

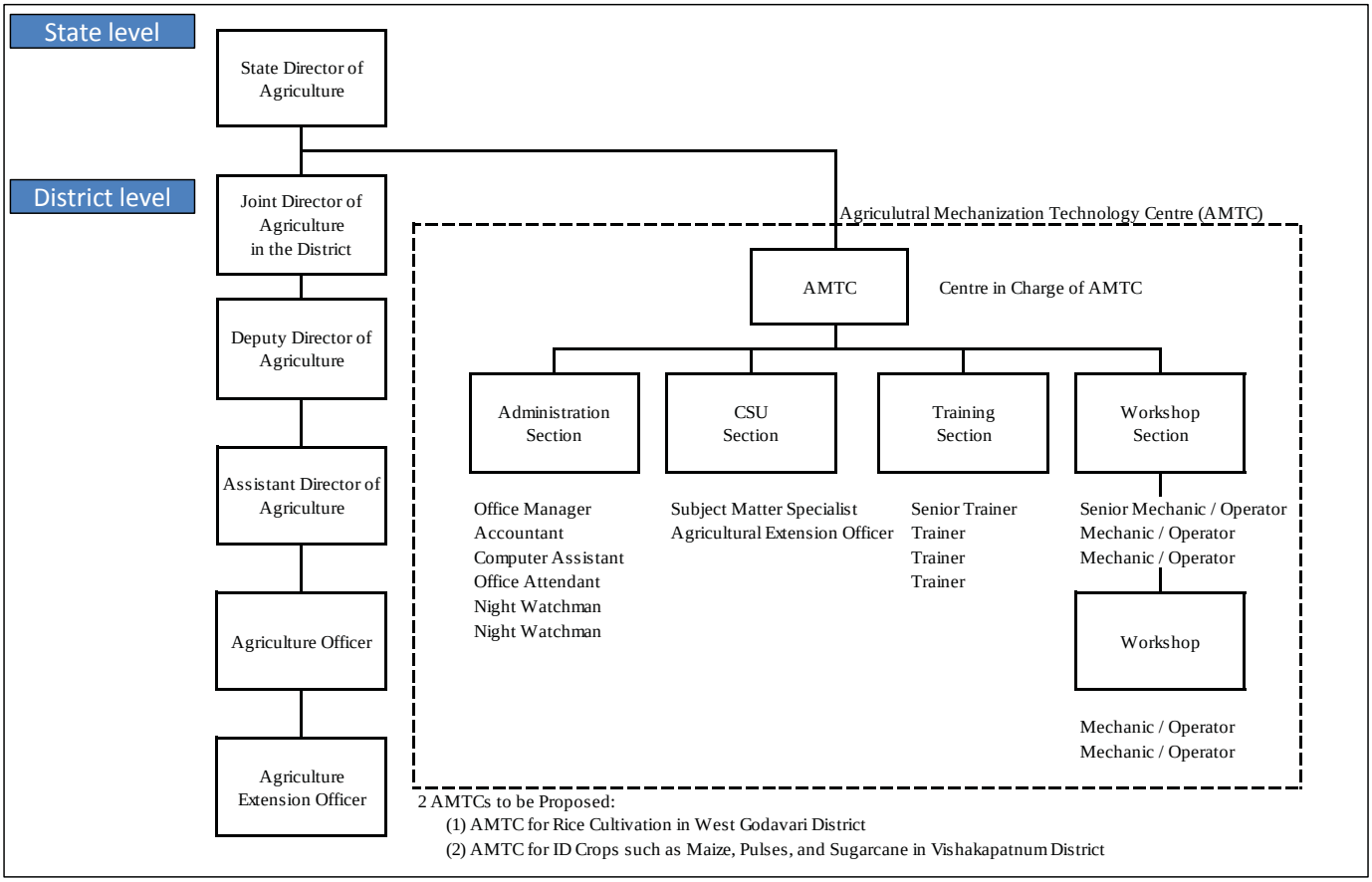
Project Components, Target Products and Scale

Components:

(1) Establishment of Agricultural Mechanisation & Technology Center (AMTC): 2 AMTCs
(2) Establishment of workshop: 10 units
(3) Training of Custom Service Units (CSUs): 107CSUs
(4) Procurement of farm machinery for training purpose (2sets for rice, 2 sets for ID crops)

AMTC	Target Crops	Custom Service Units (CSUs)		District	Period
1 center in West Godavari	Rice	Rice	45	West Godavari, East Godavari, Krishna	6years
1 center in Visakhapatnam	ID crops (Maize, Pulses, Sugarcane)	Maize Pulses Sugarcane	15 33 14	Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari, Krishna	6years

Implementation Structure for Farm Mechanisation



Environmental condition at Screening

(JICA Guideline for Environmental & Social Consideration(2010))

1. Environmentally sensitive items

- Avoidance of involuntary resettlement should be confirmed at the planning (many cultivation at dried tank)
- Forest Dwellers (Indigenous/ethnic minority)

2. Environmentally sensitive area

- Some Forest Area, Scheduled Area and Wildlife Sanctuary may be involved even the impact is limited.

3. Environmental Clearance

- Adequate legal process should be conducted.

Baseline Condition

Items	Description	Remarks
1. Natural Environment	• Irrigation Project is principally been planning to select only rehabilitation of existing Medium/Minor irrigation facilities, which can be assumed no additional impact. However, the detail information for sub-projects are not available yet. • A medium project, Siva Basham Irrigation is located partly within Nagarjunasagar-Srisailam Wildlife Sanctuary (tiger Reserve) and some small scale rehabilitation works is proposed and this is required a permission from Forestry Department. • Also, some minor tanks are in Scheduled area.	Adequate process such as EC, Forest Clearance should be taken.
2. Social Environment	• Irrigation Project is principally been planning to select only rehabilitation of existing irrigation facilities and impact may be limited. • There are some Scheduled Areas (5th schedule in the Constitution) in AP state in Srikakulam, Vizianagaram, Visakhapatnam,East Godavari and West Godavari districts and some irrigation projects are fell into those mandals.	Forest Dwellers Plan should be prepared, in case of impacts.
3. Pollution	• No large impact	

Legal Process on Environmental Clearance on Irrigation modernisation

- EIA notification 2006 (S.O 1533, 2006), Article 7(ii). Prior Environmental Clearance(EC) process for Expansion or Modernisation or Change of product mix in existing projects:
- Amendment of EIA notification 2006(S.O 1599, 2014), Article 1. for item1(c) :

"1(c)	(i) River Valley projects (ii) Irrigation projects	(i) ≥ 50 MW hydroelectric power generation; (ii) ≥ 10,000 ha. of culturable command area.	(i) ≤ 50 MW ≥ 25 hydroelectric power generation; (ii) < 10,000 ha. > 2000 ha. of culturable command area.	General condition shall apply. Note:- Category 'B' river valley projects falling in more than one state shall be appraised at the central Government Level...";

- Amendment of EIA notification 2006(S.O. 195, 2009), (I) In para 2, after sub-para (iii):, In case of "Modernisation or expansion proposals without any increase in pollution load and, or without any additional water and or land requirement",
  "A self certification, stating that the proposal shall not involve any additional pollution load, waste generation or water requirement, be submitted to the regulatory authority by the project proponent."

Gender Consideration

(1) Women participation in social organisation

- Women in AP state have been well empowered in a certain aspect, having their financial resources, platform for their social activities, and access to information and supports. On the other hand, women are hardly participating in decision making especially in water resource management as mentioned.
- Therefore, it is strongly recommended to make specific provision for women in membership and management positions for the organisations to be supported through the project.

(2) Division of works in agriculture related activities

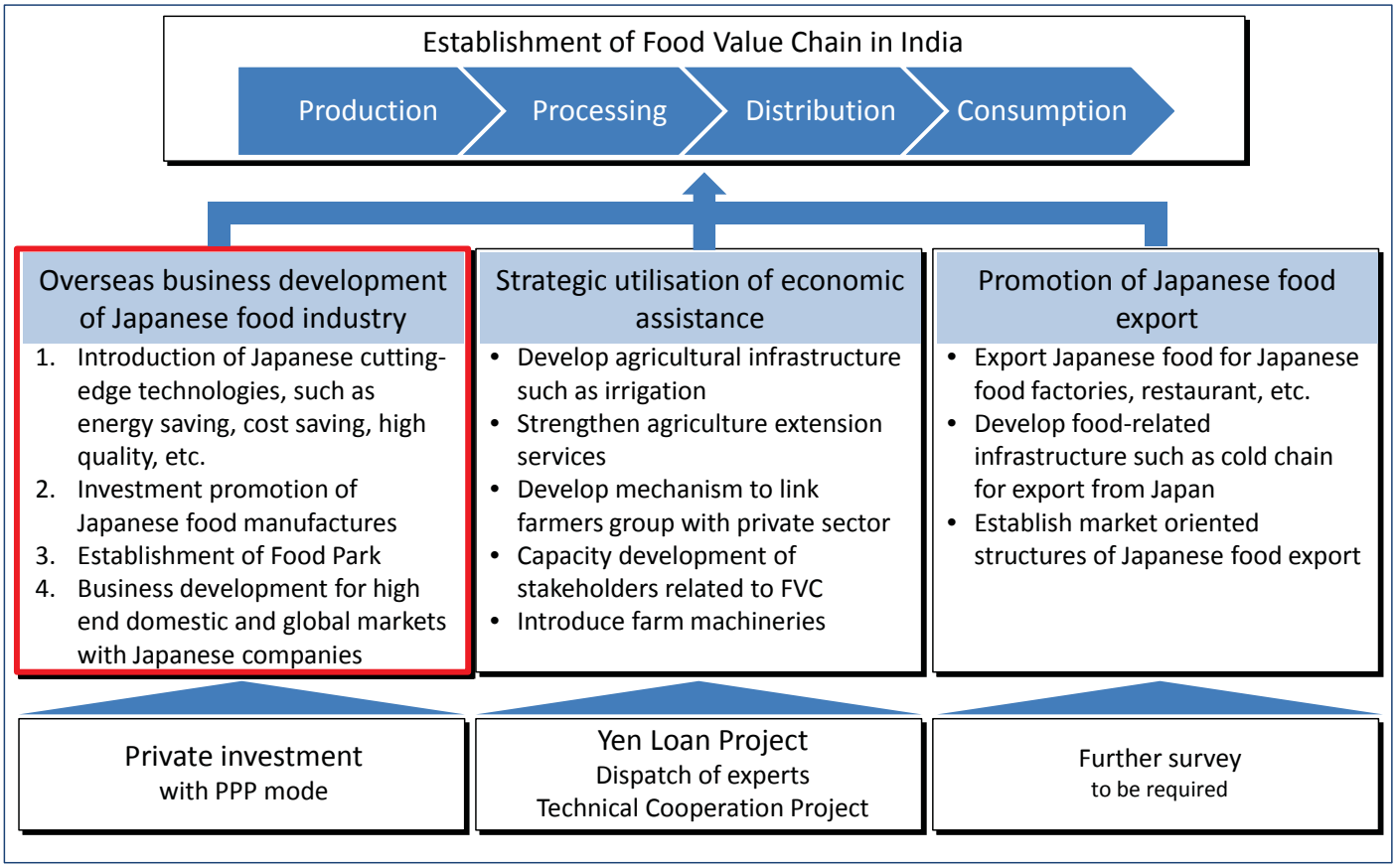
- Intervention in the project shall target either equally or with positive discrimination to fill the gap of gender needs depending on the gender related situation of each activity.
- Convergence meetings with different departments and stakeholders can be also utilised as one of the opportunity to collaborate with gender specific programme to make the project intervention more gender sensitive.

Climate Change Resilience

JICA Climate Finance Impact Tool for Adaptation- Irrigation and Drainage Sub-Sector and Measures by APILIP-II.

Vulnerability	Adaptation Measure by APILIP-II
- Decrease in precipitation and shift of rain pattern - Increase in air temperature, precipitation, rain intensity, and frequency, intensity, and duration of natural disaster (e.g. cyclone, drought) - Rise in sea level	- Modernisation of medium and minor irrigation projects for restoring of storage capacity and improvement of irrigation system efficiency (Component-1) - Capacity building for participatory irrigation management and agriculture for water saving agriculture (Component-2) - Conservation and management of forests for water resources (by GoI/GoAP) - Construction of rain water harvesting structures, - check dams, percolation tanks, farm ponds for groundwater recharge (by GoI/GoAP) - Construction of dug-wells and bore-wells (by farmers)

Overall Strategy for Private Sector Partnership

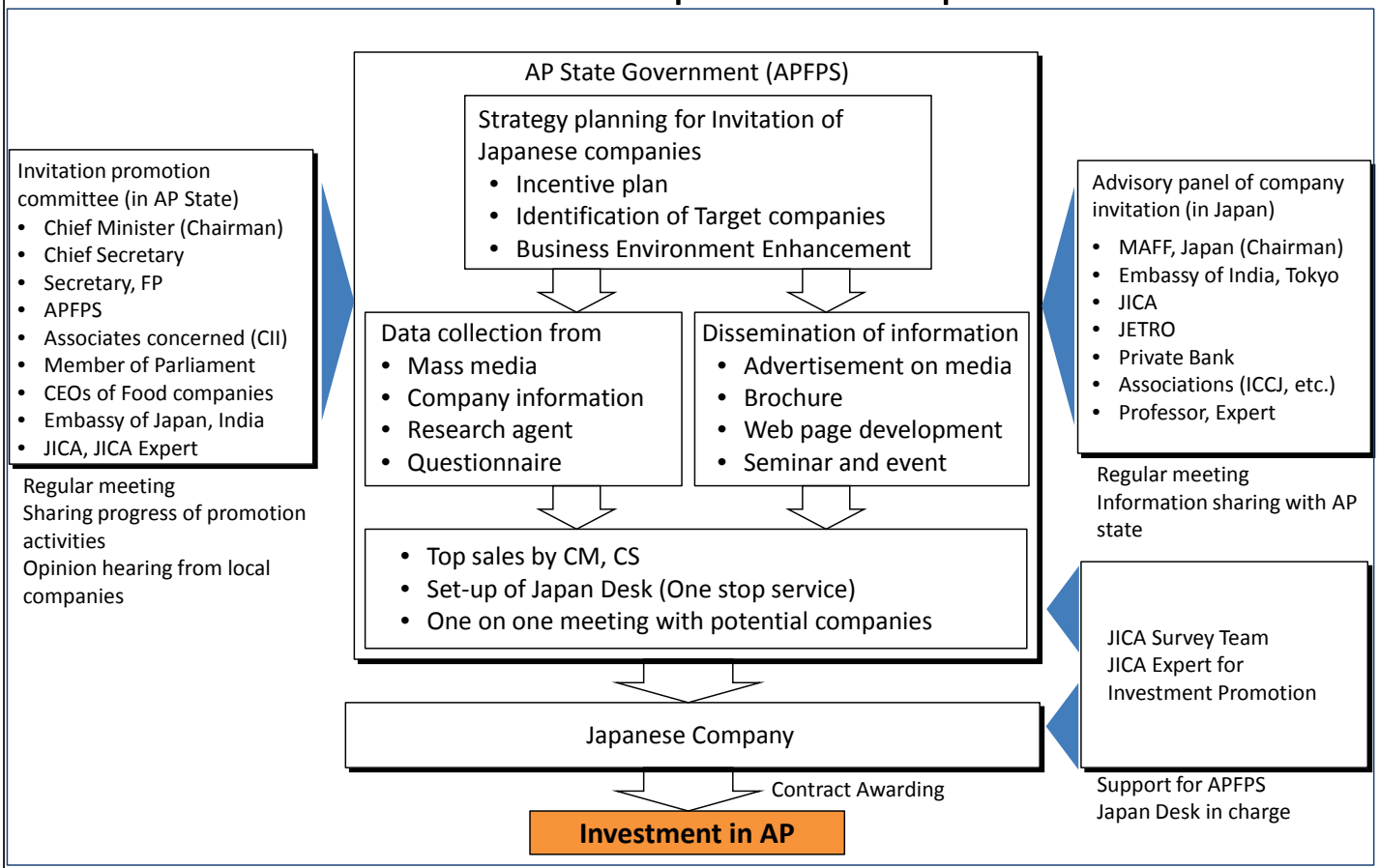


Note: prepared by JICA survey team based on Strategy for the Global Food Value Chain prepared by MAFF, Japan

Identified Needs on Technology and Machinery in AP State

Target Crops	Production	Post-harvest/ Processing	Distribution/ Sales
Rice	• Farm machines (Rice trans-planter, combine harvester, etc.) • Fertilizers and agro-chemicals • Nursery Seeding Machine	• Rice milling machine • Processing machines (Rice bran oil) • Quality check system • Hygiene management	• Products development, sales promotion
Fruits and Veggies (Mango/ Tomato/ Chili)	• Traceability (GAP, etc.) • Farm management • Quality Seeds (for processing purpose) • Drip irrigation • Contract farming system • Harvesting technology • Harvesting machine	• Post-harvesting technology (crate, ripening) • Sorting and Grading • Processing machine (concentrated, dehydrated) • Aseptic packaging • Packaging/ boxing technology • Vapor Heat Treatment facility • IQF/ freezing facility • Quality check system • Hygiene management	• Cold chain (cooling/ freezing) • Logistics management • Products development, sales promotion
Fishery (Shrimp/ Tuna)	• Traceability for shrimp farming • Environmental-friendly aquaculture • Disease prevention • Fishing technology (electric shocker, electric line howler) • Processing on board	• IQF/ freezing facility • Weighing machine • Quality Tester • Quality check system • Hygiene management	• Cold chain (cooling/ freezing) • Logistics management • Products development, sales promotion

Investment Promotion for Japanese Companies

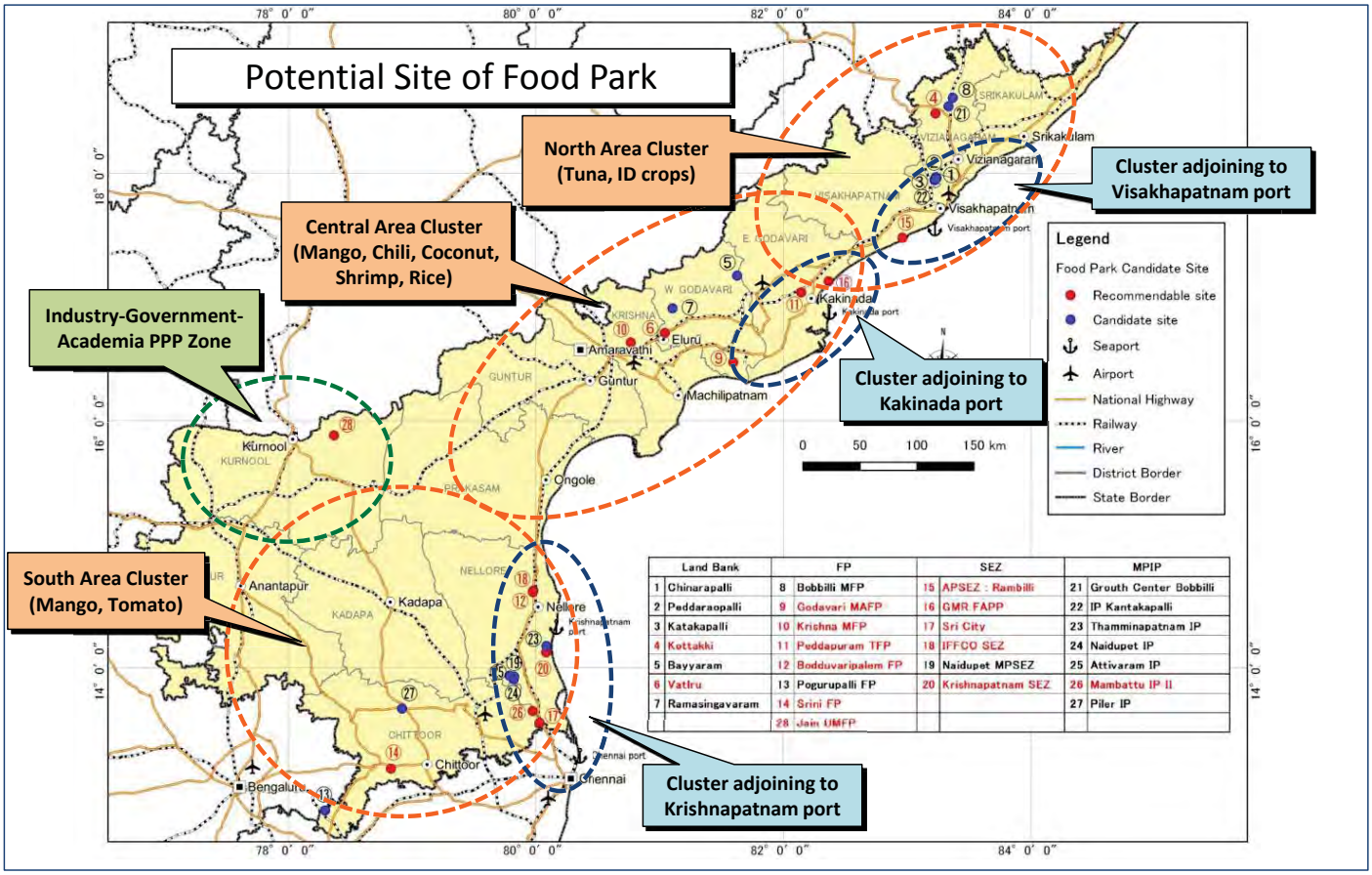


Potential Site of Food Park Development

Area	Food Park Development
North	➢ High potential area for development of Food Park with strategic crops (Tuna, Coconut) ➢ APSEZ (Rambilli) is a potential site as a combinat adjoining to Visakhapatnam port
Central	➢ High potential area for Food Park with strategic crops (Mango, Chili, Coconut, Shrimp) ➢ GMR FAPP is a potential site for a combinat as Kakinada SEZ and/or with improvement of existing Kakinada Port ➢ Collaboration with Krishna Mega Food Park proposed by APIIC ➢ Possible for new Food Park development under APIIC's land bank
South	➢ High potential area for Food Park with strategic crops (Mango, Tomato) ➢ Collaboration with existing Food Park (Srini Food Park) ➢ Development of new Food Park in Krishnapatnam SEZ adjoining to Krishnapatnam port ➢ Possible to formulate an Industry-Government-Academia PPP development in Kurnool District

Further studies are required to promote FP development.

Location Map of Potential Site for Food Park Development



Land Bank		FP		SEZ		MPIP	
1	Chinarapalli	8	Bobbili MFP	15	APSEZ : Rambilli	21	Grouth Center Bobbili
2	Peddaraopalli	9	Godavari MAFP	16	GMR FAPP	22	IP Kantakapalli
3	Katakapalli	10	Krishna MFP	17	Sri City	23	Thamminapatnam IP
4	Kottakki	11	Peddapuram TFP	18	IFFCO SEZ	24	Naidupet IP
5	Bayyaram	12	Bodduvaripalem FP	19	Naidupet MPSEZ	25	Attivaram IP
6	Vatlru	13	Pogurupalli FP	20	Krishnapatnam SEZ	26	Mambattu IP II
7	Ramasingavaram	14	Srini FP			27	Piler IP
		28	Jain UMFP				

Conclusion

(1) Modernisation of irrigation projects consisting of (i) 20 medium irrigation projects and (ii) 449 minor irrigation projects, which will be executed in phases: Moreover, 155 units of multi-purpose community centres and other agriculture infrastructure will be constructed under the project. Livelihood support to local poor in animal husbandry and inland fishery communities will be implemented by phase.

(2) The project itself builds in a mechanism to ensure project sustainability. In concrete terms, institutional development and capacity building of water utility associations (WUAs) and farmers producer organisations (FPOs) coincide with the national and state policies and plans. This programme will be continuously supported by GoAP even after the project is over.

(3) Food value chain for strategic crops and farm mechnisation, which have high local demands, will be implemented on pilot basis under the project.

(4) The economic internal rate of return (EIRR) of the project is estimated at 24.4%, which is economically good enough to justify the project. Moreover, this project requires no land acquisition and resettlement.

(5) Taking the abovementioned reasons into account, it can be said that the proposed APILIP-II is technically viable, economically feasible, institutionally sustainable, and environmentally friendly.

Recommendations

<u>To DoWR/GoAP</u>

(1) Actions to be taken before loan agreement
- All DPRs of irrigation projects selected for the proposed APILIP-II shall be prepared before the project appraisal that would be made by JICA.

(2) Actions to be taken right after loan agreement
- Setting up of PSC/PMU/DIU by GoAP,
- Selection of PMC by DoWR,
- Clearance of technical advisory committee (TAC), administrative and technical sanctions
- Formation of farmer groups/FPOs in the target medium irrigation clusters by DoA, and
- Preparation of annual work plan and budget proposal of all project components for the 1st year's operation by all the departments concerned.

<u>To JICA</u>

(1) Adjustment of the Project Cost

(2) Follow-up action for promoting agri-business in AP State
- Establishment of an agri-business promotion committee both in Andhra Pradesh State and Japan;
- Preparation of a joint action plan for promoting food industry in Andhra Pradesh State with Japanese technologies and investments; and
- Implementation of the action plan on PPP mode with technical and financial assistance by GoAP and GoJ.

Republic of India

Data Collection Survey on Agriculture, Food Processing and Distribution in Andhra Pradesh State

Final Report

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List of Abbreviation

ADB	:	Asian Development Bank
AE	:	Assistant Engineer
AEE	:	Assistant Executive Engineer
AGROS	:	Agro Industries Corporation Limited
AH	:	Animal Husbandry
AIDIP	:	Agribusiness Infrastructure Development Investment Program
AMC	:	Agriculture Market Committees
AP	:	Andhra Pradesh
APCBTMP	:	Andhra Pradesh Community Based Tank Management Project
APCOB	:	Andhra Pradesh State Cooperative Banks
APDDCF	:	AP Dairy Development Cooperative Federation
APDPIP	:	Andhra Pradesh District Poverty Initiatives Project
APEDA	:	Agricultural and Processed Food Products Export Development Authority
APERP	:	Andhra Pradesh Economic Restructuring Project
APFMIS Act	:	Andhra Pradesh Famers Management of Irrigation System Act
APFPS	:	Andhra Pradesh Food Processing Society
APGENCO	:	Andhra Pradesh Power Generation Corporation Limited
APILIP	:	Andhra Pradesh Irrigation and Livelihood Improvement Project
AP-IQMPHIP	:	Andhra Pradesh Water Management and Post Harvest Investment Promotion Project
APMC	:	Agriculture Produce Marketing Committees
APPRP	:	Andhra Pradesh Rural Poverty Reduction Project
APRIGP	:	Andhra Pradesh Rural Inclusive Growth Project
APSDPS	:	Andhra Pradesh State Development Planning Society
APSIDC	:	Andhra Pradesh State Irrigation Development Corporation
APSEZ	:	Andhra Pradesh Special Economic Zone
APTDC	:	Andhra Pradesh Technology Development and Promotion Centre
APTRANSCO	:	Transmission Corporation of Andhra Pradesh Limited
APWSIP	:	Andhra Pradesh Water Sector Improvement Project
ATIF	:	Agri-Tech Infrastructure Fund
ATMA	:	Agricultural Technology Management Agency
BC	:	Backward Class
BCM	:	Billion Cubic Metres
BPL	:	Below Poverty Line
BSNL	:	Bharat Sanchar Nigam Limited
CAA	:	Coastal Aquaculture Authority
CAD	:	Command Area Development
CADA	:	Command Area Development Authority
CAGR	:	Compound Annual Growth Rate
CC	:	Collection Centre
CC lining	:	Cement Concrete lining
CCA	:	Cultivable Command Area
CDO	:	Central Design Office
CE	:	Chief Engineer
CHC	:	Custom Hiring Centre
CIBA	:	Central Institute of Brackish Water Aquaculture
CIF	:	Community Investment Fund

CIFA	:	Central Institute of Freshwater Aquaculture
CIFNET	:	Central Institute of Fisheries Nautical Engineering and Technology
CIFRI	:	Central Inland Fisheries Research Institute
CIFT	:	Central Institute of Fisheries Technology
CIG	:	Common Interest Group
CIP	:	Cleaning in Process
CMEY	:	Chief Minister's Empowerment of Youth
CMFRI	:	Central Marine Fisheries Research Institute
COF	:	College of Fisheries
COT	:	Commissionerate of Tenders
CPC	:	Central Processing Center
CPCB	:	Central pollution control board
CSO	:	Central Statistics Office
CST	:	Central Sales Tax
CWC	:	Central Water Commission
DC	:	Distributory Committee
DC	:	Dairy Cooperatives
DCCB	:	District Central Cooperative Banks
DIPP	:	Department of Industrial Policy and Promotion
DISCOMs	:	Distribution Companies
DoA	:	Department of Agriculture
DoAC	:	Department of Agriculture and Cooperation
DoH	:	Department of Horticulture
DoWR	:	Department of Water Resources
DPR	:	Detailed Project Report
DWCRA	:	Development of Women and Children in Rural Areas
DWCUA	:	Development of Women and Children in Urban Areas
DyEE	:	Deputy Executive Engineer
EAP	:	Employee Assistance Programmes
ECoR	:	East Coast Railway
EDP	:	Entrepreneurship Development Programmes
EE	:	Executive Engineer
EEZ	:	Exclusive Economic Zone
EIA	:	Export Inspection Agency
ET	:	Embryo Transfer
EOI	:	Expression of Interest
FAPP	:	Food & Agri Processing Park
FCC	:	Field Collection Centre
FDI	:	Foreign Direct Investment
FDO		Fisheries Development Officer
FMD	:	Foot and Mouth Disease
FO	:	Farmer Organisations
FP	:	Food Park
FPC	:	Farmer Producer Company
FPG	:	Farmer Producer Group
FPO	:	Farmer Producer Organisation
FPPO	:	Farmers Producers Processors Organisations
FPS	:	Fair Price Shops
FPTC	:	Food Processing Training Centres
FSI	:	Fisheries Survey of India
FSSAI	:	Food Safety and Standards Authority of India

FVC	:	Food value chain
FY	:	Financial Year
GAP	:	Good Agricultural Practice
GDP	:	Gross Domestic Product
GHP	:	Good Hygienic Practices
GMP	:	Good Manufacturing Practices
GMS	:	Godavari Mahasamakhya
GoI	:	Government of India
GSDP	:	Gross State Domestic Product
GST	:	Goods and Services Tax
GVA	:	Gross Value Added
HACCP	:	Hazard Analysis and Critical Control Points
IALA	:	Industrial Area Local Authority
IAMAI	:	Internet and Mobile Association of India
IAMWARM	:	Irrigated Agriculture Modernisation and Water Bodies Restoration and Management
ICAR	:	Indian Council of Agricultural Research
ICD	:	Inland Container Depot
ICM	:	Integrated Crop Management
ICRIER	:	Indian Council for Research on International Economic Relations
ICRISAT	:	International Crops Research Institute
ID (crop)	:	Irrigated Dry (crop)
IDP	:	Industrial Development Policy
IGCARL	:	Indira Gandhi Centre for Advance Research on Livestock
IICPT	:	Indian Institute of Crop Processing Technology
IMAC	:	Inter-Ministerial Approval Committee
INM	:	Integrated Nutrient Management
IPM	:	Integrated pest management
IQF	:	Individual Quick Freezing
ISAC	:	Integrated Scheme of Agriculture Cooperation
ISAC&S	:	Integrated Scheme on Agri-Census & Statistics
ISAM	:	Integrated Scheme of Agriculture Marketing
JBIC	:	Japan Bank for International Cooperation
JETRO	:	Japan Export Trade Research Organisation
JICA	:	Japan International Cooperation Agency
KCCMP	:	Kurnool Cuddapah Canal Modernisation Project
KPCL	:	Krishnapatnam Port Company Limited
KVK	:	Krishi Vegyan Kendras (Farm Science Centres)
LT	:	Low Voltage Transmission
MA	:	Modified Atmosphere
MACS	:	Mutually Aided Co-operative Society
MAFF	:	Ministry of Agriculture, Forestry and Fisheries
MEIS	:	Merchandise Exports from India Scheme
METI	:	Ministry of Economy, Trade and Industry
MFF	:	Multitranche Financing Facility
MFP	:	Mega Food Park
MGD	:	Million Gallons per day
MGNREGS	:	Mahatma Gandhi National Rural Employment Guarantee Scheme
MIDH	:	Mission for Integrated Development of Horticulture

MIP	:	Minor Irrigation Project
MMGs	:	Mahila Matsya Mitra Groups
MMS	:	Mandal Mahila Samakhya
MMT	:	million metric tonnes
MoEF	:	Ministry of Environment and Forest
MoFPI	:	Ministry of Food Processing Industries
MOP	:	Muriate of Potash
MoRD	:	Ministry of Rural Development
MPEDA	:	Marine Products Exports Development Authority
MSE	:	Micro and Small Enterprises
MSMED	:	Micro, Small And Medium Enterprises Development
MSP	:	Minimum Support Prices
MSW	:	Municipal solid waste
MT	:	Metric Ton
MTNL	:	Mahanagar Telephone Nigam Limited
NABARD	:	National Bank for Agriculture and Rural Development
NABL	:	National Accreditation Board for Testing and Calibration Laboratories
NaCSA	:	National Centre for Sustainable Aquaculture
NALA	:	Non-Agriculture Land Assessment
NBFGR	:	National Bureau of Fish Genetics Resources
NCCD	:	National Centre for Cold-chain Development
NCIP	:	National Crop Insurance Programme
NDA	:	National Democratic Alliance
NDDB	:	National Dairy Development Board
NDP	:	National Dairy Plan
NFDB	:	National Fisheries Development Board
NFSM	:	National Food Security Mission
NGO	:	Non-Governmental Organisation
MGNREGA	:	Mahatma Gandhi National Rural Employment Guarantee
NIA	:	Net Irrigation Area
NIFPHATT	:	National Institute of Fisheries Post Harvest Technology and Training (Earlier named as Integrated Fisheries Project)
NIFTEM	:	National Institute of Food Technology, Entrepreneurship & Management
NIO	:	National Institute of Oceanography
NIOT	:	National Institute of Ocean Technology
NITI	:	National Institution for Transforming India
NLM	:	National Livestock Mission
NMAET	:	National Mission on Agricultural Extension & Technology
NMOOP	:	National Mission on Oil Seeds and Oil Palm
NMSA	:	National Mission for Sustainable Agriculture
NREGA	:	National Rural Employment Guarantee Act
MNP	:	Mobile Number Portability
MoA	:	Ministry of Agriculture
NSA	:	Net Sown Area
NSP	:	Nagarjuna Sagar Project
NTPC	:	National Thermal Power Corporation Limited
OBCs	:	Other Backward Castes
O&M	:	Operation and Maintenance

PACS	:	Primary Agriculture Cooperative Society
PC	:	Project Committee
PCC	:	Pollution control committee
PDS	:	Public Distribution System
PGS	:	Participatory Guarantee System
PHE	:	Public health engineering department
PIM	:	Participatory Irrigation Management
PKVY	:	Paramparagat Krishi Vikas Yojna
PMA	:	Program Management Agency
PMC	:	Project Management Consultant
PMKSY	:	Pradhan Mantri Krishi Sinchayee Yojana
PMU	:	Project Management Unit
POPI	:	Producer Organisation Promoting Institution
PPC	:	Primary Processing Center
PPP	:	Public Private Partnership
PPR	:	Pest des Petits Ruminants
PSF	:	Price Stabilisation fund
PWD	:	Public Works Department
R&D	:	Research and development
RDF	:	Refuse Derived Fuel
RGCA	:	Rajiv Gandhi Centre for Aquaculture
RKVY	:	Rashtriya Krishi Vikas Yojana (a State Plan Scheme)
RSA	:	Resource Support Agencies
RWSS	:	Rural water supply and sanitation department
SAU	:	State Agriculture University
SC	:	Scheduled Caste
SCs	:	Scheduled Castes
STs	:	Scheduled Tribes
SE	:	Superintendent Engineer
SEIS	:	Service Exports from India Scheme
SERP	:	Society for Elimination of Rural Poverty
SEZ	:	Special Economic Zones
SFAC	:	Small Farmers' Agri-Business Consortium
SGSY	:	Swarnajayanti Gram Swarozgar Yojana
SHG	:	Self Help Group
SIFT	:	State Institute of Fisheries Technology
SLM	:	State Livestock Mission
SMAM	:	Sub-Mission of Agricultural Mechanisation
SPCB	:	State pollution control boards
SPF	:	Specific Pathogen Free
SPV	:	Special Purpose Vehicle
SSP	:	Single Super Phosphate
ST	:	Scheduled Tribe
SVP	:	Seed Village Programme
SWM	:	Solid waste management
TC	:	Technical Committee
TDP	:	Telegu Desam Party

TDR	:	Transferable Development Rights
TMR	:	Total Mixed Ration
TPDS	:	Targeted Public Distribution System
UMFP	:	Ultra Mega Food Park,
UT	:	Union Territories
VAS	:	Veterinary Assistant Surgeons
VHT	:	Vapour Heat Treatment
VO	:	Village Organisation
VSS	:	Vana Samrakshana Samithis
WALAMTARI	:	Water and Land Management Training and Research Institute
WB	:	World Bank
WCRC	:	Water Charge Review Committee
WDC	:	Watershed Development Committees
WTE	:	Waste-to-Energy
WUA	:	Water Users Association
ZRS	:	Zonal Research Station
ZS	:	Zilla Samakhya

Measurement Units

Length

mm = millimeter(s)
cm = centimeter(s) (cm = 10 mm)
m = meter(s) (m = 100 cm)
km = kilometer(s) (km = 1,000 m)

Extent

cm^2 = square centimeter(s) (1.0 cm × 1.0 cm)
m^2 = square meter(s) (1.0 m × 1.0 m)
km^2 = square-kilometer(s) (1.0 km × 1.0 km)
ha = hectare(s) (10,000 m^2)
Acre = 0.4047 hectare(s) (4,047 m2)

Volume

cm^3 = cubic centimeter(s) (1.0 cm × 1.0 cm × 1.0 cm, or 1.0 ml)
m^3 = cubic meter(s) (1.0 m × 1.0 m × 1.0 m or 1.0 kl)
MCM = million cubic meter(s)
BCM =billion cubic meter s
L = liter (1,000 cm^3)
Gallon =4.546 litre

Weight

g = gram(s)
kg = kilogram(s) (1,000 grams)
ton(s) = metric ton(s) (1,000 kg)

Time

sec = second(s)
min = minute(s)
hr = hour(s)

Others

ppm = parts per million
° = degree
°C = degrees Celsius
% = percent
mS = millisiemens

Currency

USD = United State dollar(s)
JPY = Japanese yen(s)
INR = Indian Rupee(s)
Rs. = Indian Rupees(s)
lakh = hundred thousand
crore = ten million

Exchange Rate as of April 2016
USD 1.0 = JPY 113.1 = INR 67.0

1. INTRODUCTION

1.1 Authority

The final report is prepared in accordance with the terms of reference (TOR) of the contract agreement between the Japan International Cooperation Agency (JICA) and the Joint Venture of Nippon Koei Co., Ltd. and Kaihatsu Management Consulting Incorporation signed on 6th November 2015 for the Data Collection Survey on Agriculture, Food Processing and Distribution in Andhra Pradesh State.

1.2 Background of the Survey

Andhra Pradesh State, which is situated on the south-eastern coast of the country, is one of most extensive states of agriculture production in India. Thanks to the 6 distinctive agro-climatic zones, various types of agricultural products such as rice, mango, chilies, and etc. are produced in the state. Andhra Pradesh State also has a geographical advantage to develop the food value chain in terms of connectivity; currently operational 4 seaports, 7 airports and the extensive road and railway networks in and around the state. Based on these advantages, the Government of Andhra Pradesh (GoAP) has been actively promoting foreign investments in agriculture and food industries as stated in a recent government publication of “Sunrise State of Andhra Pradesh”.

JICA has been supporting modernization projects of irrigation facilities in Andhra Pradesh State through Yen Loan schemes since 1996 onwards. The percentage of irrigable area out of total land area in Andhra Pradesh State has been improved up to 42.2%. However, the productivity in the Andhra Pradesh State is still below the sufficient level since the irrigation facilities have not been fully developed. Furthermore, there is a big gap between the planned irrigable area and the actual irrigated area due to improper maintenance, water leakage and etc. On farm level, farmers are vulnerable to the price fluctuations of the agriculture produce since they sell the produce at the market in fresh. Farmers also earn less money since value addition on the produce is insufficient due to lack of the food processing industry.

Addressing these issues, GoAP plans to upgrade the livelihood of the farmers as well as to improve the value addition chain of agricultural produce through the development of agriculture and food processing industries with the support of Japan. In November 2014, a Memorandum of Cooperation (MoC) was signed between the Government of Japan and the GoAP to promote direct investments in agriculture and food processing industries in the state by Japanese companies. The Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan has also established the “Public-Private Council for Promoting the Global Food Value Chain” to support investment of Japanese companies in India through the exchange of knowledge and experiences on agriculture and food processing industries and also cold chain development. Based on these intends of the GoAP and the Japanese government, JICA determined to implement this preparatory survey to formulate a Yen Loan project and a technical cooperation project in agriculture, food processing and distribution sectors in the Andhra Pradesh State.

1.3 Objective and Scope of the Survey

The main objectives of the survey are (i) to formulate irrigation modernisation projects proposed by the state government, (ii) to review quality food value chain from agriculture production to marketing, (iii) to review possible adaptation of advanced Japanese technologies including food park through collection and analysis of basic information and data on agricultural production, food processing, distribution and marketing in Andhra Pradesh State. The expected output of the survey is to make recommendations to JICA for Yen Loan project and technical assistance in the field of agriculture, food processing and distribution sector in the state.

1.4 Target Area of the Survey

The target survey area is the whole area of the residual state of Andhra Pradesh (all 13 districts), which is illustrated in the map of Andhra Pradesh State on the first page of the report.

1.5 Concerned Departments and Working Group for the Survey

The survey team will carry out the data collection survey, exchanging views with concerned authorities including Water Resources Department as the main counterpart body, Departments of Planning, Agriculture, Horticulture, Animal Husbandry, Fisheries, Industries and Commerce, and other relevant line departments of the GoAP. Upon request of the survey team, GoAP has constituted the working group including nodal officers of the relevant departments as shown below:

Working Group (Dept.)	Nodal Officers (Dept.)
1. Mr. S.P. Tucker, Chief Secretary, (GoAP) 2. Mr. Vijaya Kumar, Special Chief Secretary (Ariculture) 3. Mr. Sanjay Gupta, CEO, (APSDPS) cum Special Secretary (Planning) 4. Mr. V. Venkatramaiah, Special Commissioner, (Water Resources) 5. Representatives of the relevant departments including the nodal officers	1. Mr. NDRK Sharma (Agriculture) 2. Mr. Rantnacharyulu (Horticulture) 3. Mr. Surya Prakash (APMI) 4. Mr. Dr. Srinivas Raju (Animal Husbandry) 5. Mr. P. Shankar Rao (Fishery) 6. Mr. JPS Kumar (Major & Medium Irrigation) 7. Mr. Y.S. Prasad (CEO, Food Processing)

Interactive Communication and Coordination

JICA Survey Team	
(International Expert)	(National Specialist)
1. Kenichi Shibuta (Team Leader, Agriculture Development Policy) 2. Mitsuru Nanakubo (Co-T/L, Business Partnership) 3. Tatsuhiko Hiaiwa (Irrigation Planning) 4. Yoshiyuki Ishizaki (Agriculture and Farm Mechanisation) 5. Ayako Mitsui (Farmer Organisation) 6. Chiyo Mamiya (Food Value Chain 1) 7. Yoshiko Honda (Food Value Chain 2) 8. Nobuo Nagawara (Irrigation Design 1) 9. Shoji Mizuma (Irrigation Design 2) 10. Kazuo Iiyama (Environmental and Social Consideration) 11. Tomoyuki Tajitsu (Animal Husbandry) 12. Kazuo Udagawa (Fishery) 13. Hideyuki Wakasa (Food Park Infrastructure) 14. Ayumi Fukuo (Financial and Economic Analysis) 15. Yasuhiro Kamiya (Project Organisation) 16. Akiko Oinuma (GIS/ Assit. Irrigation Planning/Coordinator)	1. Rahul Sen (Agriculture Development Policy) 2. Y Abudul Basheer (Hydrology and Irrigation Planning) 3. Ramarao Prakash (Food Value Chain) 4. Jitesh Kumar Panda (Animal Husbandry/ Fishery) 5. Veena V. Rao (Farmer Organisation) 6. V. Krishnamurthy (Agriculture) 7. Ch. Bhavani Rama Shanker (Irrigation Design 1)

Source: JICA Survey Team, prepared based on letter No. Com/CAD/APILIP-II/DEE-I/306/2014-15 dated 25.11.2015, etc.

Figure 1.5.1 Constitution of Working Group for JICA Survey

1.6 Work Progress of the Survey

The major work activities and events during the survey period are as follows:

- Prior to the field survey, preliminary secondary data collection was requested to the Government of Andhra Pradesh through the letter issued by JICA India office on 9th November 2015;
- Discussion with Ministry of Agriculture, Forestry and Fisheries (MAFF) on 11th November 2015 and discussion with members of working group of global food value chain (GFVC) for India on 18th, 20th and 24th November 2015;
- Kickoff meeting on 17th November 2015 at the state secretariat office of Andhra Pradesh

(refer to Attachment 1.6.1);
- Submission of inception report to JICA on 24th November 2015;
- Participation in Japanese Delegation for food processing to India and Andhra Pradesh State from 30th November to 2nd December 2015;
- Data collection and discussions at relevant government departments, research centres, banks, and NGOs during 1st Field Survey;
- Site visits to Visakhapatnam, Vizianagaram, Krishna, Guntur, West and East Godavari, Kurnool, Chittoor, Kadapa, and Nellore during 1st Field Survey;
- Selection of sample irrigation projects and target crops;
- Wrap-up meetings of 1st Field Survey at respective offices; Department of Water Resources on 26th December and Departments of Planning, Agriculture& Horticulture, Animal Husbandry & Fisheries on 28th December 2015;
- Contract agreement for interview survey to community based organisation and farmers on 28th December 2015 and its completion on 17th February 2016;
- Reporting the outputs of 1st Field Survey to JICA Headquarter on 7th January and JICA India Office on 15th January 2016;
- Interview and questionnaire survey to Japanese and Indian companies in food industry in Japan and India;
- Submission of interim report to JICA on 29th January 2016;
- Additional data collection and discussions with various stakeholders during 2nd Field Survey;
- Site visits to Visakhapatnam, Vizianagaram, West and East Godavari, Kurnool, Chittoor, Anantapur, and Guntur during 2nd Field Survey;
- Attending to TV conference connecting JICA Headquarter and JICA India Office on 15th February 2016 in respect of the survey progress;
- Attending to JICA Fact Finding Mission from 23rd to 27th February 2016;
- Attending to GoAP delegation to Japan (MAFF, Foodex JAPAN 2016, etc.) and data collection in Japan from 7th to 15th March 2016;
- Wrap-up meeting of 2nd Field Survey for soft components at DoWR conference room on 28th March 2016 (refer to Attachment 1.6.2);
- Final wrap-up Meeting of 2nd Field Survey for all components at DoWR conference room on 18th April 2016 (refer to Attachment 1.6.3);
- Reporting the outputs of 2nd Field Survey to JICA Headquarter and JICA India Office on 2nd May 2016 by video conference;
- 3rd Field Survey from 15th to 24th May 2016;
- Submission of draft final report to JICA on 6th June 2016;
- Discussion with JICA on draft final report for the finalisation; and
- Submission of final report to JICA on 17th June 2016.

2. OVERVIEW OF POLICIES AND REGULATIONS FOR PROMOTING AGRICULTURE AND VALUE CHAIN

2.1 General

The Government of India as well as the Government of Andhra Pradesh considers agriculture reform for the revitalisation of primary sector through promotion of food value chain from production up to marketing as the priority objective. This chapter reviews policies and regulations in respect of agriculture development in the central government as well as the Government of Andhra Pradesh in this context.

2.2 Policy and Plan of Agriculture and Allied Sectors in Central and Andhra Pradesh State Governments

2.2.1 Policy and Plan of Agriculture and Allied Sectors in Central Government

At 157.35 million ha, India holds the second largest agricultural land in the world. With 20 agro-climatic regions, all 15 major climates in the world exist in India. India is the largest producer of spices, pulses, milk, tea, cashew, and jute; and the second largest producer of wheat, rice, fruits and vegetables, sugarcane, cotton, and oilseeds. Furthermore, India is the second in global production of fruits and vegetables, and is the largest producer of mango and banana. It also has the highest productivity of grapes in the world.

The total food grains production in India reached an all-time high of 251.12 million metric tonnes (MMT) in FY2015 (as per 3rd advance estimates). Rice and wheat production in the country increased by at 102.54 MMT and 90.78 MMT, respectively. India is amongst the 15 leading exporters of agricultural produce in the world. Agricultural export constitutes 10% of the country's exports and is the fourth-largest exported principal commodity.

Agriculture, therefore, plays a vital role in India's economy. Over 58% of the rural households depend on agriculture as their principal means of livelihood. Agriculture, along with fisheries and forestry, as per estimates by the Central Statistics Office (CSO) contributed about 16.1% of the gross value added (GVA) during 2014–15 at 2011–12 prices. During Q1 FY2016, agriculture and allied sectors grew 1.9% year-on-year and contributed 14.2% of GVA.

At the central government level, the Department of Agriculture and Cooperation (DoAC) under the Ministry of Agriculture (MoA) is responsible for the development of the agriculture sector in India.

(1) Important Agricultural Policy Measures in India since Its Independence

Important agricultural policy measures in India since independence are in Table 2.2.1 below.

Table 2.2.1 Important Agricultural Policy Measures in India since Its Independence

SN.	Policy	Important Agricultural Policy Measures
(a)	Technological Measures	Initiation of measures to increase agricultural production substantially to meet the growing needs of the population and also to provide a base for industrial development, which include steps to increase both extensive and intensive cultivation. For the former, irrigation facilities were provided to a large area on an increasing basis and area hitherto unfit for cultivation was made fit for cultivation. For the latter, new agricultural strategy was introduced in the form of a package programme in selected regions of the country in 1966. To sustain and extend this programme to larger areas of the country, steps were initiated to increase the production of high-yielding varieties of seeds, fertilisers, and pesticides within the economy and supplement domestic production by imports whenever necessary. This has made the country self-reliant, India has turned from large importer of food grains to net exporter of food grains.
(b)	Land Reforms	Land reform measures to abolish intermediary interests on land and transfer of land to actual tiller of the soil were expected to be taken up on a priority basis. Measures taken under this includes: - Abolition of intermediaries. - Tenancy reforms to: ❖ Regulate rents paid by tenants to landlords;

SN.	Policy	Important Agricultural Policy Measures
		❖ Provide security of tenure to tenants; and ❖ Confer ownership rights on tenants. - Imposition of ceilings on holdings in a bid to procure land for distribution amongst landless labourers and marginal farmers.
(c)	Institutional Credit	After the nationalisation of banks in 1969, nationalised banks have paid increasing attention to the needs of agriculture. Regional rural banks were also set up to deal specially with the needs of agricultural credit. The National Bank for Agriculture and Rural Development (NABARD) was also set up. As a result of the expansion of institutional credit facilities to farmers, the importance of moneylenders has suddenly declined and so has the exploitation of farmers at the hands of moneylenders.
(d)	Procurement and Support Prices	Another policy measure of significant importance is the announcement of procurement and support prices to ensure fair returns to the farmers so that even in years of surplus, the prices do not tumble down and farmers do not suffer losses. This is necessary to ensure that farmers are not 'penalised' for producing more. In fact, the policy of the Commission for Agricultural Costs and Prices has been adopted to announce fairly high prices in a bid to provide incentive to the farmers to expand production.
(e)	Input Subsidies to Agriculture	The objective of the input subsidisation is to increase agricultural production and productivity by encouraging the use of modern inputs in agriculture. Under the government policy, various inputs to the farmers are supplied at prices, which are below the level that would have prevailed in the open market.
(f)	Security System	In a bid to provide food grains and other essential goods to consumers at cheap and subsidised rates, the Government of India has built up an elaborate food security system in the form of Public Distribution System (PDS) during its planning period. PDS not only ensures the availability of food grains at cheap prices to the consumers but also operates as a 'safety net' by maintaining larger stocks of food grains in order to combat any shortages that might occur in some years and/or in certain areas of the country.
(g)	Targeted Public Distribution System (TPDS)	The government has streamlined the PDS by issuing special cards to people below poverty line (BPL) and selling essential articles under PDS to them at specially subsidised prices with better monitoring of the delivery system. Under the new system, the states are required to formulate and implement foolproof arrangements for identification of the poor, for delivery of food grains to fair price shops (FPS), and for its distribution in a transparent and accountable manner at FPS level. Under TPDS, each poor family is entitled to a 10 kg of food grains per month at specially subsidised prices. Effective from April 2002, the BPL allocation of food grains was increased from 20 kg (in April 2000) to 35 kg per family per month. According to the economic survey in 2007-08, 73% of the poor and very poor families benefited from TPDS.

Source: JICA Survey Team based on information from the Planning Department, GoAP

(2) National Policy for Farmers, 2007

The Government of India approved the National Policy for Farmers in 2007. The policy provisions, inter alia, include asset reforms in respect of land, water, livestock, fisheries, and bio-resources; support services and inputs like application of frontier technologies; agricultural bio-security systems; supply of good quality seeds and disease-free planting material, improving soil fertility and health, and integrated pest management systems; support services for women like crèches, child care centres, nutrition, health and training; timely, adequate, and easy reach of institutional credit at reasonable interest rates, and farmer-friendly insurance instruments; use of information and communication technology and setting up of farmers' schools to revitalise agricultural extension; effective implementation of minimum support prices (MSP) for crops across the country, development of agricultural market infrastructure, and rural non-farm employment initiatives for farm households; and integrated approach for rural energy.

(3) Restructuring of the Missions/Schemes during the 12th Five-Year Plan

In order to achieve the targeted growth rate of 4% during the 12th Five-Year Plan (2012-17) and ensure focused approach, as well as to avoid overlap, all the schemes of the Department of Agriculture and Cooperation (DoAC) have been restructured into five missions, i.e., National Food Security Mission (NFSM), Mission for Integrated Development of Horticulture (MIDH), National Mission on Oil Seeds

and Oil Palm (NMOOP), National Mission for Sustainable Agriculture (NMSA), and National Mission on Agricultural Extension and Technology (NMAET); four central sector schemes i.e., National Crop Insurance Programme (NCIP), Integrated Scheme on Agri-Census and Statistics (ISAC&S), Integrated Scheme of Agriculture Marketing (ISAM), and Integrated Scheme of Agriculture Cooperation (ISAC); and one state plan scheme viz. Rashtriya Krishi Vikas Yojana (RKVY).

(4) Recent Policy Agricultural Decisions (by current National Democratic Alliance (NDA) Government)

In addition to the existing missions/schemes, the new schemes introduced in the years 2014-15 are shown in Table 2.2.2.

Table 2.2.2 Recent Policy Decisions in the Years 2014-15

SN.	New Schemes	Recent Policy Decisions
(a)	Soil Health Card Scheme	Centrally sponsored scheme for issuing soil health card to every farmer. This card is a report of soil fertility status and provides an advisory on soil test based on the use of fertilisers and soil amendments. The goal of this scheme is to promote soil test based application of fertilisers in respect of all the 14 crore holdings in the country and to implement uniform norm in the sampling and testing of soil. Soil data and information will be made available to all farmers so that they can apply appropriate dosage of fertiliser to increase productivity and profitability. Demonstrations will be conducted for farmers to show balanced nutrient management. Cards will be renewed after every three years. The scheme has been approved for issuance of soil health cards to every farmer of the country during the remaining three years of the 12th Five-Year Plan (2014-15 to 2016-17). Total outlay of INR 568.54 crore has been approved for the scheme. State-wise allocation has also been made for establishing 100 mobile soil testing laboratories in 2014-15.
(b)	Paramparagat Krishi Vikas Yojna (PKVY)	To give a fillip to organic production system, groups of farmers would be motivated to take up organic farming including adoption of participatory guarantee system (PGS) certification, besides, creating facilities of production of organic manure/bio-fertiliser/bio-pesticides and marketing of produce under the scheme. Fifty or more farmers will form a cluster having 50 acres of land to take up the organic farming under the scheme. The scheme envisages formation of 10,000 clusters covering five lakh acre areas under organic farming in its first three years. There will be no liability on the farmers for expenditure on certification. Every farmer in a cluster will be provided an assistance of INR 20,000 per acre in three years towards its conversion and adoption of organic farming and towards market assistance.
(c)	Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)	It has been launched with the vision of extending the coverage of irrigation 'Har Khet ko Pani' (water to every field) and improving water use efficiency 'Per Drop More Crop' in a focused manner with end to end solution on source creation, distribution, management, field application, and extension activities. PMKSY has been approved for implementation across the country with an outlay of INR 50,000 crore in five years.
(d)	Price Stabilisation Fund (PSF) for Cereals and Vegetables	The government has established a central sector scheme of Rice Stabilisation Fund with an initial corpus of INR 500 crore to support market interventions for price control in order to reduce price volatility in perishable agricultural commodities (e.g., onions, potatoes, and tomatoes). With the setting up of this price stabilisation fund (PSF), farmers will be able to get fair price for their produce while consumers would be able to purchase the same at affordable prices. PSF will be used to advance interest free loan to state governments and central agencies to support their working capital and other expenses on procurement and distribution interventions for such commodities. For this purpose, the states will set up a revolving fund to which centre and state will contribute equally (50:5). As far as possible, the procurement of these commodities will be undertaken directly from farmers or their organisations at farm gate/Mandi and made available at a more reasonable price to the consumers.
(e)	Augmented Agricultural Credit Flow	Government has decided in June 2014 to double the flow of agriculture credit in three years with reference to the base year 2003-04. Against the credit flow of INR 86,981 crore in 2003-04, agriculture's credit target of INR 8 lakh crore has been set for 2014-15. Concessional crop loan at 7% interest is available to the farmers up to the limit of INR 3 lakhs. Further, 3% interest subvention is admissible to farmers who repay their loan in time. In order to discourage distress sale of crops by farmers, the benefit of interest subvention has been made available to small and marginal farmers having Kisan Credit Card for a further period of up to six months (postharvest) on the same rate as available to crop loan against negotiable warehouse receipts. Since September

SN.	New Schemes	Recent Policy Decisions
		2014, NABARD has started making available long-term loan on concessional rates in agriculture and related fields. Initial allotment of INR 5,000 crore has already been made for this purpose.
(f)	National Market through Agri-Tech Infrastructure Fund (ATIF)	The national market through ATIF has an initial allocation of INR 200 crores to address the challenges being faced in the present day agricultural marketing system, especially to ensure remunerative price to farmer. This initiative will help the farmer in enhancing marketing of the produce, improved access to market related information, better price discovery and also in accessing greater number of buyers within and outside the state through transparent auction processes. ATIF is aimed at migration towards a national market with implementation of an appropriate common e-market platform that would start with 585 regulated wholesale markets in the states across the country. This platform, both to an extent in terms of software and hardware, will be provided free of cost to the states and union territories (UTs). The state will undertake reforms prior to seeking assistance under the scheme in respect of a single license to be valid across such as single point levy of market fee, provision for electronic auction as mode for price discovery, and provision for integrating warehouse into the marketing system. To create a common e-marketing platform for agri-commodities in the Agriculture Produce Marketing Committees (APMCs) in the state as first step towards the creation of a national market. A committee has been set up under the chairmanship of Prof. Ashok Gulati to suggest a roadmap for the implementation of the model act/report of state marketing ministers.

Source: JICA Survey Team based on information from the Planning Department, GoAP

(5) Policy and Plan of Water Sector in India

The Indian economy and society face daunting challenges in the water sector. The demands of a rapidly industrialising economy and urbanising society come at a time when the potential for augmenting supply is limited. Water tables are falling and water quality issues have increasingly come to the fore. As drilling deeper for water, groundwater contaminated with fluoride and arsenic is encountered. Both rivers and groundwater are continuously polluted by untreated effluents and sewage. Climate change poses fresh challenges, with its impact on the hydrologic cycle. More extreme rates of precipitation and evapotranspiration will exacerbate the impact of floods and droughts. It is no wonder that conflicts across competing uses and users of water are growing by the day. Meanwhile, water use efficiency in agriculture, which consumes around 80% of the water resources, is only around 38%, which compares poorly with 45% in Malaysia and Morocco as well as 50–60% in Israel, Japan, China, and Taiwan.

These challenges can only be met through a paradigm shift in the management of water resources in India. This shift comprises the following elements:

- A move away from a narrowly engineering, construction-centric approach to a more multidisciplinary, participatory management approach to major and medium irrigation projects, with central emphasis on command area development and a sustained effort at improving water use efficiency.
- Since groundwater accounts for nearly two-thirds of India's irrigation and 80% of domestic water needs, it needs a participatory approach for sustainable management of groundwater based on a new programme of aquifer mapping.
- A massive programme for watershed restoration and groundwater recharge must be launched by transforming MGNREGA into the largest watershed programme, giving renewed energy to the reformed IWMP launched in the Eleventh Five Year Plan, which is a completely revamped programme, i.e., Repair, Renovation and Restoration (RRR) of Water Bodies.
- A new approach to rural drinking water and sanitation.
- All urban water supply projects to necessarily integrate sewage systems with them.
- Definite targets for recycling and reuse of water by the Indian industry to move in conformity with international standards.
- Renewed focus on non-structural mechanisms for flood management; vastly improved systems for water-related data collection and management as well as transparency in availability of data.
- Adaptation strategies to mitigate the likely impact of climate change to be pursued under the National Water Mission (NWM).

- Perennial rivers with sufficient draft through the year could be the focal point of a renewed thrust to inland waterways transport as an environment-friendly economical mode of transport compared to road and rail.
- A new legal and institutional framework for water based on broader consensus among the states.

To achieve the broad objectives, the 12th Five-Year Plan has taken up seven priority policies and plans for the water sector as stated below in Table 2.2.3.

Table 2.2.3 Priority Policies and Plans for the Water Sector

SN.	Policy	Plan
1	Need for Paradigm Shift	- Limit to large irrigation projects; - Review of major and medium irrigation (MMI) projects in India - The Accelerated Irrigation Benefits Program (AIBP) experience - Macro Management of Agriculture (MMA) reform
2	National Irrigation Management Fund (NIMF)	- Establishing a non-lapsable NIMF, for contribution to irrigation service fee (ISF) collection from irrigator
3	Modified Accelerated Irrigation Benefits Programme (AIBP)	- To modify AIBP - To emphasise the centrality of Command Area Development (CAD) to all irrigations projects
4	Groundwater: An Emerging Crisis	- Mapping India's aquifers - National Groundwater Management Program - Central Groundwater Board (CGWB) reforms - Breaking the groundwater-energy nexus - Promoting groundwater development in Eastern India
5	Integrated Watershed Management Programme (IWMP)	- Integration of watershed management programmes - Capacity building and institutional building - Convergence of IWMP with allied programmes such as MGNREGA, NRLM, and Rastriya Krishi Vikas Yojna (RKVY) - Focus on physical outcomes and monitorable indicators
6	Repair, Renovation and Restoration (RRR) of Water Bodies	- Restoring the health of the catchment areas to reduce the rate of siltation of the water bodies and to prolong their life - Developing the command areas to be served by these water bodies
7	Urban Water and Waste Management	- Management and equitable support of water - Groundwater: missing link in city water accounts - Water-waste connection - Investment in water and sanitation

Sources: 12th Five-Year Plan (2012–2017), Faster, More Inclusive and Sustainable Growth, Volume I, Planning Commission, GoI (2013).

(6) Policy in Food Processing Sector

(a) Food Processing Sector in 12th Five-Year Plan 2012-17

During the 11th Five-Year Plan 2007-2011, the Government of India focused on introducing public-private partnership (PPP) and appropriate infrastructure investment toward the development of food processing industry. The government, therefore, formulated the three plans such as: 1) mega food park scheme, 2) cold chain, value addition and preservation infrastructure, and 3) modernisation of abattoirs. The 12th Five-Year Plan 2012-17 basically follows the previous plan. In addition, decentralised process of implementation with greater involvement of states is addressed in selection of projects vis-à-vis beneficiaries and monitoring their implementation so as to consider the balanced growth amongst the states as well as to involve small and medium enterprises, which account for a major part of food processing industry. The main objectives, strategy, and key recommendations for food processing sector in the 12th Five-Year Plan are stated in Table 2.2.4.

Table 2.2.4 Recommendations for Food Processing Sector in the 12th Five-Year Plan 2012-17

Item	Statement
Objectives	- Develop the food processing sector to enable containment of food inflation and food wastage. - Create one million additional jobs during the 12th Five-Year Plan period.
Strategy	- Decentralised process of implementation with greater involvement of states in selection of projects vis-à-vis beneficiaries and monitoring their implementation.

Item	Statement
	- Focus on policy making and coordination so as to address critical issues impacting the value chain.
	- Infrastructure development such as mega Food Park, cold chain, and abattoirs to be continued with the expansion of scope and depth so as to ensure sustainability of the value chains.
Key Recommendations	- Setting up of the National Mission on Food Processing to improve coordination and implementation of schemes and to enable greater involvement of state governments. - Expanding and modifying existing infrastructure development schemes such as Mega Food Parks Scheme and Integrated Cold Chain Scheme. - Setting up and modernisation of abattoirs such as establishment of new abattoirs and modernisation of existing abattoirs. - Developing and strengthening of existing and new institutions. - Taking up a nationwide skill development programme along the lines of special projects for skill development of rural youths under the Swarnajayanti Gram Swarozgar Yojana (SGSY) of the Ministry of Rural Development (MoRD). - Putting in place a network of food testing laboratories (government/private) through provision of incentives. - Encouragement for larger participation in Codex deliberations and setting up/strengthening of Codex Cell in the Food Safety and Standards Authority of India (FSSAI) to promote, coordinate, and monitor related initiatives at the level of stakeholders. - Setting up of an innovation fund and venture capital fund for food processing to promote innovations and technology development.

Source: 12th Five-Year Plan 2012-17

(b) Roles of the Ministry of Food Processing Industries

The Ministry of Food Processing Industries (MOFPI) was set up in 1988 to formulate and implement the policies and plans for food processing industries. The role of MOFPI is to facilitate and act as a catalyst to attract quality investments within India and abroad into the food processing sector, which aims:

- Better utilisation and value addition of agricultural produce for the enhancement of income of farmers;
- Minimising wastage at all stages in the food processing chain by the development of infrastructure for storage, transportation, and processing of agro-food produce;
- Induction of modern technology into the food processing industries from both domestic and external sources;
- Encourage research and development (R&D) in food processing for product and process development and improved packaging;
- Provide policy support and support for the creation of infrastructure, capacity expansion/upgradation, and other supportive measures from the growth of these sectors; and
- Promote export of processed food products.

Table 2.2.5 shows the central sector schemes for food processing sector during the 12th Five-Year Plan period (2012-2017).

Table 2.2.5 Central Sector Schemes and their Outline

Name of Schemes	Outline of the Schemes	Budget Allocation in 2015-16 (Rs in million)
Scheme for Infrastructure Development		3,290.0
Mega Food Parks (MFP)	Mega Food Parks Scheme aims to create a modern food processing infrastructure for the processing units based on a cluster approach and on a hub and spoke model in a demand driven manner. The scheme intends to facilitate the establishment of an integrated value chain, with food processing at the core and supported by requisite forward and backward linkages.	
Cold Chain, Value Addition, and Preservation Infrastructure	The scheme provides assistance for developing integrated and complete cold chain and preservation infrastructure facilities from the farm gate to the consumer.	
Modernisation of Abattoirs	The main objective of the scheme is to assist in setting up of modern municipal abattoirs so as to provide scientific and hygienic slaughtering of animals, waste management and pollution control,	

Name of Schemes	Outline of the Schemes	Budget Allocation in 2015-16 (Rs in million)
	and chilling facility so as to ensure supply of safe and hygienic meat to consumers.	
Scheme for Technology Upgradation/Establishment /Modernisation of Food Processing Industries	The objective of the scheme is the creation of new and upgradation of existing processing capacity in various sectors e.g., milk, fruit and vegetables, meat, poultry, fishery, wine, bakery products and grain milling including cereals, oil seeds, rice milling, flour and pulses.	1,000.0
Scheme for Quality Assurance, R&D, and Promotional Activities	Under this scheme assistance is provided for (i) setting up/upgradation of food testing laboratories; (ii) adoption of food safety and quality assurance systems such as ISO 9000/ISO 22000/hazard analysis and critical control points (HACCP), good manufacturing practices (GMP), and good hygienic practices (GHP); and (iii) grant-in-aid for R&D for product and process development, improved packaging, and value addition to benefit the food processing industries.	300.0
Scheme for Human Resource Development	The scheme provides financial assistance by way of grants for establishing food processing training centres (FPTC), creation of infrastructure for running degree/diploma courses in food processing by educational institutions/universities and to conduct entrepreneurship development programmes (EDPs).	50.0
Scheme for Strengthening of Institutions and Administration	Under this scheme grants are provided for the National Institute of Food Technology, Entrepreneurship and Management (NIFTEM) at Kundli, Haryana; the Indian Institute of Crop Processing Technology (IICPT) Thanjavur, Tamil Nadu; Indian Grape Processing Board, Pune, Maharashtra; and National Meat and Poultry Processing Board, New Delhi.	160.0
Total		4,800.0

Source: Outcome budget of the Ministry of Food Processing Industries 2015-16.

(c) Mega Food Park Scheme

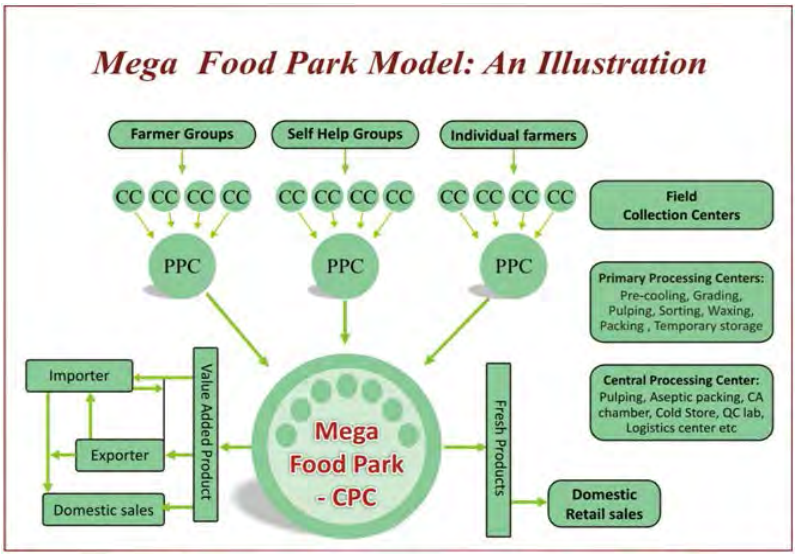
The Government of India launched the Mega Food Park (MFP) Scheme to establish mega food cluster in India. Prior to the MFP scheme, the MOFPI had launched the Central Sector Food Park Scheme in the 8th Five-Year Plan (1992-1997). However, the scheme was concluded as under-utilisation due to the following reasons:

- According to the 11th Five-Year Plan document published in 2008, most of the 54 food parks sanctioned.
- Even in operational parks, the number of tenants was limited since only 28 units were running in the eight parks.
- The fund that went to the schemes was not directly from the central government but from the state governments. It resulted in failure to build parks and the amount of fund given to the scheme was low.

Therefore, the government replaced the Food Park Scheme with the Mega Food Park Scheme during the 11th Five-Year Plan[1].

The Mega Food Parks Scheme aims to create a modern food processing infrastructure for the processing units based on a cluster approach and on a hub and spoke model in a demand driven manner. The scheme intends to facilitate the establishment of an integrated value chain, with food processing at the core and supported by requisite forward and backward linkages, which includes collection centres (CC), primary processing centres (PPC), central processing centre (CPC), and cold chain infrastructure.

[1] Report on Evaluation of the Impact of the Scheme for Mega Food Park of the Ministry of Food Processing Industries, ICRIER, July 2015.

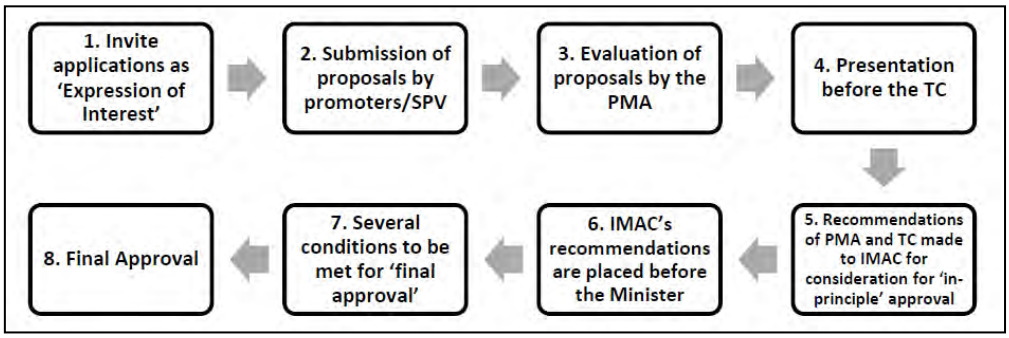


Source: Website of the Ministry of Food Processing Industries

Figure 2.2.1 Mega Food Park Model

The extent of land required for establishing the CPC is around 50-100 acres, although the actual requirement of land would depend upon the business plan, which may vary from region to region. In addition to land required for setting up the CPC, land would be required for setting up PPCs and CCs at various locations.

The scheme envisages a one-time capital grant of 50% of the project cost (excluding land cost) subject to a maximum of INR 500 million in general areas except for difficult and hilly areas, such as the northeast region. Approval procedure of mega food parks is illustrated in Figure 2.2.2.



Source: Report on Evaluation of the Impact of the Scheme for Mega Food Park of the Ministry of Food Processing Industries, ICRIER, July 2015.

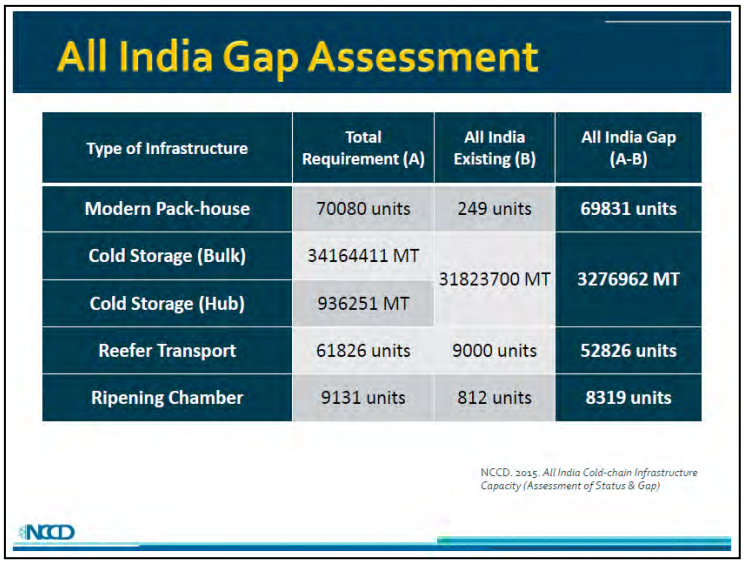
Figure 2.2.2 Approval Procedure of Mega Food Parks

The ministry will invite applications as expression of interest (EOI) from the special purpose vehicle (SPV) [1]. The proposal submitted in response to the EOI will be evaluated by the Program Management Agency (PMA) appointed by the ministry [2, 3]. The applicants will be invited to make a presentation of their proposals before the technical committee [4]. The final evaluation report along with the recommendations of the technical committee will be placed before the Inter-Ministerial Approval Committee (IMAC) for consideration of "In-Principle Approval" to the projects [5]. Recommendation of the IMAC will be placed before the minister for approval [6]. Project will be accorded with final approval on fulfilment of the several conditions, such as submission of detailed project report (DPR), proof of possession for at least 50 acres of contiguous land, and proof of appointment of project management consultant (PMC) [7, 8][2].

[2] Revised Guidelines for Mega Food Park Scheme effective from 2 October 2014, F.No.21-MFPI/11-Mega Food Park, Ministry of Food Processing Industries.

(d) Cold Chain, Value Addition and Preservation Infrastructure

The scheme provides assistance for developing integrated and complete cold chain and preservation infrastructure facilities to encourage setting up of backward and forward linkages in the agricultural supply chain in the country, to minimise the postharvest losses, and to enhance value addition in the agricultural produce.



Source: Cold Chain Opportunities in India 2015, NCCD

Figure 2.2.3 Assessment of Status and Gap of Cold Chain Infrastructure in India

Under this scheme, the financial assistance of 50% of the total cost of plant and machinery and technical civil works is provided in the general areas and 75% for northeast region and difficult areas. The components of the cold chain projects are the following:

- Minimal processing centre at the farm level with the centres having facilities for weighing, sorting, grading waxing, packing, pre-cooling, control atmosphere/modified atmosphere cold storage, normal storage, and individual quick freezing (IQF).
- Mobile pre-cooling vans and reefer trucks.
- Distribution hubs with multi products and multi control atmosphere/modified atmosphere chambers/cold storage/variable humidity chambers, packing facility, cleaning in process (CIP), fog treatment, individual quick freezing (IQF), and blast freezing.
- Irradiation facility.

Source: Website of the Ministry of Food Processing Industries

Figure 2.2.4 Cold Supply Chain Model

During the 11th Five-Year Plan period, the government had approved 79 cold chain projects for financial assistance by the ministry. The ministry had endorsed 74 cold chain projects for financial assistance although it cancelled 19 projects later. Thus, 55 cold chain projects were implemented. Likewise, 57 projects during the 12th Five-Year Plan (as of October 2014) are at various stages of implementation. These are shown in Table 2.2.6.

Table 2.2.6 Status of Cold Chain Projects

Item	Approved	Endorsed	Cancelled	Implemented
11th Five-Year Plan Period	79	74	19	55
12th Five-Year Plan Period (as of October 2014)	75	66	9	57
Total	154	140	28	112

Source: Annual Report 2014-15, Ministry of Food Processing Industries

The facilities expected to be created by the approved 112 cold chain projects are as follows:

- Cold storage, controlled atmosphere/modified atmosphere storage, and deep freezer (388,000 MT)
- Individual Quick Freezing (94.05 MT/hour),
- Milk storage (106.29 MT/day)
- Reefer carriers (624 units)

(e) Modernisation of Abattoirs

The main objective of the scheme is to assist in setting up of modern municipal abattoirs in order to provide scientific and hygienic slaughtering of animals, waste management and pollution control, and chilling facility ensuring the supply of safe and hygienic meat to consumers.

Financial assistance for setting up of new abattoirs/modernisation of existing abattoirs is provided at 50% of the cost of plant and machinery and technical civil works in general areas, which are subjected to a maximum of Rs. 150 million for each project. For difficult areas, the ceiling is 75% of the cost of plant and machinery and technical civil works, which are subjected to a maximum of Rs. 150 million for each.

During the 11th Five-Year Plan period, setting up of ten new abattoirs was approved by the government and about Rs. 1,290 million was sanctioned by the ministry. Out of the ten projects, five projects have been completed as of October 2015. Currently, 20 new abattoirs have been approved under the 12th Five-Year Plan and about Rs. 2,200 million was sanctioned.

Box 2.2.1 Food Losses in India

A study sponsored by MOFPI in 2010 estimated that the post-harvest losses in India was about INR 441.43 billion per year at 2009 wholesale prices for 46 agricultural produces in 106 randomly selected districts. The rate of cumulative wastage is shown in the table. The rate of fruits and vegetable is particularly high in India due to the complexity of supply chain and lack of proper cold chain.

Post-harvest losses by crop (2010)

Crop	Wastage (%)
Cereals	3.9-6.0
Pulses	4.3-6.1
Oil seeds	6.0
Fruits and vegetables	5.8-18.0
Milk	0.8
Fisheries	2.9-6.9
Meat	2.3
Poultry	3.7

Source: MOFPI

2.2.2 Policy and Plan of Agriculture and Allied Sectors in Andhra Pradesh State Government

The residual state of Andhra Pradesh has 13 districts spread over the six agro-climatic zones and broadly five different soil types to cultivate a wide range of crops. The average rainfall of the state is 911 mm. The total geographical area of Andhra Pradesh is 16.020 million ha. Out of this, 40.96% is under the net sown area, including fish culture (6.561 million ha). The state has a net irrigated area of 3.014 million ha (2013-2014) and cropping intensity of 1.26 (2013-14). The total irrigation potential created up to December 2015 is 4.157 million ha.

The contribution of agriculture and allied sector to the gross state domestic product (GSDP) in 2014-15 was 27.59%. During the past 11 years, the GSDP contribution of agriculture and allied sectors has declined from 29.85% to 27.59%. From this, agriculture is the largest contributor to the GSDP

accounting for over 31% of the primary sector followed by livestock at 25.64%, horticulture at 24.68%, and fisheries at 14.86%. The compound annual growth rates (CAGR) clocked by each of these sectors from 2004-05 to 2014-15 are 10%, 12%, 16%, and 21%, respectively. Meanwhile, nearly 70% of the rural working population in the state is still dependent on agriculture. As per the second advance estimates, the area under food grains is estimated to be 3.908 million ha in 2014-15 as against 4.281 million ha in 2013-14, showing a decrease of 8.7%. The total production of food grains in 2014-15 is estimated at 11.143 million MT while it was 11.698 million MT in 2013-14, showing a decrease of 4.7%.

(1) Past Important Agricultural Policy Measures in the State

Andhra Pradesh over the decades has witnessed gradual transformation in the agricultural sector. The nature of the transformation itself has undergone changes overtime. During the 1980s, there was a shift in agriculture from traditional cereal based system towards commercial commodities such as oilseeds, cotton, and sugarcane. By the 1990s, even though the crop sector witnessed high volatility due to consecutive droughts and decelerating crop yields, the transformation continued towards high-value commodities such as fruits, vegetables, milk, meat, poultry, and fish. In fact, high-value commodities performed impressively and rescued the agriculture sector to a great extent. Making the agriculture sector viable and profitable and improving income in agriculture and allied sectors are the top priorities of the state. Towards this, during the 12th Five-Year Plan period renewed foci are on micro irrigation, system of rice intensification (SRI) cultivation, micronutrient application, development of dry land agriculture, farm mechanisation, increasing storage capacity, and other agriculture related strategies.

(2) Recent Agricultural Policy Decisions (by the Government of Residual State of Andhra Pradesh)

While the current incumbent government of residual state of Andhra Pradesh is yet to issue its agricultural policy, the "White Paper on Agriculture, Horticulture, Sericulture, Animal Husbandry, Dairy, Fisheries and Agricultural Marketing[3]" issued in July 2014 and "A Strategy Paper for Mission on Primary Sector-Agricultural Transformation in Andhra Pradesh[4]" published in October 2014 lay out its policy and programme focus for these sectors. The former is summarised in Attachment 2.2.1 and the latter is briefly stated in Table 2.2.7.

Table 2.2.7 Outline of a Strategy Paper for Mission on Primary Sector

Sector	Key Strategy
Agriculture	1. Soil health mapping and promote the use of micronutrients 2. Bridge crop yield gaps in pigeon pea, chick pea, and groundnut 3. Pulses and oilseeds revolution 4. Enhance utility of rice fallows on the coastal of Andhra Pradesh 5. Promote rainwater harvesting 6. Integrated water resource management (IWRM) 7. Support organic farming 8. Ensure food security
Horticulture	1. Increase cultivation of vegetables for better quality and higher production. 2. Distribute more farm fresh vegetable vending vans to farmer groups for direct marketing of their produce. 3. Encourage oil palm cultivation in the state. 4. Identify crop specific clusters and promote high value crops (fruits, vegetables, and flowers). 5. Converge the Mahatma Gandhi National Rural Employment Scheme (MGNREGS) with Horticulture Department for better utilisation of labour and empowerment of backward communities. 6. Promote postharvest management practices through the establishment of pack houses, cold storage and ripening chambers, reduce postharvest losses and promote exports. 7. Improve marketing facilities through Rythu bazaars, vegetable markets, collection centres and refer vans so that the farmers get remunerative prices for their produce. 8. Promote precision farming through micro irrigation, fertigation, greenhouse cultivation, mulching for better water conservation and quality production.
Sericulture	1 Reorient the strategies for better productivity of bivoltin silk. 2. Increase in mulberry area, production, and productivity. 3. Integrate project planning, i.e., leaf to cloth (soil to silk). 4. Cluster approach in pre and post cocoon sectors (i.e., mulberry cultivation, silkworm rearing, silk reeling, twisting, and weaving sectors).

[3] http://ap.meeseva.gov.in/DeptPortal/Download-lat/White%20Paper%20on%20Agriculture%20Department.pdf
[4] http://www.aponline.gov.in/apportal/Downloads/ICRISAT%20Book%20English.pdf

Sector	Key Strategy
Animal Husbandry	1. Enhance milk production and productivity of animals; enable all supporting services. 2. Promote higher egg production and value addition within the state. 3. Encash huge demand for meat. Provide better breeds and emergency animal health care. 4. Establish modern wool harvesting, processing and marketing centres with private entrepreneurs.
Diary	1. Develop dairy value chain in uncovered areas under cooperative ambit. 2. Provide online milk monitoring and payment gateway (OMM&PG) such as Milkosoft, aiming direct payment to farmers through their bank account to enable timely payment to farmers. 3. Increase the share of milk procurement by organised sector to about 70% from the present level of 30% in next the five years by 2018-19 by establishing rural cold chain, i.e., bulk milk cooling units (BMCUs), milk chilling centres (MCC), dairy plants under cooperative, joint ventures, and PPP modes. 4. Evolve effective coordination between livestock development and dairy development activities to ensure seamless service delivery to farmers.
Fisheries	1. Establish more fishing harbours in Juvvaladinne (Nellore District), Uppada (East Godavari District), Vadarevu (Prakasam District) and Nizampatnam Phase II (Guntur District) through PPP mode. 2. Establish specific pathogen free (SPF) brood stock for freshwater aquaculture and brackish water aquaculture and import of SPF seed for shrimp farming to make available quality seed to shrimp farmers. 3. Provide a policy framework to promote fish processing and fish feed industry by private players and for allotment of marine areas and areas in large reservoirs for cage culture through fishermen cooperatives/private participation. 4. Promote large scale participation of women through the Mahila Matsya Mitra Groups (MMGs) in fish marketing and fish processing through upgradation of their skills. 5. Promote "Blue Revolution" through a multipronged approach including large-scale cage culture in sea and large reservoirs in coordination with the Central Marine Fisheries Research Institute (CMFRI), and establishment of cold chain through PPP mode/government schemes.
Agricultural Marketing	1. Strengthen the existing Rythu bazaars and establish new Rythu bazaars wherever feasible. 2. Link these bazaars to efficient agri-logistics parks (includes storage, cold storage, and transportation) in hub and spoke model to be established across the state in collaboration with private agencies on a build-own-operate model. They may utilise the warehouse infrastructure fund of the Government of India. 3. Establish the National Commodity and Derivatives Exchange (NCDEX) of the Government of India terminals across the state to enable transparent procurement, grading, pricing, e-trading, and provide credit. A good bet for low investment and high benefits. This can be done for all major commodity markets across the state. 4. Rythu Bandhu Pathakam–pledge loan to increase from INR 1 lakh to lakhs, free of interest up to 180 days.
Common to All Sectors	1. The crop yield gaps between the state and the country should be reduced through the introduction of high yielding varieties and better extension facilities. 2. Skill upgradation at all levels of government departments, private agencies, and farmers. 3. Enabling single window facilities for availing all kinds of support from the government agencies. 4. Establish PPP mode, pay and use, technological and knowledge sharing mechanisms for farmers and any other users. 5. Innovatively and technologically easy to operate and access extension systems to all farmers in all sectors. 6. Set up a help centre with a three-digit phone number (working 24-7) for agriculture and allied sectors. 7. In all sectors, promote small, medium, and big entrepreneurs for all value addition activities with adequate financial incentives and approvals under single window system. 8. Build and operate efficient and tech savvy management information system (MIS) for all sectors with easy access to all government agencies (at all levels), farmers, traders, processing industries, and universities/colleges. 9. Design and implement result framework document in all departments. 10. Introduce suitable policies and guidelines to promote value addition at all levels and mobilise funds.

Source: A Strategy Paper for Mission on Primary Sector- Agricultural Transformation in Andhra Pradesh, GOAP

(3) Policy and Plan of Water Sector in Andhra Pradesh State

Andhra Pradesh State Water Policy was published on 1st January 2010 before the bifurcation of the state in 2014. A paper titled as Initiatives in irrigation sector published in January 2016 is a part of water policy of residuary Andhra Pradesh State, which aims to make the state drought proof.

According to the above paper, the government of Andhra Pradesh is committed to the outlined objectives and initiated number of measures to ensure the outcomes under the clear cut directions of the Chief Minister a great visionary of the time has directed the water resources development of the state to assess available water resources and utility from village level. Based on the clear understanding about the concerns and challenges in irrigation and allied sectors, the government has devised a specific target oriented mission based strategy for effective results under the guidance of the Department of Water

Resources (DoWR). The time bound targets of water resources sector in Andhra Pradesh State are set as follows.

- Drought proof state
- Water conservation
- Groundwater recharge
- Water management
- Modernisation of irrigation systems
- Completion of on-going projects
- Inter linking of major rivers
- Development of tank cascade system
- Desilting, renovation and repairs to the tanks, feeder channels and supply channels
- Repairs to the existing rain water harvesting systems (RWHS) and construction of new RWHS
- Construction of farm ponds
- Conjunctive use of surface and groundwater
- Improving water use efficiency by 20%
- Bridging the gap ayacut
- Revival of lift irrigation schemes
- Appointment of management committee members of water user associations (WUAs), Distributory committees (DCs) and Project Committees (PCs)
- Tree plantation
- Micro irrigation, rain guns for drought mitigation and life saving irrigation
- Involvement and participation of all the stakeholders and awareness creation
- Monitoring water resources on real time basis, etc.

(4) Food Processing Policy

(a) Outline of Andhra Pradesh Food Processing Policy (2015-2020)

Andhra Pradesh State government formulated a new Food Processing Policy (2015-2020) in July 2015 as shown in Table 2.2.8. The aim of the policy is to capitalise on the rich and diverse food production base of Andhra Pradesh to provide fillip to the sector.

Table 2.2.8 Outline of Andhra Pradesh Food Processing Policy 2015-2020

Item	Statement
Target	・ Make Andhra Pradesh one of the most preferred destinations for food processing sector ・ Attract new investments worth INR 5,000 crore by 2020. ・ Create additional employment opportunity for 50,000 personnel by 2020
Objectives	・ Develop commodity-based clusters to enable a focused and planned approach to develop the food processing industry through a coordinated approach between government departments. ・ Identify and bridge existing infrastructure gaps affecting the food processing industry. ・ Promote innovation and R&D in the industry and ensure continuous technology upgradation. ・ Undertake capacity building and enhance competitiveness of food processing industry in both domestic and international markets.
Major supports	・ Set up integrated food parks across all districts of the state ・ Provide VAT/CST/GST reimbursement for integrated food parks ・ Labour concessions in order to prevent flash strikes ・ Single desk clearance in accordance with the Single Desk Policy (2015-20) ・ Skill development initiatives ・ Assistance for R&D works and testing laboratories ・ Inland Container Depot (ICD): Set up ICD at Chittoor and Kakinada ports to facilitate the import/export of food products. ・ Setting up of Mango Development Board and Banana Development Board ・ Infrastructure support: land allotment and power tariff subsidy. ・ Fiscal incentives, such as land conversion charges, capital subsidy, and interest subsidy. ・ Export incentives: Reimbursement of 30% on road transport charges till inland container depot (ICD).

Source: Andhra Pradesh Food Processing Policy 2015-2020

The policy covers the subsectors of agriculture, horticulture and animal husbandry, however, aquaculture and marine production will be covered under the Fisheries Policy (2015-2020).

The nodal agency to implement the policy is the Andhra Pradesh Food Processing Society (APFPS), which will act as knowledge support centre and is empowered to empanel consultants for pooling and dissemination of information in the food processing sector.

(b) Assistance for Food Parks

Amongst the schemes under Andhra Pradesh Food Processing Policy (2015-2020), the promotion of food parks is highlighted as top priority project. According to the policy, Andhra Pradesh State

government would strive to set up food parks across "all districts" of Andhra Pradesh. These food parks are set up in three categories as shown in Table 2.2.9.

Table 2.2.9 Categories of Food Parks

Category	Required Size of the Park	Pattern of Assistance	
Integrated Food Park	The minimum area of each food park will be 30 acres, with a minimum of ten food processing units in each.	GoAP will provide a grant of 50% of project cost for setting up these food parks, with a limit of INR 20 crore.	GoAP will provide VAT/CST/GST reimbursement during the construction period for a period of two years limited to a maximum INR 2 crore.
Mega Food Park	The minimum area of each food park will be 50 acres, with a minimum of 20 food processing units in each.	GoAP will provide a grant of 50% of project cost for setting up these food parks, with limit of INR 50 crore.	
Ultra-Mega Food Park	GoAP will strive to develop an Ultra Mega Food Park in Kuppam with state-of-the-art infrastructure.	Customised incentives would be offered.	

Source: Andhra Pradesh Food Processing Policy (2015-20), APFPS, Department of Industries and Commerce, Andhra Pradesh State.

Out of the three categories, Ultra Mega Food Park is a unique scheme of Andhra Pradesh State. Since Ultra Mega Food Park is exceeding the expected size of land under Mega Food Park Scheme under MOFPI, Andhra Pradesh State government will customise incentives as per applicable business case.

Andhra Pradesh State government emphasises on "commodity-based cluster development" founded on the food production strengths of respective geographies, therefore, food parks will be also prioritised according to the commodity produced in the identified cluster.

2.3 Policies and Regulations for Foreign Investment to India and Andhra Pradesh State

2.3.1 Policies and Regulations for Foreign Investment to India

Policy and regulations for foreign investment at the central level are formulated by the Ministry of Commerce and Industry. The Ministry of Food Processing Industry also has set up a window for investors to disseminate information on the resource potential in India, policy support, and fiscal incentives offered to investors in the food processing sector.

Table 2.3.1 Policy and Regulations for Foreign Investment to India

Ministry	Policy/Regulation
Ministry of Commerce and Industry	Foreign Direct Investment Policy 2015
	Foreign Trade Policy (2015-2020)
	National Manufacturing Policy
Food Safety and Standards Authority of India (FSSAI) under the Ministry of Health and Family Welfare	Food Safety and Standards Act 2006
Ministry of Food Processing Industries	Investors' Portal

Source: JICA Survey Team

(1) Foreign Direct Investment Policy 2015

(a) Institutions of Investment Promotion

The Department of Industrial Policy and Promotion (DIPP) has announced a Consolidated Foreign Direct Investment (FDI) Policy Circular of 2015, which was effective from May 12, 2015. There are two routes by which India gets FDI. Automatic route is the procedure without prior approval by the government and FDI is permitted by post-notification to the Reserve Bank of India (RBI). The government route, in turn, requires prior approval by the government. Foreign Investment Promotion Board is the responsible agency to oversee this route.

Furthermore, DIPP has set up a special management team to facilitate and fast track investment proposals from Japan. The team, known as "Japan Plus", will comprise representatives from the Government of India and Ministry of Economy, Trade and Industry (METI), Government of Japan.

(b) Regulations on Foreign Investment

FDI is permitted up to 100% without prior approval by the government via automatic route except for

the prohibited sectors and permitted sectors as shown in Table 2.3.2

Table 2.3.2 Prohibited Sectors and Permitted Sectors under FDI Policy 2015

Category	Sector	% of FDI Cap, Entry Route
Prohibited Sectors	a) Lottery business including government/private lottery, and online lottery b) Gambling and betting including casinos c) Chit funds d) Nidhi Company e) Trading in transferable development rights (TDRs) f) Real estate business or construction of farm houses g) Manufacturing of cigars, cheroots, cigarillos, cigarettes, tobacco or tobacco substitutes h) Activities/sectors not open to private sector investment	-
Permitted Sectors	Agriculture a) Floriculture, horticulture, apiculture and cultivation of vegetables and mushrooms under controlled conditions; b) Development and production of seeds and planting materials; c) Animal husbandry (including breeding of dogs), pisciculture, and aquaculture under controlled conditions; and d) Services related to agro and allied sectors. Beside the above, FDI is not allowed in any other agricultural sector/activity	100%, automatic
	Tea plantation a) Tea sector including tea plantations Aside from above, FDI is not allowed in any other plantation sector/activity.	100%, government
	Manufacture of items reserved for production in micro and small enterprises (MSEs) FDI in MSEs, as defined under the Micro, Small and Medium Enterprises Development (MSMED) Act 2006 will be subject to sectoral caps, entry routes, and other relevant sectoral regulations	Depend on undertaking
	Industrial parks Industrial parks - new and existing	100%, automatic
	Trading Cash and carry wholesale trading/wholesale trading (including sourcing from MSEs)	100%, automatic
	Retail trading Single brand product retail trading	100%, automatic up to 49% or government route beyond 49%
	Retail trading Multi brand retail trading (FDI in all products will be permitted subject to conditions mentioned in the policy)	51%, government

Source: Consolidated FDI Policy of 2015, Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Government of India

(2) Foreign Trade Policy 2015-20

The Foreign Trade Policy 2015-20, is notified by the central government, in exercise of powers conferred under Section 5 of the Foreign Trade (Development and Regulation) Act, 1992 (No. 22 of 1992) as amended. In connection with the policy "Make in India" of the current Indian government, the policy has been announced on April 1, 2015. Specifically, the major objectives and applicable schemes of the policy are listed below.

i) Simplification and merger of reward schemes
- Merchandise Exports from India Scheme (MEIS)
- Service Exports from India Scheme (SEIS)
- Chapter 3 Incentives (MEIS and SEIS) to be available for special economic zones (SEZs)
- Duty credit scrips to be freely transferable and usable for payment of custom duty, excise duty, and service tax

ii) Boost to “Make in India”
- Reduced export obligation for domestic procurement
- Higher level of rewards under MEIS for export items

iii) Trade Facilitation and Ease of Doing Business
- Online filing of documents/applications and paperless trade in 24-7 environment;
- Online inter-ministerial consultations;

- Simplification of procedures/processes, digitisation, and e-governance; and
- Forthcoming e-governance initiatives.

iv) Other New Initiatives

In the policy, it has been also decided to add Visakhapatnam and Bhimavaram in Andhra Pradesh as towns of export excellence (product category– seafood), although the government has already recognised 33 towns as export excellence towns.

(3) National Manufacturing Policy

The Government of India has announced a national manufacturing policy in November 2011, with the objectives of enhancing the share of manufacturing in the gross domestic product (GDP) to 25% and creating 100 million jobs by 2022. It also seeks to empower rural youth by imparting necessary skill sets to make them employable. The following focused sectors are given with special attention:

- Employment-intensive industries like textiles and garments, leather and footwear, gems and jewellery and food processing industries;
- Capital goods industries like machine tools, heavy electrical equipment, heavy transport, earthmoving and mining equipment;
- Industries with strategic significance like aerospace, shipping, IT hardware and electronics, telecommunication equipment, defence equipment, and solar energy;
- Industries where India enjoys a competitive advantage such as automobiles, pharmaceuticals, and medical equipment;
- Small and medium enterprises; and
- Public sector enterprises.

(4) Food Safety and Standard Act 2006

Food Safety and Standard Act has been commenced since 2006 instead of repealing various central acts, such as Prevention of Food Adulteration Act 1954, Fruit Products Order 1955, and Milk and Milk Products Order 1992. The act aims to establish a single reference point for all matters relating to food safety and standards as an independent statutory authority such as the Food Safety and Standards Authority of India (FSSAI). The Ministry of Health and Family Welfare of the Government of India is the administrative ministry for the implementation of FSSAI.

(5) Investors' Portal

An "Investors' Portal" has been developed by the Ministry of Food Processing Industries with the intention to disseminate information on the state specific resource potential, policy support, infrastructure facilities, and fiscal incentives offered to investors in food processing sector. The portal also offers online support to investors with regard to their queries and provides hand holding services in the initial stage of setting up their units.

2.3.2 Policies and Regulations for Foreign Investment to Andhra Pradesh State

Andhra Pradesh attracts foreign direct investments in India in the property, petrochemicals, automotive, textiles, aerospace, renewable energy, food processing, and leather sectors. Policy and regulations related to foreign investment in Andhra Pradesh State are formulated by the Department of Industry and Commerce.

Table 2.3.3 Policy and Regulations Related to Foreign Investment in Andhra Pradesh State

Department	Policy/Regulation
Department of Industry and Commerce	Industrial Development Policy (IDP) 2015-20
	Food Processing Policy 2015-20

Source: JICA Survey Team

(1) Industrial Development Policy (IDP) 2015-20

The Government of Andhra Pradesh accords top priority to industrial development to make Andhra Pradesh a progressive and highly industrialised state. In this regard, the Industrial Development Policy (IDP) 2015-20 has been prepared to make Andhra Pradesh the most preferred destination for investors

by providing favourable business climate, excellent infrastructure, good law and order, and peaceful industrial relations. Under the new policy, the government approved the following fiscal benefits covering the categories:

- Micro, Small and Medium Enterprises (a unit having the investment on plant and machinery up to limit as defined by the Government of India from time to time).
- Large Industries (industries in which the investment on plant and machinery is less than Rs. 500 crores except for micro, small and medium enterprises).
- Scheduled caste and scheduled tribe entrepreneurs (a unit established as sole proprietor or invariably having 100% share in partnership/private limited companies).
- Backward Class Entrepreneurs (a unit established as sole proprietor or invariably having 100% share in partnership/private limited companies).
- Women Entrepreneurs (a unit established as sole proprietress or invariably having 100% share in partnership/private limited).
- Mega Projects (projects with an investment of at least Rs. 500 crores or direct employment generation of 2,000).

The Industrial Policy also aims to promote accelerated growth in foreign investments in the state. The government is committed to provide world class infrastructure, state-of-the-art R&D centres and human capital quality to attract FDI inflows into the state.

(2) Food Processing Policy 2015-20

The Andhra Pradesh State government formulated a new Food Processing Policy 2015-20 in July 2015. Assistance schemes under Andhra Pradesh Food Processing Policy 2015-20 are summarised in Table 2.3.4.

Table 2.3.4 Summary of Schemes under Andhra Pradesh Food Processing Policy 2015-2020

No	Scheme	Eligibility	Maximum Limit of Grant-in-Aid
1	Food parks		
	I) Integrated Food Park	50% of project cost	Rs. 20 crore
	II) Mega Food Park	50% of project cost	Rs. 50 crore
	III) Ultra Mega Food Park	Customised	Customised
2	New food processing units	25% of project cost (includes plant and machinery, and civil works)	Rs. 5 crore and interest subsidy of five years
3	Technology upgradation/ modernisation of existing food park units	25% of new/upgraded equipment cost	Rs. 1 crore
4	Setting up of Primary Processing Centres (PPCs) and Collection Centres (CCs)	50% of project cost	Rs. 2.5 crore and interest subsidy 5 years
5	Cold chain units	35% of project cost	Rs. 5 crore and interest subsidy of five years
6	Modernisation of abattoirs	50% cost of plant and machinery, civil works and other eligible items	Rs. 15 crore
7	Reefer vehicles	50% of cost of reefer vehicle	Rs. 2 crore
8	Units for processing of waste produced in food processing units in identified clusters	50% of project cost	Rs. 2 crore
9	Scheme for setting up/upgrading testing laboratories		
	I) For NABL* approved laboratories	50% of project cost	Rs. 5 crore
	II) For existing food processing units	50% of project cost	Rs. 5 lakhs
	III) For state government organisations and universities	a) 80% of eligible project b) 80% of cost of two technical staff in such laboratories for three years	-
Fiscal Incentives: - Reimbursement of power consumption charges at Rs. 1.50 per unit for five years - Reimbursement of Non-Agriculture Land Assessment (NALA) tax for the produce purchased directly from farmers. - Reimbursement of 100% stamp duty and transfer duty. - VAT/CST/GST reimbursement for micro and small enterprises (100%), medium industries (75%), and large industry			

No	Scheme	Eligibility	Maximum Limit of Grant-in-Aid
	unit (50%) for five to seven years - Industrial Area Local Authority (IALA) status to food parks. - Marketing cess waiver for produce purchased directly from farmers.		

Note: NABL = National Accreditation Board for Testing and Calibration Laboratories

Source: Andhra Pradesh Food Processing Policy 2015-20, APFPS, Department of Industries and Commerce, Andhra Pradesh State.

3. ANDHRA PRADESH AT A GLANCE

3.1 General

The erstwhile state of Andhra Pradesh was bifurcated into the new state of Telangana and the residual state of Andhra Pradesh on 2nd June 2014 in accordance with the Andhra Pradesh Reorganisation Act 2014. Hyderabad remained as the common capital of the state of Telangana and the state of Andhra Pradesh for almost ten years. It is now a transition period for the state of Andhra Pradesh to move its capital from Hyderabad to Amaravathi. The residual state of Andhra Pradesh in its Rolling Plan 2015-2016 has set out a vision as the "Sunrise State" to become the best state in India by 2029.

Key information about the residual state of Andhra Pradesh is highlighted in this chapter as a quick reference of the state.

3.2 Administrative Profile

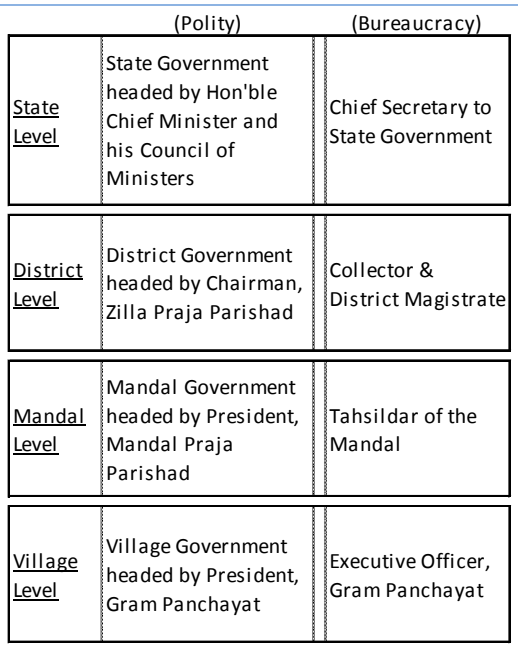
As a result of bifurcation in June 2014, the residual state of Andhra Pradesh has started its administration services in 13 districts, 664 mandals (sub-districts), and 17,039 villages as shown in Table 3.2.1. The population size of a district is 3.8 million on average varying from 2.3 million in Vizianagaram to 5.3 million in East Godavari. Similarly, the population size of a mandal is 75,000 on average ranging from 56,000 in Kadapa to 100,000 in Visakhapatnam, and that of a village is 2,900 on average ranging from 1,500 in Srikakulam and 6,800 in Guntur.

The hierarchy of public administration of the Government of Andhra Pradesh (GoAP) is briefly presented by different level in Figure 3.2.1.

Table 3.2.1 Administrative Division

SI. No.	District	Population	No. of Mandals	No. of Villages
1	Srikakulam	2,703,114	38	1,802
2	Vizianagaram	2,334,474	34	1,520
3	Visakhapatnam	4,290,589	43	3,265
4	East Godavari	5,285,824	60	1,374
5	West Godavari	3,995,742	46	881
6	Krishna	4,517,398	50	968
7	Guntur	4,887,813	57	712
8	Prakasam	3,397,448	56	1,081
9	Nellore	2,963,557	46	1,177
10	Kadapa	2,882,469	51	919
11	Kurnool	4,053,463	54	898
12	Anantapur	4,081,148	63	949
13	Chittoor	4,174,064	66	1,493
	Andhra Pradesh	49,577,103	664	17,039

Source: Part I State Administrative Division 2011, Census of India, Retrieved 18 Jan. 2015, Primary Census Abstract, Census 2011, Directorate of Census Operation, Hyderabad, Andhra Pradesh State



Source: Andhra Pradesh Government Portal

Figure 3.2.1 Hierarchy of Public Administration in Andhra Pradesh State

The official language of Andhra Pradesh State is Telugu, the biggest linguistic unit in India second only to Hindi. In addition to Telugu, the languages often spoken in the state are Hindi, Tamil, and English.

3.3 Demography

The demography of the residual state of Andhra Pradesh, which covers only 13 districts, is summarised in Table 3.3.1.

Table 3.3.1 Demography of Andhra Pradesh State

No.	Item	Unit	Andhra Pradesh*1			Entire India
			1991	2001	2011	2011
1	Population	million	40.419	45.223	49.577	1,210.570
	(a) Male	%	50.60	50.43	50.08	51.47
	(b) Female	%	49.40	49.57	49.92	48.53
	(a) Rural	%	75.23	75.77	70.53	68.85
	(b) Urban	%	24.77	24.23	29.47	31.15
	(a) Scheduled Caste	%	15.63	16.43	17.08	16.63
	(b) Scheduled Tribes	%	4.85	5.03	5.53	8.61
	(a) Hinduism	%	-	89.0	88.5	79.8
	(b) Islam	%	-	9.2	9.6	14.2
	(c) Christianity	%	-	1.5	1.3	2.3
	(d) Others	%	-	0.3	0.4	3.7
	Population Growth Rate	%	21.13	11.89	9.21	17.69
2	Population Density	persons/km^2	252	282	304	368
3	Literacy Rate	%	45.86	62.14	67.35	72.99
	(a) Males	%	56.53	71.36	74.77	80.89
	(b) Females	%	34.92	52.78	59.96	64.64
4	Number of Households	million	8.829	10.480	12.719	249.454
	(a) Rural	%	75.76	76.69	71.27	67.57
	(b) Urban	%	24.24	23.31	28.73	32.43
5	Workers	million	18.228	20.820	23.081	481.743
	(a) Agriculture	%	66.26	64.80	62.36	54.60
	(b) Non-Agriculture	%	33.74	35.20	37.64	45.40
6	Poverty (No. of BPL)*2	million	-	-	7.878	269.783
	(a) BPL Rate in Rural	%	-	-	10.96	25.70
	(b) BPL Rate in Urban	%	-	-	5.81	13.70

*Note: *1= Covering 13 states of a residual state of Andhra Pradesh. *2= Below Poverty Line in 2011-12*
Source: 1. Statistical Abstract of Andhra Pradesh 2014, Directorate of Census Operations, Hyderabad, Andhra Pradesh State
2. Press Note on Poverty Estimates, 2011-12, Government of India Planning Commission, July 2013

(1) Population

The state population of 49.6 million which accounts for 4.10% of the country's population makes it the 10th most populous state in the country as per the Census 2011. The growth rate of population, as per 2011 census came down to 9.21% compared with 11.89% in 2001 while 70.53% of the total population lives in rural areas and 29.47% lives in urban areas of the state. Of the total population, 24.8 million (50.08%) are males and 24.7 million (49.92%) are females. East Godavari District with a population of 5.285 million is the most populous district in the state while Vizianagaram ranks last with 2.344 million. Of the total population of the state, Scheduled Castes (SCs) and scheduled tribes (STs) constitute to 17.08% and 5.53%, respectively. East Godavari and Guntur are at the top with 0.957 million SC population and Vizianagaram is the lowest with 0.247 million. Visakhapatnam stands first with 22.57% of total ST population of the state while Kadapa with 2.77% has the least amongst the districts.

(2) Population Density

In 2011, the population density of Andhra Pradesh State was 304 persons/km^2 as against 368 persons/km^2 for entire India. Amongst the districts, the population density of Krishna is the highest at 518 persons/km^2 while Kadapa and Prakasam districts have the lowest population density with less than 200 persons/km^2.

(3) Literacy

Literacy rate in Andhra Pradesh State has been on an upward trend and was 67.4% as per 2011 population census. The literacy rate in rural areas is 62.4% while in urban areas it is 79.2%. Male literacy stands at 74.8% while female literacy is at 60.0%. In 2011, West Godavari was at the top amongst the districts with 74.32% while Vizianagaram is at the lowest with 58.89%.

(4) Number of Households

The total number of households has been estimated at 12.719 million in Andhra Pradesh State and 249.454 million in all India as per the 2011 population census. Consequently, the average size of the household is estimated at 3.90 in Andhra Pradesh State against 4.85 for entire India. The percentage of rural households in Andhra Pradesh State is 3.66% higher than the average for entire India.

(5) Workers

The total number of workers in Andhra Pradesh State was estimated at 23.081 million as per 2011 population census, of which agricultural workers accounts for 62.36%. Similarly agricultural workers occupy 54.60% of 481.743 million total workers in India. The percentage of agricultural workers in Andhra Pradesh State is 7.76% higher than the average for entire India.

(6) Poverty

The below poverty line (BPL) population in Andhra Pradesh State is much lower than the average of entire India in 2011-12; it is ranked 6th lowest amongst the states of the union territory. According to the Planning Commission and NSSO Data, 61st Round, the percentage of BPL population in Andhra Pradesh State has improved from 15.77% in 1999-2000 to 9.20% in 2011-12.

3.4 Economy

The gross state domestic product (GSDP), its sectoral composition, and the per capita income at 2004-05 constant prices for Andhra Pradesh State covering 13 districts are shown in Table 3.4.1.

Table 3.4.1 GSDP of Andhra Pradesh State by Industry at Constant Prices 2004-05

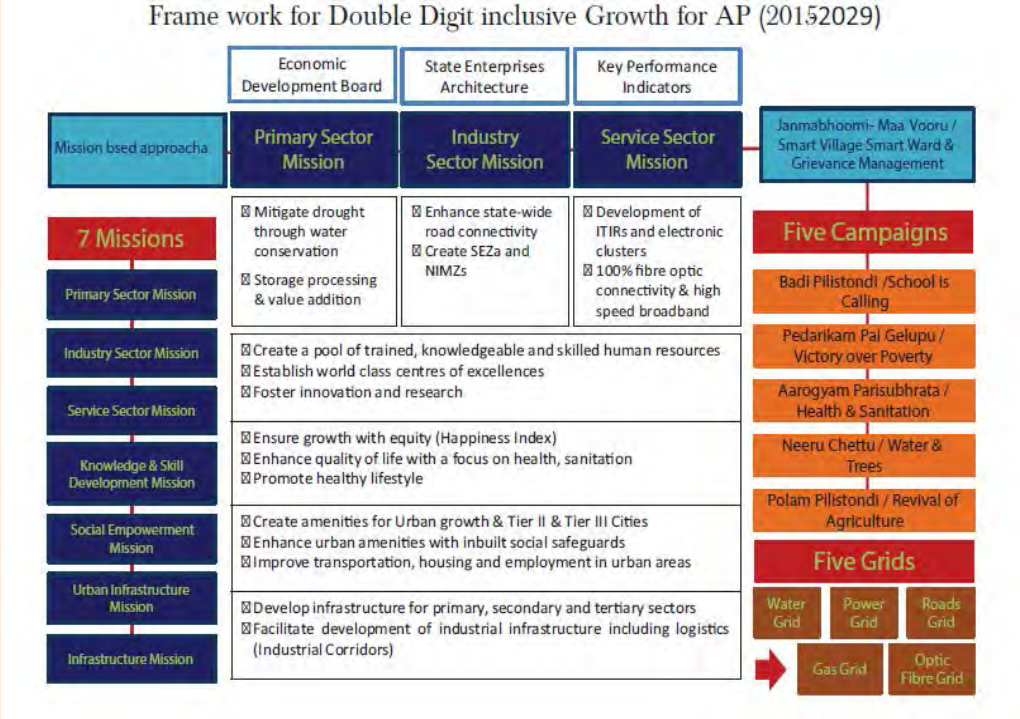
Sector	Item	Andhra Pradesh*1				All India
		2011-12 (TRE)	2012-13 (SRE)	2013-14 (FRE)	2014-15 (AE)	2013-14 (P)
GSDP	Value (INR Crore)	221,285	230,240	246,724	264,521	5,741,791
	Growth Rate (%)	6.25	4.05	7.16	7.21	4.74
Per Capita Income	Value (INR)	38,556	39,645	42,170	44,831	39,904
	Growth Rate (%)	2.25	2.82	6.37	6.31	2.70
Agriculture	Value (INR Crore)	51,624	55,473	55,879	63,414	800.548
	% to GSDP	23.33	24.09	24.27	23.97	13.94
	Growth Rate (%)	3.21	7.46	7.94	5.90	4.71
Industry	Value (INR Crore)	50,911	48,690	49,187	51,771	1,500,225
	% to GSDP	23.01	21.15	19.94	19.57	26.13
	Growth Rate (%)	12.94	-4.36	1.02	5.25	0.35
Services	Value (INR Crore)	118,750	126,077	137,658	149,336	3,448,226
	% to GSDP	53.66	54.76	55.79	56.46	60.05
	Growth Rate (%)	4.93	6.17	9.19	8.48	7.00

*Note: - *1= Covering 13 districts of the new state of Andhra Pradesh.*
- Constant Prices (2004-05), TRE= Third Revised Estimate, SRE= Second Revised Estimate, AE= Advanced Estimate
- Estimates for entire India for 2014-15 are available only at base year 2011-12.
Source: - Socio Economic Survey 2014-15, Planning Department, Government of Andhra Pradesh
- Central Statistical Organisation (CSO) - 31.05.2014

Andhra Pradesh State has set the vision to lay foundation of the Sunrise State of Andhra Pradesh as shown in Box 3.1. Achievement of this vision is incumbent upon a fast paced and sustainable double digit growth delivered through a combination of programmatic and project interventions with focus on sustainable and inclusive development.

Box 3.3.1: Achieving Double Digit Inclusive Growth - A Rolling Plan 2015-16

The government of Andhra Pradesh sets out key milestones of the long-term vision that Andhra Pradesh will become the best state in the country by 2029-30 by achieving inclusive growth and ranking better on happiness index; and a leading investment destination in the world by 2050-51. To achieve the ambitious vision, the state will have to step up from the current growth rate of 7% GSDP to a growth rate of more than 10% for each upcoming year, starting from 2015-16 (constant prices). The growth engine has been identified on conditions that i) components of GSDP which contribute more than 80% to their sector with potential for future growth, ii) sub-sectors which have been delivering a sustained double digit growth over the last five years, and iii) sector of GSDP which are aligned with national trust sectors with the promise of a large future potential.



3.5 Land Use and Land Holding

(1) Land Use

The land use in Andhra Pradesh State for the past five years is shown in Table 3.5.1 below. Cropping intensity of the state varies from 123% to 127%.

Table 3.5.1 Recent Trend of Land Distribution by Use in Andhra Pradesh State ('000 ha)

No.	Classification		2010-11	2011-12	2012-13	2013-14	2014-15**
1	Geographical Area	Geographical Area	16,020	16,020	16,020	16,020	16,276
2	Forest	Forest	3,487	3,487	3,484	3,493	3,663
3	Not Available for Cultivation	Area under Non-Agricultural Uses	1,900	1,921	1,987	1,982	2,002
		Barren and Un-cultivable Land	1,409	1,407	1,343	1,341	1,351
4	Other Cultivable Land excluding Fallow Land	Permanent Pastures and Other Grazing Land	252	250	212	212	214
		Lands under Misc. Trees and Crops and Groves	176	175	165	160	160
		Cultivable Wasteland	459	449	414	392	392
5	Fallow Lands	Fallow Land Other than Current Fallow	710	732	819	792	858
		Current Fallow	831	1,037	1,134	1,087	1,401
6	Net Area Sown	Net Area Sown	6,796	6,562	6,462	6,561	6,235
7	Total Cropped	Total Cropped Area	8,644	8,057	7,959	8,128	7,689

No.	Classification		2010-11	2011-12	2012-13	2013-14	2014-15**
	Area (Gross Cropped Area)	(Gross Cropped Area)					
8	Area Sown more than Once	Area Sown more than Once	1,848	1,495	1,497	1,567	1,454
9	Cropping Intensity*	Cropping Intensity (%)	127.19	122.78	123.20	123.90	123.32

*Note: *) Cropping intensity is % of the gross cropped araea to the net area sown.*
***) Six Mandals of Telangana State was merged to Andhra Pradesh State*
Source: Socio-Economic Survey 2015-16, Planning Department, GoAP

(2) Land Holding

The status of land holding in Andhra Pradesh State is as shown in Table 3.5.2. For the five years from 2005-06 to 2010-11, land segmentation have slowly gone off in the state. The average size of operational land holding is 1.13 ha/farmer in 2005-06 and 1.06 ha/farmer in 2010-11. The marginal and small farmers account for 86% in number and 54% in operational lands, meanwhile medium and large farmers occupy 3.3% in number and 20% in operational lands.

Table 3.5.2 Distribution of Operational Land Holdings in Andhra Pradesh State in 2005-06

Category	No. of Operational Holdings ('000)		Area Operated ('000 ha)		Average Size of Operational Holding (ha) (B) / (A)
	Number (A)*	%	ha (B)	%	
Year 2005-06					
Marginal (< 1.0 ha)	4,619	64.0%	2,001	24.4%	0.43
Small (1.0-2.0 ha)	1,492	20.7%	2,111	25.8%	1.41
Semi-Medium (2.0-4.0 ha)	813	11.3%	2,152	26.3%	2.65
Medium (4.0-10.0 ha)	264	3.6%	1,491	18.2%	5.65
Large (10.0 ha and above)	28	0.4%	434	5.3%	15.50
All Holdings	7,216	100.0%	8,189	100.0%	1.13
Year 2010-11					
Marginal (< 1.0 ha)	4,984	65.4%	2,160	26.7%	0.43
Small (1.0-2.0 ha)	1,591	20.9%	2,251	27.8%	1.41
Semi-Medium (2.0-4.0 ha)	796	10.4%	2,100	25.9%	2.64
Medium (4.0-10.0 ha)	230	3.0%	1,282	15.8%	5.57
Large (10.0 ha and above)	20	0.3%	304	3.8%	15.20
All Holdings	7,621	100.0%	8,097	100.0%	1.06

*Note: *) Number of agriculture land owners (= farm households)*
Source: Directorate of Economics and Statistics, GoAP

3.6 Irrigation

Andhra Pradesh State called a "River State" and blessed with major river systems like the Godavari, Krishna, Pennar, Vamsadhara and other rivers, is giving utmost importance for irrigation development as well as its management. The state is allocated 685 TMC for on-going projects in addition to 1,303 TMC for existing irrigation projects. The total irrigation potential created is 4.157 million ha up to December 2015, newly adding 47,000 ha in 2015. The details of sector-wise irrigation potential created are as shown in Table 3.6.1 below.

Table 3.6.1 Sector-wise Irrigation Potential Created

No.	Sector	up to Dec. 2014 ('000 ha)	up to Dec. 2015 ('000 ha)
1	Major Irrigation	2,566 (63%)	2,613 (63%)
2	Medium Irrigation	225 (5%)	223 (5%)
3	Minor Irrigation	1,036 (25%)	1,037 (25%)
4	APSIDC	272 (7%)	284 (7%)
5	Total	4,099 (100%)	4,157 (100%)

Note: APSIDC: Andhra Pradesh State Irrigation Development Corporation, which *is a state subsidised company*
Source: Socio-Economic Survey 2015-16, Planning Department, GoAP

The total irrigated area is 2.975 million ha in net and 3.953 million ha for gross on average of the past five years. As seen in Table 3.6.2 below, the irrigated area under wells is rather stable in comparison with those under canals and tanks.

Table 3.6.2 Source-wise Irrigated Area

No.	Source	2010-11	2011-12	2012-13	2013-14	2014-15
Net Irrigated Area ('000 ha)						
1	Canals	1,431	1,492	1,175	1,430	1,429
2	Tanks	412	367	346	339	293
3	Wells	1,066	1,122	1,158	1,121	1,080
4	Others	121	123	122	124	125
5	Total	3,030	3,105	2,801	3,014	2,927
Gross Irrigated Area ('000 ha)						
1	Canals	1,999	1,784	1,563	1,956	1,882
2	Tanks	450	394	379	377	327
3	Wells	1,561	1,599	1,634	1,623	1,532
4	Others	143	144	135	140	145
5	Total	4,153	3,921	3,711	4,096	3,886

Source: Socio-Economic Survey 2015-16, Planning Department, GoAP

Irrigation coverage is estimated as percentage of irrigated area (net/gross) against the (net/gross) area sown. As shown in Table 3.6.3 below, irrigation coverage is between 43% to 47% for net area sown and 47% to 50% for gross area sown.

Table 3.6.3 Irrigation Coverage

No.	Item	2010-11	2011-12	2012-13	2013-14	2014-15
1	Net Area Sown ('000 ha)	6,796	6,562	6,462	6,561	6,235
2	Net Irrigated Area ('000 ha)	3,030	3,105	2,801	3,014	2,927
3	Net Irrigation Coverage (%)	44.6	47.3	43.3	45.9	46.9
4	Gross Area Sown ('000 ha)	8,644	8,057	7,959	8,128	7,689
5	Gross Irrigated Area ('000 ha)	4,153	3,921	3,711	4,096	3,886
6	Gross Irrigation Coverage (%)	48.0	48.7	46.6	50.4	50.5

*Note: *) Cropping intensity is % of the gross cropped araea to the net area sown.*
***) A part of Telangana State was merged to Andhra Pradesh State*
Source: Socio-Economic Survey 2015-16, Planning Department, GoAP

3.7 Agriculture and Non-Agriculture Products

Andhra Pradesh State is rich in natural resources and one of the major producers of agriculture, horticulture, livestock, and fishery produces in the country as shown in Table 3.7.1.

Table 3.7.1 Major Agricultural and Non-Agricultural Produces

SN.	Crop / Component	Productivity (MT/ha)	Production in Andhra Pradesh (Million MT)	Andhra Pradesh Rank in Entire India*1 (Production)	India Rank in the World*2 (Production)
Agricultural and Horticultural Crops					
1	Mango	9	2.73	1	1
2	Papaya	80	1.55	1	1
3	Lime/Lemon	15	0.35	1	1
4	Palm Oil	12	1.61	1	-
5	Tomato	20	3.36	1	2
6	Chillies	3	0.73	1	1
7	Turmeric	7	0.25	1	-
8	Okra	15	0.67	1	1
9	Cashew	0.68	0.56	2	3
10	Groundnut	0.9	3.0	2	2
11	Rice	3.3	13.91	2	2
12	Maize	6	5.3	2	-

SN.	Crop / Component	Productivity (MT/ha)	Production in Andhra Pradesh (Million MT)	Andhra Pradesh Rank in Entire India*1 (Production)	India Rank in the World*2 (Production)
13	Brinjal (Eggplant)	20	1.16	2	2
14	Millets	0.8	0.5	3	1
15	Coconut (no. of nuts)	15,000	1,829	3	3
16	Banana	35	3.16	3	1
17	Sugarcane	78	1.57	5	2
18	Onion	18	1.0	6	2
Non- Agricultural and Horticultural Crops					
19	Egg (no. of eggs)	-	12,727	1	3
20	Meat	-	0.48	2	-
21	Aqua	-	2.20	2	-
22	Milk	-	9.08	3	1

*Source: *1= A Land of Unlimited Opportunities..., Department of Industries (Food Processing), GoAP*
**2= FAOSTAT (The Food and Agriculture Organization Corporate Statistical Database) 2013*

3.8 Transport Infrastructure in Andhra Pradesh State

Vijayawada in Krishna District; the second largest city of Andhra Pradesh State, is a strategic hub of public transportation, with Visakhapatnam in the north and Kurnool and Tirupati in the south. The major transport infrastructures are listed in Table 3.8.1 and locations of those infrastructures are illustrated in the survey map on the first page of text.

Table 3.8.1 Transport Infrastructure in Andhra Pradesh State

SN	Infrastructure	Particular	Remarks
1	Road Networks (major national highways)	1) National Highway NH-16 (old NH-5)	NH-16 runs along India's east coast through the states of Odisha, Andhra Pradesh, and Tamil Nadu.
		2) National Highway NH-44 (old NH-7)	NH-44 connects several important Indian cities such as Varanasi, Nagpur, Hyderabad, Bangalore, Madurai, and Kanyakumari. It is the longest national highway in India.
		3) National Highway NH-65 (old NH-9)	NH-65 is a major national highway in Central India, stretching 841 km from Pune in Maharashtra through the states of Karnataka and Telangana to Machilipatnam in Andhra Pradesh.
		4) National Highway NH-40 (old NH-18)	NH-40 runs entirely within the state of Andhra Pradesh. The northern terminal is in Kurnool at the intersection of NH-7 and the southern terminal is in Chittoor at the intersection of NH-4.
		5) National Highway NH-26 (old NH-43)	NH-26 links Borigumma in Odisha with Natavalasa in Andhra Pradesh.
		6) National Highway NH-67 (old NH-63)	NH-67 is a national highway within the two southern states of Karnataka and Andhra Pradesh in India.
		7) National Highway NH-42 (old NH-205)	NH-42 connects Chennai in Tamil Nadu to Anantapur via Madanapalle in Andhra Pradesh.
		8) National Highway NH-216 (old 214A)	NH-216 starts from Kathipudi (junction of NH-16, formerly NH-5) and ends at Ongole (junction of NH-16, formerly NH-5), both places are in the state of Andhra Pradesh.
2	Railway Networks	There are 237 railway stations in Andhra Pradesh State (before separation of the state).	There are in all three railway zones like the southern railways, S.C.R, and the south-eastern railways. Vijayawada railway junction is the biggest junction found in Andhra Pradesh and connects the north and the south Indian rail routes.
3	Sea Port (currently operational)	1) Visakhapatnam Port	Visakhapatnam District, one of the country's largest port in terms of cargo handling
		2) Gangavaram Port	Visakhapatnam District, a deep seaport
		3) Kakinada Port	East Godavari District, a deep seaport
		4) Krishnapatnam Port	Nellore District, a deep seaport
4	Airport (currently operational)	1) Visakhapatnam Airport	Visakhapatnam District, currently the only international airport in Andhra Pradesh (except Hyderabad)
		2) Tirupathi Airport	Chittoor District
		3) Rajahmundry Airport	East Godavari District
		4) Vijayawada Airport	Krishna District
		5) Kadapa Airport	Kadapa District
		6) Tadepalligudem Airport	West Dodavari District
		7) Puttaparthy Airport	Anantapur District

Source: JICA Survey Team

In addition to the details above, the new state capital city of Andhra Pradesh State will be in Amaravathi of Guntur District before long, which is briefly stated in Box 3.8.1. The distance between Amaravathi and Vijayawada is approximately 40 km or one hour drive by car.

Box 3.8.1: A World Class City Amaravathi; The New State Capital of Andhra Pradesh

The historical region of Amaravathi, the capital for Andhra Pradesh after bifurcation, will be a fabulous riverfront city modeled on Singapore. The foundation stone for Andhra Pradesh's new capital Amaravati was laid on 22 October 2015 in the presence of Prime Minister Narendra Modi. Pitched as a world-class riverfront capital city, Amaravati will be an energy-efficient green city with concentration on industrial hubs. The followings are the general features of the new capital:

» Core capital area is spread across 16.9 km^2,
» Amaravati will cater to a population of 11.5 million,
» To create 3.3 million jobs by 2035,
» Open and green spaces to cover 40% of capital area, and
» Mega city will be linked to seven regional centres which in turn will become industrial hubs.

3.9 Natural Environment

Andhra Pradesh State lies between 12°41' and 19°N latitude and 77° and 84°40'E longitude and is bordered by Chhattisgarh, Telangana, and Odisha in the north; the Bay of Bengal in the east; Tamil Nadu to the south; and Karnataka to the west. Three major rivers, Godavari, Krishna, and Pennar, run across the state. A small enclave of 30 km^2 - the Yanam district of Puducherry, lies in the Godavari Delta in the northeast of the state. The state includes the eastern part of Deccan Plateau and a considerable part of Eastern Ghats. The state is richly endowed with natural and human resources with competitive socio-economic advantages. Its geographical area of 160,204 km^2 makes it the 8th largest state in the country. Andhra Pradesh State is situated in a tropical region and has the 2nd longest coastline in the country with a length of 974 km. The state has a forest area of 34,572 km^2 as per forest records, which accounts for 21.58% of the total geographical area. The state has a variety of physiographic features ranging from high hills and undulating plains to coastal and deltaic environment.

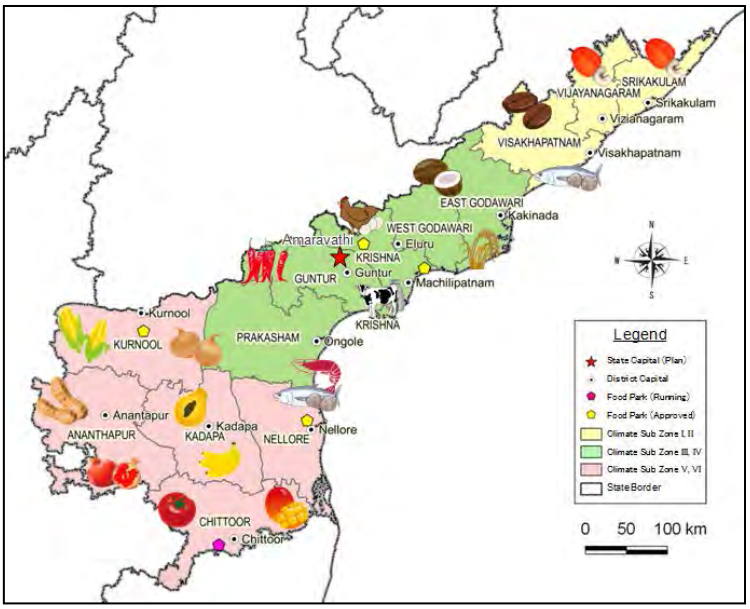
Andhra Pradesh State was broadly divided into six agro-climatic zones as stated in Table 3.9.1 and Figure 3.9.1. The natural environment in Andhra Pradesh State is presented in Figure 3.9.2.

Table 3.9.1 Agro-Climatic Zones of Andhra Pradesh State and Their Characteristics

SN.	Zone	District	Climate	Soil Type	Crop Grown
I	High altitude and tribal areas	Northern borders of Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, and Khammam	Temperature: Max. 29-42 ºC Min. 16-24 ºC Rainfall: > 1400 mm	Hill slopes and undulating transported soils	Horticultural crops (cashew, mango, etc.), millets, pulses, chilly, turmeric, and pepper
II	North Coastal Zone	Srikakulam, Vizianagaram, Vishakhapatnam, and uplands of East Godavari District	Temperature: Max. 29-42 ºC Min. 18-27 ºC Rainfall: 1000-1100 mm	Red soils with clay base, pockets of acidic soils, and laterite soils with PH 4-5.	Rice, groundnut, mesta, jute, sunhemp, seasmum, sorghum, pearl millet, blackgram, sugarcane, and horticultural crops (banana and mango)
III and IV	Krishna-Godavari Zone	East Godavari, West Godavari, Krishna, Guntur, and contiguous areas of Khammam, Nalgonda, and Prakasam	Temperature: Max. 29-42 ºC Min. 16-24 ºC Rainfall: 800-1100mm	Deltaic alluvium, red soils with clay, black cotton soils, red loams, coastal sands, and saline soils	Rice, groundnut, sorghum, pearl millet, tobacco, cotton, chilli, sugarcane, and horticultural crop (mango and tomato)
V	Southern Zone	Nellore, Chittoor, southern parts of Prakasam and Kadapa, and eastern parts of Anantapur	Temperature: Max. 28-40 ºC Min. 13-27 ºC Rainfall:	Red loamy soils, shallow to moderately deep.	Rice, groundnut, cotton, sugarcane, millets, tomato, and horticultural crops (mango, papaya, and tomato)

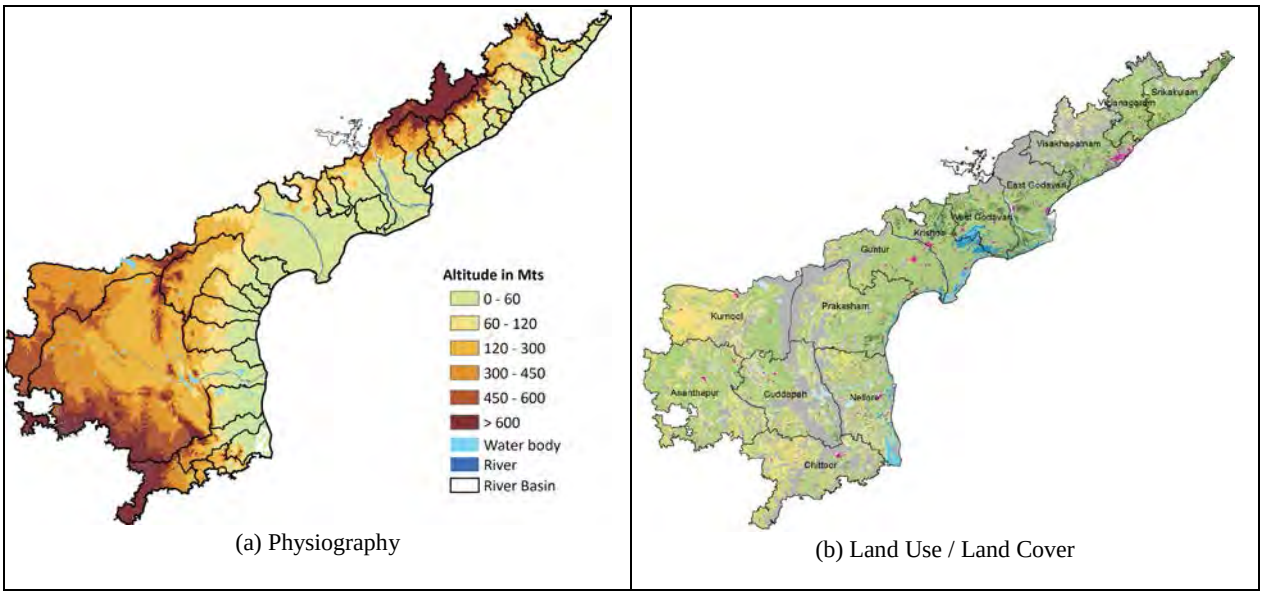
SN.	Zone	District	Climate	Soil Type	Crop Grown
			700-1000 mm		
VI	Scarce Rainfall Zone	Kurnool, Anantapur, Prakasam (western parts), Prakasam (western parts), Kadapa (northern part), and Mahaboobnagar (southern border).	Temperature: Max. 32-40 ºC Min. 13-28 ºC Rainfall: 500-750 mm	Red earths with loamy soils (chalkas), red sandy soils, and black cotton soils in pockets.	Cotton, sorghum, millets, groundnut, pulses, horticultural crops (mango, papaya, banana, and orange) and rice

Source: Department of Agriculture, Andhra Pradesh
http://apwsipnsp.gov.in/APWSIP/Downloads/PIP%20Final/Component%20A/Chapter%201%20Introduction/Annex%201.pdf



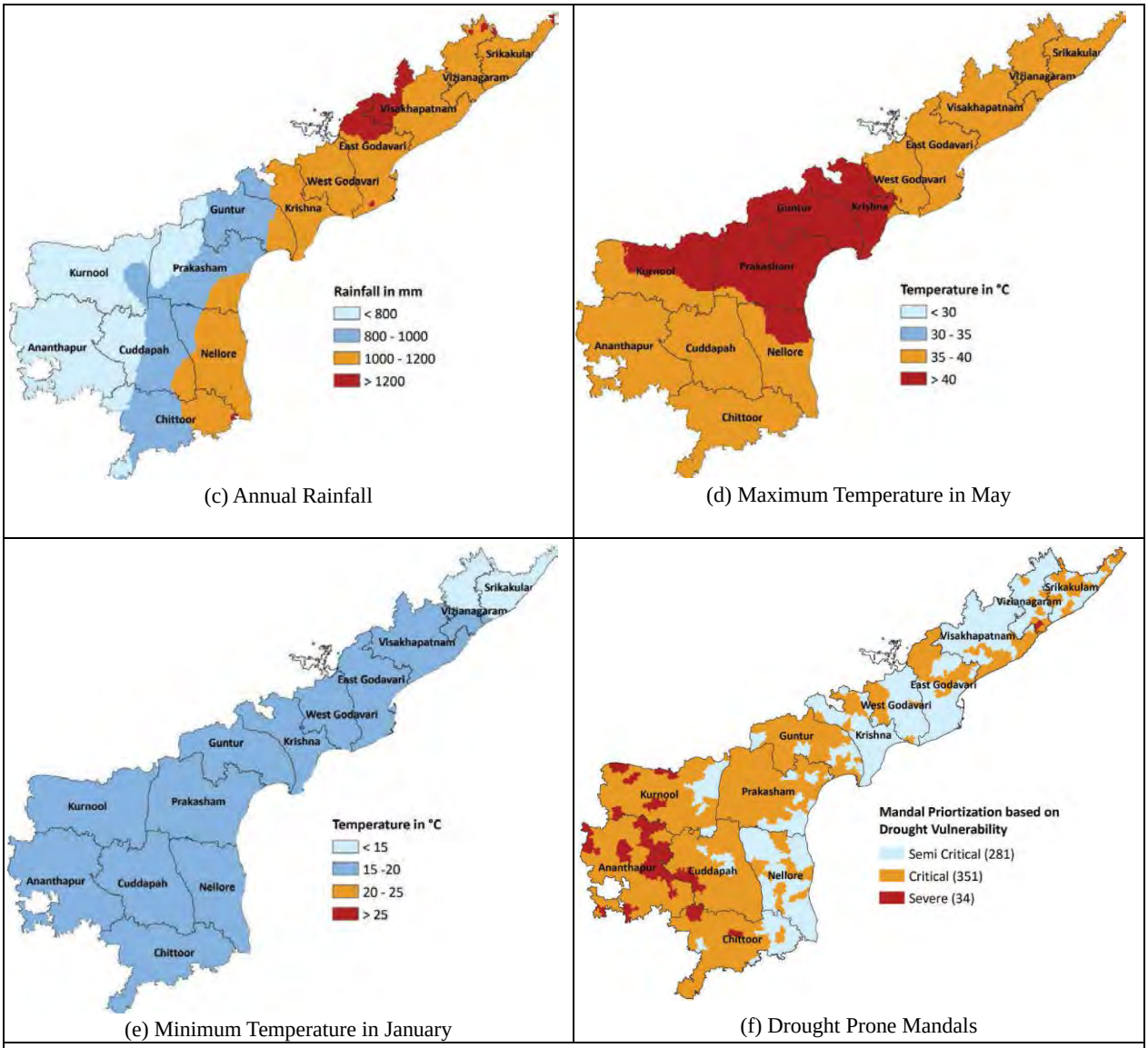
Source: Department of Agriculture, Andhra Pradesh State

Figure 3.9.1 Agro-Climatic Zones of Andhra Pradesh State



(a) Physiography

(b) Land Use / Land Cover



(c) Annual Rainfall

(d) Maximum Temperature in May

(e) Minimum Temperature in January

(f) Drought Prone Mandals

Source: Andhra Pradesh Statistics Summary 2014

Figure 3.9.2 Natural Environment in Andhra Prasesh State

3.10 Annual Budgets and Expenditures

Annual budgets and annual expenditures of the Andhra Pradesh State for the last three years are shown in Table 3.10.1 and Table 3.10.2, respectively. The revenue balance shifts from surplus to deficit in the fiscal year 2014-15 due to the bifurcation of the state from erstwhile Andhra Pradesh (including Telangana) to the residual Andhra Pradesh (excluding Telangana) in June 2014. The primary deficit also shifts from surplus to deficit but the fiscal deficit was maintained at the same level in 2013-14.

Table 3.10.1 Annual Budgets of Andhra Pradesh State

(Unit: INR in million)

Particulars	Accounts*1 2013-14	Revised Estimate*2 2014-15	Budget Estimate*3 2015-16
I. Opening Balance	-5,592.923	-909.964	-18,033.894
II. Revenue Receipts	1,107,188.296	840,660.539	901,249.900
III. Capital Receipts	262,787.412	262,890.092	227,274.900
IV. Total Receipts (II+III)	1,370,975.708	1,103,550.631	1,128,524.800
V. Non-Plan Expenditure	944,439.267	893,185.493	786,365.111
VI. Capital Expenditure	82,067.267	61,745.414	54,128.215

Particulars	Accounts*1 2013-14	Revised Estimate*2 2014-15	Budget Estimate*3 2015-16
VII. Plan Expenditure	421,853.482	227,489.068	344,124.720
VIII. Total Expenditure (V+VII)	1,366,292.749	1,120,674.561	1,130,489.831
IX. Overall Transactions (IV-VIII)	4,682.959	-17,123.930	-1,965.031
X. Closing Balance (I+IX)	-909.964	-18,033.894	-19,998.925
XI. Revenue Surplus (+)/ Deficit (-)	3,443.362	-142,425.731	-72,997.867
XII. Fiscal Deficit (-)	-180,500.633	-203,200.987	-175,842.440
XIII. Primary Deficit (-)	51,394.205	-106,438.715	-63,860.507

*Note: *1= Old Andhra Pradesh, *2= Transition to new Andhra Pradesh (Old Andhra Pradesh for April and May, the rest for new Andhra Pradesh), *3= New Andhra Pradesh*
Source: Abstract from Andhra Pradesh Budget in Brief 2015-16, pp. 3-4, Minister of Finance, Andhra Pradesh

Looking into the annual expenditures, allocation to the economic services decreased from 37% in 2013-14 to 33% in 2015-16 in the context of reduction in the total expenditure.

Table 3.10.2 Annual Expenditures of Andhra Pradesh State

(Unit: INR in million)

Particular	Accounts 2013-14*1			Revised Estimate 2014-15*2			Budget Estimate 2015-16*3		
	Non-Plan	Plan	Total	Non-Plan	Plan	Total	Non-Plan	Plan	Total
Economic Services	258,722.7 28.87%	229,166.4 54.62%	487,889.1 37.08%	300,597.7 33.65%	116,933.8 51.40%	417,531.5 37.26%	185,222.3 23.55%	186,895.3 54.31%	372,117.6 32.92%
Social Services	224,197.3 25.01%	184,807.4 44.05%	409,004.7 31.08%	228,826.2 25.62%	106,372.1 46.76%	335,198.3 29.91%	232,677.9 29.59%	149,015.1 43.30%	381,693.0 33.76%
General Services	461,519.2 48.87%	7,879.6 1.87%	469,398.8 34.36%	363,761.7 40.73%	4,183.1 1.84%	367,944.8 32.83%	368,464.9 46.86%	8,214.3 2.39%	376,679.2 33.32%
Grand Total	944,439.2	421,853.4	1,366,292.6	893,185.6	227,489.0	1,120,674.6	786,365.1	344,124.7	1,130,489.8

*Note: *1= Old Andhra Pradesh, *2= Transition to new Andhra Pradesh (Old Andhra Pradesh for April and May, the rest for new Andhra Pradesh), *3= New Andhra Pradesh*
Source: Andhra Pradesh Budget in Brief 2015-16, pp. 9-10, Minister of Finance, Andhra Pradesh

The breakdown of the annual estimated budget for economic services in 2015-16 is presented in Table 3.10.3.

Table 3.10.3 Annual Budget Estimate for Economic Services in 2015-16

(Unit: INR in million)

Particular	Budget Estimate 2015-16					
	Non-Plan		Plan		Total	
Agriculture and Allied Services	68,705.3	37%	18,750.2	10%	87,455.5	24%
Rural Development	30,152.2	16%	85,029.7	45%	115,181.9	30%
Irrigation and Flood Control	5,799.3	3%	46,781.3	25%	52,580.6	14%
Energy	42,643.9	23%	961.2	1%	43,605.1	12%
Industry and Minerals	1,162.7	1%	5,654.2	3%	6,816.9	2%
Transport	12,185.4	7%	20,155.5	11%	32,340.9	9%
Science Tech. Environment	37.2	0%	9.5	0%	46.7	0%
General Economic Services	24,536.3	13%	9,553.7	5%	34,090.0	9%
Total for Economic Service	185,222.3	100%	186,895.3	100%	372,117.6	100%

*Note: *1= Old Andhra Pradesh, *2= Transition to new Andhra Pradesh (Old Andhra Pradesh for April and May, the rest for new Andhra Pradesh), *3= New Andhra Pradesh*
Source: Andhra Pradesh Budget in Brief 2015-16, pp. 9-10, Minister of Finance, Andhra Pradesh

As seen in the above table, rural development accounts for 30% of the total budget allocated to economic services, followed by agriculture and allied services (24%), and irrigation and flood control (14%).

4. PRESENT CONDITIONS OF IRRIGATION IN ANDHRA PRADESH STATE

4.1 General

This chapter describes briefly the present conditions of irrigation in Andhra Pradesh State, its features, characteristics, and shortcomings in comparison with the national level and between states and districts. Hereinafter, all figures for Andhra Pradesh State represents data after bifurcation from Telangana State, unless otherwise explicitly indicated.

Andhra Pradesh State is blessed with 40 major, medium and minor rivers. Godavari, Krishna, Vamsadhara, Nagavali are the main rivers flowing in the state followed by 35 other medium and small rivers like Champavathi, Sarada, Varaha, Tandava, Eleru, Erra Kaluva, Tammileru, Budameru, Muniyeru etc. Out of 40 rivers, 15 are inter-state rivers. In the above rivers, 54,255 MCM of water is available with 75% dependability. In addition to 24,957 MCM of annually replenishable utilisable groundwater is available in the state. So, the total water resources available from surface water and groundwater is 67,337 MCM. But this water is not uniformly distributed all over the state. As a result, some parts of the state faces water scarcity and some other places surplus conditions.

Current status of water resources and irrigation in Andhra Pradesh State is briefly as follows:

Table 4.1.1 Basic Information for Water Resources and Irrigation in Andhra Pradesh State

No.	Item	Present Condition
1	Geographical Area	16.276 million ha
2	Total cultivable Area	8.055 million ha
3	Irrigation Potential Created	4.157 million ha
4	Normal Annual Rainfall	966 mm (500 mm to 1,200 mm)
5	No. of Major and Medium Irrigation Projects completed	80 Nos.
	- Major projects	18 Nos.
	- Medium Projects	62 Nos.
6	No. of Major and Medium Irrigation Projects on going	
	- Major Projects	23 Nos.
	- Medium Projects	9 Nos.
	- Flood Banks	4 Nos.
	- Modernisation of Deltas	7 Nos.
7	Institution of Major Projects	
	- Project committees	17 Nos.
	- Distributory committees	246 Nos.
	- Water user association	1,708 Nos.
8	Institution of Medium Projects	
	- Project committees	34 Nos.
	- Water user association	239 Nos.
9	Institution of Minor Projects	
	- Water user association	4,065 Nos.
10	Irrigated Area	
	- Gross	3.886 million ha
	- Net	2.927 million ha
11	No. of Tanks	40,817 Nos.
12	Water storage Capacity of Tanks	7,803 MCM
13	Lift Irrigation Schemes	1,136 Nos.
14	Rain Water Harvesting Structures	36, 612 Nos.

Source: Initiatives in Irrigation Sector, DoWR/GoAP

In addition to the above, irrigation area in India by State (2010-11), State-wise percent coverage of irrigated area under principal crops (2011-12), irrigation source by state in India (2011-12) are shown in Attachments 4.1.1, 4.1.2 and 4.1.3.

Andhra Pradesh State is divided into three regions in relation to climate and hydrology as shown in

Table 4.1.2 and Table 4.1.3, of which monthly data are presented in Attachments 4.1.4 and 4.1.5, respectively.

- North Region: Relatively abundant in rainfall, northern mountainous area in low temperature
- Central Region: Rivers with huge catchment areas running through the region
- South Region: Relatively high temperature, less rainfall

Table 4.1.2 Rainfall Distribution by District and Season (1901-2002, 2009-2013)

(Unit: mm)

No.	Region	District	South West Monsoon (Jun. to Sep.)	North East Monsoon (Oct. to Dec.)	Winter Period (Jan. to Feb.)	Hot Weather Period (Mar. to May)	Total
1	North	Srikakulam	608.7	254.0	17.7	85.5	965.8
2		Vizianagaram	750.5	239.7	19.5	109.3	1,119.0
3		Visakhapatnam	722.4	270.8	16.0	86.4	1,095.6
4	Central	East Godavari	675.7	276.8	12.2	65.9	1,030.6
5		West Godavari	637.6	259.7	10.2	62.2	969.7
6		Krishna	545.5	273.5	9.9	67.0	896.0
7		Guntur	441.4	283.3	9.5	63.3	797.5
8		Prakasam	379.4	281.2	6.4	58.6	725.6
9	South	Nellore	375.6	401.1	11.9	66.9	855.6
10		Kadapa	367.3	212.3	3.8	85.5	668.8
11		Kurnool	322.1	156.4	2.5	67.4	548.5
12		Anantapur	351.1	185.7	2.7	112.5	652.0
13		Chittoor	429.7	310.0	11.4	119.3	870.4
Entire Andhra Pradesh State			508.2	261.9	10.3	80.7	861.2

Source: India Water Portal (http://www.indiawaterportal.org/)
Customised Rainfall Information System (http://hydro.imd.gov.in/hydrometweb/)

Table 4.1.3 Mean Temperature by District and Season (1901-2002)

(Unit: °C)

No.	Region	District	South West Monsoon (Jun. to Sep.)	North East Monsoon (Oct. to Dec.)	Winter Period (Jan. to Feb.)	Hot Weather Period (Mar. to May)	Average
1	North	Srikakulam	26.4	22.8	21.6	27.0	24.9
2		Vizianagaram	26.7	22.9	21.9	27.8	25.2
3		Visakhapatnam	28.1	24.4	23.4	29.4	26.7
4	Central	East Godavari	29.0	25.2	24.1	29.8	27.4
5		West Godavari	29.4	25.4	24.3	30.0	27.7
6		Krishna	29.1	25.0	24.3	30.1	27.5
7		Guntur	29.4	25.2	24.7	31.0	28.0
8		Prakasam	29.4	25.2	25.1	31.4	28.2
9	South	Nellore	27.9	24.6	24.9	31.2	27.4
10		Kadapa	27.1	23.6	23.6	29.5	26.2
11		Kurnool	27.9	24.6	24.9	31.2	27.4
12		Anantapur	25.6	23.3	23.7	28.9	25.5
13		Chittoor	27.0	23.5	23.2	28.5	25.9
Entire Andhra Pradesh State			27.9	24.3	23.8	29.7	26.8

Source: India Water Portal (http://www.indiawaterportal.org/)

The Krishna and the Godavari rivers have big catchment areas and flow through the central region of Andhra Pradesh State as shown in Figure 4.1.1. On the other hand, the northern and southern regions are covered by rather small river basins.

Source: Website of DoWR, Andhra Pradesh State (http://irrigationap.cgg.gov.in/wrd/basinMaps)

Figure 4.1.1 Andhra Pradesh State Basin Map

Therefore, each area presents its remarkable characteristics in irrigation source. As shown in Table 4.1.4, the central region takes advantage of big river basins and major irrigation canal systems serving water to their vast plains while tank irrigation is developed in the northern region and groundwater irrigation is relatively popular in the southern region.

Table 4.1.4 District-wise Irrigation Area by Water Source in Andhra Pradesh State

	District	Gross Irrigated Area	By Canal*			By Tank**			By Groundwater		
		(ha)	(ha)	(%)	Rank	(ha)	(%)	Rank	(ha)	(%)	Rank
North	Srikakulam	219,231	111,193	50.7%	5	75,658	34.5%	2	29,549	13.5%	13
	Vizianagaram	183,597	44,973	24.5%	10	87,793	47.8%	1	45,561	24.8%	9
	Visakhapatnam	158,500	66,468	41.9%	8	37,730	23.8%	3	28,052	17.7%	12
Central	East Godavari	500,709	337,721	67.4%	2	37,105	7.4%	8	112,465	22.5%	11
	West Godavari	673,127	355,102	52.8%	4	19,403	2.9%	12	24,471	42.3%	6
	Krishna	446,154	292,726	65.6%	3	35,014	7.8%	7	100,796	22.6%	10
	Guntur	514,144	358,819	69.8%	1	5,618	1.1%	13	128,756	25.0%	8
	Prakasam	261,892	96,289	36.8%	9	24,154	9.2%	5	126,101	48.2%	4
South	Nellore	337,261	153,169	45.4%	6	77,947	23.1%	4	99,119	29.4%	7
	Kadapa	202,500	30,118	14.9%	11	8,208	4.1%	11	162,917	80.5%	2
	Kurnool	288,639	121,693	42.2%	7	15,000	5.2%	9	134,945	46.8%	5
	Anantapur	165,393	21,778	13.2%	12	8,501	5.1%	10	132,826	80.3%	3
	Chittoor	203,175	9,359	4.6%	13	18,126	8.9%	6	175,612	86.4%	1
All Andhra Pradesh		4,154,322	1,999,408	48.1%	-	450,257	10.8%	-	1,561,170	37.6%	-

Source: Andhra Pradesh Statistic Summary 2014
** By Canal: Water resources are reservoirs and headworks.*
*** By Tank: Water resources are ponds.*

In view of actual irrigation practice, Table 4.1.5 shows that irrigation intensity is not so high, especially in tank irrigation, resulting to the possibility of increasing irrigation areas.

Table 4.1.5 Irrigation Intensity by Water Source in Andhra Pradesh State (Average 2009-14)

Source	Irrigation Area (ha)		Intensity (Gross/Net)
	Gross	Net	
Tanks	380,716	347,999	1.09
Canals	1,799,435	1,367,179	1.32
Wells	1,583,468	1,098,099	1.44
Others	139,206	121,002	1.15
Total	3,902,825	2,934,279	1.33

Source: Directorate of Economics and Statistics, Hyderabad, Andhra Pradesh (Statistical Abstract of Andhra Pradesh 2014)

4.2 Department in Charge of Water Resources and Irrigation Development

4.2.1 Responsible Department

The Ministry of Water Resources[1], Government of India is the competent authority for water resources and irrigation development at the national level in India, and Department of Water Resources (DoWR), Government of Andhra Pradesh (GoAP) is the responsible department for these concerns in Andhra Pradesh State.

The main functions of the DoWR of Andhra Pradesh State are:

- Hydrological assessment of the availability of water in the river basins including water allocation to irrigation and other purposes duly assessing the availability in the basin,
- Planning and design of irrigation systems,
- O&M of reservoirs and canal systems,
- Construction of new projects to create irrigation potential for economic development of the state,
- Stabilisation of existing ayacut (command area) by rehabilitation of the age-old projects,
- Modernisation of age-old major and medium irrigation projects,
- Improvement of water use efficiency by integrated and coordinated interventions and implementation of operation and maintenance plans for existing irrigation projects,
- Flood management, and
- Restoration and maintenance of flood banks.

The developed water resources such as dam storage are being used for power generation, domestic and industrial water, and other purposes as well.

The department is headed by an engineer-in-chief for administration and an engineer-in-chief for irrigation, and there is a commissioner of tenders (at same level as engineer-in-chief).

Assisting the above engineers-in-chief, there are 19 posts of chief engineers[2] who are responsible for specific units such as medium irrigation or hydrology, or specific major irrigation projects such as Projects Ongole or Projects Kurnool.

Under the chief engineer, superintending engineers are responsible for their circles. The hierarchy of DoWR officials is summarised in Table 4.2.1 and illustrated in Attachment 4.2.1.

Table 4.2.1 Hierarchy of DoWR Officials

Position	Abbreviation	Responsibility
Superintending Engineer	SE	Circle
Executive Engineer	EE	Division
Deputy Executive Engineer	DyEE	Sub-division
Assistant Executive Engineer	AEE	Section

Source: JICA Survey Team

As related organisations, the following institutions are established:

[1] The official name is The Ministry of Water Resources, River Development, and Ganga Rejuvenation (http://wrmin.nic.in/)

[2] http://irrigationap.cgg.gov.in/uploadedFiles/Employee%20Contacts/CE.pdf

i) Central Designs Organisation of Water Resources Department
Central Organisation of Water Resources Department is a part of DoWR and has specific duties such as furnishing design and drawings of various irrigation structures, finalising lay out of projects, construction drawing, interaction with other organisations, plan for rehabilitation of distress dams, their structural and hydrological review etc.

ii) Water and Land Management Training and Research Institute (WALAMTARI)
WALAMTARI was established in the year 1983 under World Bank aided project. It was registered as a society in the year 1992, under the Societies Registration Act. The institute is widely known in India and outside for the activities under participatory irrigation management.

iii) Commissionerate of Tenders (COT)
COT was constituted in 1987 to overcome several deficiencies in the tender accepting procedure and to ensure all round perception of objectivity and impartiality in the process of finalisation and acceptance of tenders.

iv) Andhra Pradesh State Irrigation Development Corporation Limited (APSIDC)
APSIDC was established in 1974 as an autonomous corporation under the Government of Andhra Pradesh, with main objective to take up the onus to provide irrigation facilities to upland areas to uplift small and marginal farmers and beneficiaries.

v) Ground Water Department
Mandate of Ground Water Department is to develop and disseminate technologies, and monitor and implement national policies for the scientific and sustainable development and management of ground water resources, including their exploration, assessment, conservation, protection from pollution and distribution, based on principles of economic and ecological efficiency and equity.

4.2.2 Budget and Expenditure

The sector-wise budgets and expenditures for irrigation and flood control for the last three years are summarised in Table 4.2.2.

Table 4.2.2 Expenditure and Budget for Irrigation and Flood Control in Andhra Pradesh State

(Unit: INR million)

Category	Budget Estimates 2014-2015	Budget Revised 2014-2015	Budget Estimates 2015-2016
Major Irrigation	23,883	24,009	38,357
Externally Aided Projects	6,286	6,287	9,092
AIBP[3]	2,257	2,257	8,552
State Schemes	15,340	15,465	20,713
Medium Irrigation	1,308	1,249	1,315
AIBP	380	380	448
State Schemes	928	869	867
Minor Irrigation	5,613	5,612	6,081
Externally Aided Projects	1,084	1,083	1,057
NABARD-RIDF[4]	2,000	2,000	1,100
AIBP	1,013	1,013	1,000
State Schemes	1,467	1,467	2,887
Ground Water Department	49	49	37
Command Area Development	146	145	135
Flood Control and Drainage	857	1,553	793
Total	31,808	32,568	46,681

Source: Annual Plan 2015-2016, Minister of Finance, Andhra Pradesh State (http://www.apsdps.ap.gov.in/dp/downloads/Annual_Plan_2015_16.pdf)

Looking into the budget estimate for 2015-16, the budget allocation for major irrigation comprises 82% of the total budget followed by minor irrigation (13%) and medium irrigation (3%).

[3] Accelerated Irrigation Benefits Programme (http://wrmin.nic.in/forms/list.aspx?lid=399)
[4] National Bank for Agriculture and Rural Development – Rural Infrastructure Development Fund (https://www.nabard.org/english/RIDFLoan.aspx)

4.3 Water Resources

4.3.1 Surface Water

Andhra Pradesh State has three major rivers, Godavari, Krishna, and Pennar. In addition to these rivers, 69 medium and minor rivers such as Bahuda, Nagavali, Sarada, Yeleru, Yerra Kalva, Vogarivagu, Gundlakamma, Manneru, Upputeru drain directly into the sea. The river basin map of Andhra Pradesh and Telangana states is shown in Figure 4.3.1.

Remarks: 12 sub-basin in total (No.20 – 26 and 43 – 44 and 47 – 49) are located in Telangana State.
Source: Water Resources of Andhra Pradesh, Andhra Pradesh State Remote Sensing Application Centre

Figure 4.3.1 River Basin Map in Andhra Pradesh and Telangana States

According to DoWR, the surface and groundwater resources of the sub basins are analysed in Table 4.3.1.

Table 4.3.1 Water Availability, Utilisation and Balance for Surface and Groundwater in Andhra Pradesh and Telangana States

(Unit: Million Cubic Meters)

Sub Basin No.	Basin Name	Items	Availability	Utilization	Balance	Sub Basin No.	Basin Name	Items	Availability	Utilization	Balance
1	Bahuda	Surface Water	64.93	60.85	4.08	37-39	Yerrakalva	Surface Water	917.90	473.09	444.81
		Ground Water	46.16	6.80	39.36			Ground Water	850.08	354.25	495.83
		Total	111.09	67.65	43.44			Total	1,767.98	827.34	940.64
2	Mahendratanya	Surface Water	138.07	355.72	-217.65	40	Tammileru	Surface Water	273.66	380.10	-106.44
		Ground Water	75.61	10.48	65.13			Ground Water	112.42	76.46	35.96
		Total	213.68	366.20	-152.52			Total	386.08	456.56	-70.48
3	Pundi Minor Basin	Surface Water	40.89	52.87	-11.98	41	Ramuleru	Surface Water	58.90	0.00	58.90
		Ground Water	55.50	10.19	45.31			Ground Water	290.53	125.73	164.80
		Total	96.39	63.06	33.33			Total	349.43	125.73	223.70
4	Noupada Minor Drainages	Surface Water	130.23	287.76	-157.53	42	Budameru	Surface Water	305.82	339.04	-33.22
		Ground Water	344.05	74.76	269.29			Ground Water	97.13	67.11	30.02
		Total	474.28	362.52	111.76			Total	402.95	406.15	-3.20
5	Vamsadhara	Surface Water	1,486.64	1,292.67	193.97	43-55	Krishna	Surface Water	22,965.09	29,407.20	-6,442.11
		Ground Water	237.86	61.45	176.41			Ground Water	11,340.39	4,438.12	6,902.27
		Total	1,724.50	1,354.12	370.38			Total	34,305.48	33,845.32	460.16
6	Nagavali	Surface Water	1,936.88	1,996.18	-59.30	56	Romperu	Surface Water	186.98	126.78	60.20
		Ground Water	615.05	150.65	464.40			Ground Water	455.34	31.15	424.19
		Total	2,551.93	2,146.83	405.10			Total	642.32	157.93	484.39
7	Peddagedda	Surface Water	71.73	193.38	-121.65	57	Fundlakamma	Surface Water	579.90	726.73	-146.83
		Ground Water	43.33	25.20	18.13			Ground Water	830.54	307.24	523.30
		Total	115.06	218.58	-103.52			Total	1,410.44	1,033.97	376.47
8	Kandivalasagedda	Surface Water	54.28	50.77	3.51	58	Minor Drainages between Musi & Gundlakamma	Surface Water	60.17	24.92	35.25
		Ground Water	61.45	31.72	29.73			Ground Water	118.65	23.50	95.15
		Total	115.73	82.49	33.24			Total	178.82	48.42	130.40
9	Champavathi	Surface Water	236.45	447.32	-210.87	59	Musi (A) - K11	Surface Water	145.35	78.07	67.28
		Ground Water	300.44	73.62	226.82			Ground Water	135.92	53.80	82.12
		Total	536.89	520.94	15.95			Total	281.27	131.87	149.40
10	Gosthani	Surface Water	243.98	227.33	16.65	60	Paleru (A)	Surface Water	164.72	138.67	26.05
		Ground Water	214.08	41.34	172.74			Ground Water	144.98	78.44	66.54
		Total	458.06	268.67	189.39			Total	309.70	217.11	92.59
11	Mathurvada	Surface Water	32.51	52.87	-20.36	61	Manneru	Surface Water	324.23	400.09	-75.86
		Ground Water	23.22	5.95	17.27			Ground Water	289.97	149.80	140.17
		Total	55.73	58.82	-3.09			Total	614.20	549.89	64.31
12	Narvagedda	Surface Water	45.59	157.92	-112.33	62	Kandleru	Surface Water	125.30	110.61	14.69
		Ground Water	68.81	15.86	52.95			Ground Water	609.95	103.92	506.03
		Total	114.40	173.78	-59.38			Total	735.25	214.53	520.72
13	Anakapalli	Surface Water	34.97	75.10	-40.13	63-72	Pennar	Surface Water	2,765.13	5,559.53	-2,794.40
		Ground Water	30.58	3.11	27.47			Ground Water	3,987.03	2,550.23	1,436.80
		Total	65.55	78.21	-12.66			Total	6,752.16	8,109.76	-1,357.60
14	Sarda	Surface Water	354.13	549.89	-195.76	74-75	Swarnamukhi	Surface Water	490.76	451.46	39.30
		Ground Water	262.78	76.46	186.32			Ground Water	487.62	239.28	248.34
		Total	616.91	626.35	-9.44			Total	978.38	690.74	287.64
15	Varaha	Surface Water	204.39	151.89	52.50	76-77	Kalangi	Surface Water	246.05	167.38	78.67
		Ground Water	94.01	32.85	61.16			Ground Water	230.78	84.10	146.68
		Total	298.40	184.74	113.66			Total	476.83	251.48	225.35
16	Thandava	Surface Water	303.47	279.49	23.98	78	Arani	Surface Water	178.94	189.10	-10.16
		Ground Water	131.39	31.43	99.96			Ground Water	116.95	100.53	16.42
		Total	434.86	310.92	123.94			Total	295.89	289.63	6.26
17	Pampa	Surface Water	96.70	45.08	51.62	79	Kushustali	Surface Water	148.18	118.90	29.28
		Ground Water	74.19	20.67	53.52			Ground Water	86.37	87.22	-0.85
		Total	170.89	65.75	105.14			Total	234.55	206.12	28.43
18	Suddagedda	Surface Water	103.13	58.42	44.71	80	Ponnair	Surface Water	5.07	24.64	-19.57
		Ground Water	232.77	72.77	160.00			Ground Water	0.00	0.00	0.00
		Total	335.90	131.19	204.71			Total	5.07	24.64	-19.57
19	Yeleru	Surface Water	577.07	534.31	42.76	81	Paiar	Surface Water	469.95	498.49	-28.54
		Ground Water	169.62	13.59	156.03			Ground Water	436.08	371.24	64.84
		Total	746.69	547.90	198.79			Total	906.03	869.73	36.30
20-36	Godavari Basin (Total)	Surface Water	41,909.16	37,988.44	3,920.72	Total Surface Water			78,477.30	84,073.06	-5,595.76
		Ground Water	9,882.92	3,703.86	6,179.06	Total ground Water			33,584.55	13,704.88	19,879.67
		Total	51,792.08	41,692.30	10,099.78	Total Water			112,061.85	97,777.94	14,283.91

Source: Water Resources of Andhra Pradesh, Andhra Pradesh State Remote Sensing Application Centre

Regarding the balance of the surface water resources, 19 of 39 basins, including the sub basins in Telangana State, are in minus (availability < utilisation). Based on the analysis, there are categorised low potential basins (minus balance) and high potential basins (plus balance). The total balance in Andhra Pradesh and Telangana states is minus due to minus balance of major basins of the Krishna and Pennar rivers.

4.3.2 Groundwater

Regarding the balance of groundwater resources, 38 of 39 basins, including the sub-basins in Telangana State, are in plus. Only one basin (Kushustal basin) is in minus balance. The total balance of Andhra Pradesh and Telangana is also a plus. Godavari and Krishna basins, especially, are in plus balance of more than 6,000 million m^3.

In total of the surface water and groundwater, ten (including the main basin of Pennar River) out of 39 basins are in minus balance. Comparing surface water and groundwater, the development potential of groundwater is generally higher than that of surface water. Both surface water and groundwater of Godavari basin are in plus balance and the total balance is more than 10,000 million m^3.

4.4 Irrigation System

4.4.1 Surface Irrigation

In India, irrigation systems are classified into the following three categories according to their command areas.

- Major Irrigation Project: Command area is greater than 10,000 ha.
- Medium Irrigation Project: Command area is between 2,000 ha and 10,000 ha.
- Minor Irrigation Project: Command area is less than 2,000 ha.

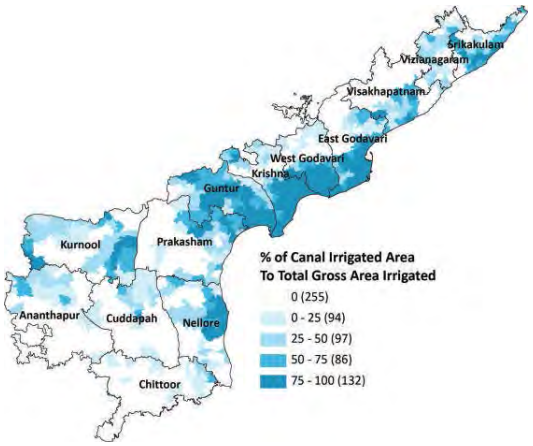
In Andhra Pradesh State, water users associations (WUAs) are organised for irrigation schemes of which the command area is greater than 40 ha. About four million ha of irrigation potential has been created so far, as summarised in Table 4.4.1.

Table 4.4.1 Total Irrigation Potential in Andhra Pradesh State

Description	Irrigation Potential Created	
	(acre)	(ha)
Irrigation Potential Created before 1956		
Major and Medium Irrigation	2,972,721	1,189,000
Irrigation Potential Created 1956 to 2015/02		
Major and Medium Irrigation	3,935,689	1,574,000
Irrigation Potential Created Since Inception up to 2015/02		
Minor Irrigation	2,560,444	1,024,000
APSIDC[5]	703,426	281,000
Total	10,172,280	4,068,000

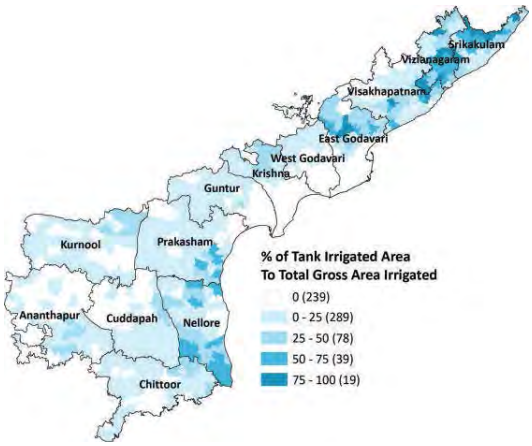
Source: Website of DoWR, Andhra Pradesh ((http://irrigationap.cgg.gov.in/wrd/projects)

The distributions of irrigation areas by water source are illustrated in Figure 4.4.1 and Figure 4.4.2.



Source: Andhra Pradesh Statistic Summary 2014

Figure 4.4.1 Canal Irrigation Area



Source: Andhra Pradesh Statistic Summary 2014

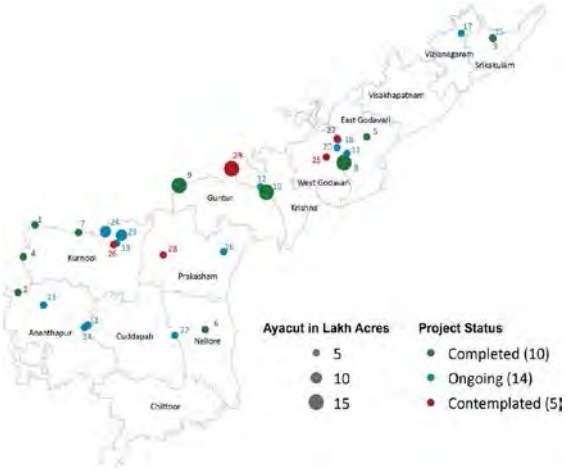
Figure 4.4.2 Tank Irrigation Area

[5] AP State Irrigation Development Corporation Limited is an AP State company mainly for irrigation development of upland areas (http://apsidc.ap.nic.in/aboutAPSIDC.html).

As observed from the figures above, the central region is mainly irrigated by canals namely major and medium irrigation projects. The area irrigated by canals occupies 48.1% of the total irrigation area in Andhra Pradesh State.

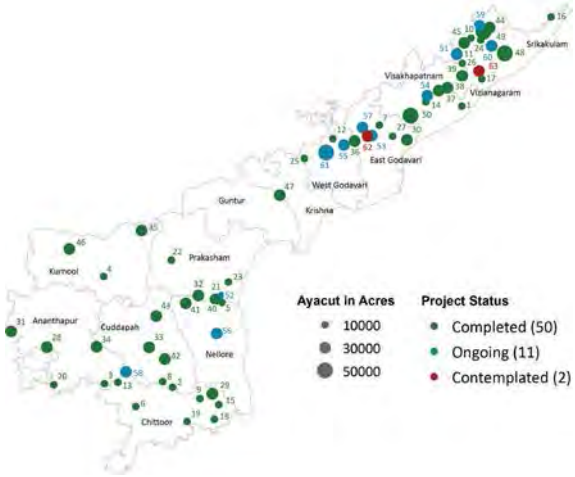
On the other hand, tank irrigation systems are developed more in the northern and southern regions, where rivers with big catchments are scarce. Tank irrigation consisting of medium and minor irrigation schemes covers 10.8% of the total irrigation area in Andhra Pradesh State.

Andhra Pradesh State has ten major irrigation projects and 50 medium irrigation projects already completed, forming 2.1 million ha of command area. The state also has 14 major and 11 medium ongoing projects, of which the total command area is 1.2 million ha as of May 2014. As shown in Figure 4.4.3 and Figure 4.4.4, major irrigation projects exist mainly in the central region while many medium irrigation projects are operating in the northern region.



Source: Andhra Pradesh Statistic Summary 2014

Figure 4.4.3 Major Irrigation Projects



Source: Andhra Pradesh Statistic Summary 2014

Figure 4.4.4 Medium Irrigation Projects

Minor irrigation projects, defined as projects with command areas of less than 2,000 ha, are scattered all over Andhra Pradesh State. The small-scale schemes of which the command area is less than 40 ha were superintended until 2005 by the Panchayati Raj Department, and had been transferred to DoWR. The numbers of minor irrigation projects are 6,361 with command areas of over 40 ha and 35,376 with command areas of less than 40 ha, for a total number of 41,737. The total command area works out to be about one million ha.

However, the actual irrigated area fluctuates between 272,000 ha and 537,000 ha (2008-2014) as shown in Table 4.4.2.

The following are reckoned as the reasons for this gap.

- Decrease in inflows to the tank
- Decrease in storage due to silting
- Deterioration of physical system
- Poor canal system
- Poor water use efficiency

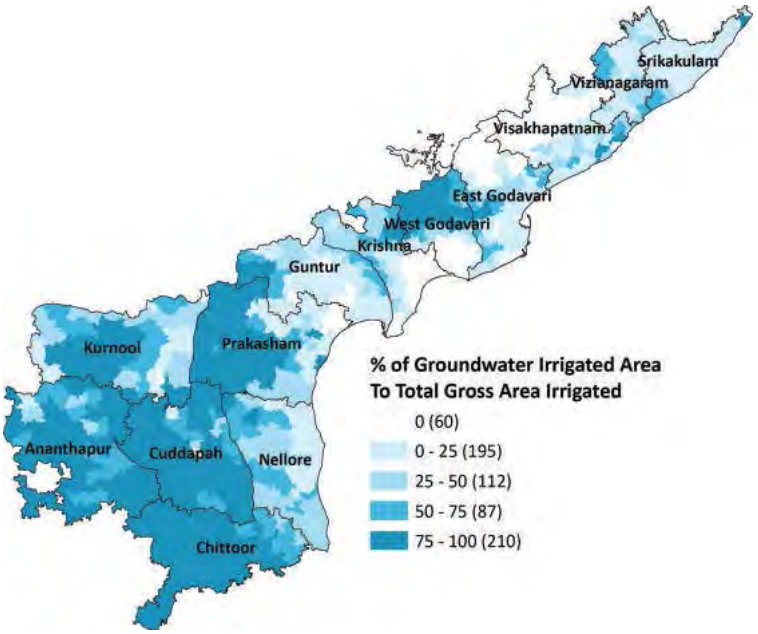
Table 4.4.2 Total Irrigated Area in Andhra Pradesh State

Crop Season	Irrigated Area	
	In 100,000 acres	In 1,000 ha
2008-2009	9.03	362
2009-2010	6.81	272
2010-2011	9.97	399
2011-2012	11.27	451
2012-2013	13.43	537
2013-2014	11.56	462

Source: Web Site of DoWR (http://irrigationap.cgg.gov.in/wrd/minorirrigation)

4.4.2 Groundwater Irrigation

Groundwater irrigation comprises 37.6% of the total irrigation areas in Andhra Pradesh State. The development of groundwater irrigation is conducted by the State Ground Water Department under DoWR. The southern and central regions depend mainly on groundwater irrigation as shown in Figure 4.4.5.



Source: Andhra Pradesh Statistic Summary 2014

Figure 4.4.5 Groundwater Irrigation Area

It is considered that groundwater has not been utilised enough in comparison to its potential. A White Paper on Irrigation (2014) issued by DoWR, Andhra Pradesh State declares the following and emphasises poor utilisation of groundwater for irrigation purpose.

- Neglecting water conservation methods.
- Areas like minor irrigation, water conservation measures, rainwater harvesting for ground water recharge, conjunctive use of surface and ground water, sprinkler, and drip irrigation were totally neglected which resulted in the reduction of areas under irrigation.

4.4.3 Conjunctive Use of Surface Water and Groundwater for Irrigation

Conjunctive use of surface water and groundwater for irrigation means:

The practice of storing surface water in a groundwater basin during wet seasons and withdrawing it from the basin during dry seasons so that the combination of surface water and groundwater helps in constant irrigation supply to crops throughout the year

In Andhra Pradesh State, the Ground Water Department under DoWR is aiming at expanding conjunctive use in order to decrease the gap ayacut[6] and increase net irrigation areas; however it is still in the stage of studies, investigations, and planning.

Considering the high gap ayacut and especially frequent droughts in some areas, it is considered useful to introduce conjunctive use of surface water and groundwater.

The White Paper on Irrigation 2014 is focusing on the conjunctive use of surface water and groundwater, taking up lift irrigation schemes with micro irrigation in order to popularise irrigated dry (ID) crops, horticulture, floriculture, and other low water-consuming commercial crops.

DoH is implementing Andhra Pradesh Micro Irrigation Project (APMIP[7]) aiming at promotion of micro irrigation (MI) in Andhra Pradesh State. The objectives are as follows.

- To increase the area under MI through improved technologies
- To enhance water use efficiency
- To increase productivity of crops and farmer income

[6] The gap between command area and actual irrigated area of which the cause is water loss due to deficiencies in facilities and poor operation and management, assuming that the water allocated to the project is available.
[7] http://horticulturedept.ap.gov.in/Horticulture/(S(ilngo5fgb3bmhwy2tnyom4xj))/Home.aspx

- Saving energy in Agriculture sector
- Higher fertilizer use efficiency

The irrigation methods are mainly drip and sprinkler for fruits, horticulture crops and vegetables utilising groundwater. The system and procedure of this programme is given below.

- The size of farmland for micro irrigation is 50 acre (20 ha) at the maximum, and farmers who possess lands larger than 54 acre are not eligible.
- A farmer who is already a beneficiary under an existing public irrigation scheme is also allowed to apply for this programme.
- An applicant farmer registers the application online through Mee Seva[8] centre
- The farmer should have water source and power supply.
- After examination by APMIP officers (Project Director, Deputy Project Director, MI Engineer and MI Area Office), a sanction is given if deemed applicable.
- The sanction is notified to the farmer by SMS and the amount to be borne by him/her.
- The farmer negotiates and selects a registered firm for provision and installation of MI system. At present 26 companies are registered in Andhra Pradesh State in this regard.
- After installation of MI system, the company is obligated to provide free follow-up/after-sales service for five years (stipulated in the contract).
- The GoI and Andhra Pradesh State subsidize majority of the costs. For SC/ST beneficiaries, 100% of the cost is subsidised, and 90% for small farmers.

This program was started in 2003 and under this program, farmlands of 437,376 ha and 161,645 ha were provided with drip and sprinkler irrigation respectively as of 2014/15, and the action plan for 2015-16 aims at 100,000 ha development.

4.5 Participatory Irrigation Water Management and Water User Associations

4.5.1 Irrigation Management Reform

Irrigation sector reform in Andhra Pradesh State was initiated to involve farmers in irrigation management and ultimately to achieve irrigation management transfer to farmer's organisations. The irrigation management transfer to farmer's organisations was associated with policy, legislative, public expenditure, and institutional reforms through a timely linkage with the Andhra Pradesh Economic Restructuring Project (APERP). The actions taken for reform are summarised in Box 4.5.1.

Box 4.5.1: Major Features of Irrigation Management Reform

- A new irrigation policy:
- Tripling of water charges in 1996/97 *rabi* season for sustainable O&M of the schemes,
- Issuance of legislation for farmer management of irrigation (Andhra Pradesh Famers Management of Irrigation System (APFMIS) Act)
- Community outreach: the policy and programmes were prepared through substantial consensus both in the community and the political levels
- Creation of water users associations across the state (10,292 WUAs and 174 distributary committees were formed)
- Established Water Charge Review Committee (WCRC) in 1997 for review of revenue collection and O&M expenditure needs;
- WUA, staff, and NGO training programmes conducted with a major training campaign
- Joint diagnostic of scheme deficiencies and needs by WUAs and department staffs
- Minimum rehabilitation: deferred maintenance works were taken up by WUAs, which enabled them to manage maintenance works including procurement, negotiation for machineries, and maintenance of records.

Source: The World Bank, 1999, 'the Irrigation Sector' The International Bank for Reconstruction and Development

[8] 'Mee seva' means 'at your service' in Telugu, which provides public services through technology such as internet. There are 62,000 centres in AP state. (http://www.meeseva.gov.in/Meeseva/intro.html)

Achievement of the reform was additional area of more than 20,000 ha opened to irrigation[9]. It was assessed that the cost of maintenance works taken up by the WUAs was on an average 20% lower than that of works let out to contractor[9].

Within the irrigation reforms programme, participatory irrigation management (PIM) was promoted in three phases as follows:

First phase: A pilot programme of water users association (WUA) in the management of irrigation system in a small-scale minor scheme under Sriramsagar Project, which was gradually expanded to wider areas.

Second phase: The experience of the first phase was scaled up to the entire state. During this period, an act was passed to provide policy and legal space for WUAs, and WUAs were provided with capacities and resources required for PIM. At this point, emphasis was given to minimum rehabilitation, so as to improve the system before WUAs could take over maintenance.

Third phase: Focusing on water management and annual repairs and maintenance by WUAs, there was a delay in elections of the WUA managing committees and no effort to build a perspective to deal with change management. As a result, and with limited financial resource, the reform progress was hindered.

4.5.2 Procedure of District Irrigation Plan

India has two crop seasons, Kharif and Rabi. Kharif season is from June 1 to October 31 and Rabi season is from November 1 to March 31. The dates of irrigation water supply (District Irrigation Plan) for Kharif / Rabi crop for each and every irrigation scheme (major/medium/minor) are decided by the Irrigation Advisory Board of the district before the beginning of each season. The chair of the Irrigation Advisory Board is the district collector. All the members of parliament and state legislature in the district and all district officers including executive engineers, presidents of distributory committees, and Project Committees (PCs) of WUAs in the district are members of the Irrigation Advisory Board. In addition to the dates of irrigation water supply, weekly/10-day supplies of quantities (discharge) of water are also decided by the Irrigation Advisory Board of the district. Irrigation schedules decided by the board can be modified after commencement of irrigation if deemed necessary, although it still requires approval by the board. For minor irrigation schemes, WUAs of the concerned minor irrigation projects propose their irrigation plan to the board for their approval, through the concerned executive engineer. The WUAs of minor irrigation projects can participate in the decision making through discussions with their executive engineer.

4.5.3 Andhra Pradesh Farmers Management of Irrigation Systems (APFMIS) Act

The APFMIS Act was enacted in 1997 as a legal framework for the reform of irrigation management, followed by the Andhra Pradesh Farmer's Organisation Rules, 1997 for detailed implementation provisions. It devolves power to water users to take over the management and maintenance of irrigation systems. It encouraged farmers to improve irrigation utilisation by providing water rights and created an enabling environment by building institutional frameworks through formation of WUAs in all irrigation projects that have more than 40 ha of command area in the state and by making department staff accountable to WUAs. The act was revised in 2009[10].

[9]J.Raymond Peter (2001) IMT Case Study India, Irrigation Reforms in Andhra Pradesh, India, International Network on Participatory Irrigation Management (INPIM)

[10] 'The Andhra Pradesh Farmers Management of Irrigation System Act, 1997 (with updated amendment as of June 2009) and The Andhra Pradesh Farmers' Organisation Rules, 1997' Water and Land Management Training and Research Institute (WALAMTARI)

Box 4.5.2: Major Features of APFMIS Act 1997

- Transfer of power for the management of state-owned assets
- Creation of new autonomous institutions as legal entities
- Areas defined on a hydraulic basis
- Equity achieved within the structure of a WUA by introducing the concept of territorial constituencies
- All land holders in possession of land in an irrigation system become WUA members with voting rights
- One member, one vote
- Elections by secret ballot
- Functional and administrative autonomy
- Freedom to raise resources
- Resolution of disputes and compounding of offenses
- Simplified procedures for taking up works
- Five-year tenure for farmer's organisations
- Irrigation department, as the responsible authority, is made fully accountable to the farmer's organisations
- Right to recall an elected member after one year
- Social audit and annual accounts audit.

Source: J.Raymond Peter, INPIM, 'IMT Case Study, Irrigation Reforms in Andhra Pradesh, India'

4.5.4 Water Users Association (WUA)

WUAs were formed as legal entities through the APFMIS Act. The act defined farmer's organisations that includes WUA at the primary level, distributory committees (DCs) at the secondary level, and project committees (PCs) at the project level. A distributory committee is comprised of the presidents of all WUAs and a project committee is comprised of all the presidents of the distributory committees. In Andhra Pradesh State, it forms three-tiered structure of PC, DCs and WUAs for major irrigation project, two-tiered structure of PC and WUAs for medium irrigation project, and one-tiered structure of WUA for minor irrigation project. The roles of each farmer's organisation is summarised in Attachment 4.5.1.

The functions of the WUAs include:

- Preparation and implementation of a rotational water supply schedule for each irrigation season based on crop plan to match water deliveries with crop requirements;
- Regulation of water use and monitoring of flow of water for irrigation;
- preparation and implementation of a plan for the maintenance of the distributor system;
- organisation of repair of the system by the farmers free of cost or on payment;
- Education of farmers on preparation of field and irrigating field as well as agriculture operation such as new crop varieties, pesticides, and weedicide; and
- Procurement and hiring of implements and gadgets for agricultural operation as required.

The structure of a WUA comprises of president, vice president, territorial committee members (six per WUA), and farmers in a given territory who are utilising water for irrigation and paying water cess as recorded in the revenue records. The managing committee (MC) of the WUAs, consisting of the territorial committees, have tenures of six years each with one third of the members seeking re-election every two years. The president, vice president, and MC members are elected directly by the water users through a democratic process of secret voting. Elections are organised by the district collector with authorisation by the Water Resources Department. Each member has a vote regardless of the extent of his or her land holdings. If an election is not conducted at the expected time, a competent authority will discharge all the responsibilities in the absence of elected committees. This situation occurred after the election in 2002.

WUAs were established in 1997 after the APFMIS Act came into effect. As the WUA MCs are supposed to be elected every five years, the following elections were conducted in 2002. However, after the election of the MC in 2002 (the election had been delayed and actually was conducted in 2003), no election has been done in most of the WUAs and the WUAs became dormant after the elected MC ended their term in 2007. This was mainly due to the priority of the government at the time that did not stress

the importance of the WUAs. During the absence of the MC of WUAs, deputy executive engineers took the role of the WUA president and vice president organising meetings, having financial responsibility, and maintenance works until the recent WUA elections in 2015.

By the end of February 2016, the elections of the WUAs have been conducted in the whole of Andhra Pradesh and 5,715 WUAs (out of total 6,012) have formed MCs through elections led by DoWR. After the election of MCs of WUAs, the DoWR started some training programmes for the newly elected MC members. However, the DoWR has not yet established a clear vision for further development of the WUA. In consideration of this situation, it is a very crucial time to support establishing an optimal PIM strategy. The DoWR formed a working group to prepare the new strategy and guideline for WUAs.

4.5.5 Water Tax and Revenue for O&M

Water tax (cess) was set through the Andhra Pradesh Water Tax Act, 1988 followed by the Water Tax Rules 1990. Water tax has been levied in every land receiving water for irrigation and aqua-culture purpose from any government source of irrigation. Water tax collection is done through joint azmoish carried out both by DoWR and the Revenue Department (Azmoish means the inspection of lands and fields to record the details of the raised crops, trees, and wells.). In order to fund the different/diverse activities, the tax demand is estimated and raised through an assessment of the irrigated cropped area and crop types. At the field level, the assessment of the irrigated area is to be carried out by WUAs and competent authorities through a joint azmoish.

Cess is collected by the Revenue Department as revenue tax. A certain percentage of the collected cess is allocated for maintenance of irrigation scheme. The Andhra Pradesh government, through the policy change to delegate the water management to WUAs, issued an order regarding plough back rate of cess for O&M by WUAs in 2008 (Attachment 4.5.2) which stated that the whole amount of the collected cess is to be used for maintenance and repair work of the irrigation schemes by ploughing back to WUAs and Gram Panchayats. The cess collected is allocated based on the regulation with different portion depending on the level of FO (WUAs, distributory committee, project committee) and Gram Panchayat. For minor irrigation scheme, 90% of the collected revenue is ploughed back to WUA (80% for maintenance works and 10% for administration and water management) and 10% goes to Gram Panchayat. However, due to dormant WUAs, cess plough back has not been credited to WUA accounts and instead was paid in the form of maintenance work through the DoWR.

4.5.6 O&M Budget and Expenditure

The O&M primarily depends on the type of works, methods of assessing the irrigated area (joint inspection by Agriculture, Revenue, and Water Resources departments), tax liability, apportionment and procedure for ploughing back of tax, and source of revenue to make it sustainable. Maintenance and repair works with cost less than INR 500,000 are the responsibility of the WUA, while those above INR 500,000 are under responsibility of the government. The expected works to be done by WUAs include regular maintenance works, de-silting, weed removal, embankment repairs, revetment, repairs to shutters, masonry, lining, cleaning, oiling of screw-gearing shutters, and painting of hoists and gates. However, the present status of O&M of the irrigation projects in general is not satisfactory, as WUAs are dependent on government machinery for O&M works. O&M cost is covered in collected cess that is earmarked for O&M works, and government subsidised schemes of maintenance works. Cess in a minor irrigation scheme is INR 200 per acre per crop season for paddy (wet crop) and INR100 per acre per crop season for ID crops. In the case of a minor irrigation scheme with command area of 200 acre (average command area of the proposed minor irrigation schemes), where farmers cultivate paddy in *Kharif* and ID crops in *Rabi*, the maximum annual cess collection amounts only to INR 60,000. Even though the government has been allocating some portion of budget as their own scheme or as donor funded project, insufficient financial source have been hindering O&M works.

4.6 Donor Support for Water Resources and Irrigation Development

4.6.1 Externally Aided Programmes and Projects

The GoAP is implementing three major externally aided projects in the state for agricultural/irrigation development. These are the following:

i) Andhra Pradesh Irrigation and Livelihoods Improvement Project-I under JICA (APILIP-I);
ii) Andhra Pradesh Community Based Tank Management Project under WB (APCBTMP); and
iii) Andhra Pradesh Water Sector Improvement Project under WB (APWSIP).

KC Canal Modernisation Project under JICA was executed and completed successfully in 2013. The irrigation water was provided up to the tail-end farm and the farmers are enjoying good crop production with irrigation.

The above three ongoing projects are in good progress and nearing completion in 2016/2018. The abstract of these projects and one completed project is presented in Table 4.6.1.

Table 4.6.1 Summary of Other Externally Aided Programmes

Donor Agency	Name of Project	Main Scope of Works	Main Works Attained/Progress	Data Source
Japan International Cooperation Agency (JICA)	Andhra Pradesh Irrigation and Livelihoods Improvement Project – I (APILIP-I)	(i) Construction of 55 minor irrigation projects, (ii) improvement of 20 medium irrigation projects, (iii) participatory irrigation water management, and (iv) capacity building for livelihood improvement.	Scope of the project, project cost, implementation schedule, organisational structure for project implementation and OandM, project effects, and lessons learned. (May 2008 to July 2016)	Project (interim) completion report and interview to Department of Water Resources.
World Bank (WB)	Andhra Pradesh Community Based Tank Management Project (APCBTMP)	(i) Participatory groundwater management targeting 975 minor tank irrigation projects. (ii)Institutional development, agriculture,horticulture,and fisheries.	Scope of the project, project cost, implementation schedule, organisational structure for project implementation and OandM, project effects, and lessons learned. (July 2007 to July 2016)	Post evaluation report, progress reports, and interview to Department of Water Resources.
World Bank (WB)	Andhra Pradesh Water Sector Improvement Project (APWSIP)	(i) Improvement of irrigation service delivery on a sustainable basis to increase productivity of irrigated agriculture in the Nagarjunasagar Scheme (ii)Establishment of a model of groundwater management by individual farmers and farmer's groups	Scope of the project, project cost, implementation schedule, organisational structure for project implementation and O&M, project effects, and lessons learned. (2007 to July 2018)	Post evaluation report, progress reports, and interview to Department of Water Resources
Japan Bank for International Cooperation (JBIC)	Kurnool and Kadapa Canal Modernisation Project (KCCMP)	(i) Constrcution of Sunkesula Barrage, Alaganur Balancing Reservoir (ii) CC lining of main canal (306 km) and distributaries (iii) Participatory irrigation water management, and capacity buildings.	Scope of the project, project cost, implementation works, organisational structure for the project implementation and OandM, project effects, and lessons learned. (Jan 1998 to June 2013)	Project completio report of KCCMP

Source: JICA Survey Team

4.6.2 Lessons from the Past Programmes and Projects

DoWR is preparing a detailed project report (DPR) for implementation of irrigation projects. So far, twelve DPRs have been prepared for medium irrigation projects and twelve DPRs of remaining ten projects are in progress. For the minor irrigation projects (proposed 485 projects), preparation of DPRs is under process in Command Area Development Authority (CADA).

The DPRs of sample projects will be reviewed by the JICA Survey Team. The JICA Survey Team keeps attention on the hydrological study, cost estimates, rehabilitation/strengthening works, and feasibility of the project. The cost estimate in DPR prepared by DoWR for APILIP-II projects will be carefully examined as the estimated cost will become the basis of the project appraisal.

Nippon Koei Co. Ltd. has been engaged in two similar yen loan projects in Andhra Pradesh State.

Therefore, work experiences and technical know-how of irrigation and agricultural development have been gained in the state. The JICA Survey Team has discussed with department officials collection of data/information and conducted field survey/interview of the WUA and farmers in November and December 2015 referring to the lessons learned. The lessons learned from the projects of "Kurnool Kadapa Canal Modernisation Project (KCCMP)" and "Andhra Pradesh Irrigation and Livelihoods Improvement Project (APILIP)" are summarised in Table 4.6.2.

Table 4.6.2 Lessons Learned from Similar Yen Loan Projects Implemented in Andhra Pradesh State

Item	Lessons Learned	Countermeasures proposed by the JICA Survey Team
(1) Preparation of DPR* (Minor Irrigation)	Most of existing minor irrigation schemes were designed and constructed under the old design standard.	a) To apply the latest Indian Standards (IS) code for design in general. b) To prepare DPRs of all candidate minor irrigation projects before the project appraisal by JICA.
	The candidate minor irrigation schemes are not necessarily suitable for modernisation.	a) To examine the water balance of the projects. b) To examine the cost - benefit ratio (B/C) of the projects.
(2) Preparation of DPR (Medium Irrigation)	Preparation of DPR often takes time including the approval from Central Water Commission (CWC).	a) To apply the latest Indian Standards (IS) code for design in general. b) To prepare DPRs of all candidate medium irrigation projects before the project appraisal by JICA.
	Minimising cost increases due to design changes during construction stage.	To carefully review and finalise DPRs with attention to hydrology, water balance and B/C of the projects.
(3) Technical and Administrative Sanction, Tendering and Contract Signing	Avoiding unnecessary delay due to pre-construction activities.	a) Timely arrangement of the meetings for the technical advisory committee (TAC), administrative and technical sanctions. b) To use standard bid documents authorised by DoWR/GoAP. c) To standardise bid evaluation reports for all projects. d) To attend commissionarate of Tenders (COT) to be held once a month with all necessary documents.
(4) Major Design Change	Central Design Office (CDO) is in charge for the major design change of main structures.	a) To request the Central Design Office (CDO) immediately for design change of major structures such as aqueduct, siphon, bridge, etc whenever requires. b) To keep a cooperative relationship with the CDO for the smooth design changes of major structures.
(5) Work Progress Control	Construction works are often delayed due to the design changes, limited time due to irrigation cropping period, and capacity of contractors.	a) To organise the monthly project meeting chaired by Secretary-DoWR and/or state project director (SPD) inviting the contractors if necessary, and to discuss work progress, quality and safety control, problems and measures. b) To guide the contractors for (i) provision of necessary construction equipment with good working conditions. (ii) procurement of construction material such as cement, steel, fuel, sand, good embankment, and to support the contractors in procurement of local sand and embankment materials with the local government and land owners concerned. c) To commence the works as soon as dry season (December to June) begins since the construction period is limited due to cropping season (July to November). d) To make special attention on finishing (balance) works because it usually takes quite long time (more than 3 months) to complete the finishing works. e) Timely preparation of final payment statement, as-built drawings by contractors and completion certificate by DoWR. f) Timely settlement of the progress payment to the contractors and close communication with Project Account Officer (PAO) for smooth payment.

Item	Lessons Learned	Countermeasures proposed by the JICA Survey Team
(6) Quality Control	Contractors generally have low awareness of safety control.	To achieve better quality of works attributable to long life of structure and less maintenance costs. - Head work (dam bund and spillway): To repair based on the project specifications and the Indian Standards (IS) codes, and communicate with CDO for their guidance. - Main canals and distributory: Hydraulic Particulars should be prepared based strictly on the site conditions. - Earthwork: Selection of adequate soils and proper compaction with specifications. - Concreting: Proper mixing (weight base) and strict curing work. - Structures: Analysis of works by equipment on compaction works and concrete mixing at the site.
(7) Safety Control	Contractors generally have low awareness of safety control.	To minor and guide the safety control measures strictly based on the safety report submitted by the contractors.
(8) Modern Irrigated Agriculture	Farmers are not accustomed to modern irrigated agriculture practices.	a) To provide training in modern farming practices to the farmers and WUAs through promotion of involvement of WALAMTARI and NGOs. b) It is proposed to organize workshop at the project area time to time. c) The exposure visits to the similar project will be quite effective.
(9) Implementation Body	A comprehensive project for irrigation development, food value chain, and poverty eradication requires close coordination amongst relevant departments.	To establish a project steering committee (PSC) as an appropriate implementation body for the project and also establish a project management unit (PMU) under the committee as the management body.
(10) Participatory Irrigation Management (PIM)	Irrigation management by WUA has been revived through different projects. Issues identified from the previous project are insufficient intervention and resources organisational development.	Intensive support to WUA is proposed with enough budget and supporting agencies. The practical number of supporting organisation to support WUAs is to be assigned with enough staffs and budget. Capacity development of the staffs of the supporting organisation shall be conducted.

*Note: *DPR = Detailed Project Report*
Source: JICA Survey Team

Good lesson learned from similar Yen loan projects are as follows;

i) Preparation of Detailed Monthly/Bi-monthly Monitoring Report by the Consultant (PMC) where detailed actual progress problems and those measures should be indicated. The monitoring report will be effectively utilised for decisions of the proper measures by SPD, CE, EE.

- Guidance to the project site engineers for smooth project implementation
- Guidance to the contractor for procurement of necessary equipment, construction materials as well as safety control works.

ii) Prepare the sample completion report for the project-wise medium and minor irrigation projects (several samples).

iii) Assistance for preparation of annual disbursement schedule to JICA together with Action Plan.

iv) Organise Mini-Workshop at the Project/Construction Site inviting WUA, farmers and contractor, for

- Procurement of construction materials (embankment soils, gravel and sand)
- Smooth employment of construction workers
- Construction works during ID crop season
- Construction of WUA facilities
- Guidance for actual irrigation practice together with NGO, etc
- Safety control activities

5. PRESENT CONDITIONS OF FOOD VALUE CHAIN IN ANDHRA PRADESH STATE

5.1 General

(1) Agro-climatic Zone of the Andhra Pradesh State

Agro-climatically, the state has been divided into five zones. Features of rainfall, temperature, soil type, and crops cultivated differ by category. Details of each climatic zone can be referred to Table 3.9.1.

(2) Agricultural Land

The total geographical area of the state is around 16 million ha, while net sown area of the state is around 6,500,000 ha. District-wise detailed data of agricultural land in the state is shown as Table 5.1.1:

Table 5.1.1 District-wise Land Use of Andhra Pradesh State

No.	District	Total Land (ha)	%	Net Area Sown (ha)	%
1	Srikakulam	583,700	4	302,328	5
2	Vizianagaram	653,900	4	262,713	4
3	Visakhapatnam	1,116,100	7	286,925	4
4	East Godavari	1,080,700	7	423,197	6
5	West Godavari	774,200	5	470,992	7
6	Krishna	872,700	5	511,186	8
7	Guntur	1,139,100	7	640,209	10
8	Prakasam	1,762,600	11	645,277	10
9	Nellore	1,307,600	8	339,989	5
10	Kurnool	1,765,800	11	909,613	14
11	Anantapur	1,913,000	12	1,040,091	16
12	Kadapa	1,535,900	10	356,888	5
13	Chittoor	1,515,100	9	371,721	6
Total		16,020,400	100	6,561,129	100

Source: Statistical Abstract 2014, Andhra Pradesh State

(3) Land Holding and Land Tenure

In the district, average land holding size is around 1.06 ha as shown in Table 5.1.2. Furthermore, the number of holdings with less than 1 ha accounts for around 5 million, which is around 65% out of the total number of holdings.

Table 5.1.2 District-wise Number of Operational Holdings and Area Operated

No.	District	Total Number of Holdings	Total Area (ha)	Average Holding Size (ha)
1	Srikakulam	525,870	349,412	0.66
2	Vizianagaram	446,841	342,484	0.77
3	Visakhapatnam	474,738	400,083	0.84
4	East Godavari	698,714	501,366	0.72
5	West Godavari	565,831	470,051	0.83
6	Krishna	551,567	508,413	0.92
7	Guntur	760,648	701,404	0.92
8	Prakasam	670,553	847,508	1.26
9	Nellore	457,015	478,919	1.05
10	Kurnool	632,902	1,050,086	1.66
11	Anantapur	727,951	1,278,010	1.76
12	Kadapa	441,306	542,399	1.23
13	Chittoor	667,182	626,306	0.94
Total		7,621,118	8,096,441	1.06

Source: Statistical Abstract 2014, Andhra Pradesh State

5.2 Departments In-charge of Agriculture, Food Processing, and Distribution

5.2.1 Responsible Departments

As the administrative jurisdiction for agriculture and food processing in Andhra Pradesh State spreads over multiple departments ranging from irrigation and agricultural production to food processing and marketing, the jurisdiction and authority of each department are described in Table 5.2.1 below.

Table 5.2.1 Administrative Units of Government of Andhra Pradesh for Agriculture and Food Processing

Department	Administration/Function
Planning	Collection, compilation, tabulation, and publication of the socioeconomic data
Agriculture	Production support of grains, oilseed, and cotton
Horticulture	Production support of vegetable, fruits, flower, and spices
Farmers Organisation (FO)	FOs participation in policy making is usually limited to some consultations. Planning is done by the respective departments both at the central and state level.
Agricultural Marketing	Establish and maintain public market, which deals with grains, horticultural, livestock, and fishery products
Livestock, Daily, Fishery	Production support of livestock, dairy, and fishery
Industry and Commerce	Promotion of food processing industry

Source: JICA Survey Team

(1) Planning Department

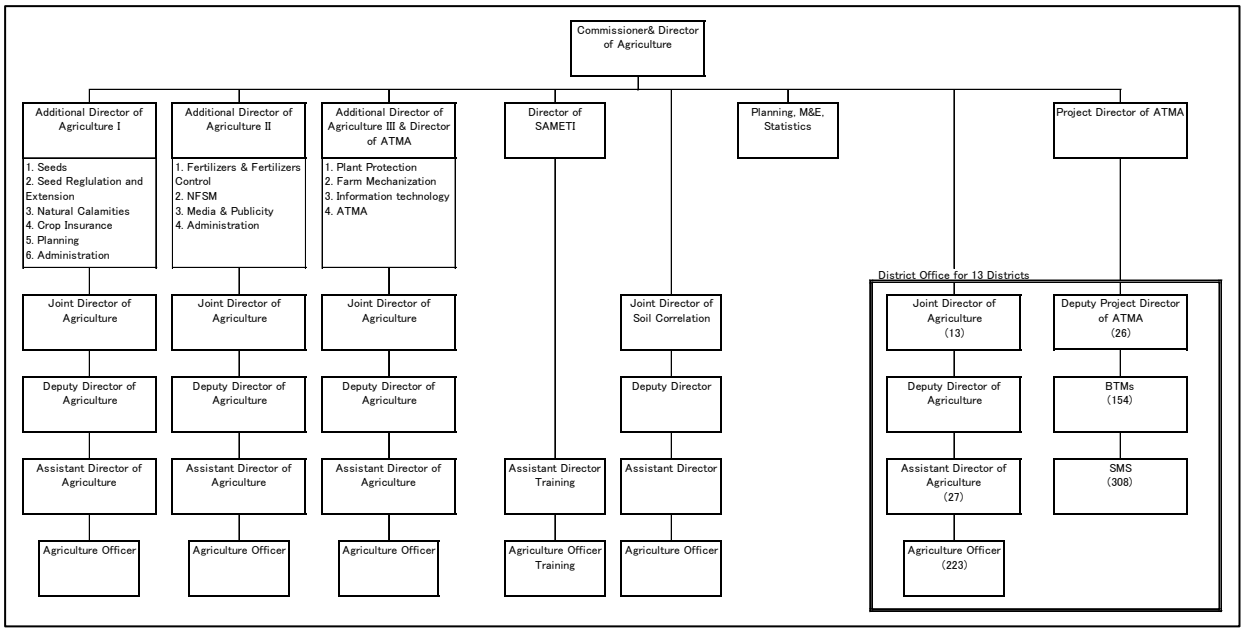
In addition to the overall responsibility for the preparation of all state plans including the Five-Year Plans and monitoring, the Department of Planning is engaged in the collection, compilation, tabulation, and publication of the socioeconomic data related to Andhra Pradesh State. The functional areas of the department include:

- Agricultural statistics covering rainfall statistics, area statistics comprising data on land use, area and production and yield statistics of various crops produced in the state.
- Industrial statistics are covered under two parts: Organised factory sector and unorganised non-factory sector.
- Prices and wages statistics covers collection, compilation, analysis and publication of a wide variety of prices including farm harvest prices, peak marketing prices of agricultural products, wholesale prices of 33 agricultural commodities, and more.
- Official statistics covers the preparation of *Mandal Gananka Darshini* (Annual Mandal-wise Statistics at a Glance), which covers essential statistical data on climate, demography, and agricultural husbandry by mandals.
- State Economy (GSDP and Capital) Formation: State domestic product popularly known as state income is one of the important indicators of economic development. The estimates of the state domestic product at current and constant prices by industry of origin are prepared in four stages for every year.
- Special Censuses
- Agricultural Census
- Socioeconomic Survey

(2) Department of Agriculture

The Department of Agriculture and Cooperation is responsible for formulating and implementing state policies and programmes to achieve rapid agricultural growth through optimum utilisation of the state's land, water, soil, and plant resources.

The organisational structure of the Department of Agriculture (DoA) is shown in Figure 5.2.1.



Source Planning Department, GoAP

Figure 5.2.1 Existing Structure of the Department of Agriculture (Technical Sections only)

The DoA has a primary sector mission to support the economic growth of the state by providing high quality services, which result in a secure and safe food supply, increased agricultural output, and added value on a sustainable and cost effective basis to agricultural sectors, in partnership with the International Crops Research Institute (ICRISAT) to enable Andhra Pradesh State to become amongst the best three performing states in India by 2022. Especially, the followings are major objectives of the mission:

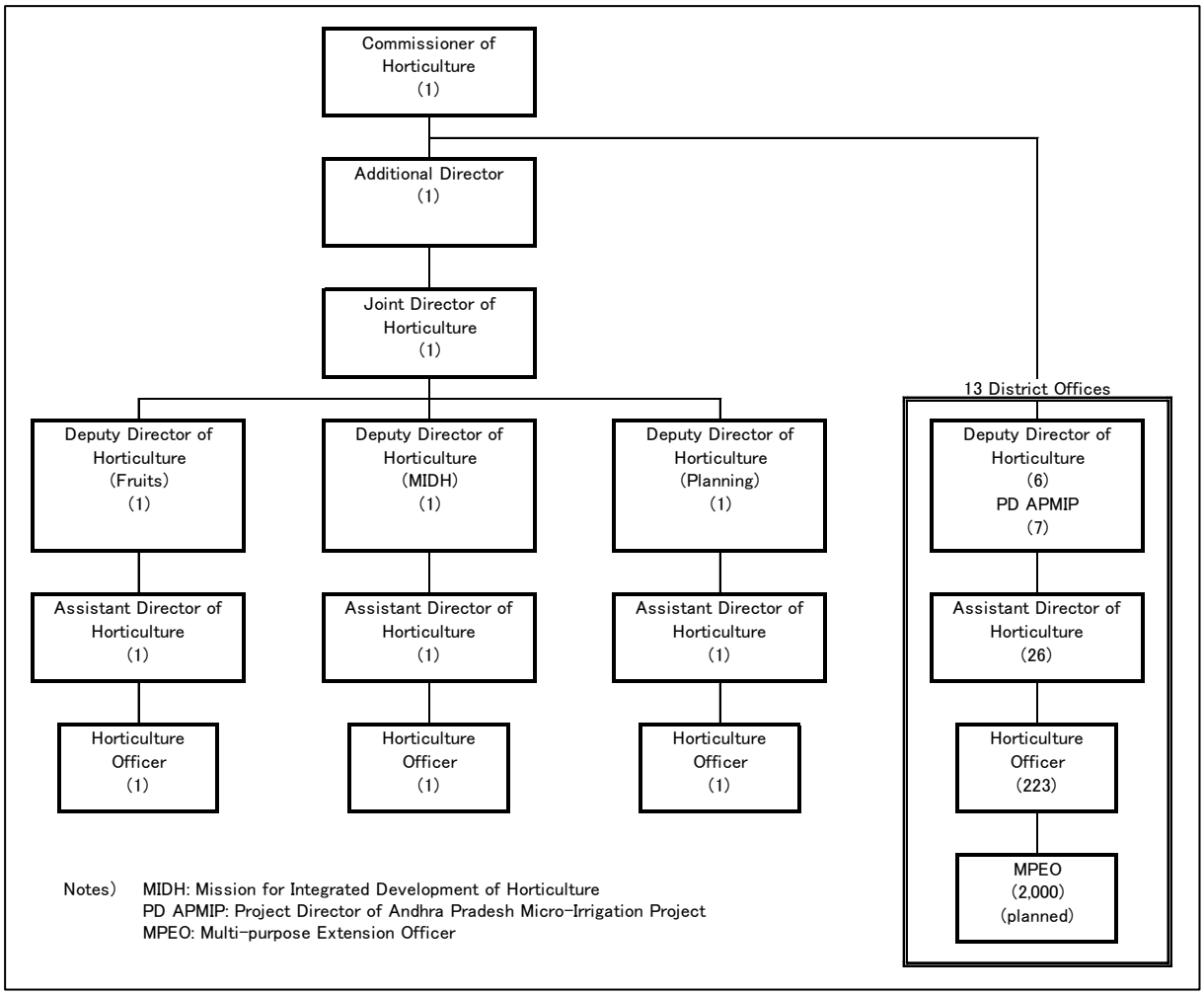
- Increasing productivity of the primary sector;
- Mitigating the impact of droughts through water conservation and micro-irrigation;
- Post-harvest management to reduce the wastage; and
- Establishment of processing, value addition capacity, and supply chain of the identified crops.

Based on a strategy paper summarised in Table 2.2.7, DoA has prepared the agricultural action plan 2015-16 as shown below.

- Soil test based fertiliser recommendation and supply of soil health cards;
- Promotion of self-reliance in seed production amongst farmers;
- Promotion of Integrated Crop Management (ICM) through Integrated Pest Management (IPM), Integrated Nutrient Management (INM), and efficient water management;
- Promotion of organic farming to meet the demand of the world market;
- Soil health based nutrient recommendation and correcting micronutrients like zinc, iron, boron, etc.;
- Farm mechanisation for cost-effective farming practices;
- Promotion of farmers' organisation (Rythu Mitra Groups) for technical and monetary benefits;
- Facilitate farmers to avail agricultural credit;
- Women empowerment and gender balance;
- Re-engineering extension approach for effective extension reach;
- Empowering farmers with advance agricultural practices;
- Capacity enhancement of the department staff for an efficient extension of technology; and
- Provide day-to-day information to farmers on crop production, input supply, and marketing.

(3) Department of Horticulture

The organisational structure of the Department of Horticulture (DOH) is shown in Figure 5.2.2.



Source: Planning Department, GoAP

Figure 5.2.2 Existing Structure of the Department of Horticulture (Technical Sections only)

The state government has recognised horticulture as a means of diversification in agriculture in an eco-friendly manner through efficient use of land and optimum utilisation of natural resources. The following horticulture action plan 2015-16 has prepared by the the DoH in line with a strategy paper summarised in Table 2.2.7.

- Provision of technologies, better management practices, and genuine plant materials to farmers;
- Identification of suitable areas for cultivation of various horticultural crops; motivate, educate, and encourage farmers of those areas to take up cultivation of identified crops on large scale;
- Provision and transfer of new technologies for quality production and productivity of horticultural crops;
- Provision of creation of awareness on water-use management and cropping patterns;
- Act as the nodal agency for implementation of various horticultural programmes of different agencies and state and central organisations;
- Extension of all the benefits of the state and central government; and
- Facilitation of promotion of exports within and outside the state.

(4) Department of Animal Husbandry and Fisheries

Optimal utilisation of natural resources for fish production, promote freshwater aquaculture supported by infrastructure and trained manpower. The main objective of the vision is to consolidate the gains made and transform the animal husbandry sector into profitable livestock agricultural business to further strengthen the rural economy.

- Tap the unused potential of the animal husbandry sector;

- Restructuring and revitalising the credit institutions;
- Revitalising research, technology, and extension to the growing demand;
- Working out the strategy for up gradation of existing livestock for higher production;
- Exploring the scope and need for increased private participation in ensuing veterinary health care and disease control utilising latest biotechnologies;
- Formulating new strategies for scientific feed and fodder development;
- Evolving innovations relevant to the needs of 2020;
- Exploiting marketing avenues for livestock and livestock products through the development of rural marketing grid; and
- Spelling out policy interventions to harness potentialities of various categories of Livestock Sector.

(5) Department of Industry and Commerce

The Department of Industries and Commerce is primarily responsible for the development of industries in general and small-scale industries in particular. The department also plans and implements various schemes for industrial development in the state. The key objectives of the mission are to:

- Make Andhra Pradesh State a leading "Manufacturing Hub" in the country;
- Increase the share of manufacturing sector in the overall state's gross domestic product (GDP); and
- Create large-scale employment.

5.2.2 Budget and Expenditure

(1) Department of Agriculture

The budget and expenditure of the Department of Agriculture (DoA) for the last three years is summarised in Table 5.2.2.

Table 5.2.2 Annual Budget and Expenditure of Department of Agriculture in Andhra Pradesh State

(Unit: INR. in millions)

Category	2013-14*1	2014-15*2 (Revised Estimate)	2015-16*3 (Budget Estimate)
Plan Schemes			
(1) Crop Husbandry	16,038	9,575	8,915
(2) Soil and Water Conservation	11	-	-
(3) Food Storage and Ware Housing	-	-	600
(4) Agricultural Research and Education	-	1,000	1,000
(5) Other Agricultural Programmes	-	-	-
(6) Capital Outlay on Crop Husbandry	6	88	200
Subtotal (Plan schemes)	16,055	10,662	10,715
Non-Plan Schemes			
(1) Crop Husbandry	2,651	59,402	53,593
(2) Soil and Water Conservation	267	313	233
Subtotal (Non-plan schemes)	2,918	59,715	53,826
Total	18,973	70,377	64,541

*Note: *1= Old Andhra Pradesh State, *2= Transition to new Andhra Pradesh State (Old Andhra Pradesh State for April and May, the rest for new Andhra Pradesh State), *3= New Andhra Pradesh State*
Source: Vol.III/11, Budget Estimate 2015-16, Department of Finance, GoAP

The budget of DoA shares a large portion of the annual budget allocated to agriculture and allied services; say 74% in 2015-16. The budget allocation for plan schemes accounts only for about 20%, and the rest for non-plan schemes.

(2) Department of Horticulture

The budget and expenditure of the Department of Horticulture (DoH) for the last three years is summarised in Table 5.2.3.

Table 5.2.3 Annual Budget and Expenditure of Department of Horticulture in Andhra Pradesh State

(Unit: INR. in millions)

Category	2013-14*1	2014-15*2 (Revised Estimate)	2015-16*3 (Budget Estimate)
Plan Schemes			
(1) Crop Husbandry	2,731	376	3,100
(2) Forestry and Wildlife	8	-	-
Subtotal (Plan schemes)	2,739	376	310
Non-Plan Schemes			
(1) Crop Husbandry	200	200	194
(2) Forestry and Wildlife	123	-	5
Subtotal (Non-plan schemes)	323	200	199
Total	3,062	576	3,299

*Note: *1= Old Andhra Pradesh State, *2= Transition to new Andhra Pradesh State (Old Andhra Pradesh State for April and May, the rest for new Andhra Pradesh State), *3= New Andhra Pradesh State*
Source: Vol.III/11, Budget Estimate 2015-16, Department of Finance, GoAP

Contrary to the expectation, the budget of DOHis minimal in comparison with that of DoA, say only 5% of the annual budget allocated to DoA in 2015-16. Amongst the budget allocated to DOH, crop husbandry under plan schemes is the largest.

(3) Department of Animal Husbandry and Fisheries

The budget and expenditure of the Department of Animal Husbandry, Dairy Development, and Fisheries (DoAH&F) for the last three years is summarised in Table 5.2.4.

Table 5.2.4 Annual Budget and Expenditure of Department of Animal Husbandry, Dairy Development and Fisheries in Andhra Pradesh State

(Unit: INR. in millions)

Category	2013-14*1	2014-15*2 (Revised Estimate)	2015-16*3 (Budget Estimate)
Plan Schemes			
(1) Agricultural Research and Education	375	152	152
(2) Animal Husbandry, HOD	859	1,960	1,830
(3) Fisheries, HOD	262	131	1,872
Subtotal (Plan schemes)	1,496	2,243	3,854
Non-Plan Schemes			
(1) Animal Husbandry, Dairy Development, and Fisheries, Secretariat Department	1,701	1,224	1,267
(2) Animal Husbandry, HOD	4,801	5,211	4,897
(3) Fisheries, HOD	394	469	365
Subtotal (Non-plan schemes)	6,896	6,904	6,529
Total	8,392	9,147	9,383

*Note: *1= Old Andhra Pradesh State, *2= Transition to new Andhra Pradesh State (Old Andhra Pradesh State for April and May, the rest for new Andhra Pradesh State), *3= New Andhra Pradesh State*
Source: Vol.III/11, Budget Estimate 2015-16, Department of Finance, GoAP

The budget allocation to DoA H&F occupies some 11% of the total budget allocation to agriculture and allied services or 15% of the DoA's budget in 2015-16. Amongst the budget allocated to DoAH&F, animal husbandry under un-plan schemes is the largest.

5.3 Agriculture and Horticulture

5.3.1 Agricultural Production

(1) Cultivated Area, Production and Unit Yield

In terms of crop productivity (unit yield) in Andhra Pradesh State, major crops except paddy, maize, chilli, and mango have lower productivity, compared with India average as shown in the following Table 5.3.1.

Table 5.3.1 Area, Production, and Unit Yield of Major Crops in Andhra Pradesh State and India

Crop	Andhra Pradesh State (2012/13)			India Average (2012/13)		
	Area (million ha)	Production (million ton)	Unit Yield (kg/ha)	Area (million ha)	Production (million ton)	Unit Yield (kg/ha)
Paddy	2.21	6.86	3,106	42.41	104.40	2,462
Maize	0.30	1.91	6,182	8.71	22.23	2,552
Total Pulses	1.34	1.13	843	23.47	18.45	786
Ground Nut	1.16	0.78	674	4.77	4.95	996
Chilli	0.22	0.66	3,000	0.79	1.30	1,600
Tomato	0.13	2.64	20,000	0.88	18.22	20,700
Cauliflower	0.02	0.22	11,000	0.40	7.89	19,600
Mango	0.30	2.69	9,000	2.50	18.00	7,200
Cashew Nut	0.07	0.07	900	0.99	0.76	800

Source: 1) Agricultural Statistics at a Glance 2014, Andhra Pradesh State, 2) Statistical Yearbook 2014

Meanwhile, production of major crops varies by district of the state as shown in Tables 5.3.2 to 5.3.4.

Table 5.3.2 District-wise Production of Major Crops in Andhra Pradesh State (2013-14)

No.	District	Paddy ('000ton)	Maize ('000ton)	Tomato (ton)	Chilli (dried) (ton)	Mango (ton)
1	Srikakulam	355	55	145,166	21,758	85,101
2	Vizianagaram	291	127	147,335	8,607	433,393
3	Visakhapatnam	185	17	67,766	11,808	147,713
4	East Godavari	1,212	94	62,024	5,251	65,557
5	West Godavari	1,342	382	205,366	22,358	162,875
6	Krishna	1,176	228	250,289	57,015	544,373
7	Guntur	1,096	648	269,288	401,166	8,426
8	Prakasam	532	174	63,084	94,453	63,775
9	Nellore	911	13	98,691	14,164	104,671
10	Kurnool	458	310	605,897	19,433	615,393
11	Anantapur	88	111	339,493	9,740	216,042
12	Kadapa	178	37	361,991	20,583	174,473
13	Chittoor	169	17	738,077	46,454	115,216
Total		7,993	2,213	3,354,466	732,790	2,737,008

Source: Department of Agriculture, Department of Horticulture 2015

Table 5.3.3 District-wise Cultivated Area of Major Crops in Andhra Pradesh State (2013-14)

No.	District	Paddy ('000ha)	Maize ('000ha)	Tomato (ha)	Chilli (dried) (ha)	Mango (ha)
1	Srikakulam	203	11	7,258	7,253	9,456
2	Vizianagaram	117	29	7,367	2,869	48,155
3	Visakhapatnam	105	7	3,388	3,936	16,413
4	East Godavari	405	11	3,101	1,750	7,284
5	West Godavari	421	54	10,268	7,453	18,097
6	Krishna	363	33	12,514	19,005	60,486
7	Guntur	328	87	13,464	133,722	936
8	Prakasam	139	23	3,154	31,484	7,086
9	Nellore	225	2	4,935	4,721	11,630
10	Kurnool	125	52	30,295	6,478	68,377
11	Anantapur	40	35	16,975	3,247	24,005
12	Kadapa	63	5	18,100	6,861	19,386
13	Chittoor	50	3	36,904	15,485	12,802
Total		2,583	352	167,723	244,263	304,112

Source: Department of Agriculture, Department of Horticulture 2015

Table 5.3.4 District-wise Unit Yield of Major Crops in Andhra Pradesh State (2013/14)

(Unit: kg/ha)

No.	District	Paddy	Maize	Tomato	Chilli (dried)	Mango
1	Srikakulam	1,749	5,159	20,000	3,000	9,000
2	Vizianagaram	2,491	4,415	20,000	3,000	9,000
3	Visakhapatnam	1,752	2,366	20,000	3,000	9,000
4	East Godavari	2,994	8,370	20,000	3,000	9,000
5	West Godavari	3,191	7,086	20,000	3,000	9,000
6	Krishna	3,235	6,921	20,000	3,000	9,000
7	Guntur	3,340	7,446	20,000	3,000	9,000
8	Prakasam	3,841	7,544	20,000	3,000	9,000
9	Nellore	4,051	6,815	20,000	3,000	9,000
10	Kurnool	3,670	5,978	20,000	3,000	9,000
11	Anantapur	2,177	3,189	20,000	3,000	9,000
12	Kadapa	2,843	6,753	20,000	3,000	9,000
13	Chittoor	3,390	5,423	20,000	3,000	9,000
Total		3,094	6,286	20,000	3,000	9,000

Source: Department of Agriculture, Department of Horticulture 2015

Although this difference could be brought about by some conditions such as rainfall pattern and soil condition, it is judged that there is a possibility of further improvement in crop productivity, considering high level of consciousness on farm management of farmers in the state. Current situations of agriculture and horticulture in major districts are shown in "Potential Linked Credit Plan, NABAS (National Bank for Agriculture and Rural Development) 2015".

5.3.2 Food Processing

Andhra Pradesh State is a key state that contributes significantly to the food processing industry in India. According to the data from MOFPI, the number of registered food processing units is highest in Andhra Pradesh State followed by Tamil Nadu and Telangana. However, most of the units in Andhra Pradesh State are of small scale; and the number of integrated units with facilities conforming to international standard is smaller compared with the more advanced states such as Maharashtra or Karnataka. If small-scale units are included, Andhra Pradesh State has approximately 23,000 units as per data from the Department of Industries. The industry is dominated by rice milling and parboiling units, while fruits and vegetable processing also has prominent share.

Table 5.3.5 State-wise Registered Food Processing Units (2012/13)

No.	Name of the State/UTs	Number of Registered Units
1	Andhra Pradesh State	5,735
2	Tamil Nadu	5,161
3	Telangana	3,716
4	Maharashtra	3,077
5	Punjab	2,792
6	Uttar Pradesh	2,097
7	Karnataka	2,038
	All India	37,175

Source: MOFPI

Source: Andhra Pradesh State Rolling Plan

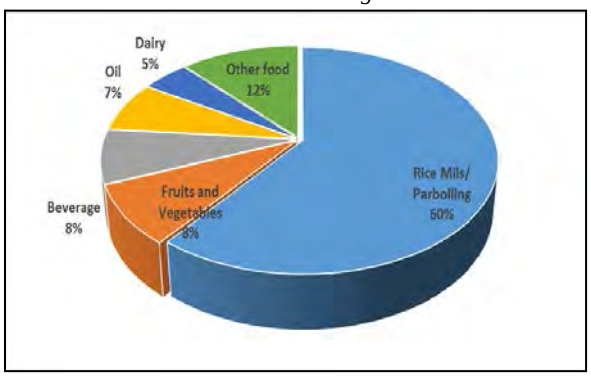


Figure 5.3.1 Details of Food Processing Units in Andhra Pradesh State

The major factors which make Andhra Pradesh State the leading state in food processing of agricultural commodities are summarised below.

- Andhra Pradesh State has strong and diverse agricultural raw material base. It is the largest producer of maize, spices, mango, papaya, citrus, lime, and tomato.Subsequently, the second largest producer of rice, groundnut, cashew, and cacao. It is also the leading producer of coconut,

banana, guava, pomegranate, and sugarcane. Agriculture sector in Andhra Pradesh State contributes to around 23.3% to the gross state domestic product (GSDP)[1] in 2013-2014.

- Andhra Pradesh State has good logistics and infrastructure facilities, which provide ample opportunity for industry development. It has situated in a strategic geographic location with 980 km of coastline, and it has four major and intermediate container ports (Visakhapatnam, Kakinada, Krishnapatnam, and Gangavaram) and over ten minor deep water ports. It also accommodates six airports. Additionally, eight new airports are being developed in the state.
- Andhra Pradesh State has a conducive policy environment. As a nodal agency for development of food processing sector in the state, Andhra Pradesh Food Processing Society (APFPS) has been established by the state government under the Andhra Pradesh State Societies Act. The government introduced various incentives to support the industry by providing grant for building/modernisation of units, cold chain, infrastructure, and human resources. It announced the Food Processing Policy 2015-2020 aiming to attract new investments worth Rs. 50,000 million and create 50,000 additional employment opportunities in the sector by 2020 and develop commodity-based clusters to enable a focused and planned approach in developing the food processing industry through a coordinated approach between the government and the departments.

Tables 5.3.6 and 5.3.7 show the current status of registered food processing units in Andhra Pradesh State. It indicates that there are many units in Visakhapatnam, East Godavari, and Anantapur. Those are rice mills or small-scale units, which have less than 20 workers. According to the information from APFPS, majority of large-scale processing units for fruits and vegetable exist in Chittoor District. In addition, there are several mega food parks developed under the central government scheme as explained in Chapter 5.6.

Table 5.3.6 District and Sector-wise Food Processing Units in Andhra Pradesh State as of 2015

Name of District	Agriculture	Horticulture
Srikakulam	67	103
Vizianagaram	28	13
Visakhapatnam	64	419
East Godavari	286	458
West Godavari	109	15
Krishna	44	9
Guntur	96	49
Prakasam	16	40
Nellore	185	5
Kurnool	44	31
Anantapur	619	66
Kadapa	67	30
Chittoor	54	63
Total	1,679	1,301

Source: APFPS

Table 5.3.7 Distribution of Registered Food Processing Units based on Worker Size excluding Rice, Flour and Beverage

Worker Size	Below 20	21-50	51-100	Over 101	Total
Srikakulam	163	49	0	1	213
Vizianagaram	50	1	0	2	53
Visakhapatnam	211	14	2	19	246
East Godavari	479	11	11	14	517
West Godavari	153	14	3	12	182
Krishna	201	6	6	11	224
Guntur	174	14	5	5	198
Prakasam	150	9	0	3	162
Nellore	90	5	2	9	106
Kurnool	211	3	1	0	216

[1]Andhra Pradesh State Portal (http://www.ap.gov.in/)

Worker Size	Below 20	21-50	51-100	Over 101	Total
Anantapur	226	7	3	0	236
Kadapa	130	2	0	0	132
Chittoor	195	33	9	13	250
Total	2,433	168	42	89	2,735

Source: Andhra Pradesh State Rolling Plan

To support food processing industry, good post-harvest handling facility is necessary. The government provides subsidies to set up a post-harvest infrastructure as explained above. The number of multipurpose cold storage units is concentrated in Guntur and Prakasam, as they are used mainly for dry chili storage, which is the prominent crop in the region. Ripening chambers exist abundantly in Kurnool, Anantapur, and Kadapa where banana production is high.

Table 5.3.8 District-wise Post-Harvest Infrastructure in Andhra Pradesh State (2015)

District	Cold Storage		Ripening Chamber	
	Number	Capacity (MT)	Number	Capacity (MT)
Srikakulam	0	0	0	0
Vizianagaram	5	32,500	0	0
Visakhapatnam	1	6,500	3	78
East Godavari	4	26,000	0	0
West Godavari	2	13,000	0	0
Krishna	27	176,000	5	130
Guntur	79	512,500	12	321
Prakasam	55	359,500	4	278
Nellore	5	32,500	1	26
Kurnool	16	102,000	25	1,350
Anantapur	8	52,000	14	364
Kadapa	2	13,000	14	364
Chittoor	4	32,000	4	282
Total	209	1,357,500	79	3,193

Source: Department of Horticulture

There are also two vapour heat treatment (VHT) facilities in Tirupati of Chittoor District and Nuzvid, Krishna District, which can be used to treat pest in fruits for export to developed countries such as Japan and Australia. Among the four existing VHT facilities in India,Andhra Pradesh State has two. These facilities were established by the state government in 2008, but they had been idle as there are no export orders. Therefore, the management has been handed over to a private company (Srini Food) in 2014. They resumed operation and started exporting in 2015.

5.3.3 Distribution and Marketing

(1) Commercialisation

The following table shows the marketed surplus ratio of major agricultural crops in Andhra Pradesh State, which calculates the ratio of crop farmers sold against the entire volume of crop they produced. The marketed surplus ratio indicates the level of commercialisation for respective crops. As Table 5.3.9 shows, the marketed surplus ratios in Andhra Pradesh State are higher than all India on the average for most of the crops.

Table 5.3.9 Marketed Surplus Ratio of Major Crops in Andhra Pradesh State

Crop	Andhra Pradesh	All India
Rice	87.86	81.51
Maize	90.71	84.32
Groundnut	94.40	93.54
Sugarcane	99.91	77.84

Source: Agricultural Statistics at a Glance 2014

Although similar data for horticultural crops are not available, the marketed surplus ratios for these crops are supposed to be the same or higher than those for agricultural crops with more possibility for self-consumption. Thus, it is considered that commercialisation of crops in Andhra Pradesh State is relatively advanced compared with other states in India.

(2) Agricultural Marketing Regime in Andhra Pradesh State

The summary of market infrastructure in Andhra Pradesh State is shown below, and the detail are shown in Attachment 5.3.1.

Table 5.3.10 Summary of Market Infrastructure in Andhra Pradesh State

Market Infrastructure		Number
Agriculture Market Committee		190
Of which those without site		20
Wholesale market	Regulated market	50
	Non-regulated market	120
Regulated wholesale market	Fruit market	19
	Vegetable market	22
	Commercial crop market	10
	Cotton market	17
	Cattle market	29
Rythu Bazar (Farmer's market)		80

Source: Andhra Pradesh State Agricultural Marketing Department

The Agricultural Marketing Department is responsible for regulating sales and purchase of agricultural produce. There are 190 Agriculture Market Committees (AMC), on average, there are 14.6 committees per district organised by the department. Out of 190 AMCs, 170 AMCs have their own market yard and 20 have no land. As the agricultural marketing system has been gradually deregulated, the presence of regulated wholesale markets is fading. Out of 170 AMCs, 50 AMCs are regulated and function as regular markets with registered commission agents while others are non-regulated and do not have regular trading activities. For food grains such as paddy and maize, and commercial crops such as sugarcane and cotton, the Government of India decides the Minimum Support Price (MSP) at which the government agencies procure commodities. These commodities are traded in ten commercial crop markets in Andhra Pradesh State at announced market prices. Paddy and cotton are also procured at MSP at the temporary procurement centres set up by the government agencies in the villages itself during the peak arrival seasons. However, large volume of commodities is now traded outside AMC marketing channels.

In order to ensure transparent and fair transactions and remunerative prices for farmers, the state government carried out various market reforms. One reform is the introduction of electric trading system where all prices offered and agreed are displayed in the market yard or website, thus minimising the chances of cheating. The system is piloted in three wholesale markets in Kurnool District.

Another reform is the decentralisation of market system. As most transactions of agricultural products happen outside the AMC system, the government is trying to allow and regulate these activities. It first set up ‘Rythu Bazar’ which allows farmers to sell their produce directly to consumer in 1999 and it allowed direct marketing of agricultural products from farmers and contract farming in 2005. The number of Rythu Bazar’ has increased to 80 to date, and direct purchasing from farmers by processors or exporters become prevalent although it is not always practiced in line with government regulations. It has also promoted private markets. For this purpose, the state government reduced the requirement of initial investment by private market operators from Rs. 100 million to Rs. 50 million and AMC is now allowed to declare processing units, warehouses, and cold storages as markets.

As the agricultural production is diversified and marketing channels are decentralised, the government distribution and marketing system has also been in transition. It is not possible to regulate all the transactions of agricultural products. It becomes more important to show an appropriate model for new type of transactions as well as strengthen the capacity of market stakeholders to adjust them to changing market conditions.

5.3.4 Major Stakeholders (Agriculture and Horticulture Related Farmer's Organisations)

(1) Cooperative Societies

The Primary Agriculture Cooperative Society (PACS) is a basic unit of credit institutions in India. PACS was initially formed nearly three decades ago in almost every gram panchayat through the cooperative movement. The effectiveness of this was recognised as contributing force towards poverty alleviation and enhancing social integration in the country. PACS has mainly been concerned with agriculture credit, marketing of agricultural produce, and distribution of fertilisers, pesticides, and other essential commodities, which had made significant strides in the field of rural credit. PACS became unionised at the district level as District Central Cooperative Banks (DCCB), further at the state level as State Cooperative Banks (APCOB). Along the journey of cooperatives, there was the increase control of government over PACS; and PACS staff came under the control of government, which further led to PACS gradually becoming defunct. Today, 90% of PACSs merely function to provide agriculture loans to large farmers and only 10% of PACSs are performing their key role and reaching out to small and marginal farmers. Local leaders' (President) role is significantly instrumental behind 10% of PACS being functional. Ninety percent of PACSs that lost its core in providing rural credit were increasingly providing agriculture loan to larger farmers. As a result of the above, small and marginal farmers' multipurpose needs were not met. Small and marginal farmers, in search of alternatives, took the"tied" loan from pesticide dealers and grocery shop owners, thus were caught in higher riskof credit. In order to address the challenges of poverty and poverty alleviation by way of organising the poor, the idea of formation of women's self-help groups (SHGs) was born and initiated by GoAP. Furthermore, the Mutually Aided Co-operative Act came into force in 1995. The act provides for voluntary formation of cooperative societies as accountable, competitive, and self-reliant business enterprises based on thrift, self-help, and mutual aid,which is owned,managed and controlled by members for their economic and social betterment. The significant difference of MACS from PACS is the less interference of government. In the MACS Act, government cannot interfere apart from registration process of MACS. Under this act, the Dairy Cooperatives (DC) were given the choice to be either in MACS or be as DC itself. However, PACSs were not allowed to be part of MACS, thus, became fully fledged entities of the government.

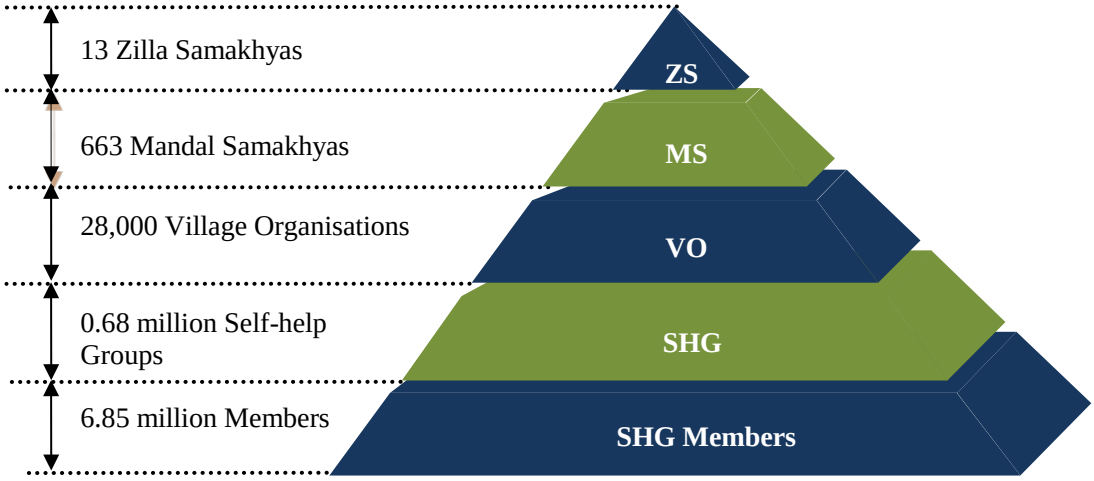
(2) Self-help Group (SHG)

SHGs were identified as socially viable community organisations having democratic values, relevant developmental orientation, and oriented towards attaining individuals and groups' sustainability. They began with normal savings and credit activities, and further developed to social concerns such as family welfare, child care, and literacy. Credit is the means of economic activity and foundation for growth and development. Credit through SHG enabled members to start on productive and income generating activities. Gradually, the effective functioning of these grassroots organisations became almost inevitable for most of the government programmes. SHGs, over a period of time, were increasingly seen as contributors to poverty alleviation programmes by providing opportunities for the poor through engaging into productive activities and access community assets. SHGs promoted at the neighbouring community level were federated into Village Organisation (VO) and further into *Mandal Mahila Samakhya* (MMS) at the *mandal* level and as *Zilla Samakhya* (ZS) at the *Zilla* level. The need to federate them into VOs/MMS/ZS was to provide them with more power inaccessing to new economic opportunities. Federation enabled the groups to gather strength not only to influence the legislature but also to mobilise public opinion in favour of the community members. One of the strengths and reasons of stability of the federations is their structured financial source with a huge community foundation. Each SHG member pays Rs. 10/- towards membership fee in VO and each SHG as a group pays Rs. 100/- as share capital to VO. Each VO pays Rs. 500/- as membership fee to MMS and also every month VO pays Rs. 1,000/- as share capital to MMS. The MMS receives loans from the Community Investment Fund (CIF) and from Srinidihi, which are lent to VO at 6% interest rate and further the loan amount is disbursed to individual members.

The VO conducts meeting every month and discusses the internal agenda, which mainly focuses on loan amount disbursed, repayment, livelihood programmes, and others. VO has seven subcommittees,i.e.,1) gender subcommittee; 2) insurance subcommittee; 3) poorest of the poor elaborate subcommittee; 4) audit subcommittee; 5) health and nutrition subcommittee; 6) marketing subcommittee; and 7) recovery

subcommittee. Each subcommittee comprises three members. Apart from the above, it also creates awareness on various agriculture practices and relevant information.

Federation at the MMS level is an important vehicle of change registered under the Societies Act. Ideally, the executive body of an MMS meets every month and it prepares agenda on discussing various issues, such as Srinidhi repayment, issues in VOs, CIF, problems with employees, information and implementation of welfare schemes. The MMS also has three committees, i.e.; Committee for CIF Recovery, Committee for Beneficiary Selection to Welfare Schemes, and Monitoring Committee. At the MMS level, both the accountant and computer operator are salary paid by MMS for their services. The insurance scheme is also routed through MMS.



Source: SERP PPT material

Figure 5.3.2 Structure of SHG Federations

According to the SERP database of SHG, nearly 80% of households are covered under SHGs in Andhra Pradesh State.

As the importance of SHG evolved, SHGs have been adopted as the appropriate people's institutions. These small groups later linked up together into larger associations depending on the objectives and roles, with which the SHGs invest these apex associations. The government also promoted different community-based organisations for different issues, applying SHG concept. The following community organisations were formed based on the SHG concepts.

Table 5.3.11 Community Organisations Established Based on SHGs

Functions	Community Organisations Established
SHGs organised for the development of natural resources:	Water Users' Associations (WUA) Watershed Development Committees (WDC) Vana Samrakshana Samithis (VSS)
SHGs organised for employment generation:	Women and Children in Rural Areas (DWCRA) Development of Women and Children in Urban Areas (DWCUA) Chief Minister's Empowerment of Youth (CMEY)
SHGs organised for human resource development	Mothers' Committees School Education Committees

Source: Kurien Thomas (2003) "Andhra Pradesh State Community Self Help Model" CGG Collected Working Papers: 2003 Volume 2, Centre for Good Governance

(3) Farmer Producer Organisation (FPO)/Farmer Producer Company (FPC)

The Government of India recognised and stated as its national policy that 'collectivisation of producers, especially small and marginal farmers into producer organisations has emerged as one of the most effective pathways to address the many challenges of agriculture but most importantly, improved access to investments, technology and inputs and markets'[2]. Farmer Producer Company (FPC) is a legal form

[2] 'Policy and Process Guidelines for Farmers Producer Organisations', (2013) Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India

of the company registered under the special provisions of the Companies Act 1956, amended in 2003. While the cooperatives faced several difficulties such as political influence, corruption, elite capture, and lack of financial and managerial resources, FPC was promoted as a cooperative form of business enterprise democratically owned and controlled by its members, by retaining advantage of the cooperatives and breaking their negative aspects. The FPC aims to improve returns to farmers through collective inputs purchase, collective marketing and processing, increasing productivity through better inputs, increasing knowledge of farmers, and ensuring quality. Therefore, only farmer-producers can be members of the FPC and the farmer members themselves will manage this company. The most remarkable feature of FPCs that is different from other private companies is the equal right to vote irrespective of their landholdings and share of equity. This assures equal right to small and marginal farmers.

Box 5.3.1: Key Features of FPCs

- FPC provides more legitimacy and credibility in the immediate business environment compared with the traditional cooperatives.
- Free from negative images of cooperatives such as welfare-oriented, inefficient, and corruption-ridden.
- The members have to be primary producers (to avoid outsiders' control and to allow raising investments from other players in the supply chain).
- Allowing registered and non-registered groups such as SHGs to become equity holders (while cooperatives allow only individual producers to be members).
- One member one vote principle irrespective of shares or patronage.
- Equity share is not transferable but are tradable within the membership (not open to investors).
- Allowing the co-option of professionals in the governance structure so that small and marginal producers can avail professional management inputs while retaining qualitative governance control.

Source: Sukhpal Singh and Tarunvir Singh (2013), 'Producer Companies in India: A Study of Organization and Performance', CMA Publication No.246, Centre for Management in Agriculture, Indian Institute Management

Although economy of scale is not a new issue, the emergence of FPOs is driven and realised recently by policy support, legislations, and public funds to cover the initial cost, as well as, active involvement of resource institutions who took initiative in mobilising people and establishing FPOs. Policy and Process Guideline for FPOs was issued by the Ministry of Agriculture, Government of India in 2013[3]. FPOs include farmers' organisations registered as different formal entity (i.e., cooperative society, produce company, multi-state cooperative, etc.) with the same principles of farmer-member-control. Promotion of FPOs is set as one of the key strategies of growth in agriculture and horticulture sector in the Andhra Pradesh State Government Rolling Plan 2015-16[4] as the effectiveness of FPOs was recognised in addressing challenges by collectivisation of producers for improving access to investment, technology and inputs and markets. Formation of FPOs is supported by government policy and public funds. FPOs are expected to be totally independent after the establishment period supported by the promotion agencies. Although the department will continue its technical support, management should be autonomously taken by the FPO following the regulatory mechanism of a particular act under which the FPO is registered.

Following the state strategy plan, Andhra Pradesh State government prepared the 'Strategy for Promoting and Nurturing Farmer Producers Organisation in Andhra Pradesh State', and has taken steps forward by taking initiative such as a meeting with potential private farms to be linked with FPOs. Relevant departments include FPO promotion in their plans and programmes. Table 5.3.12 shows summarises a current progress of FPO formation in Andhra Pradesh State.

[3] 'Policy and Process Guidelines for Farmer Producer Organisations' (2013), Government of India, Ministry of Agriculture, Department of Agriculture and Cooperation.

[4] 'Achieving Double Digit Inclusive Growth – A Rolling Plan 2015-16', Planning Department, Government of Andhra Pradesh

Table 5.3.12 Progress of FPO Formation and Approach

Responsible Organisation	No. of FPO	Approach
Department of Horticulture	27 + (data not updated)	Horticulture department supports the establishment of FPO by aggregating farmers group based on horticulture cluster in collaboration with the National Bank for Agriculture and Rural Development (NABARD) and promotion agencies. NABARD and the promotion agencies are in-charge of the mobilisation while the department provides technical guidance. Although FPO is expected to be an organisation with a certain number of farmers (more than 500), currently established FPOs have started with much smaller number of farmers by emphasising process approach, cohesion of the organisation, and practical management.
Department of Agriculture	Formations are still initial stages. Identification of potential clusters were completed and detail survey has been conducted	SHGs, CBOs, and other FGs are to be aggregated to form a FPO (one FPO generally has more than 50 members). First, agriculture-related groups are to be identified (as some groups do not have any agriculture related activities) to form FPO on commodity basis (1~2 crops in each FPO). The FPO is expected to cover a village or be formed even at the mandal level. After identification of the agriculture-related groups, active members of the groups with similar commodities are linked toeach other for discussion. FPOs are expected to be formed by adding one more family member of the current member of the group (e.g., letting spouse of the current group member to join the FPO). This is because, in the case of SHGs, majority of the current members are not capable enough to manage larger group. The formation of FPOs are undertaken within the current ongoing schemes (such as organic farming scheme, and revitalisation of millet, which cover 131 clusters and 47 mandals, respectively). Formation of FPOs is included as one of the components in all those schemes. Institutions (NGOs) in-charge of those schemes are responsible for the formation of FPOs. Support of those schemes last about 3-5 years.
NABARD	79 (105 FPOs are expected to be formed through the NABARD Scheme in Andhra Pradesh State) (the number double counted with other institutions)	NABARD scheme of FPO support started in 2014 to scale-up Small Farmer'a Agri-Business Consortium (SFAC) programme of FPO. Support of initial handholding of 10 lakhs for three years through Producer Organisation Promoting Institutions (POPI) aggregated existing farmers clubs and other farmer's organisations. The approach of the NABARD Scheme is as follows: 1. Identification of potential areas and commodities based on the abovementioned 'potential linked credit plans' by the NABARD officers at the district level involving POPIs. (Basic criteria are: agriculture-related commodities (to form an agriculture produce centric group), small farmers, and commodities (area) with marketable quantities available). 2. Mobilise people by promoting awareness through POPI (identified NGOs) and encouraging farmers to form FPOs (potential FPOs amongst successful WDF/Wadi projects and their federations, farmers clubs/federation, SHGs and federation, PACs, MACs). 3. Training of FPO members by the resource support agencies (RSA). 4. Handholding support: FPOs are expected to hire outside resources (experts) for its management. In the first year of establishment, the NABARD supports their salary expenses and from the following year, FPOs are supposed to establish a self-funding to cover the cost. FPOs are supposed to be 'producer entity' not 'business entity'. This means farmers can decide what they (farmers) want to do instead of being exploited. NABARD approach does not require registration as a company. Cooperatives or societies are fine enough to support.
SFAC	6	SFAC supports the establishment of 2,000 FPOs in the whole country. Resource institutions (NGOs/consulting farms) identify potential area and commodities.
SERP	28 (formation process has been started recently)	Through Andhra Pradesh State Rural Inclusive Growth Project (APRIGP) that support inclusive growth in 150 backward mandals through expansion and diversification of livelihood opportunities. The project supports the formation of 28 FPOs covering 54 mandals. The structure of the FPO promoted is shown in Attachment 5.3.2. FPO consists of smaller farmer producer groups. Basically, FPG

Responsible Organisation	No. of FPO	Approach
		members are SHG members, although not all the members become FPG members, depending on their interest. This automatically makes an FPG a women group. FPG membership is only for women but all their family members can participate in the activities and meetings. The project supports the establishment of value chain of major commodities, emphasising on marketing linkage with companies and rural retail chain (community-based/community-oriented value chain that every village organisation runs a village mart (Kirana stores) as market platform for local market.

Source: JICA Survey Team based on the interview with officers in-charge and data provided by each organisation

5.4 Animal Husbandry

5.4.1 Livestock Production

Andhra Pradesh State is known for its rich livestock population in India. Especially in the number of buffaloes it ranks sixth among the states in India with 6.4 million headcounts, while for sheep, it ranks first with 13.5 million and third for poultry with 80.5 million. In case of sheep, one fifth of sheep in the country is in Andhra Pradesh State.

Within Andhra Pradesh State, Chittoor captures the most number of cattle headcounts, whereas, Guntur has the most number of buffaloes. Anantapur has the highest number of sheep and goat, while West Godavari led in poultry production.

Table 5.4.1 Total Number of Livestock of Andhra Pradesh State in 2012

District	Cattle	Buffalo	Sheep	Goats	Poultry
Srikakulam	790,026	126,328	575,046	212,300	2,726,062
Vizianagaram	385,119	133,056	423,123	173,751	3,537,875
Visakhapatnam	504,947	306,265	252,610	324,024	5,714,509
East Godavari	375,247	642,208	246,722	292,201	13,987,575
West Godavari	188,107	620,184	436,810	193,218	**16,206,532**
Krishna	79,420	696,118	508,061	151,118	11,751,991
Guntur	110,071	**1,007,942**	621,122	213,249	6,975,527
Prakasam	74,845	970,366	1,406,578	406,239	1,237,864
Nellore	115,968	624,664	1,051,938	351,426	1,491,093
Kurnool	408,623	412,812	1,504,671	506,173	1,201,430
Anantapur	617,270	371,127	**3,879,840**	**785,210**	1,589,278
Kadapa	139,141	466,933	1,403,224	457,896	1,562,509
Chittoor	**926,865**	84,368	1,250,077	428,721	12,600,851
Total	4,715,649	6,462,371	13,559,822	4,495,526	80,583,096
All India	190,904,000	108,702,000	65,069,000	135,173,000	729,209,000
% of Andhra Pradesh State	2.47	5.94	20.84	3.32	11.05
Rank of Andhra Pradesh State in India	15	6	1	14	3

Source: Livestock Census 2012

Andhra Pradesh State is a leading state of livestock production as well. In 2013-2014, the estimated milk production of Andhra Pradesh State was 9.08 million MT which accounted for 6.86% of the country's production and ranked fifth among the states in India in terms of production. Similarly, meat production was 488,000 MT, accounted 8.22% of the country's production and ranked fourth among the state. On the other hand, egg production was 12.72 billion eggs, accounted 18.25% and ranked first in the country.

Within Andhra Pradesh State, Prakasam District produces the highest volume of milk with 1.04 million MT. Krishna, Guntur, and Chittoor also produce over 900,000 MT in a year. In terms of meat production, Chittoor is the highest with 65,000 MT, and Krishna and Kurnool districts follow. Regarding egg production, East Godavari is a prominent district which produces over 4.4 billion eggs a year.

Table 5.4.2 Livestock Production of Andhra Pradesh State 2013-14

District	Milk Production (thousand MT)	Meat Production (thousand MT)	Egg Production (million no.)
Srikakulam	425.55	13.73	124.021
Vizianagaram	414.34	28.22	321.849
Visakhapatnam	552.44	29.95	835.910
East Godavari	828.64	43.97	4,453.689
West Godavari	832.49	29.85	1,978.170
Krishna	989.19	58.89	1,543.999
Guntur	976.78	38.69	1,071.684
Prakasam	1,049.91	48.67	212.454
Nellore	558.70	29.18	164.783
Kurnool	705.82	49.37	124.994
Anantapur	482.22	34.13	218,881
Kadapa	318.66	18.98	138.731
Chittoor	948.00	65.12	1,537.714
Total	9,082.74	488.75	12,726.879
All India	132,430.59	5,948.17	697,307.17
% of Andhra Pradesh State	6.86	8.22	18.25
Rank of Andhra Pradesh State	5	4	1

Source: Animal Husbandry Annual Report 2013-14

In terms of productivity, the average milk yield of cow (Cow-Exotic) in Andhra Pradesh State was 7.42 kg per day according to the "Basic Animal Husbandry and Fishery Statistic 2014". The state ranked 9th in India. The top state is Punjab with 11.04 kg, and the country average is 6.78 kg.

In case of buffalo, the average milk yield is 4.73 kg per day, which ranked 10th in the country. Top state was Punjab with 8.72 kg and the average was 4.91 kg.

The average egg (of improved fowls) yield per year in Andhra Pradesh State was 298.82 eggs. It ranked as the top state in India, where the total average was 276.61 eggs.

The average yield of buffalo meat in Andhra Pradesh State was 103.22 kg per animal. It ranked 14th state in the country, where the average was 119.59 kg.

According to the State Department of Animal Husbandry, major challenges of the sector are the following:

- Shortage of feed and fodder,
- Effective control of animal diseases,
- Breed improvement while preserving diverse genetic resources, and
- Dissemination of technology, skills, and quality services to farmers for improving productivity.

To cope with the shortage of feed and fodder, the department allocated an amount of Rs. 28 billion for 2014-15. During the 12th Five-Year Plan, the National Livestock Mission (NLM) has been launched with the main objective to secure availability of feed and fodder to substantially reduce the gap between availability and demand.

For the effective control of animal diseases, Rs. 31 billion is allocated. The department has launched the National Control Programme for major animal diseases such as foot and mouth disease (FMD), peste des petits ruminants (PPR), and brucellosis. The FMD Control Programme has been expanded in February 2014. A new component entitled Classical Swine Fever Control Programme had been also included in the existing scheme of the Livestock Health and Disease Control.

Andhra Pradesh State generally follows the national livestock strategy. According to the National Livestock Policy 2013, the main focuses are to increase production, expand better breeding, and prevent animal diseases. Some of the marketing activities are included only for the support to small poultry farmers. The abstracts of the national policy are summarised in Table 5.4.3.

Table 5.4.3 Strategy for Enhancing Livestock Production

Milk	The yield levels for cows and buffaloes would be improved by: - Increased availability of feed and fodder, - Genetic upgradation through crossbreeding, - Strengthening progeny testing, - Selective breeding, - Converting unproductive animals to productive, and - Improved disease control and surveillance. The problem of infertility amongst improved milch animals would be suitably addressed with the: - Provision of area specific mineral mixture and - Appropriate feed and fodder.
Meat and Wool	- Emphasis on small ruminants and pigs would be to improve nutrition, genetics, breeding strategies, and health cover to increase prolificacy, carcass weights, and reduce mortality leading to improvement in quality and quantity of meat, skin, and wool. - Selection of breeding stocks through large-scale screening involving farmers' flocks would be taken as a national program. - The farmers would be encouraged to organise as cooperatives or farmers'/producers' organisation for better access to inputs and marketing.
Egg and Poultry	Provide appropriate support in the form of: - Financial assistance, - Genetic stocks and improved technologies, - Scientific advice, and - Extension/awareness, particularly on bio-security measures. Conservation of indigenous poultry breeds would be encouraged by: - Producing poultry birds suitable for backyard poultry. To minimise the risks of the farmers; - Provide remunerative marketing opportunities to farmers, - Encourage mutually beneficial contracts between the poultry farmers and purchasers, and - Provide opportunities to associate with corporates in an integrated model through self-help groups or cooperatives.

Source: National Livestock Policy, 2013

5.4.2 Food Processing, Distribution and Marketing

There is a variety of processed food made from livestock animals. In the following, the supply chain of livestock processed food is described in detailed information. Major processed foods from livestock are dairy, poultry, and meat products. Amongst those products, milk has a variety of processed foods (The range of products is shown in Table 5.4.4 below). On the other hand, poultry and meat have limited processed products.

Table 5.4.4 Range of Products from Livestock

Milk and milk products	Sweetened condensed milk, milk powder, ghee, ice cream, malted milk food, butter, cheese, milk-based baby food items, dairy milk whitener, chilled and processed milk.
Poultry products	Eggs, egg powder, chilled, and frozen meat.
Meat products	Canned meat, chilled and frozen meat products

Source: JICA Survey Team

(1) Milk and Milk Products

In the dairy industry, a substantial portion of milk is dealt by unorganised sector5. Currently, a total of 10.3 million litres of milk per day, amounting to 73%, is procured by the unorganised sector. On the other hand, only 3.8 million, or 27%, is bought by the organised sector6, although Andhra Pradesh State has strong dairy processing capacity of 14.1 million litres per day. The organised sector covers a total of 7,979 villages (46%) in Andhra Pradesh State.

Regarding the dairy infrastructure, due to bifurcation, Andhra Pradesh State has neither milk products processing factory nor cattle feed factory, which is the major challenge. Presently, a total of seven dairy

[5]Traditional milk man etc.
[6] Dairy cooperatives and private companies etc.

factories, one milk cooling centre, and 137 bulk milk chilling units are working in Andhra Pradesh State[7]. Along with the increasing milk production, the number of cooperative dairies and private sectors are also growing.

With the successful increase of livestock production, the volume of export products is also growing. According to Agricultural and Processed Food Products Export Development (APEDA), India's export of dairy products was 66,000 MT to the world amounting to Rs. 12.05 billion during the year 2014-15. Major export destinations are Bangladesh, United Arab Emirates, Pakistan, Nepal, and Bhutan.

(2) Poultry

The poultry industry is mainly dealt by a few established private companies for processing. Andhra Pradesh State produces 11% of the total poultry production of the country with an estimated poultry population of 80 million. Ninety percent of the poultry famers produce eggs hence the state is also the national leading supplier of eggs. Both live and chilled poultry products are sold in the retail stores. The major processing poultry producers are: Sugana, Venky's, Rami Reddy Chicken, etc., where the birds are produced and processed in their own farms.

Regarding poultry products, the country has exported 5.56 million MT amounting to Rs. 6.51 billion. Major export destinations are Oman, Germany, Japan, Saudi Arabia, and Indonesia.

(3) Meat

The meat industry is mainly dealt by some private companies for processing. Overall, the state produces 480,000 MT of meat. Ninety-eight percent of this meat is consumed within the state. The remaining 2% is processed for meat products. Meat products are mainly in three forms, i.e., raw, chilled, and frozen; and the organised processors are the main actors at present in the chilled and frozen segment. Frozen meat which has a limited market size because people prefer to buy only fresh meat, is meant for export to other countries and also major cities of India.

There are only two companies dealing with buffalo meat in the state, which are the Allanasons and Al-Kabeer. On the other hand, for poultry meat, there are several large companies such as Suguna Chicken, Sneha Farms, Star Chicks, Diamond and Sumeru. These processors are mainly catering to the export and high-end domestic markets.

A value of Rs. 292.82 billion of buffalo meat and Rs. 8.28 billion of sheep/goat meat were exported in 2014-15. Export-oriented plants produce fresh frozen meat.

India is the largest buffalo meat exporting country in the world. Currently, India is exporting quality and safe meat to about 64 countries. India has a competitive advantage in the export of buffalo meat because livestock in India is reared on green pastures and agricultural crop residues, thus, are raised under green livestock production system. Also, there is no practice of using hormones, antibiotics, or any other chemicals to promote growth and fattening of livestock. Surely, the animals are slaughtered strictly according to "Halal" method. Buffalo meat export price over the years is also increasing. It was USD 1.04/kg in 2000-2001 and 2009-2010 was USD 2.36/kg.

For the practice of domestic animal trade, live animals, namely: buffalo, cattle, sheep, goats, and pigs are sold in livestock markets, which are mostly weekly markets and are owned privately or by local bodies. In most of the markets, the transactions take place after examination of the animals by buyers through brokers/commission agents. Traders/individual butcher buy their animal from weekly livestock markets and bring them to slaughter houses which cater either to domestic market or export-oriented units.

One of the major constraints in meat processing industry is the unhygienic processing practice. Especially the domestic markets with traditional slaughter houses are causing environmental pollution. Also, traditional retailers in the industry are not exposed to modern technologies and hygiene education which escalate issues of unhygienic products.

Another constraint in the food processing sector is the lack of primary processing, storage, and

[7]Andhra Pradesh Dairy Development Co-op. Federation Limited.

distribution facilities. Considerable investments are required in infrastructure especially after the bifurcation of Andhra Pradesh State. Majority of the processing infrastructures are concentrated in Hyderabad, which now lies in the new Telangana State. To encourage public investments which significantly increase the processing capacity, the government provides incentives for the food processing of animal husbandry produce as shown in Table 5.4.5.

Table 5.4.5 Incentive for Investment on Animal Husbandry Food Processing

Incentive Type	Target	Contents
Subsidy	Setting up of cold chain for agriculture/horticulture/dairy/meat produce, up to a maximum of Rs. 50 million.	Capital subsidy of 35%
Central Excise Duty	Machinery for the preparation of meat, poultry, fruits, nuts, or vegetables; and on presses, crushers and similar machinery used in the manufacturing of wine, cider, fruit juices or similar beverages; and packing machinery	Reduction from 10% to 6%
Income Tax	New units engaged in processing, preservations, and packaging of fruits or vegetables, meat and meat product, poultry, marine or dairy products	100% tax exemption for the first five years of operation, and after that, at the rate of 25% of the profits being exempted from tax; 30% in case of company

Source: Food Processing Policy 2015 -2020

5.4.3 Major Stakeholder (Animal Husbandry)

Development of dairy cooperative started in the 'Operation Flood' of the National Policy in 1940. Andhra Pradesh State Cooperative Society Acts came into effect in 1964. Whereas, Mutually Aided Cooperative Societies Act that was issued in 1995 which assures more independent society without government intervention. Even though the agriculture cooperative society (PACS) could not transform to MACS, many of the dairy cooperatives re-registered under MACS. Cooperative societies were federated at the district level and formed district cooperative unions (it is called Andhra Pradesh Dairy Development Cooperative Federation (APDDCF) in Andhra Pradesh State). Collected milk at the PAC level is brought to the APDDCF as private companies were not allowed to deal with processing and marketing of dairy products. District cooperative unions are in-charge of milk production, procurement, processing and marketing. Most unions also provide extension services like breeding (artificial insemination) and animal health.

After the 2004 Assembly Election, the government decided to remain their control on dairy cooperatives. During economic liberalisation, some of the dairy cooperatives turned into companies. Further, legislation backed support through amendment of the Companies Act, which encouraged the cooperatives to become autonomous companies. Through the FPO promotion strategy of GoAP, department and relevant institutions support dairy FPOs. Dairy cooperatives and FPOs tend to have a huge number of members that often exceed 10,000.

Even though both the dairy cooperatives and dairy FPOs are owned by farmer members, produce of milk is procured from individual farmers either by company staffs or appointed intermediators. Advantages of being a member of an FPO are: receiving competitive milk price, participating in a fair and transparent system of milk collection, getting regular and timely milk payment, receiving additional benefits like price incentives and patronage linked bonus, receiving dividend as the business grow in the long run, getting opportunities to participate in various capacity building programs, and availing various input services provided by the company to increase milk production.

5.5 Fisheries

Fishery is one of the most important economic activities in Andhra Pradesh State. It contributes 6.04% of the state's GDP and 42% of India's marine export. Andhra Pradesh State has one of the longest coastlines in India (974 km), with 160,800 seagoing fishermen and 29,195 fishing boats. Regarding inland fisheries, there are 104 reservoirs (240,000 ha), 25,400 irrigation tanks (338,000 ha), and 11,514 km of rivers and canals. An already developed coastal aquaculture area consists of 74,000 ha while the inland aquaculture area is 117,000 ha.

5.5.1 Fishery Production

Fishery production in Andhra Pradesh State has been increasing considerably in the last ten years from

853,050 tons in 2004/2005 to 2,018,420 tons in 2013/2014. Within India, Andhra Pradesh State is the top fish production state in 2014/15 with inland fish production at the top and marine fisheries production in the fourth position.

Table 5.5.1 Fisheries Production (Marine and Inland) by Top Five States from 2004/05 to 2013/14

(Unit: 1,000 tons)

State	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
AP	853.05	891.09	856.93	1010.09	1252.78	1305.86	1368.20	1603.20	1808.08	2018.42
WB	1215.00	1250.00	1359.10	1447.26	1484.00	1517.01	1443.26	1472.05	1490.01	1580.65
GR	635.21	733.82	747.33	721.91	765.90	771.51	774.90	783.72	788.49	793.42
KR	678.31	636.89	677.63	667.33	685.99	698.86	681.61	693.21	679.74	708.85
TN	459.43	463.03	542.28	559.36	534.17	582.93	614.81	611.49	620.40	624.30

Note: AP: Andhra Pradesh State, WB: West Bengal, GR: Gujarat, KR: Kerala, TN: Tamil Nadu.
Source: Handbook on Fisheries Statistics 2014

Marine fisheries production in Andhra Pradesh State was 438,000 tons in 2013/14 and major marine fish species produced were sardines (88,000 tons), mackerel (56,000 tons), tuna and billfish (30,000 tons), ribbonfish (20,000 tons), and carangid (19,000 tons).

Inland fish production in Andhra Pradesh State was 1,396,148 tons in 2012/13 and the major inland fish species were Indian major carp (catia, rohu, mrigal, calbasu: 832,446 tons), catfish (wallago, attu, pangasius, bararius: 108,522 tons), exotic carp (common, silver, grass: 78,206 tons), and murrels (ophiocephauls spp.: 55,584 tons). Eighty percent of the inland production is from fish farming (Fisheries Department, Andhra Pradesh State).

Shrimp and prawn production in Andhra Pradesh State was 255,000 tons in 2013/2014 of which 64,908 tons came from marine capture fishery, 88,036 tons from brackish water aquaculture, and 102,793 tons from fresh water aquaculture. Captured shrimps have been declining due to heavy fishing pressure in the coastal areas. Species include tiger prawn (penaeid shrimps) such as black tiger. As for cultured species, production of vannamei shrimp（*Litopenaeusvannamei*）is rapidly increasing while black tiger prawn (*Penaeus monodon*) and scampi（*Macrobrachiumrosenbergii*）production is limited. Vannamei shrimp is being cultured in low salinity or even in freshwater ponds that increased the culture area drastically.

5.5.2 Food Processing

According to the Handbook on Fisheries Statistics of India 2014, majority of fish marketed in Andhra Pradesh State was fresh (55%), followed by frozen (32%), cured (3%), and canned (0.7%). Table 5.5.2 shows the disposition of fish catch in Andhra Pradesh State in 2012.

Table5.5.2 Disposition of Fish Catch in Andhra Pradesh State 2012

(Unit: tons**)**

Fresh	Frozen	Cured	Canned	Reduction	Misc. Purposes	Offal for Reduction	Unspecified	Others	Total
842,202	486,634	44,982	11,308	1,200	37,723	0	22,832	75,116	1,512,997

Source: Handbook on Fisheries Statistics 2014

Most of the freshwater and marine fishes are sent to other states as fresh fish. Fish are packed in insulated boxes and then filled with ice, which will easily keep the fish fresh for a week. Fish are not processed at landing sites or wholesaler sites until they are purchased by consumers or restaurants. This is due to the traditional purchasing habit of local consumers who prefer to buy whole fish and then process them at site. Most of the retailers offer fish processing services to consumers. They may provide such service directly or by employing a person to provide such service. Sometimes, they take additional payment for providing such services. Some fish are frozen at packing firms in fish consuming cities such as Chennai, Cochin, and Kolkata for later export to the Gulf countries and Southeast Asian countries. Some fish are

salted and dried depending on the preference of the importing countries.

Tuna and billfish are mainly caught by traditional fishing boats using longlines, handlines, and gillnets. Many of traditional non-motorised fishing boats do not carry ice due to limited space on board. Wholesalers purchase the fish and send them to fish consuming cities where the fish are canned or exported as chilled fish. The small-sized tuna, which is not suitable for exports get sold in domestic market.

Small fish as well as the bycatch of trawling is dried or salted by fishermen on board and women on the shore. Processing and marketing of dried fish is an important economic activity for women in fishing villages.

Cultured shrimp as well as good quality wild caught shrimp/prawn is for the export market and processed (mainly frozen) in different forms in accordance with the request of the buyers. There are a number of modern processing facilities in Andhra Pradesh State which are often equipped with Individual Quick Freezing (IQF) machines.

5.5.3 Distribution and Marketing

In Andhra Pradesh State, most of the fresh fish product is sent to the other states in India where demand for fish is high, while most of the shrimp is exported overseas as frozen products. Distribution channels for the various fish depend on the species and processing methods.

At the landing sites, agents of whole sellers and exporters from Kerala, Tamil Nadu, West Bengal, and others states make the purchases. The agents purchase high quality fish and shrimp as well as tuna and billfish species. Fishes are purchased through auction or negotiation with fishing boat owner or his/her representative. In Kakinada, there are private auctioneers who charge their service to the boat owners. Fishes are packed in insulated boxes with ice and sent to destination by insulated trucks. At the destination, fishes are examined and processed in accordance with species and quality. Fresh chilled tuna is exported to Turkey, Jordan, and European Union (EU) countries as sashimi grade tuna.

Shrimp/prawn is exported from Andhra Pradesh State to the United States of America (USA), EU, Japan, and other countries. Andhra Pradesh State exported 42% of India's marine exports in 2014/15 most of which came from shrimp/prawn. Table 5.5.3 shows the distribution channels and preservation/processing by fish species.

Table 5.5.3 Fish Distribution Channels and Preservation/Processing by Fish Species

Species	Fishing type	On board/ farm gate handling	Landing site processing		Final distination in India and processing		
Sardines	Traditional	No	wholesalers	Ice	Factories	Canned	Expoort
	Mechanized	No					Retailers
Trash fish	Trawl	No/dry on board	wholesalers	Sun dry	Feed mills	Feed process	Retailers
		No/dry on board		Salt+ dry	Rural Inland mkt	No	Retailers
Demersal fish		Ice		Fresh	Local mkt	Ice	Retailers
Mackerels, Scads, Scianidae, Ribbonfish, Pomphret, Groupers etc	Traditional	No/Ice	wholesalers	Ice	Local mkt	Ice	Retailers
	Mechanized	Ice		Ice	Fish consuming cities	Ice	Retailers
						Freeze	Export
						Salt+dry	Export
Tuna and billfish	Traditional	No/Ice	wholesalers	Ice	Fish consuming cities	Ice	Retailer
	Mechanized	Ice				Canned	Export/ Retailers
						Freeze	Export
						Ice	Export
Shrimp/ prawn	Trawl	Ice	wholesalers	Ice	Local mkt	Ice	Retailers
					Local packers	Process/Freeze	Export
	Aqua farm	Ice					Export
Freshwater fish	Aqua farm	Ice	wholesalers	Fresh	Local mkt	Fresh	Retailers
				Ice	Fish consuming cities	Ice	Retailers
						Freeze	Export

Source: JICA Survey Team based on interview and observation

5.5.4 Major Stakeholders (Fisheries)

The most important community-based institutions are the traditional governance systems (caste/kinship-based, with geographical origin are also important in case of migrant/settler communities). Some of traditional management systems are still in place to provide fisheries governance at the local level.

Fishery in India is an important part of our economy. There are over 18 thousand functional primary fisheries cooperative societies having a membership of around three million fishers in the country, who are socially, economically and educationally backward. National Federation of Fisheries Cooperative Ltd. (FISHCOPFED) is the umbrella organization of India's Fisheries Cooperative Societies under the Ministry of Agriculture. FISHCOPFED implements the most acclaimed Centrally Sponsored Group Accident Insurance Scheme for active fishermen in collaboration with the concerned state and Union Territory fishery departments throughout the country. FISHCOPFED also making its efforts to train & educate the fishers of the country as well as marketing and Institutional strengthening. .Under FISHCOPFED, there are 23 state level federations, one regional federation, 129 district level federations, and 18,144 primary fisheries societies in India (FISHCOPFED Web site: http://www.fishcopfed.in/)

Beside the community-based institutions, there are three other institutions in the fishing communities of India, namely: state supported cooperatives, community-based organisations (CBOs) led by NGOs, and fishworker's organisations. (India Marine Fisheries Issues, Opportunities and Transitions for Sustainable Development, 2010 World Bank)

An example of state-supported cooperatives in Andhra Pradesh State is Kanopur Inland Fishermen Society. It represents the fishers to use and manage Kanopur PWD tank of 1,000 acre. This society has 300 members and all the members belong to schedule caste category. The society collects fees from the members and pays nominal rent to the government to use the tank. Fifty percent of the rent goes to Water Users Association (WUA), 30% to local government, and 20% to the Fisheries Department. The society also conducts group marketing activities to sale the fish in Chennai and Nellore and now wants to develop capture nursery that is an intermediate culture of freshwater shrimp from fry to fingerling size

(4-5 inches) in pen.

There is a good example of community-based organisation in Andhra Pradesh State. The marine fisher women federation was registered in 2007. Godavari Mahila Samakhya (GMS) was promoted under Fisher Women Empowerment Project under the National Rural Livelihood Mission (NRLM: a poverty alleviation project implemented by the Ministry of Rural Development, Government of India). This scheme is focused on promoting self-employment and organisation of rural poor through Self Help Groups (SHGs) at the villages, mandals, and district levels. GMS works on the basis of Annual Work and Finance Plan. The government has contributed Rs. 5.8 million to GMS. Similarly, district administration has given Rs. 40 lakh support to GMS. NRLM has provided Rs. 8.0 million as corpus to GMS. GMS now has 1,744 SHGs in 72 villages, 12 mandals, and over 20,000 families are involved. Some of the key issues dealt by GMS include food security, pension to needy families, pre-school education, and provision of individual sanitary latrines. GMS is also associated with the provision of water purifying system, health savings services, career counselling, and life insurance.

An example of Fisherworker's Association is the Andhra Pradesh State Mechanised Fishing Boat Operators Association. The association has 500 members and shares technical and market information for their fishing activities. The association also functions to voice fishermen's needs to government authorities.

Other important organisation is 'the Seafood Exporters Association of India (SEAI)'. SEAI is the representative body of seafood exporters. It takes an active part, in conjunction with the MPEDA, in conducting International Seafood Fairs in India, besides participating in various international fairs and exhibitions.

5.6 Food Park

5.6.1 Present Status of Food Parks

(1) Mega Food Park Projects in India

According to the Sixteenth Report of Mega Food parks for Committee on Agriculture (2014-2015), it has so far approved the setting up of 40 mega food parks in the country. Out of the 40 projects, 21 projects have been accorded final approval and 19 projects have been accorded in-principle approval as on 20 May 2015.

Table 5.6.1 Current Status of MFP Projects

Status	Number
Projects with Final Approval	21
Projects Partly Operational	5
Projects Likely to be Operational in 2015-16	2
Projects Expected to be Operational in 2016-17	14
Projects In-principle Approval	19
Total	40

Source: Sixteenth Report of Mega Food parks for Committee on Agriculture (2014-2015), August 2015

Out of the 21 projects with final approval, five projects are in operation, namely; Srini Food park in Andhra Pradesh State, North East Mega Food park in Assam, Integrated Food park in Karnataka, International Mega Food Park in Punjab, and Patanjali Food and Herbal Park in Uttarakhand. Those five projects were accorded final approval from March 2009 to May 2011.

Table 5.6.2 List of Five Projects in Operation

Amount in Rs.

	Party	Project Location	District	State	Project Cost	Approval Date	Grant Approved	Grant Released
1	Srini Food Park Pvt.Ltd.	Mogili Village, Bangarupalem	Chittoor	Andhra Pradesh	1,169,400,000	27.03.2009	500,000,000	499,194,560
2	North East Mega Food Park Ltd.	Nathkuchi village, Tihu	Nalbari	Assam	759,800,000	27.03.2009	500,000,000	400,000,000
3	Integrated Food Park Pvt. Ltd.	Vasanta Narasapura Industrial Area	Tumkur	Karnataka	1,443,300,000	27.03.2011	500,000,000	450,000,000
4	International Mega Food Park Ltd.	Village Dhabwala Kala, Malout-Fazilka Road, Dana Mandi Rd, Arniwala Shakh Subhan	Fazilka	Punjab	1,303,800,000	25.05.2011	500,000,000	450,000,000
5	Patanjali Food & Herbal Park Pvt. Ltd	Village Padartha	Haridwar	Uttarakhand	950,800,000	27.03.2009	500,000,000	500,000,000

Source: Ministry of Food Processing Industries

According to the guidance given by the ministry, core processing facilities such as CPC and Primary Processing canters (PPC) are essential to install in the food park. All five operational projects have facilities like testing laboratory, cleaning, grading, sorting and packing facilities, dry warehouses, specialised storage facilities, and cold storage as common facilities of CPC. Each project also sets up three to six PPCs to create a backward linkage as shown in Table 5.6.3 below. However, the table also shows the number of units in operation is few except for Patanjali Food & Herbal Park.

Table 5.6.3 Major Facilities and Status of Operation for Five Operational Projects

	Party	State	Land size	Facilities in CPC	Cold Storage	IQF (MT/h)	Number of PPCs	Units in Opertion
1	Srini Food Park Pvt.Ltd.	Andhra Pradesh	142 acre	Aseptic Pulping, Cold Storage, and Warehouse, Ripening Sheds, IQF & Deep Freeze and Tetra Pack line	200MT	1.5	4 in operation	2 units
2	North East Mega Food Park Ltd.	Assam	N/A	Warehouse, Common facility building, Cold storage, QC lab equipment, ETP & septic tank, truck terminal, procurement of reefer vans.	N/A	N/A	3 (proposed)	1 unit
3	Integrated Food Park Pvt. Ltd.	Karnataka	110 acre	warehouse, silos and fruit and vegetable block including cold storage, ripening chambers, IQF etc	660MT	1	6 (proposed)	1 unit
4	International Mega Food Park Ltd.	Punjab	N/A	grain silos, cold storage, IQF and deep freeze, warehouse etc.	4000MT	2	4 (under construction)	4plots (2 acres)
5	Patanjali Food & Herbal Park Pvt. Ltd	Uttarakhand	N/A	cold storage & warehouse, QC lab with installation of various equipments	3000MT	not filled	6 (constructed)	18 units (out of 25 units proposed)

Source: JICA Survey Team, Sixteenth Report of Mega Food parks for Committee on Agriculture (2014-2015), August 2015. Report on Evaluation of the Impact of the Scheme for Mega Food park of the Ministry of Food Processing Industries, ICRIER, July 2015

(2) Food Parks in Andhra Pradesh State

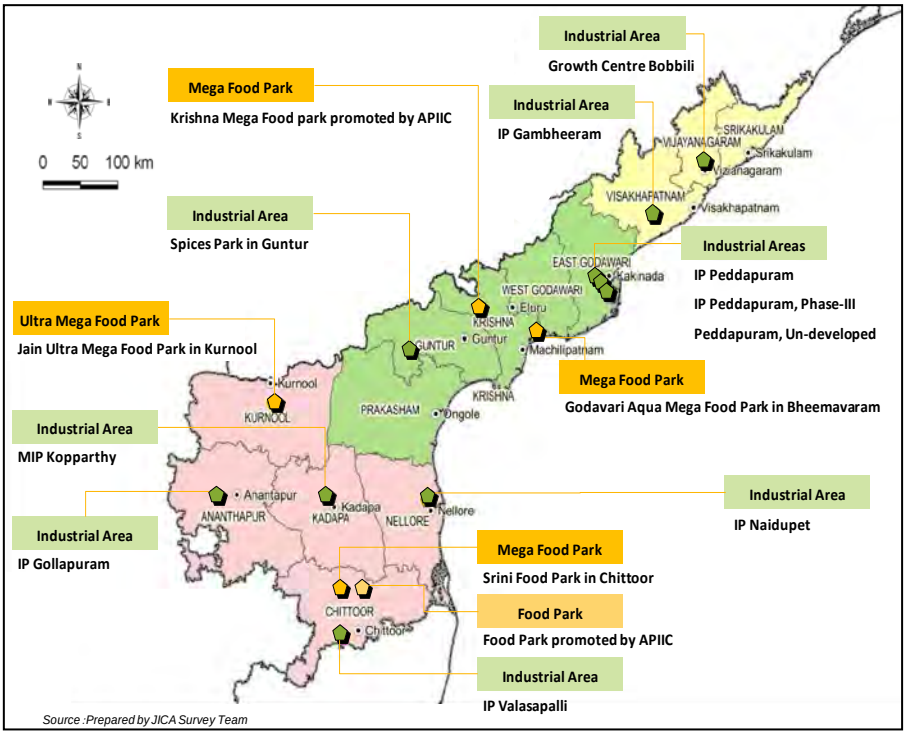
According to the Office Memorandum of F.No.15-MFPI/14-Mega FP, the Ministry of Food Processing Industries dated on 2nd August 2015, MOFPI notify the consolidated list of designated 146 food parks for the purpose of making available affordable credit from Food Processing Fund 2015-16 established by the Reserve Bank of India in NABARD. Out of 146 food parks, 14 food parks are located in Andhra Pradesh State.

Table 5.6.4 List of Food Parks in Andhra Pradesh State

No	Name of Food parks	District	Category
1	Srini Food park	Chittoor	MFP
2	Food park promoted by Andhra Pradesh Industrial Infrastructure Cooperation (APIIC)	Chittoor	FP
3	Mega food park promoted by Andhra Pradesh Industrial Infrastructure Cooperation (APIIC)	Krishna	MFP
4	Godavari Mega Aqua Park	West Godavari	MFP
5	MIP Kopparthy	Kadapa	IA
6	IP Peddapuram	East Godavari	IA
7	IP Peddapuram, Phase-III	East Godavari	IA

No	Name of Food parks	District	Category
8	Peddapuram, Undeveloped	East Godavari	IA
9	IP Naidupet	Nellore	IA
10	IP Valasapalli	Chittoor	IA
11	IP Gambheeram	Visakhapatnam	IA
12	Growth Centre Bobbili	Vizianagaram	IA
13	IP Gollapuram	Anantapur	IA
14	Spices Park	Guntur	IA
15	Ultra Mega Food park	Kurnool	UMFP

Note: UMFP– Ultra Mega Food park, MFP– Mega Food park, FP- Food park, IA- Industrial Area, IP- Industrial Park
Source: 14 food parks are identified from the Office Memorandum F.No.15-MFPI/14-Mega FP, Ministry of Food Processing Industries dated on 02.09.2015. No. 15 Ultra Mega Food park in Kurnool is added by the JICA Survey Team.



Source: JICA Survey Team

Figure 5.6.1 Location Map of Major Food Parks in Andhra Pradesh State

5.6.2 Present Status of Infrastructure

(1) Road Network and Drainage

The national highways including the North-South Corridor provide connections to industries/cities from key areas in India making them more accessible as shown in Figure 5.6.2. The highways are categorised into four types: single lane with 2,092 km long, intermediate lane with 1,001 km long, double lane with 6,902 km long, and multi-lane with 236 km long in India.

The state is well connected with inter-state and intra-state road network. The state has a total road network of 45,831 km. The Transport Roads and Buildings Department is responsible for the construction and maintenance of roads, bridges, causeways, and national highways in the state. The status of road network is given in Table 5.6.5 below.

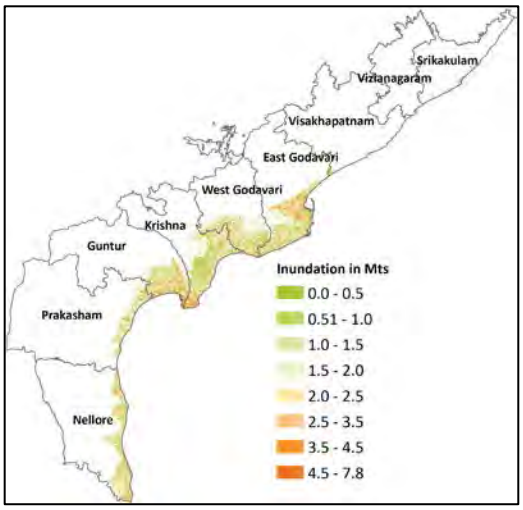
Source: Socioeconomic Survey 2014-15

Figure 5.6.2 National Highway

Table 5.6.5 Status of Road Network

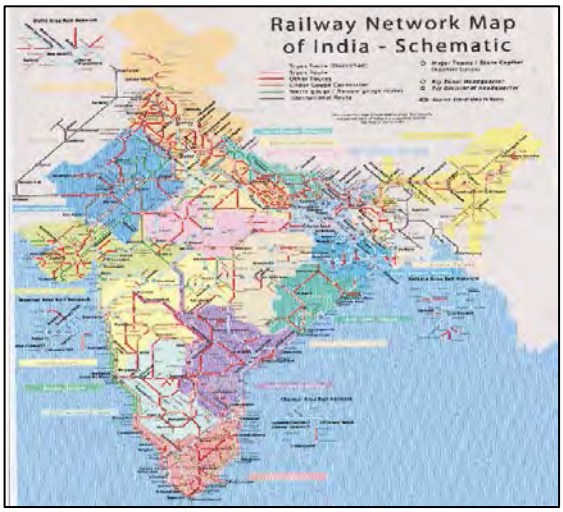
Type of Roads	Length (km)
National Highways	4,423
State Highways	6,167
Major District Roads	19,674
Rural Roads	15,567
Total	45,831

Source: Socioeconomic Survey 2014-15



Sauce: APS Development Planning Society (APSDPS) May 2014

Figure 5.6.3 Inundation Map in Andhra Pradesh State



Sauce: Socioeconomic Survey 2014-15

Figure 5.6.4 Railway Network

Drainage system is composed of road network, rivers with tributaries, irrigation canal, and rain harvest ponds. In cities, separated sewer system is partially adopted in almost all areas, combined sewers are installed. Not only drainage but also the sewerage systems are not functioning effectively since these are not well designed and their facilities are degraded due to lack of maintenance. Coastal areas prone to storm surge inundation due to cyclones are shown in Figure 5.6.3

A developer of food park (FP) shall properly make the plan of access roads in consideration of the accessibility between the Food Park and trunk roads such as national highway and state highway and also considering the drainage system at the vicinity of the food park.

(2) Railway

Andhra Pradesh State is well connected through the rail network. Visakhapatnam, the largest city in the state, has rail accessibility to nine out of 13 district headquarters as shown in Figure 5.6.4. The Government of India is also planning to form a separate railway zone, namely: South Coast Railway with Visakhapatnam as its headquarter. The new zone will consist of Waltair Division of the East Coast Railway (ECoR) as well as Vijayawada, Guntur, and Guntakal divisions of South Central Railway. Additionally, Andhra Pradesh State has proposed the metro rail projects in the cities of Visakhapatnam, Vijayawada, and Tirupathi.

(3) Sea Port

There is one major seaport in Visakhapatnam managed by the Government of India and 14 non-major ports managed by the state government. Visakhapatnam Port is one of 13 major ports in India and the only major port of the state at present. It is India's second largest port by volume of cargo handled. It is located on the east coast of India and is located midway between the Chennai and Kolkata ports as shown in Figure 5.6.5. Visakhapatnam Port is undergoing modernisation and expansion program aimed at increasing its capacity to 130 million tons by 2016-17. Status of Visakhapatnam Port is shown in Table 5.6.6.

Gangavaram Port is developed as the most modern, all weather, deep water, multipurpose world class port facility, and offers major tangible benefits to the Indian industry through deeper drafts, advanced cargo handling equipment, highly efficient operations, supported by vast storage areas for all types of cargo and extensive ancillary facilities, making it the most important gateway on the east coast of India as shown in Figure 5.6.5. Status of Gangavaram Port is indicated in Table 5.6.8.

Source: JST

Figure 5.6.5 Location Map of Main Infrastructures

Kakinada Port is located in Kakinada off the east coast of India. The port is 170 km (106 mi) south of Visakhapatnam Port as shown in Figure 5.6.5. Outline of Kakinada Port is presented in Table 5.6.8.

Krishnapatnam Port is a privately built and owned all weather deep water port on the east coast of India, lying in the Nellore District of the state as shown in Figure 5.6.5. The port also is located about 190 km north of the Chennai Port and 18 km east of the city of Nellore. The port is owned and operated by the Krishnapatnam Port Company Limited (KPCL) which is 92% owned by Hyderabad-based CVR Group. Status of Krishnapatnam Port is shown in Table 5.6.9.

Table 5.6.6 Outline of Visakhapatnam Port

Item/Feature	Inner Harbour	Outer Habour
Annual Cargo Tonnage	65 milliontons/year	
Water Spread	100 ha	200 ha
Number of Berths	18	6
Berths Length	3,683 m	2,375 m
Max. Draft	11 m	17 m
Source: Visakhapatnam Port		

Table 5.6.7 Outline of Gangavaram Port

Item	Feature
Annual Cargo Tonnage	20.74 million tons (2014-2015)
Number of Available Berths	5
Total Length of Quay	1,458 m
Width of Quay	25 m to 31 m
Max permissible draught	14.0 m to 19.5 m
Source: Gangavaram Port	

Table 5.6.8 Outline of Kakinada Port

Item	Feature
Annual Cargo Tonnage	12.07 million tons/year
Number of Available Berths	4 + 2 (under construction)
Total Length of Quay: Six Berths	1,510 m
Total Width of Quay	25 m
Max. Permissible Draught	13 m on high tide
Source: Kakinada Port	

Table 5.6.9 Outline of Krishnapatnam Port

Item	Feature
Annual Cargo Tonnage	40.72 million tons (2014-15) Note: 75 million tons capable
Number of Berths	2
Total Berth Length	650 m
Straight line Draft alongside	13.5 m
Number of Container Berths	7
Total Container Berth Length	2,000 m
Draft Alongside	18.0 m
Source: Krishnapatnam Port	

The government is developing the Machilipatnam Port under a public-private partnership (PPP) model. In addition to the existing non-major ports, the government has also decided to develop 14 minor ports under the PPP mode, which include Bhavanapadu and Kalingapatnam in Srikakulam District, and Narsapur in West Godavari District. There has been a proposal from the Government of India to establish

a second major port in the state at Duggirajapatanam in Krishna District, for which, the GoAP has conveyed its consent and has agreed to provide available government land as equity.

(4) Airport

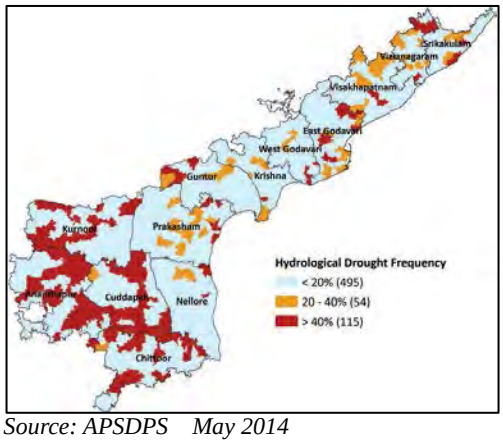
Andhra Pradesh State has seven operational airports/air strips in Visakhapatnam, Tirupathi, Rajahmundry, Vijayawada, Kadapa, Tadepalligudem, and Puttaparthy. The state government is extending support to the Airport Authority of India for expansion or modernisation of existing airports in Vijayawada, Rajahmundry, and Tirupathi. There has been a proposal for the development of greenfield airport in Bhogapuram, Vizianagaram District. It has been proposed to develop no-frills airports inNagarjuna sagar, Guntur District and Donakonda, Prakasam District; and to develop regional airports inKuppam-Chittoor District, Dagadarthi-Nellore District, and Orvakallu-Kurnool District. Expansion of the existing Visakhapatnam, Vijayawada, and Tirupati airports is proposed to conform with international standards. At present, an international airport is located in Hyderabad, Bangalore and Chennai outside of the state as shown in Figure 5.6.5. In the near future, Tirupathi is planned to be an international airport.

(5) Water Supply

The Andhra Pradesh State Rural Water Supply and Sanitation Department (RWSS) under the government has the responsibility to provide water supply to the rural areas while the Public Health Engineering Department (PHE) has the responsibility in the management of water supply to the urban areas. The total water resources of the state are estimated to be about 108 billion cubic meter (BCM) consisting 78 BCM from surface water and 30 BCM from groundwater. Nearly 65 BCM out of 108 BCM water capacities are currently utilised, i.e., 0.6 BCM for drinking, 64 BCM for irrigation, 0.3 BCM for industry and 0.3 BCM for power generation. Most of the water (about 98%) is currently supplied for irrigation, although other sectors' needs are expected to grow in the future.

The state is rich in water resources consisting of three major perennial rivers, namely: Godavari, Krishna and Pennar as shown in Figure 5.6.5, ten medium rivers, and several other rivers of lesser significance. Rainfall varies from 561 mm in Rayalaseema Region including the southern districts of Anantapur, Chittoor, Kadapa, and Kurnool to 1,113 mm in Coastal Andhra Region in the northeastern part of the state. The number of rainy days varies from 52 days in Coastal Andhra to 41 days in Rayalaseema.

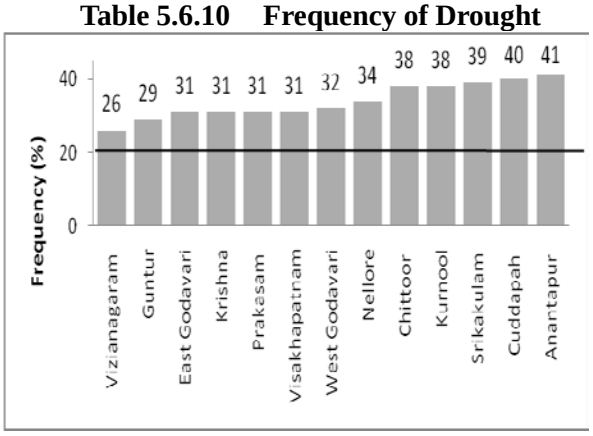
Although net annual groundwater availability in the state is 30 BCM, the groundwater level varies significantly in each district and season. In many parts of the state, in the summer during May and June, many irrigation wells and drinking water wells run dry every year due to significant depletion of groundwater level. Groundwater levels measured in January and May showed a very high depletion of groundwater with 7.56m in Rayalseema during the summer. Coastal Andhra also has a high depletion with 3.29m differences between pre-monsoon and post-monsoon. This depletion of groundwater seriously affects the sustainability of drinking water sources, especially during the summer. The state, especially Rayalseema, suffers from drought as shown in Figure 5.6.6.



Source: APSDPS May 2014

Figure 5.6.6 Drought Map in Andhra Pradesh State

Table 5.6.10 Frequency of Drought



Source: APSDPS May 2014

While the state has three major rivers and also significant amount of groundwater, it faces serious challenges in water resources management for drinking and domestic purposes. The challenges of depletion of groundwater levels and quality problems (fluoride and salinity) in some parts of the state need to be addressed urgently by APRWSS (Rural Water Supply and Sanitation). There is a high dependence on groundwater for drinking and other domestic purposes not only in rural area but also in urban area. Therefore, planning of a food park requires careful consideration of selection of water sources and water resource development. Bulk water for the park could be supplied from water resources constructed for irrigation purpose.

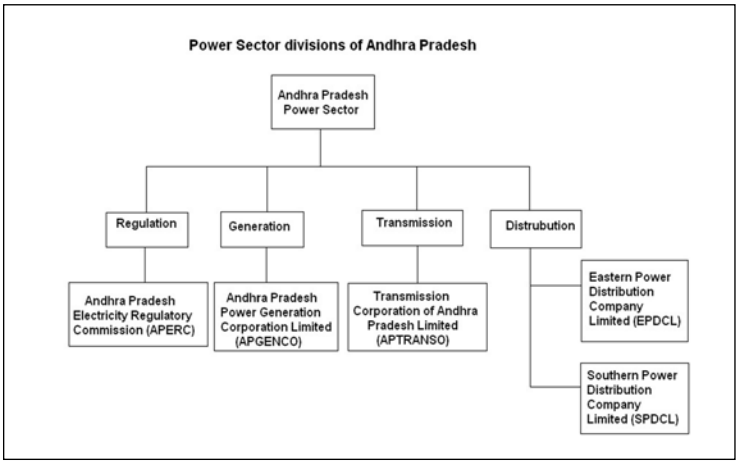
(6) Sewerage

At present, the public sewer collection system including wastewater treatment is not developed in the state. The present level of sanitation coverage is around 59% in the state, while the rural household coverage is about 30%. It is reported that only half of the rural households with latrines are using theirs latrines regularly. This implies that still more than 80% of rural population resorts to open defecation with its associated risks relating to public health and also pollution of water supply sources.

Open defecation is quite prevalent, leading to significant pollution and health issues. This problem is more acute in densely populated settlements. Wastewater generated by households including cattle sheds flows into open surface drains. Currently, only 6.3% of rural households are connected to the closed drainage system. Therefore, food parks should establish their own sewerage system with wastewater treatment plant within the park.

(7) Power Supply

The Andhra Pradesh State Power Generation Corporation Limited (APGENCO), who undertakes the operation and maintenance of power plants and setting up of new power projects alongside with the upgrading of plant's capacity, is the responsible organisation for power generation. Transmission Corporation of Andhra Pradesh State Limited (APTRANSCO) manages power supply as single buyer in purchasing and selling of power to Distribution Companies (DISCOMs) as shown in Figure 5.6.7. There are four DISCOMS in the state that distribute power to theirs consumers.



Source: APGENCO

Figure 5.6.7 Organizational Chart

The total installed utility power generation capacity is nearly 20,000 MW in the state. Only 11,400 MW is the committed power supply to the state. APTRANSCO has made long-term power purchase agreements for 9,611.29 MW, as of July 31, 2015. The rest of the capacity is used as electricity exported mainly to Telangana State depending on fuel availability. The gross electricity with 48,323 million KWh is supplied in the year 2014-15 and the unit electricity consumption is estimated at 1,003 KWh per capita. The hydropower plants in the state are shown in Table 5.6.11 and those capacities are estimated at 1,748 MW.

Table 5.6.11 Hydropower Station

Name of Power Station	Basin	Installed Capacity (MW)
Donkarayi Power House	Godavari	25
Lower Sileru Project Power House	Godavari	460
Nagarjunasagar Right Canal Power House	Krishna	90
Penna Ahobilam Power House	Pennar	20
Pulichintala Project Power House	Krishna	120
Srisailam Right Bank Power House	Krishna	770
Upper Sileru Project Power House	Godavari	240
Others		23
Total		1,748

Source: APGENCO

Table 5.6.12 Coal-based Thermal Power Plants

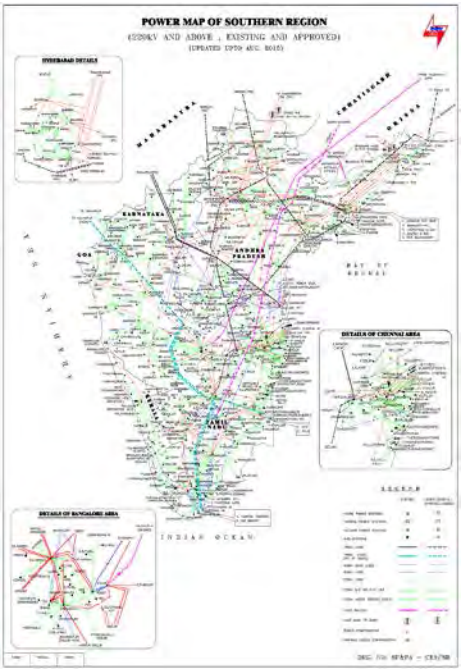
Name	Operator	Location	District	Sector	Capacity (MW)
Simhadri Super Thermal Power Plant	NTPC	Visakhapatnam	Visakhapatnam	Central	2,000
Dr Narla Tatarao TPS	APGENCO	Ibrahimpatnam	Krishna	State	1,760
Rayalaseema Thermal Power Station[8]	APGENCO	Kadapa	Kadapa	State	1,050
Sri Damodaram Sanjeevaiah Thermal Power Station	APPDCL	Krishnapattanam	Nellore	State	1,600
Simhapuri Thermal Power Station	SEPL	Krishnapattanam	Nellore	Private	600
Meenakshi Thermal Power Station	MEPL	Krishnapattanam	Nellore	Private	300
Pynampuram Power Station	TPCIL	Krishnapattanam	Nellore	Private	1,320
TOTAL					8,630

Source: APGENCO

Table 5.6.13 Combined Cycle Gas Turbine and Diesel Engine Power Plants

Name	Capacity (MW)
APGPCL Plant	272
Lanco Kondapalli Power Plant	1,466
Gautami Combined Cycle Power Plant	464
Konaseema Combined Cycle Power Plant	445
Vemagiri Combined Cycle Power Plant	370
GMR Rajamundry Combined Cycle Power Plant	768
Samarlakota Combined Cycle Power Plant	2,620
Jegurupadu Combined Cycle Power Plant	445
Spectrum Combined Cycle Power Plant	209
GMR (barge mounted)	237
LVS Diesel Engine Power Station	37
Panduranga CCPP	116
RVK Energy Power Plant	28
Sriba Power Plant	30
Silkroad Sugar Power Plant	35
Total	7,542

Source: APGENCO



Source: APTRANSCO

Figure 5.6.8 Power Transmission Line

Thermal power plants are installed based on fuel, coal, gas, diesel, etc. Public sector undertaking NTPC, state level power generating companies, and private firms are engaged in this sector for power generation. Currently, operating coal-based thermal power plants in the state are listed in Table 5.6.12 above.

There are 15 combined cycle gas turbine power plants and diesel engine power plants with total capacity of 7,542 MW at present in the state as shown in Table 5.6.13. However, it is reported that many of these power plants are not operating due to non-availability of natural gas and high cost of liquid fuels.

The state has solar power with a total capacity of 279.44 MW, as of September 2015, and wind power with a capacity of 1,062 MW, as of July 2015. In addition, there are nearly 89.1 MW small hydro plants; about 421.14 MW bagasse, bio-mass co-generation and bio-mass based projects; nearly 78.79 MW mini

power plants (grid connected); and nearly 67.20 MW other (grid connected) plants based on isolated gas wells, waste heat, industrial waste, municipal waste, etc., in the private sector. These power plants are not covering captive power capacity in various industries which are not grid connected. In addition, innumerable diesel generator sets are installed in the state for stand-by supply and emergency power supply to be required during power outages.

The state has well spread transmission system. APTRANSCO/DISCOMs owned and operated transmission lines varying from 400 KV to 11 KV with a total length of 231,127 km formed by the circuit system in the state as presented in Figure 5.6.8. The high voltage transmission (HT) lines with a capacity of 11 KV and more are spread by means of formation of a square matrix with an area of 1.93 km^2. It is expected that a high voltage transmission line is able to access within 0.7 km vicinity at least in the state.

DISCOMs owned and operated the low voltage transmission (LT) lines with a capacity of less than 11 KV with a total length of 292,158 km formed by the circuit system. It represents that one HT or LT line is available at least within the vicinity of 306 m on the average in the entire state area. The state has 2,905 substations with a capacity of 33 KV and more. The substation is located in every area of 56 km^2 and within 4 km distance on the average. It is noted that the accessibility from food park to a substation is excellent.

(8) Telecommunications

India's telecommunication network is the second largest in the world based on the total number of telephone users (both fixed and mobile phone). It has one of the lowest call tariffs in the world enabled by the mega telephone networks and hyper-competition amongst them. It has the world's third-largest internet user-base. According to the Internet and Mobile Association of India (IAMAI), the internet users and broadband internet users are estimated respectively around 317 million and 121 million, as of October 2015. Number of mobile subscribers is more than 996 million in India, as of September 2015 and in Andhra Pradesh State, about 79 million as shown in Table 5.6.14.

Table 5.6.14 Number of Subscribers by Telephony

Telephony	India	AP State
Mobile subscribers (million)	996.66	79.10
Fixed line subscribers (million)	25.85	1.96
Total (million)	1,022.51	81.06

Source: States book 2015

Until the New Telecom Policy was announced in 1999, only the government-owned BSNL and MTNL were allowed to provide landline phone services through copper wire in India. Due to the rapid growth of the cellular phone industry in India, landlines are facing stiff competition from cellular operators. This has forced landline service providers to become more efficient and improve their quality of service. Landline connections are now also available on demand, even in high density urban areas.

The dominant players are Airtel, Reliance Infocomm, Vodafone, Idea Cellular, and BSNL/MTNL. There are many smaller players, with operations in only a few states. International roaming agreements exist between most operators and many foreign carriers. The government allowed the mobile number portability (MNP), which enables mobile telephone users to retain their mobile telephone numbers when changing from one mobile network operator to another.

(9) Solid Waste Management

The Ministry of Environment and Forest (MoEF) is the nodal agency dealing with all environmental matters in India. MoEF is required to examine the awareness, research and sustainable development initiatives, location of industries and secured landfills for hazardous wastes and use of environmentally sound technologies. All State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs) are directed to produce a comprehensive report on illegal waste dumpsites in their jurisdiction. The Central Pollution Control Board (CPCB) has to issue guidelines to be followed by all concerned including SPCBs, PCCs, and the operators of disposal sites for proper functioning. They are also entitled to form authenticated National Inventory on Hazardous Waste dumpsite. The Ministry of Health deals

with toxicological aspects of wastes like heavy metals and hormone disrupting chemicals.

The problem of solid waste management (SWM) in combination with rapid urbanisation, population growth and unplanned development is worsening day by day not only in Andhra Pradesh State but also in other states. The municipal solid waste (MSW) is categorised by degradable, partially degradable, and non-degradable materials. An improvement in waste collection, segregation, storage, transportation and disposal was reported to be urgently required in the state. Each municipality has the overall responsibility for conducting practically the solid waste management (SWM). In the state, the municipal solid waste is estimated at 4 ton/day with a generation rate of 0.364 kg/day per capita. Additionally, the state has been a leader in applying waste management technology with the help of Andhra Pradesh State Technology Development and Promotion Centre (APTDC). The state was the first to host two plants, i.e., Refuse Derived Fuel (RDF) and Waste-to-Energy (WTE), one is located near Hyderabad and the others are located between Vijayawada and Guntur.

5.6.3 Basic Infrastructure of Food Parks

(1) Status of Basic Infrastructures and Common Facilities for Food Parks

During the first site survey, an interview survey was conducted to three food parks and two units through a questionnaire sheet and results of the survey are summarised in Table 5.6.15.

Table 5.6.15 Results of the Questionnaire Survey

Mega Food Park/Food Processing Unit	Srini Food Park	India Food Park	Godavari Mega Aqua Food Park	Jain Irrigation Systems Ltd Unit I & II	Galla Foods Unit
1. General					
Location	Chitteor	Tumkur	Khargone	Chittoor	Chittoor
Completion Year	Oct. 2012	Sep. 2014	under Construction		2005
Area (acre)	142.8	110 (46 ac developed)	55.5	120	7.53
Project Cost (Rs. crores)	122.68	144.33	150	NA	NA
Unit Project Cost (Rs. per Acre)	859,104	1,312,091	2,702,703	-	-
Number of plots/Products	22 (area: 46.65 ac)	18 to 20 (1 to 10 ac)	30 (area: 24.45 ac)	Products: Tropical fruit & Vegetable Purees, Concentrates, Juices & Paste	Products: Fruit Pulp-11 ton/hr & Beverage 1500 L/h
Existing & Prospect Units/Employees	3 + 2 (0.5 ac to 4 ac)	1	Non	Employees: 1000	Employees: 173
Plot for MSMEs as lease base	provided	provided	provided	-	-
Land Sale Unit Cost	-	-	Rs 1 crore per ac	-	-
Lease Unit Cost & Period	Rs. 50 lack/ac 99 years	Rs. 1.2 crore/ac 99 years	Rs 25/ft2 8-10 years	-	-
O&M Cost per Year	Rs. 3.00 crores	NA	Around Rs 7 crores estimated	-	-
2. Basic Infrastructure					
Transportation	Road: 12km-NH 4, Railway: 30km-Chittoor, Port: 170km-Chennai & Krishna Patnam, Airport: Chennai, Bengaluru	NH4: Double 2x2, Airport:100km-Bangalore	Road: NH214, Railway: 12km-Bhimavaram, Airport: 125km-Rajahmundry, Seaport: 120km - Kakinada, 280km-Visakhapatnam	SH 42, Port: Krishnapattanam -160km, Chennai-160km, Airport: Trupati-90km, Bangalore-185km, Chennai-160km	NH18, NH4-1km, Port: Krishnapattanam -160km, Chennai-160km, Airport: Trupati-90km, Bangalore-185km, Chennai-160km
Internal Road	Internal grid connecting all plots, Double 2x2 with ROW:18m	Single 1.5x1.5 w: 9m	Main Road – 100 feet road with central lighting and greenbelt	Single 1.5x1.5 w: 9m	Single 1.5x1.5 w: 9m
Rainwater Harvesting Pond (L)	300,000	4,000,000	3,600,000,000	6,000,000	NA
Drainage	25 mm/hr, Elevated land (Cutting ground)	provided, NA in detail	provided, NA in detail	discharge to Niva River	provided, NA in detail
Water Source	Bore Wells 4: 5-6 lack L/d	Bore Wells	Canal water from irrigation Dept.	Bore Wells	Bore Wells
Purification Plant (m3/d)	1,000	provided, NA in detail	600	1,600	provided, NA in detail
Effluent Treatment Plant (m3/d)	300 (1 MLPD to be expaned)	provided, NA in detail	100	1,000	provided, NA in detail
Power S/S	11 kV	11 kV & Ring Main Unit system	5500 kVA	APSPDCL Unit-I: 1123 Unit-II: 937 MWh/month	provided, NA in detail
Telecommunication	BSNL for Optical Fiber Cable & Internet, Wireless: AIRTEL	provided, NA in detail	Fixed Phone Line, Wireless LAN, Cell Phone Service	BSNL, TATA	provided, NA in detail
Solid waste management	Radam Infrastructure Pvt. Ltd for generator	NA	Village panchayat waste service	Self/Bio fertilizer generation	NA
Fire fighting facility	Fire Hydrant/Sprinkler System	Sole line for extention with 10 bar, caverage of hydrant: 47m in diameter	Fire Hydrant/Sprinkler System	Fire Hydrant/Sprinkler System	Fire Hydrant/Sprinkler System
3. Core infrastructures of CPC	provided	provided	to be provided	provided	provided
4. Non-core Infrastructure & Facility	provided	provided	to be provided	provided	provided
5. PPCs	4 places	provided, NA in detail	2 places	provided, NA in detail	provided, NA in detail
6. FCCs	13 places	provided, NA in detail	9 places	provided, NA in detail	provided, NA in detail
Source: JST	Note: NA is to be No Answer and MSMEs is to be medium, small and micro enterprises				

All food parks and units are well designed and developed by developers in terms of infrastructure and common facilities as indicated in the above table. Accessibility from food parks and units to power transmission lines and national/state highways are well secured except for the Godavari Aqua Food park of which access road is not developed yet by the government. Food parks and units belonging to Rayalaseema Region provided borewells and rain harvest ponds as their water sources. Godavari Aqua Food park will be supplied with bulk water from irrigation canal.

The core processing infrastructures of Central Processing Centre (CPC) are ordinarily to be; cold storage, deep freeze, pack house, dry warehouses for raw materials and finished goods, platform/unloading sheds for storage silos, individually quick frozen (IQF) including pre-process set-up and packaging of finished goods, ripening chambers, control atmosphere (CA)/ modified atmosphere (MA) storage chamber, quality assurance, food testing, and product development lab but the required facilities and those capacities are different definitely depending on the type and scale of industry. Table 5.6.16 shows the status of provision of CPC's core infrastructures at each mega food park. It is noted that Srini Food park is assessed to capably conduct its operation and maintenance (O&M), and another mega food parks are presumed not to control their infrastructures and facilities.

Table 5.6.16 Status of Central Processing Centre's Core Infrastructures in Mega Food Parks

Core Infrastructures	Patanjali Food and Herbal Park		Srini Food Park		India Food Park		International Mega Food Park	
	Proposed	Status	Proposed	Status	Proposed	Status	Proposed	Status
Cold Storage (MT)	3000	3000	4 with capacity of 50 MT each	4 with capacity of 50 MT each	500	600	4,000	4,000
Individually Quick Frozen (MT/Hour)	Not filed	Not filed	1.5	1.5	1	1	2	2
Pack House - Washing, Sorting, Grading, packaging etc. (MT/Hour)	Not filed	Not filed	1.5	1.5	10	10	Yes	Not filled
Dry Warehouse (m2)	2 (size not mentioned)	2 (size not mentioned)	10,000	10,000	13,500	14,800	3,716	3,716
Quality Assurance, Food Testing and Development lab (Numbers)	1	1	2	2	numbers not provided	numbers not provided	Yes	Under Construction
Boiler and Steam Generation (Numbers)	Not filed	Not filed	2	2	1	1	1	1
Reefer Vans (Numbers)	3	3	1	1	5	0	Yes	Not filled
Ripening Chambers (Numbers)	Not filed	Not filed	11	11	9	9	Not proposed	-

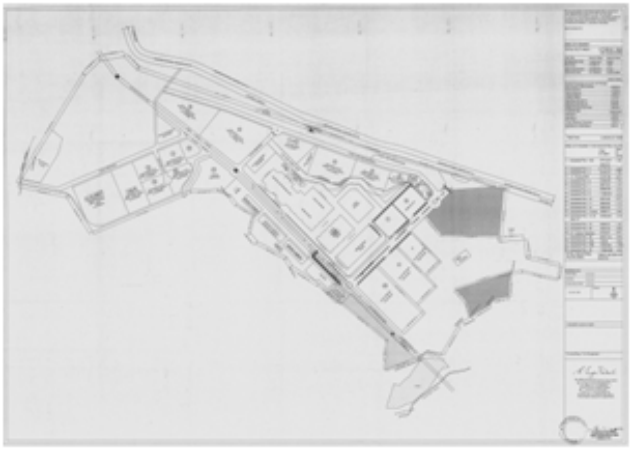
Source: DII Survey 2014 -2015

The Primary Processing Centres (PPCs) would provide for primary processing facilities such as storage, washing, sorting, grading, weighing, and packaging. It may also have certain need based on the processing facilities as may be required. While the PPCs would be directly linked to CPC, they would also have linkages to retail markets in major consumption centres within the state as well as in neighbouring states. PPCs are supported by Field Collection Centres (FCCs). Produce collected at the PPCs would be transported using reefer vans for highly perishable produce while all other items shall be transported under ambient conditions. PPCs will also serve as a point of contact with farmers and would be the points of price discovery. These centres may also have facilities for transfer of technology, information, and supply of inputs.

(2) Framing of Food Park Plan

A food park is to be planned based on the following concepts and criteria in consideration of collected data and results of the questionnaire survey.

- Location of Food park shall be carefully selected in order to secure effective accessibility between PPCs, FCCs, and CPC through food value chain.
- The peripheral infrastructures and present land use shall be confirmed for food park planning.
- Land use plan of mega food park.
- Food parks area varies from 50 acres (20 ha) to 148 acres (60 ha). The general layout plans of Srini Food park with an area of 148 acres (60 ha) and Godavari Aqua Food park with an area of 55 acres (22 ha) are presented in Figures 5.6.9 and 5.6.10, respectively, in order to determine the land use plan of food park for reference. Development area of food park is to be 70 acres (28.34 ha) on an average. Number of industrial plots varies from 20 to 35 and the range of plot area is from 0.5 acres (0.2 ha) to 8 acres (4 ha).



	Category	Area		Occupancy Raito (%)
		acre	ha	
1	Administrative Building	0.69	0.28	0.5%
2	CPC	3.84	1.55	2.7%
3	Ripening Chamber	2.49	1.01	1.7%
4	Warehouse	2.61	1.06	1.8%
5	MSME SHEDS	1.67	0.67	1.2%
6	Dmitry & Toilet Blocks	0.09	0.04	0.1%
7	Industrial Plots	46.65	18.89	32.7%
8	Boilers & Power station	1.19	0.48	0.8%
9	Road Area	22.50	9.11	15.8%
10	Open Area	61.01	24.70	42.7%
	Total	142.74	57.79	100.0%

Source: Srini Food park

Figure 5.6.9 Layout Plan of Srini Food Park

Category	Area		Occupancy Raito (%)
	acre	ha	
Plots	24.45	9.89	44.1%
Core Infrastructure	11.34	4.59	20.4%
Basic Infrastructure	15.07	6.10	27.2%
Non Core Infrastructure	0.09	0.04	0.2%
Standard Infrastructure	0.37	0.15	0.7%
Green Space	4.18	1.69	7.5%
Total	55.50	22.46	100.0%

Source: ANANDA Group

Figure 5.6.10 Godavari Mega Aqua Food Park

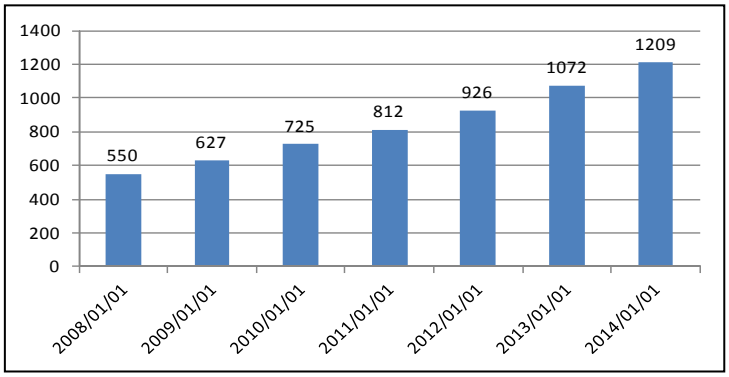
5.7 Adaptation of Advanced Japanese Technologies to Food Industries

5.7.1 Japanese Companies

(1) Overview

The Embassy of Japan in India and the Japan External Trade Organisation (JETRO) have been collectively compiled a list of Japanese business establishments in India. The latest survey data as of October 2014 shows the following findings:

- The total number of Japanese companies registered in India is 1,209 with an increase of 137 companies as compared with the previous year.
- The total number of Japanese business establishments in India is 3,961 with an increase of 1,419 establishments as compared with the previous year.



Source: Japanese Business Establishments in India, Embassy of Japan in India and JETRO, January 2015.

Figure 5.7.1 Number of Japanese Companies Registered in India

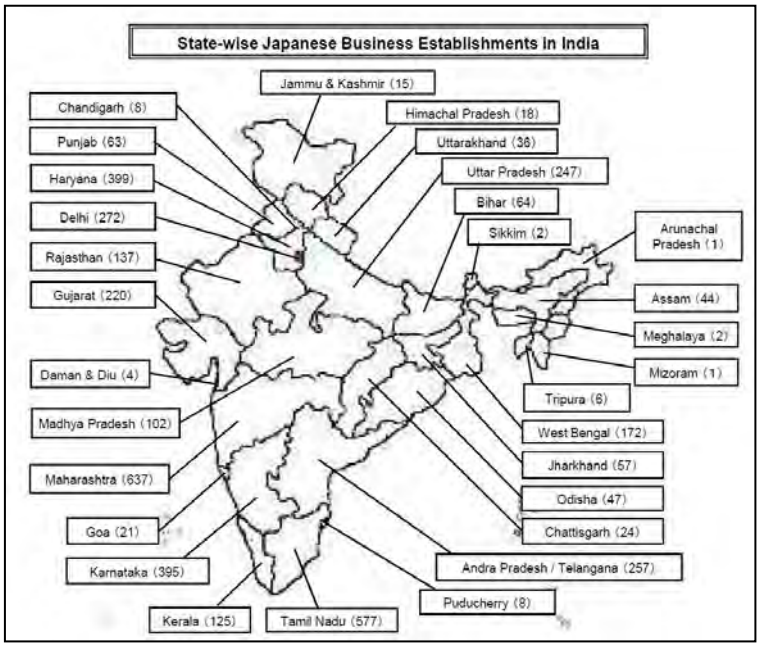
The above figure shows that India is a promising business location for Japanese companies as the number of Japanese companies registered in India has been stably increasing every year ranging from 77 to 146.

Out of the 3,961 Japanese business establishments in India, Delhi, Haryana, Maharashtra (Mumbai), and Tamil Nadu (Chennai) are the top destinations for Japanese companies. Those states cover about 50% of all establishments in India.

Table 5.7.1 State-wise Number of Japanese Business Establishments

State	Number	%
Delhi/Haryana	671	17%
Maharashtra	637	16%
Tamil Nadu	577	15%
Karnataka	395	10%
Andhra Pradesh/Telangana	257	6%
Uttar Pradesh	247	6%
Gujarat	220	6%
West Bengal	172	4%
Rajasthan	137	3%
Kerala	125	3%
Madhya Pradesh	102	3%
Other States	89	2%
Bihar	64	2%
Punjab	63	2%
Jharkhand	57	1%
Odisha	47	1%
Uttarakhand	36	1%
Chattisgarh	24	1%
Goa	21	1%
Chandigarh	8	0%
Puducherry	8	0%
Daman & Diu	4	0%
Grand Total	3961	100%
Number of Japanese Companies registered in India	1209	

Source: Japanese Business Establishments in India, Embassy of Japan in India and JETRO, January 2015.



Source: Japanese Business Establishments in India, Embassy of Japan in India, JETRO, January 2015.

Figure 5.7.2 State-wise Japanese Business Establishments in India

(2) Japanese Companies in Agriculture and Food Manufacturing

Japanese companies in agriculture and food manufacturing registered in India were identified as shown in Table 5.7.2 below.

Table 5.7.2 Japanese Agriculture and Food Manufacturing Companies Registered in India

Type of Business	Company Name	Location	Business
Agriculture, Forestry, Fishery (6 companies)	GRA India Private Limited	Mumbai	Vegetable production
	Leo Green Foods	Mumbai	Organic fertiliser
	SC Enviro Agro India Pvt. Ltd.	Mumbai	Agro chemicals
	Sakata Seeds India Pvt. Ltd.	Bangalore	Seed production
	Tokita Seed Co., Ltd.	Bangalore	Seed production
	United Genetics India Pvt. Ltd.	Bangalore	Seed production
Manufacturing-Food, Drink, Tobacco, Fodder (14 companies)	Rising Sun Import Pvt. Ltd.	New Delhi	-
	Yakult Danone India Private Limited	New Delhi	Pro-biotic fermented milk drink
	NAGOMI Consulting Pvt. Ltd.	New Delhi	-
	Indo Nissin Foods Limited	Bangalore	Instant noodle
	C.L.Aqua Foods Pvt. Ltd.	Kolkata, West Bengal	Feed mills
	J-OIL Mills, Inc. Mumbai Liaison Office	Mumbai	Vegetable oil
	Kikkoman Corporation India Representative Office	Mumbai	Soy sauce
	Ruchi Kagome Foods India Pvt. Ltd.	Mumbai	Tomato based products
	Taiyo Lucid Private Limited	Mumbai	Water-soluble dietary fibre and other nutritional ingredients
	AJINOMOTO India Pvt. Ltd.	Chennai, Tamil Nadu	Monosodium glutamate, inosinate and guanylate, food items
	Accelerated Freeze Drying Co. Ltd., Cochin Factory	Kochi, Kerala	Freeze drying food
	Higashimaru Feeds (India) Ltd.	Alleppey, Kerala	Fish feeds
	HIC-ABF Special Foods Private Limited	Shertallai, Kerala	Value-added and ready-to-eat food products
	Ruchi J-OIL Private Ltd.	Shujalpur, Madhya Pradesh	Vegetable oil
Manufacturing-Others (2 companies)	Pioneer Jellice India Pvt. Ltd.	Madurai, Tamil Nadu	Ossein and Dicalcium Phosphate
	3F Fuji Foods Private Limited	Telangana	Edible oil
Wholesale, Retail (2 companies)	Suntory Narang Private Limited	Mumbai	Food and drinks
	Meiji India Private Limited	Mumbai	Confectionary products

Source: JICA Survey Team based on Japanese Business Establishments in India, Embassy of Japan in India, JETRO, January 2015.

In agriculture, forestry, and fishery sector, there are six companies registered in India. Out of the six companies, three companies are in seed production business located in Bangalore. Others are in farming, organic fertiliser, and agro chemical businesses.

Manufacturing for food, drink, tobacco, and fodder has 14 registered companies. Out of the 14 companies, four companies are located in Mumbai, three are in New Delhi, three are in Kerala State. The product of those companies varies, such as pro-biotic fermented milk drink, instant noodle, feed mills, vegetable oil products, tomato products, and water-soluble dietary fibre.

There are also two companies of manufacturing-others and these two companies are registered as wholesale and retail business.

(3) Public-Private Mission Organised by the Ministry of Agriculture, Forestry, and Fisheries (MAFF), Japan

The JICA Survey Team attended the Public-Private Mission organised by MAFF, Japan from November 30 to December 3, 2015 to develop a network amongst Japanese and Indian food business companies and to visit several advanced companies in Andhra Pradesh State such as Srini Food park and 3F Industries. The schedule of the mission is shown in Table 5.7.3 below.

Table 5.7.3 Public-Private Mission Schedule

Date	Site	Agenda/Activities
Nov. 30 2015	Delhi/Chennai	- Attend Public-Private Seminar in New Delhi - Travel to Chennai
Dec. 1, 2015	Chennai/Chittoor/ Vijayawada	- Site visit to Srini Food park, Chittoor - Travel to Vijayawada via Bangalore
Dec. 2. 2015	Vijayawada	- Attend "Networking Conclave" of Andhra Pradesh State and Japanese Food Processing Industry in Vijayawada
Dec. 3, 2015	Vijayawada/West Godavari	- Site visit to a rice miller and 3F Industries

Source: JICA Survey Team

During the mission, there were two seminars held in New Delhi and Vijayawada in Andhra Pradesh State. The companies that participated in the mission are listed as per business category as shown in the following Table 5.7.4.

Table 5.7.4 List of Companies Participated to the Public-Private Mission

No	Company Name	Type of Business	Office in India	Participation in New Delhi (November 30, 2015)	Participation in Vijayawada, Andhra Pradesh State (December 2, 2015)
1. Developer/Promoter					
	JGC Corporation	Engineering contractor (petroleum and petro chemical, urban and industrial park development, etc.)	-	Yes	Yes
	Mizuho Financial Group	Financial Service	Mumbai, New Delhi, etc.	Yes	Yes
2. Food Manufacturer					
	Indo Nissin Foods	Food manufacturer (instant noodle)	Bengarulu	Yes	-
	Yakult Danone India	Food manufacturer (pro-biotic fermented milk)	New Delhi	Yes	-
3. Agri Machinery/Food Processing Machinery/Freezer Manufacturer					
	Innovation Thru Energy (ITE)	Manufacturer (cold chain logistics products as ice battery system)	-	Yes	Yes
	Kubota India	Manufacturer (agri machineries, industrial engines and machineries, etc.)	Chennai	Yes	-
	Mayekawa Mfg.	Manufacturer (industrial refrigeration compressor, heat pump, food processing robots, etc.)	-	Yes	Yes
	Shibuya Seiki Co.	Manufacturer (sorter for fruits and vegetable)	-	Yes	Yes
	Yanmar India	Manufacturer (industrial diesel engine, agri machineries, marine engine, construction machineries, etc.)	Chennai	Yes	Yes
	Yokogawa Solution Service Corporation	Manufacturer and solution provider (industrial automation, test and measurement, project management, etc.)	-	Yes	Yes
4. Trading/Distribution Company					
	Marubeni	General trading	New Delhi, etc.	-	Yes
	Mitsubishi Corp.	General trading	New Delhi, etc.	-	Yes
	Mitsui & Co.	General trading	New Delhi, etc.	-	Yes

No	Company Name	Type of Business	Office in India	Participation in New Delhi (November 30, 2015)	Participation in Vijayawada, Andhra Pradesh State (December 2, 2015)
	OG Corporation	Chemical trading	Mumbai	Yes	-
5. Other Supportive Services					
	Chandha & Co.	Law farm	New Delhi	Yes	-
	Dream Incubator Inc.	Professional service, investment and company management	Mumbai	Yes	-
	Fujitsu	ICT products, solution and services	New Delhi	-	Yes
	Hirohama India	Business setup services; Business centre, service apartment, hotel, rent-a-car, Japanese restaurant, consulting service	New Delhi	Yes	-
	K House Food India	Restaurant	New Delhi	Yes	-
	Nippon Koei	Engineering consultant for infrastructure and allied development projects	New Delhi, etc.	Yes	Yes
	Taisei Oncho India	Plant supplier (air conditioning and plumbing)	New Delhi	Yes	Yes
	Total = 21 companies		16	17	13

Source: JICA Survey Team

A total of 21 Japanese companies joined the mission: 1) Developer/promoter = 2 companies, 2) Food manufacturer = 2 companies, 3) Agri machinery/food processing machinery/freezer manufacturer = 6 companies, 4) Trading/distribution company = 4 companies, and 5) Others = 7 companies. Out of 21 companies, 17 companies joined the seminar in New Delhi and 13 companies participated in the program in Vijayawada, Andhra Pradesh State.

Among them, 16 companies have already established their office in India and only five companies sent participants from Japan for the mission. It was also expected that more participants of food manufacturing as potential investors to setup a factory in India; however, there was no participant of food manufacturer from Japan in the program in Vijayawada, Andhra Pradesh state. Provision of awareness of Japanese companies about Andhra Pradesh State and its potential in agriculture and food processing industry is one of key issues to call interests from companies.

5.7.2 Andhra Pradesh State Entrepreneurs

During the public-private mission from 30th November to 3rd December 2015, there was a large number of attendance from Indian private companies related to agriculture and food industries. The number of participants per business category is summarised as shown in Table 5.7.5.

Table 5.7.5 Number of Participants to Public-Private Mission

Business Category	No. of Participants in New Delhi (November 30, 2015)	No. of Participants in Vijayawada, Andhra Pradesh State (December 2, 2015)	Total
1. Developer/promoter	-	3	3
2. Food manufacturer	3	49	52
3. Agri machinery/food processing machinery/freezer manufacturer	1	1	2
4. Trading/distribution company	1	8	9
5. Other supportive services	4	22	26
6. Government/association	3	7	10
7. Unknown business*	-	3	3
Total	12	93	105

Note: Unknown companies are not clearly mentioned of their business field.
Source: JICA Survey Team based on the attendance records of the seminars.

A total of 105 participants joined the mission; 12 in New Delhi and 93 in Vijayawada. Out of 105 participants, about half of the participants (52) belong to food manufacturing business and 26

participants were in other services such as consultancy, farm input supplier, etc. There were also three developers/promoters of industrial park such as Jain Irrigation, GMR, and Sri City, those are the potential partners for the future development of food park and related infrastructure.

5.8 Donor's Support for Food Value Chain Development

5.8.1 Externally Aided Programmes and Projects

Value chain interventions are becoming increasingly popular and used amongst donors aiming to promote market-oriented growth and rural poverty reduction. Value chain interventions should enable farmers to benefit more from market development and take advantage of some of the opportunities offered by domestic and global market development. In India, among several donors who have implemented projects related to value chain development, the World Bank (WB) and Asian Development Bank (ADB) have played a pivotal role to enhance linkage between farmers and markets. Intervention of the two organisations is summarised below.

(1) World Bank

WB has assisted the agricultural sector in India mainly in the areas of water resource management, rural livelihood development and farming. In recent years it has shifted the emphasis of its assistance from research to improving competitiveness, and from productivity improvement to market-oriented production. Below Table 5.8.1 lists ongoing WB projects related to food value chain.

Table 5.8.1 Ongoing WB Projects on AVC

Project Title	Approval Date	Closing Date	Project Cost (USD in million)	Commitment Amount (USD in million)
Assam Agricultural Competitiveness Project	December 2004	March 2015	214.33	154.00
Maharashtra Agricultural Competitiveness Project	September 2010	December 2016	100.00	100.00
Rajasthan Agricultural Competitiveness Project	March 2012	April 2019	166.50	109.00

Source: WB website

The characteristics of WB's assistance to agriculture sector are twofold: market orientation and emphasis on agribusiness. As no one can predict market behaviour, WB projects do not focus on specific crops. It deals with all kinds of crops. Instead, projects place a high priority on developing alternative market channels such as contract farming, direct sales, and collective sales. They also place a lot of emphasis on agribusiness. The emphasis on agribusiness is based on the importance of producing non-agricultural employment such as in food processing in rural villages. In order to encourage rural entrepreneurs to start their business, the project provides them with incubation services such as supporting business plan development, training, and business matchmaking.

For livestock sector, the government has launched the National Dairy Plan, a scientifically-planned, multi-state fifteen-year initiative in order to meet the growing demand for milk in India. The first phase of the National Dairy Plan (NDP I), which is a central support scheme implemented through the National Dairy Development Board (NDDB) from 2011/12 to 2016/17, is financed largely by WB.

As agriculture is a state issue, WB provides assistance only at the state level. In Andhra Pradesh State, a new project titled 'Andhra Pradesh State Rural Inclusive Growth Project (APRIGP)' which includes value chain enhancement component has been launched in 2015. The summary of the project details is shown in Table 5.8.2.

Table 5.8.2 Summary of APRIGP

Project period	Feb 2015-Jun 2020
Total project cost	USD 107 million
Lending instruments	Investment project financing
Implementing agency	Society of Elimination of Rural Poverty (SERP)
Project beneficiaries	Small and marginal farmers and the SC/STs from communities in the 150 most backward mandals.

Source: Project Appraisal Document by WB

The project development objectives are to enable selected poor households to enhance agricultural incomes and secure increased access to human development services and social entitlements. There are four components in the projects; value chain development (USD 44 million), human development (USD 19 million), access to social protection services and entitlements (USD 13 million), and mission support, ICT, and partnerships (USD 20 million).

For the value chain component, the project aims to work with small farmers to help them move up the value chain and identify appropriate growth opportunities. This will be achieved by organising them into economic organisations (producer groups, companies, etc.); ensuring high quality of support services like technology, credit, extension, marketing, etc.; and sustainable access to markets. The target commodities are identified as paddy, red gram, turmeric, cashew, coffee, dairy, poultry, and fisheries. The other key aspect of this component is to create local markets by connecting rural producers and enterprises with the rural consumers and thereby enhance the quality of consumption of the poor households.

(2) Asian Development Bank

ADB started its Multitranche Financing Facility（MFF）to finance the Agribusiness Infrastructure Development Investment Program (AIDIP) in 2010. This project is the first of its kind, which ADB provides assistance for agricultural value chains. The main focus of the AIDIP is agricultural marketing infrastructure development under public-private partnership (PPP). As infrastructure development has been a priority for ADB, technical assistance components are minimal. The project is implemented in Maharashtra and Bihar. The project assists market infrastructure development for integrated value chain of potential crops such as grape, pomegranate, and tomato. There is no project related to value chain development currently implemented by ADB in Andhra Pradesh State.

5.8.2 Lessons from the Past Programmes and Projects

Experienced donors in this sector such as WB drew a range of lessons from other projects and initiatives nationally and globally. For example, the approach of the components of the three agricultural competitiveness projects was not exactly the same. This is based on the learning that the needs of the respective states are different. As agriculture in Assam is mostly at subsistence level, the main focus of assistance is improving productivity to produce a market surplus. In the case of Rajasthan, the biggest constraint is shortage of water. Therefore, the emphasis of the project is placed on the promotion of integrated farming and water-saving techniques such as drip irrigation and water harvesting. In Maharashtra, which is the most advanced in terms of agricultural marketing, the focus is on the development of alternative marketing channels, promoting agribusiness and institutional development of government entities.

WB projects related to value chain development do not focus on any specific crop but cover all kinds of crops. The staff mentioned that since the project is flexible no one can predict the market trend.

For designing the value chain component of APRIGP, below points are also incorporated based on the experience of Andhra Pradesh State District Poverty Initiatives Project (APDPIP) and Rural Poverty Reduction Project (APPRP), which were implemented from 2000 as well in the Irrigated Agriculture Modernisation and Water Bodies Restoration and Management (IAMWARM) Project in Tamil Nadu.

- Community participation and ownership are important in achieving efficiency and sustainability. They have also demonstrated how communities can contribute towards investment and operational costs if they are assured of good service.
- Convergence, partnerships, and market linkages are keys. Aggregate institutions of the poor attract mainstream market players. Convergence of programs allows bundled service delivery; increase availability, accessibility, affordability and reliability of services.
- Significant investment in producer organisations, their business plans, and capacitating them to build linkages with market enable significant increase in agricultural income. These investments should include access to extension services, financial services, and technology and market access opportunities.

6. OBSERVATION AND FINDINGS THROUGH INTERVIEWS AND SITE VISITS

6.1 General

Based on the general information described in the previous chapter, the first field survey was conducted in each subject. Observation in the field was analysed and compiled as findings. Those findings shall be further investigated or applied in the second field survey.

6.2 Irrigation Projects

6.2.1 Data Collection

(1) Medium Irrigation Project

According to the Project Concept Note, there were 21 medium irrigation projects that were proposed by the Department of Water Resources (DoWR). The total command area is at 109,306 ha (270,095 acres) and the total cost is estimated at Rs. 6,995.6 million. The medium irrigation projects are located in 12 districts (except Krishna District). The maximum command area project is located in Narayanpur, Srikakulam District with a total command area of 15,100 ha and estimated total cost of Rs. 966.4 million.

The JICA Survey Team collected 12 detailed project report (DPRs) but could not collect the 8 other DPRs as detailed in Table 6.2.1 below.

Table 6.2.1 List of DPRs of Medium Irrigation Projects

No.	SI. No.	Name of the Project	District	System Tank (nos.)	Command Area (ha)	WUAs (nos.)	Villages (nos.)	DPR
1	1	Peddankalam Anict Project	Vizianagaram	93	3,113	6	15	(1)
2	2	Vottigedda Reservoir Project	Vizianagaram	119	6,746	9	38	(1)
3	3	Vengalraya Sagaram Project	Vizianagaram	224	9,996	10	41	(1)
4	4	Peddagadda Reservoir Project	Vizianagaram	65	4,858	6	33	
5	5	Andra Reservoir Project	Vizianagaram	2	3,603	6	21	
6	6	Torrigedda Pumping Scheme Project	East Godavari	0	5,998	5	14	(1)
7	7	Tammileru Reservoir Scheme Project	West Godavari	23	3,711	6	10	(1)
8	8	Mopadu Reservoir System Project	Prakasam	3	5,147	6	14	(1)
9	9	Veeraraghavani Kota Anicut System Project	Prakasam	2	2,248	5	7	
10	10	Krishnapuram Reservoir Project	Chittoor	16	2,479	5	22	(1)
11	11	Araniar Reservoir Project	Chittoor	8	2,226	5	12	(1)
12	12	Buggavanka Project	Kadapa	3	3,926	5	14	
13	13	Upper Pennar Project	Ananthapur	6	4,066	5	14	(1)
14	14	Pennar kumudavathi Project	Ananthapur	7	2,479	5	17	(1)
15	16	Maddigedda Reservoir Project	East Godavari	0	1,710	1	7	
16	18	Narayanapuram Anicut Project	Srikakulam	147	14,995	25	101	
17	20	Raiwada Reservoir Project	Visakhapatnam	44	6,111	10	30	
18	21	Siva Bhashyam Sagar Project	Kurnool	7	4,894	6	9	
19	22	Muniyeru Irrigation Project	Krishna	13	6,648	9	25	(1)
20	23	DR-DM Project	Nellore	31	10,117	20	32	(1)
Total				813	105,071	155	476	12

Remarks: (1); Received
Source: JICA Survey Team

(2) Minor Irrigation Project

Based on DoWR proposal, there are 485 minor irrigation projects that are proposed. The total command area is at 45,122 ha (111,493 acres) and the total cost is at Rs. 2,707.32 million (Rs. 270.732 crores). The minor irrigation projects are located in 13 districts.

The JICA Survey Team discussed with DoWR regarding DPRs of minor irrigation projects and learned that DPRs for minor irrigation projects have not yet been prepared by DoWR.

Then, the JICA Survey Team made a questionnaire and implemented a survey to evaluate the minor irrigation projects. The JICA Survey Team collected 472 of 485 proposed projects as detailed in Table 6.2.2 below.

Table 6.2.2 List of Returned Questionnaires of Minor Irrigation Project

District		Number of Projects (No.)
01	Srikakulam	80
02	Vizianagaram	63
03	Visakhapatnam	50
04	East Godavari	25
05	West Godavari	20
06	Krishna	20
07	Guntur	10
08	Prakasam	20
09	Nellore	30
10	Kadapa	30
11	Kurnool	25
12	Anantapur	19
13	Chittoor	80
Total		472

Source: Prepared by the JICA Survey Team

6.2.2 Field Survey

(1) Vizianagaram District

(a) General

The geographical area of the district is at 630 km^2 of which, irrigated area is at 152,500 ha. Normal annual rainfall is recorded at 920 mm. The Vizianagaram District has one completed and two ongoing major irrigation projects.

Table 6.2.3 List of Major Irrigation Projects in Vizianagaram District

No.	Name of Projects	Status
1	Thotapalli Regulator (linked to new barrage (Nagavali River)	Completed
2	Thotapalli Barrage Project (Nagavali River)	Ongoing
3	Gajapathinagaram Branch Canal (taking-off from Thotapalli RMC)	Ongoing

Source: Prepared by the JICA Survey Team based on the Department of Water Resources website

In Vizianagaram District, there are eight completed and four ongoing medium irrigation projects. Five of them, are proposed for the Andhra Pradesh Irrigation Livelihoods Improvement Project-II (APILIP-II). The Thatipudi Reservoir Project is covered under APILIP-I.

Table 6.2.4 List of Medium Irrigation Projects in Vizianagaram District

No.	Name of Projects	Command Area (ha (Acre))	Remarks
1	Vengala Raya Sagaram Project	9,994 (24,700)	Proposed for APILIP-II
2	Vottigadda Reservoir	6738 (16,654)	Proposed for APILIP-II
3	Peddankalam Anicut	3,113 (7,693)	Proposed for APILIP-II
4	Paradhi Anicut	3,313 (8,188)	Completed
5	Thatipudi Reservoir	6,182 (15,280)	Covered under APILIP-I
6	Andra Reservoir Project	3,814 (9,426)	Proposed for APILIP-II
7	Denkada Anicut	2105 (5,203)	Completed
8	Pedda Gedda Reservoir Project	486 (1,200)	Proposed for APILIP-II
10	VKMN Janjhavathi Reservoir Project (Janjhavathi - Nagavali River)	9.969 (24,640)	Ongoing
11	Vengalarayasagar Project Extension Canal (Suvarnamukhi-Nagavali River)	2,023 (5,000)	Ongoing

No.	Name of Projects	Command Area (ha (Acre))	Remarks
12	Andra HLC (Champavathi River)	1,659 (4,100)	Ongoing
13	Tarakarama Thirtha Sagaram Reservoir Project Champavathi River)	9,998 (24,710)	Ongoing

Source: Prepared by the JICA Survey Team

There are 9,226 minor irrigation projects in Vizianagaram District, of which 75 minor irrigation projects are being proposed for APILIP-II. All the proposed minor irrigation projects are located around the command areas of the proposed five medium irrigation projects.

(b) Observations and Findings

The JICA Survey Team visited Vizianagaram District, the northern region of Andhra Pradesh State, on 8-10 December 2015. The site visit was attended by DoWR staff, during which the JICA Survey Team held discussions with them, obtained data regarding the medium and minor irrigation projects and visited the following project sites as shown in Table 6.2.5.

Table 6.2.5 List of visited Projects in Vizianagaram District

No.	Type	Name of Projects
1	Medium	Vengala Raya Sagaram Project
2	Medium	Vottigadda Reservoir Project
3	Medium	Peddankalam Anicut Projet
4	Minor	Surrapa Tank (No.12) Ajida Village
5	Minor	Gamanagurramma Tank (No.38) Joguladumma Village
6	Minor	Chellamma Tank (No.38), Tumbali Village
7	Minor	Gowrisagaram Tank (no.57) Gavaramapeta Village

Source: Prepared by the JICA Survey Team

The Vengala Raya Sagaram Project is a medium irrigation project constructed across the Suvarnamukhi River near Lakshmipuram of Salur Mandal. The project was completed in 1982. The main crop is paddy followed by sugarcane and pulses. There are 41 villages that benefitted from the project. The Vengala Raya Reservoir is intact for both bund and spillway due to good maintenance and requires only minor repairs such as drain shute, riprap, revetment, rubber seal for gate, electrification, etc. The Main Canal, however, is much dilapidated and requires cement concrete (CC) lining and side wall due to site conditions, and replacement/repair of structures including sluice shutter, jungle clearance, de-silting, etc.

The Vottigadda Reservoir Project is a medium irrigation project constructed across the Votigedda River near Rawada Village, G.M. Valasa Mandal. The main crop is paddy followed by sugarcane and pulses. There are 39 villages that benefitted from the Project. The Vottigadda Dam is intact requiring only minor repairs. The Main Canal is much dilapidated and requires CC lining and side wall due to site conditions, replacement/repair of structures, de-silting, etc.

The Peddankalam Anicut Projet is a medium irrigation project constructed across the River Suvarnamukhi near Peddankalam village, Seethanagaram Mandal, The Project was constructed in 1955 and completed in 1963. The main crop is paddy followed by sugarcane and pulses. There are 39 villages that benefitted from the Project. The Vottigadda Dam is intact requiring only minor repairs; however, the Main Canal is much dilapidated and requires CC lining and side wall due to site conditions, replacement/repair of structures, de-silting, etc.

Five minor irrigation tanks were investigated in the district, namely: Surrapa Tank, Gamanagurramma Tank, Ravibanda Tank (No.24), Chellamma Tank (No.38), and Gowrisagaram Tank. Generally the minor irrigation tanks were constructed more than 50 years ago, and the structures are already dilapidated.The tanks and the irrigation facilities showed poor maintenance and heavy damages were observed.

The major scopes of works proposed are the following:

- Tank: Replacement of sluice shutter, installation/amplification/repair of surplus weir, bund strengthening by widening and raising, de-silting, etc.
- Canal: Strengthening of feeder canals, canal re-sectioning, repair of structures, etc.

(2) Visakhapatnam District

(a) General

The geographical area of the district is at 11,161 km^2 of which, irrigated area is at 178,800 ha. Normal annual rainfall is registered at 1,202 mm. The Visakhapatnam District has two completed and three ongoing major irrigation projects.

Table 6.2.6 List of Major Irrigation Projects in Visakhapatnam District

No.	Name of Projects	Status
1	Thandava Reservoir Project	Completed
2	Yeleru Reservoir Project	Completed
3	Modernisation of Sri Raja Sagi Suryanarayana Raju Thandava Reservoir Project	Ongoing
4	Flood Control Measures of Visakhapatnam Airport	Ongoing
5	Indirasagar Polavaram Project	Ongoing

Source: Prepared by the JICA Survey Team based on the Department of Water Resources website

The Visakhapatnam District has one completed and five ongoing medium irrigation projects. One of them, Raiwada Reservoir Project is proposed for APILIP-II.

Table 6.2.7 List of Medium Irrigation Projects in Visakhapatnam District

No.	Name of Projects	Command Area (ha (acre))	Remarks
1	Raiwada Reservoir Project	9,749 (15,344)	Proposed for APILIP-II.
2	Konam Reservoir Project	6,208 (12,638)	Completed
3	Pedderu Reservoir Project	7,818(19,322)	
4	Modernisation of Sri Varada Narayana Murthy Raiwada Reservoir Project	9,861 (24,372)	Ongoing
5	Sri Vechelam Palavelli Konam & Pedderu Reservoir Project 4 L(A) Minor	4,892 (12,092) and 262 ha (647)	Ongoing

Source: Prepared by the JICA Survey Team

There are 4,327 minor irrigation projects in Visakhapatnam District of which, 50 minor irrigation projects are being proposed for APILIP-II. All proposed minor irrigation schemes are located around the command areas of Raiwada Reservoir Medium Irrigation Project.

(b) Observations and Findings

The Survey Team visited Visakhapatnam District, the northern region of Andhra Pradesh state, on 8 and 11-12 November 2015. The site visit was attended by DoWR staff, during which the Survey Team held discussions with them, obtained data regarding the medium and minor irrigation projects, and visited the following project sites listed in Table 6.2.8.

Table 6.2.8 List of Visited Projects in Visakhapatnam District

No.	Type	Name of Projects
1	Medium	Raiwada Reservoir Project
2	Minor	Reddivani-Peddivani Tank (No.8) A. Kothapalli
3	Minor	Lagudu Tank (No.23) Singanadora Village
4	Minor	Ravibanda Tank (No.24), Kintada Village

Source: Prepared by the JICA Survey Team

The Raiwada Reservoir Project is a medium irrigation project constructed across the Sarada River near the Raiwada Village in Devarapalli Mandal of the Visakhapatnam District. The Project was completed in 1982. The main crop is paddy followed by sugarcane and pulses. There are 44 villages that benefitted from the project. The Raiwada Reservoir is intact for both bund and spillway due to good maintenance and is requires only minor repairs such as drain shute, riprap, revetment, rubber seal for gate, electrification, etc. The Main Canal, however, is much dilapidated and requires CC lining and side wall due to site conditions and replacement/repair of structures including sluice shutter, jungle clearance, de-silting, etc.

Three minor irrigation tanks were investigated in the district, namely: Reddivani-Peddivani Tank (No.8), Lagudu Tank (no.23), and Ravibanda Tank (No.24). Generally, the minor irrigation tanks were

constructed more than 50 years ago and the structures are already dilapidated. The tanks and the irrigation facilities showed poor maintenance and heavy damages were observed. The typical deficiencies and problems observed are the following:

- Tank: Erosion in tank bund top and slope, leakage through bund slope, silting in tank, weeds and trees in canal, damage to sluices, broken or missing gates, dilapidation of surplus weir, etc.
- Canal: Erosion in canal slope, weeds and silt in canal, etc.

The major scopes of works proposed are the following:

- Tank: Replacement of sluice shutter, installation/amplification/repair of surplus weir, bund strengthening by widening and raising, de-silting, etc.
- Canal: Strengthening of feeder canals, canal re-sectioning, repair of structures, etc.
- Note: Water Supply to Visakhapatnam (2.7 MGD).

The Raiwada Medium Irrigation Project is supplying about 2.7 MGD drinking water to Visakhapatnam. The Government of Andhra Pradesh (GoAP) is now constructing the Polovaram Project which is expected to be completed by 2018.After completion of the project, the water supply to Visakhapatnam will be from that facility. Consequently, the Chief Engineer (CE) project office is now planning to expand irrigation to about 6,000 acres of cultivated land using this saved 2.7 MGD water.

(3) Krishna District

(a) General

The geographical area of the district is at 8,727 km^2 of which, gross irrigated area is at 417,754 ha and the net irrigated area is at 273,210 ha. Normal annual rainfall is registered at 1,034 mm. The dominant soil in Krishna District is black cotton (BC) soil. Krishna District has three major irrigation projects:

- Nagarjuna Sagar Project (dam is located between Nalgonda and Guntur districts)
- Pulichintala Project (dam is between Nalgonda and Guntur districts)
- Prakasam Barrage in Krishna District to irrigate 11 lakh acres of paddy field and sustain aquaculture in 2 lakh acres of area

Krishna District has one medium irrigation project, namely the Muniyeru Irrigation Project (not proposed for APILIP-II JICA Loan), and 910 minor irrigation projects, out of which, 20 are being proposed for the APILIP-II JICA Loan. All proposed minor irrigation schemes are located around the command area of Muniyeru Medium Irrigation Project.

(b) Observations and Findings

The JICA Survey Team visited Krishna District in the central region of Andhra Pradesh State on 8th and 11th December 2015. The visit was attended by DoWR staff, during which the JICA Survey Team held discussions with them and visited the project sites listed in Table 6.2.9.

Table 6.2.9 List of Visited Projects in Krishna District

No.	Type	Name of Projects
1	Major	Prakasam Barrage (major irrigation project Krishna Delta)*
2	Major	KE Main Canal in Krishna Delta System (major irrigation project Krishna Delta)*
3	Major	NSP Left Bank Lal Bahadur Canal (major irrigation project Nagarjuna Sagar Project)*
4	Medium	Muniyeru Barrage (medium irrigation)*
5	Minor	Reddi Tank (Vatsavi Mandal, Polampalli Village)
6	Minor	Ura Tank (Vatsavai Mandal, Kenneveedu Village)
7	Minor	Kodandarama Tank (Vatsavai Mandal, Ramachandra Puram Village)
8	Minor	Nalla Tank (Vatsavai Mandal, Dechupalem Village)
9	Minor	Ura Tank (Vatsavi Mandal, Dabbakapalli Village)
10	Minor	Pedda Tank (Vatsavai Mandal, Mangolia Village)
12	Minor	Ramballa Tank (Vatsavi Mandal, Polampalli Village)
13	Minor	Rama Tank (Vatsavi Mandal, Konakanchi Village)
14	Minor	Sree Rama Tank (Vatsavi Mandal, Konakanchi Village)

*Note: * means that the site is not proposed for APILIP-II*
Source: JICA Survey Team

The Muniyeru Medium Irrigation Project provides irrigation to its left bank for Cultivable Command Area (CCA) of 6,570 ha. The Anew Muniyeru Barrage is being constructed with an Indian own fund on the Muniyeru River and is scheduled to be completed in June 2016. The proposed 20 minor irrigation tanks are located around the command area of Muniyeru Project. The left bank canal of Nagarjuna Sagar Project (NSP) is also running hundreds of meters southwest to the command areas of some of the proposed tanks.

Due to this year's unusual drought, the Muniyeru River at the barrage construction site and the left bank canal of NSP are dried up. Accordingly, the minor irrigation tanks had little water even though it is just the beginning of the dry season. However, many minor irrigation tanks are receiving water through the command areas of Muniyeru and NSP.

In the command areas of the proposed minor irrigation tanks, the paddy fields are mostly in harvest season and chilli and cotton are the dominant irrigated dry crops.

The tanks and irrigation facilities showed poor maintenance and heavy damages were observed. The typical deficiencies and problems observed are the following:

Source: JICA Survey Team

Figure 6.2.1 Sandbags on Surplus Weir

- Tank: erosion in tank bund top and slope, leakage through bund slope toe, silting in tank, weeds and trees in tank slope, damage to sluices, broken or missing gates, dilapidation of surplus weir, lack of sluices and surplus weirs, etc.
- Canal: damage to canal sidewall, erosion in canal slope, weeds and silt in canal, etc.

Due to lack of water, in Reddi Tank, the farmers placed sandbags upon the surplus weir crest in order to increase the capacity of the tank as shown in Figure 6.2.1.

Inadequate designs were found as well. For example in Ura Tank, a sluice was installed on the surplus weir and it is being left unused for a long time.

(4) Kurnool District

(a) General

The geographical area of the district is at 17,658 km^2 of which irrigated area is at 306,567 ha. Normal annual rainfall is registered at 705 mm. The Kurnool District has five completed and six ongoing major irrigation projects.

Table 6.2.10 List of Major Irrigation Projects in Kurnool District

No.	Name of Projects	Status
1	Kurnool –Kadapa Canal (KC CANAL)	Completed
2	Tungabhadra Project Low Level Canal (TBP LLC)	Completed
3	Alaganur Balancing Reservoir (ABR)	Completed
4	Aluru Branch Canal	Completed
5	Guntakal Branch Canal	Completed
6	Telugu Ganga Project	Ongoing
7	Velugoda Balancing Reservoir	Ongoing
8	Srisailam Right Bank Canal (SRBC)	Ongoing
9	Narasimharaya Sagar Project (Gorakallu Balancing Reservoir)	Ongoing
10	Owk Reservoir	Ongoing
11	Hadri Neeva Sujala Sravanthi Irrigation Project	Ongoing

Source: JICA Survey Team based on the Department of Water Resources website

The Kurnool District has two completed medium irrigation projects and one of them is proposed for APILIP-II.

Table 6.2.11 List of Medium Irrigation Projects in Kurnool District

No.	Name of Projects	Command Area (ha (acre))	Remarks
1	Sanjeevaiah Sagar Project (Gajuladinne Project)	9,749 (24,372)	Completed
2	Siva BhashyamSagar Project (Formerly Varadaraja Swany Gudi Project (VRSP))	4,837 (12,092)	Proposed for APILIP-II.

Source: JICA Survey Team

There are 634 minor irrigation schemes in Kurnool District. Twenty-five minor irrigation projects are being proposed for APILIP-II. All the proposed minor irrigation schemes are located around the command areas of Siva Bhasyam Sagar Medium Irrigation Project.

(b) Observations and Findings

The JICA Survey Team visited Kurnool District, the southern region of Andhra Pradesh State, on 25-28 November 2015. The visit was attended by DoWR staff, during which the JICA Survey Team held discussions with them, obtained data regarding the medium and minor irrigation projects and visited the following project sites (* means that the site is not included in the survey scope) listed in Table 6.2.12

Table 6.2.12 List of Visited Projects in Kurnool District

No.	Type	Name of Projects
1	Major	Kurnool –Kadapa Canal (KC CANAL) *
2	Medium	Siva Bhashyam Sagar Project (Formely Varadaraja Swany Gudi Project (VRSP))
3	Medium	Sanjeevaiah Sagar Project (Gajuladinne Project) *
3	Minor	Yerra Cheruvu (Pedda Devalapurar Village)
4	Minor	Patha Cheruvu (Lingapuram Village)
5	Minor	Prema Cheruvu (Kadamala kalva Village)
6	Minor	Amudala Cheruvu (Ramapuram Village)
7	Minor	Chinna Cheruvu (Chinna Cheruvu Villgae)

Source: JICA Survey Team

The Siva Bahashyam Sagar Project is a medium irrigation project constructed across Munimadugula Vagu in Nagarjunasagar-Srisailam Tiger Reserve Forest 18 km away from Atmakur Village of Kurnool District. The original contemplated command area of the project is 13,220 acres (5,288 ha) but during the visit it was verified as only 12,092 acres (4,837 ha) including stabilisation of 2,944 acres (1,178 ha). There are eight existing minor irrigation tanks benefitting nine villages of Atmakur Mandal and Kothapalli Mandal. The project started in 1985 and completed in 2000.

The tanks and irrigation facilities showed poor maintenance and heavy damages were observed. The typical deficiencies and problems are the following:

- Tank: erosion in tank bund top and slope, leakage through bund slope, silting in tank, weeds and trees in tank slope, damage to sluices, broken or missing gates, dilapidation of surplus weir, etc.
- Canal: erosion in canal slope, weeds and silt in canal, etc.

[Siva Bhashyam Sagar Medium Irrigation Project]: Damaged weir

[Prema Minor Irrigation Project]: Heavy weeds on the tank slope

[Amudala Minor Irrigation Project]: Missing gate

Source: Prepared by the JICA Survey Team

Figure 6.2.2 Medium and Minor Irrigation Projects in Kurnool

(5) Chittoor District

(a) General

Chittoor District is situated in the most southern part of the state adjoining Karnataka and Tamil Nadu states. The geographical area of the district is at 15,151 km^2 of which irrigated area is at 173,000 ha. Normal annual rainfall is registered at 934 mm.

Chittoor District has currently no completed major irrigation projects; however, the following three major irrigation projects are being constructed.

- NTR Telugu Ganga (CCA 30,000 ha)
- Galelu Nagari Sujala Sravanthi (CCA 41,000 ha)
- Handri Neeva Sujala Sravanthi (CCA 73,000 ha)

The following three medium irrigation projects are operating in Chittoor District.

- Swarnamukhi Anicut (CCA 4,000 ha)
- Araniar (CCA 2,227 ha)
- Krishnapuram (CCA 2,470 ha)

Out of these three medium irrigation projects, Araniar and Krishnapuram are proposed for APILIP-II JICA Loan.

As for the minor irrigation schemes in the district, there are 668 tanks (CCA > 40 ha) and 7,395 (CCA < 40 ha). Total of CCA is 122,000 ha. Amongst these minor tanks, 80 are proposed for APILIP-II JICA loan.

(b) Observations and Findings

The JICA Survey Team visited Chittoor District on 15 and 17 December 2015. The site visit was attended by DoWR staff, during which the JICA Survey Team held discussions with them and visited the following project sites.

Table 6.2.13 List of Visited Projects in Chittoor District

No.	Type	Name of Projects
1	Medium	Araniar Medium Irrigation Project
2	Medium	Krishnapuram Medium Irrigation Project
3	Minor	Bhunderi Tank (Pichatur Mandal, Vengalathur Village)
4	Minor	Nindra Tank (Nimdra Mandal, Nindra Village)
5	Minor	Mudipalli Tank (Nagari Mandal, Mudipalli Village)
6	Minor	Ayanambakam Tank, (Nagari Mandal, Ayanambakam Village)
7	Minor	Pannur Tank (Vijayapuram Mandal, Pannur Village)
8	Minor	Mangalam Tank (Vijayapuram Mandal, Mangalam Village)
9	Minor	Rayala Tank (Ramachandra Mandal, C. K. Palli Village)
10	Minor	Thotla Tank (Nimmanapalle Mandal, Samakotavaripalle Village)
11	Minor	Veeraraghavula Tank (, Nimmanapalle Mandal, Samakotavaripalle Village)
12	Minor	Sakibanda Tank (Nimmanapalle Mandal, Vengamvaripalle Village)
13	Minor	Kalangi Reservoir (existing minor irrigation scheme, planned to construct a dam)*
14	Minor	Medikurthy Tank*
15	Medium	Araniar Medium Irrigation Project

*Note: * means that the site is not included in the survey scope*
Source: Prepared by the JICA Survey Team

In Chittoor, due to heavy rain and floods that occurred in the beginning of December, abundant water was present in the reservoirs, rivers, and tanks although the district is a drought prone area. In paddy fields, puddling and transplanting works are ongoing. Sugarcane fields were found in various sites and sugarcane factories are available.

System tanks are much developed in the district possibly due to chronic water deficit. System tanks are composed of several minor tanks located nearby that are connected through feeder channels to allow exchange of water to tanks where water is required in spite of water deficit.

In Veeraraghavula Tank, although the tank had enough water, drip irrigation utilising groundwater is being used in farmlands at the downstream of the tank (See Figure 6.2.3). The sluice of the tank lacked gates and the water was spilling over the road, which is functioning as the surplus weir.

Source: JICA Survey Team

Figure 6.2.3 Drip Irrigation just Downstream of Tank

Generally, the minor tanks were constructed 40 to 50 years ago and the structures are severely dilapidated.

The typical scopes of works in the projects visited are as follows:

- Tank: replacement of sluice gate, installation/amplification/repair of surplus weir, bund strengthening, desilting, etc.
- Canal: strengthening of feeder canals, lining/sidewall, canal resectioning, etc.

6.3 Agricultural and Horticulture

6.3.1 Observation and Findings in the First Field Survey Stage

Through the first field survey, the following situations were roughly clarified, in order to confirm the current situation of the proposed projects for restoration of irrigation facilities as well as selection of strategic crops for improvement of the food value chain.

(1) Low and Stagnant Food Crop Productivity per ha

As shown in ”Directorate of Economics & Statistics, Andhra Pradesh 2015” and “Department of Horticulture, 2015”., cultivated area and unit yield (productivity) of major crops remain stagnant and low in the state. Furthermore, the unit yield level of major crops in the state, except maize, shows significant gaps compared with other states, as shown in the table below.

Table 6.3.1 Unit Yield of Major Crops amongst Andhra Pradesh State and Other States in India

(kg/ha)

Crop	Andhra Pradesh	India		
		First Highest	2nd Highest	Average in India
Rice (milled rice)	3,172	3,989 (PU)	3,272 (HR)	2,462
Sorghum (Jowar)	1,642	2,011 (MP)	Andhra Pradesh	862
Pearl Millet (Bajra)*1	1,704	2,452 (TN)	2,040 (HR)	na
Maize	4,995	4,947 (WB)	Andhra Pradesh	2,552
Pigeon Pea (Red gram)*1	402	1,693 (KE)	1,514 (BI)	806
Ground nut	829	2,526 (WB)	2,409 (GO)	996

*Note: *1: based on the statistical data for 2011-12*
Source: 1) Statistical Yearbook 2015, India, 2) Statistical Abstract at a Glance 2014, Andhra Pradesh

It is clearly judged that the following points should be looked into in order to improve the current situation and promote agricultural development.

- Varieties and seed production
- Soil fertility and soil health management

- Poor function of the existing irrigation facilities
- Acute shortage of labour in peak season of farming practices such as transplanting and harvesting due to the National Rural Employment Guarantee Scheme (NREGS)
- It is said that the state is not sufficiently equipped to meet the demand for certified skilled extension staff at various levels in the primary sector

(2) More Production of Fruits and Vegetables

The horticulture sector is an integral element for food and nutritional security in the state. The state ranks first in production of citrus, oilpalm, tomato, chillies, and turmeric, second in production of mango and cashew, third in production of flowers, and fourth in production of banana as shown in the Indian Horticulture Database (2014) edited by the National Horticulture Board.

The horticulture sector has provided opportunity for crop diversification to farmers in the state. The current situation of horticulture sector in the state is shown in Table 6.3.2.

Table 6.3.2 Area and Production Details of Horticulture Crops for the Year 2014-15 in Andhra Pradesh State

Crop Category	Area (ha)	Production (ton)
Fruits	651,000	10,301,000
Vegetables	330,000	5,784,000
Flowers	20,000	140,000
Plantation Crops	451,000	1,704,000
Spices	287,000	844,000
Medicinal and Aromatic Plants	18,000	35,000
Total	1,757,000	18,808,000

Source: Outcome Budget XXVII (Agriculture) 2015-16, Department of Horticulture

Further major strategies for development of horticulture in the state are summarised as follows[1]:

- Increase on vegetable cultivation for better quality and higher production
- Converging Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA) with the Department of Horticulture for better utilisation of labour and empowerment of backward communities
- Promotion of postharvest management practices through establishment of pack house, cold storage, and ripening chambers, reefer vans, cashew nut processing units to reduction of postharvest losses and to promote exports
- Improvement of marketing facilities through Rythu bazaars, vegetable markets, collection centres, and reefer vans or other modes of transportation so that farmers get remunerative prices for their produces
- Promotion of precision farming through micro-irrigation, fertigation, greenhouse/shade net houses cultivation, mulching for saving irrigation water, and to produce high quality vegetables

(3) Farm Mechanisation

It was reported that farming in the state is becoming uneconomical year by year and some famers have abandoned agricultural activities. The cost of cultivation is escalating resulting in reduce profit from agriculture. GoAP has operated the following schemes for funding support to farm mechanisation.

- NSP - This scheme aims to supply individual equipment to individual farmers
- Rashtriya Krishi Vikas Yojaya (RKVY) - This scheme aims to supply crop-based set of farm machinery/equipment to farmer's group (Rythu Mithra Groups)
- Sub-Mission of Agricultural Mechanization (SMAM) - This scheme provides training and demonstration of farm mechanisation to farmers.

Moreover, in order to bring farm machinery available within the reach of small and marginal farmers, collective ownership, with the establishment of CSU, has been widely promoted since 2014 as shown in Attachment 6.3.1. Beneficiaries can select a package of farm machinery to be proposed for CSU,

1: Outcome Budget XXVII (Agriculture) 2015-16, Department of Horticulture

depending on their need as well as requirement. However, farm machinery in each package is fixed, thus beneficiaries are not allowed to change or remove them in package.

Meanwhile, training on the usage of farm machinery could be provided by the supplier at the place of operation of CSU to the beneficiaries. But it seems that the training is simple and basic one for operation and maintenance of farm machinery. Regarding rice transplanter, there is no practical training on preparation of seedlings with nursery tray. It is necessary to arrange practical training in order to disseminate scheduled rice transplanting with transplanter .

Farm mechanisation of certain farming practices has addressed critical situation to a maximum extent.

6.3.2 Observation and Findings in the Second Field Survey Stage

In the second field survey during the period from January to March 2016, the JICA Survey Team visited three districts, namely: Vizianagaram, West Godavari, and Chioor districts. These districts were selected as typical district for each region. In each district, the JICA Survey Team visited one medium irrigation scheme and two minor irrigation schemes.

The following situations were roughly clarified in order to confirm the current situation of agricultural activities in the proposed projects for modernisation of irrigation facilities.

(1) Findings of the Site Visit in the Northern Region

Rice, black gram, sugarcane, maize, mango, banana, and chillies are the major crops cultivated in medium black soils and light textured sandy soil under bore well irrigation. Usually, heavy cyclones followed by floods occur in this region causing heavy lossess to crops and human life.

- Ninety percent of the farmers are small and marginal with 1-2 ha of land holdings and low productivity (Rice: 3 tons/ha).
- Rice in Kharif, while pulses or maize in Rabi are the major cropping sequences. Sugarcane is also cultivated.
- Mango is a major orchard crop with two local varieties, namely: Suvarna Rekha and Panukula Manu.
- Labour is scarce in farm operations and mechanisation is picking up now.
- Varieties of major crops in this region are shown in Table 6.3.3.

Table 6.3.3 Summary of Major Crops in Northern Region

S No.	Crop	Varieties	Yield (kg/ha)
1	Rice	MTU-1001, 1010,RGL-3552	4,000 to 5,000
2	Black gram	LBG-365,	300 to 500
3	Green gram	LGG-736	300 to 500
4	Groundnut	JL-27, T-9	1,000 to 1,500
5	Sesamum	Local	300 to 500
6	Maize	Hybrids: Pioneer, Kaveri-50	6,000 to 9,000
7	Sugarcane	AKP varieties	50,000 to 75,000

Source: Site visit to Vottiggeda Reservoir, JICA Survey Team, 2016

(2) Findings of the Site Visit in Central Region

The Intensive Agricultural Development Programme (IADP) has highly receptive farmers. Rice is the dominant crop followed by sugarcane, oil palm, coconut, cocoa, and banana. Soils are highly productive with high yields. Mechanisation is fast picking up in this region and is considered as the rice granary of Andhra Pradesh State. Triple cropping of rice is commonly practiced in this region. The uplands have poor fertility and have low productivity due to scarcity of water.

- Tammileru Reservoir supplies water to Krishna and West Godavari districts and regulates flood water to Eluru Town besides promoting fisheries
- Rice in Kharif (4.0 to 5.5 ton/ha) and maize in Rabi (7 to 9 ton/ha) are cultivated in CCA of Tammileru.
- Labour is scare and mechanisation is picking fast. Irrigated dry crops (ID crops) like tobacco,

sunflower, chillie, tomato, papaya, and mango are cultivated under bore wells in upland area outside CCA.

- Dairying is an important source of income for farmers.

Table 6.3.4 Summary of Major Crops in Central Region

S No.	Crop	Varieties	Yield (kg/ha)
1	Rice	MTU-1001, MTU-1010	6,000-8,000
2	Maize	Pioneer, Siri, Kaveri-50	7,000-8,000
3	Chillie (Green)	Tejaswini, Nagma, Tulasi, Venus, G-4, G-5 and Swathi	30,000-40,000
4	Natu Tobacco	Pothavaram, Rangapuram, Natu special	2,000-3,000
5	Kharif Rice	Swarna, BPT-5204	4,000-5,000
6	Zero Tillage Maize	Pioneer, Siri,Kaveri-50	6,000-7,000
7	Direct Sown Maize	Pioneer, Siri,Kaveri-50, Laxmi and DHM	7,000-8,000
8	Coconut	East-Coastal, Double Century, Kalpa Prathibha	100-150 nuts/tree/ annum
9	Oil-Palm	Tehera, Dura, Pisifera	15,000-20,000
10	Cocoa	NC-42/94, NC-29/66 (CPCRI)	500
11	Rabi Rice	MTU-1001, MTU-1010	6,000-8,000
12	Sunflower for Seed	Jwalamukhi, Modern, APSH-11	1,000-2,000
13	Mango	Bangenapalli, Rasaalu	8,000-10,000
14	Guava	Allahabad Safeda, Lucknow 49, Anakapalli, Banarasi, Chittidar, Hafshi, Sardar, Smooth Green, Safed Jam, Arka Mridula	4,000-6,000

Source: Site visits to Vemanakunta Vemanakunta Minor Tank and Koppaka under Pedda Tank, JICA Survey Team, 2016

(3) Findings of the Site Visit in Southern Region

The area is served by the northeast monsoon rain and crop seasons starts in November, December to February, and March. Crop productive yields are low due to conventional methods of agriculture. Wooden ploughs are common and bullock carts are the major source of transportation in the villages.

- Rice in Kharif and groundnut in Rabi are cultivated.
- Farmers practice traditional agriculture (wooden ploughs and planks and Bullock carts are common).
- Crop yields are low and mechanisation is very slow.
- Most of the farmers are small and medium entrepreneurs with very low per capita income.
- Cows, goats, and sheep are the main income sources of farmers.
- Sugarcane is being grown in some pockets and provides supply to the Nelovoy Sugar Factory.
- Rice variety ADT-37, groundnut variety Kadiri-6, and Narayani are popular.
- Kishnapuram Reservoir is served by two rivers, namely: Lava and Kusa supply water to 9,000 acres of CCA.
- Mango varieties like Totapuri and Neelam are grown here. Tomato and papaya are cultivated for local consumption and for extraction of pulp concentrate.

Table 6.3.5 Summary of Major Crops in Southern Region

S No.	Crop	Varieties	Yield (kg/ha)
1	Rice	ADT-37, BPT-4204	4,000 to 5,000
2	Groundnut	Kadiri-6, Anantha, Narayani	1,000-2,000
3	Sugarcane	86V-96, 86V-46, 86V-48	50,000-60,000
4	Sorghum	Kinnera, Mothi, NTJ-3	2,000-3,000
5	Finger Millet	Ratnagiri, Godawari, Bharati, Hima	2,500-3,000
6	Tomato	Arka Vikas, Arka Rakshak	10,000-15,000
7	Chillie	Tejaswini	40,000-60,000
8	Mango	Totapuri, Neelam, Alphanso	10,000-20,000
9	Papaya	Red Lady	40,000-50,000
10	Guava	Allahabad Safeda	20,000-30,000
11	Maize	Siri, Pioneer	5,000-6,000

Source: JICA Survey Team, 2016

6.4 Animal Husbandry

6.4.1 Overview of the Site Visits

Animal husbandry is one of the growing and prosperous industries of Andhra Pradesh State. During the site visits to the four districts of major producers of livestock, the JICA Survey Team observed that the districts have active veterinary supports from the government, competitive dairy market, huge poultry farms, and successful buffalo meat processer. However, it was also observed that there should be more marketing activities, integrated farming, and investment on infrastructures to achieve further development of these potential fields.

Table 6.4.1 Overview of the Site Visits

Produce	District	Major Organisations Visited
Dairy	South and Central Region: Chittoor, Krishna, Guntur	Department of Animal Husbandry of Andhra Pradesh State and Districts, Andhra Pradesh Dairy Development Cooperative Federation, Andhra Pradesh Sheep and Goat Development Cooperative Federation, Export companies, Supermarkets
Poultry	Central Region: East Godavari	
Buffalo Meat	Central Region: Guntur, Krishna	
Sheep and Goat Meat	South and Central Region: Chittoor, Krishna, Guntur	

Source: JICA Survey Team

6.4.2 Observation and Findings

By means of governmental measures, Andhra Pradesh State has successfully developed the livestock and poultry industry. The volume of production has increased with better breeding and animal health care services provided by the Department of Animal Husbandry. Majority of poultry, buffalo meat, and about 30% of dairy are dealt by the organised sector. However, the number of processing facilities has been halved by the bifurcation of the state and only a few private companies produce exportable products. Furthermore, due to the food-and-mouth disease (FMD) restriction, the international market is limited except for the Gulf and south and east Asian countries.

Milk, egg, and meat are the major produce of animal husbandry in Andhra Pradesh State along with the outstanding number of livestock and poultry population. To research the details of each produce, production, processing, and market, the JICA Survey Team visited the abovementioned districts. By studying the general pattern of the value chains (details are described in Attachment 6.4.1), the JICA Survey Team has identified the overall issues and challenges at each process level.

Table 6.4.2 General Observation of the Value Chain

Production ⬇	- Milk, egg, and meat are the major produce of animal husbandry in Andhra Pradesh - Many farmers face problem of labour shortage and expensive feeding cost - Government plays a significant role to support and develop the livestock production - Intensive farming is known to increase productivity but not affordable for all farmers
Processing ⬇	- Lack of processing unit in Andhra Pradesh after bifurcation - Only a few private sectors produce exportable products - Consumers preference is always fresh food, not the processed one
Product Marketing	- Destination countries of export are mainly Southeast Asian countries - International commodity price affects the procurement of material from farmers - FMD restriction disturbs expansion of the Indian animal husbandry processed foods

Source: JICA Survey Team

(1) Production

Milk, egg, and meat are the major produce of animal husbandry in Andhra Pradesh State along with the outstanding number of livestock and poultry population. This is because the government provides significant support to the livestock rearing farmers through its various schemes. Governmental agencies, such as the veterinary dispensary, actively provide better breeding and health care services at the grassroots level based on its own strategy.

Generally, farmers are facing common problems such as the unavailability of workers, increasing price of labour, and lack of land for grazing animals. Farmers know that to increase productivity they need to practice intensive farming, such as highly nutritious feeding with housing system. However, the recent increase in fodder price has become an obstacle in implementing it.

The majority of cattle keepers, in fact, are not dairy farmers but agricultural farmers who also keep an average of two or three breeds of cattle for the purpose of supplementing their income. Therefore, not many farmers invest to increase productivity of milk or keep more than five cattle. Due to the competitive situation amongst dairy cooperatives, private companies, and traditional milk man, farmers can choose the buyer who offers the best price.

On the other hand, poultry farming is mostly organised and effectively implemented in huge scales. Also, since traders deal with the same producers over longer periods of time, little competitive situation is observed.

(2) Processing

Lack of processing facility is one of the major problems of Andhra Pradesh State. After bifurcation, Andhra Pradesh State has lost many processing units of dairy and meat to Telangana. Hence, even though production is increasing, the processing volume is not. The private sector, who primarily invests in this industry, is also limited. Only a few private companies produce exportable products. Animal husbandry food processing units need consolidated, sophisticated, and hygienic machines, and therefore require huge investment to establish them. Without governmental support especially in finance, it is difficult to start a new processing unit.

Apart from milk and milk processed products, consumers prefer food as fresh as possible. For instance, chickens are slaughtered just in front of consumers at the retail shops. Processed and frozen chicken products are available in some major supermarkets but its sales are not increasing as expected.

Regarding the potential of buffalo meat production, the processing company pointed out that slaughtering male calf before they become one-year-old is just a waste of resource. It should be raised over two years and then sold to the company to meet the increasing international demand.

(3) Product Marketing

The price of animal husbandry produce is dynamically decided by the internal and international market. For the case of eggs, since not all states of India have enough poultry farms, some states that have deficient in the productions of eggs but have huge market demands, such as Kolkata, decide the egg price. In order to reduce the monopoly of traders in key distant markets, government could facilitate the establishment of trade exchange centres where layer farms and traders can transact business. In case of milk, the price at which farmers sell to the collection centre is decided based on all necessary cost together with the consideration of the international skim milk price.

Generally, the livestock producers/farmers are not market oriented. During the interviews, it was found that they have no clue why the milk price is stagnated, how to develop the brand of your produce, or how to explore new markets. The dairy industry is unable to invest in promotion of milk products and market segmentation. Assistance and investment from other countries could support such efforts.

6.5 Fisheries

6.5.1 Marine Fishery

Since the coastal fisheries resources, such as prawn and high value demersal fishes, are declining, the fishermen's income is also declining. Andhra Pradesh State is promoting "Blue Revolution" by adopting a series of management measures to sustain aquaculture and capture fisheries. Andhra Pradesh State has imposed a fishing ban from the 15 April to 14 June in its teritorial waters, except for non-motorised traditional fishing boats. In the meantime, a diversification of fishing activities is needed as traditional coastal fishermen have started to catch large pelagic species when they come closer to the shore. Fishermen catch yellowfin tuna, swordfish, and sailfish during the period of October to February. Some of the mechanised boats are converting fishing gear from trawling to longline to improve economic performance.

The potential of yellowfin tuna fishery is high since the sustainable annual harvest has been estimated to be 350,000 tons in Indian waters while the current catch is only 22,045 tons (2012). Both the governments of India and Andhra Pradesh State have been trying to promote fishery with incentives to subsidise the cost of fishing gears.

There are two critical points when considering value additions and the development of tuna fisheries. The first is the poor quality of fish due to inappropriate handling when it is caught. Wholesalers or exporters may not pay an appropriate price for a poor quality tuna.

Training of fishermen in fishing technology and postharvest handling is needed. Also, an appropriate purchase price by wholesalers should be encouraged by the government. Landing sites do not have cold storage to keep the quality of fish to ensure a good price.

The second consideration is processing for the export market. Chilled whole tuna should be marketed through the existing market channel in Kochin and Chennai until Andhra Pradesh State develops its own chilled tuna export channel. The frozen tuna market also has a potential for development. Tuna could be properly sliced into filet (saku in Japanese) and frozen through the shrimp Indivisual Quick Freezing (IQF) line. This will enable Andhra Pradesh exporters to ship tuna using an already existing frozen shrimp marketing channel.

6.5.2 Shrimp Aquaculture

Shrimp aquaculture, its processing and exporting, are well established in Andhra Pradesh State. Nonetheless, there is always room for improvement. There are two critical issues during production.

The number of hatcheries using a specific pathogen free (SPF) broodstock are increasing but have not kept up with the demand of fish farmers. Since the Marine Product Export Development Authority (MPEDA) has started SPF broodstock production, the situation evdntually improves. With healthy and high quality seed, production of shrimp will increase as the Fisheries Department anticipated.

For shrimp culture, diseases control is critical. Since the number of public as well as private laboratories for shrimp disease have been increasing, the prevention of epidemic disease through identification will be possible. It should be noted that keeping a pond environment appropriate and maintaining a low stock density are long term solutions in disease control which reduces production cost. The development of disease diagnosis kit will also greatly help the situation. Rehabilitation of abandoned brackish water ponds and then re-starting black tiger prawn culture would be also one option.

Regarding production cost, feed is the costliest component. Locally made shrimp feed needs to be developed. Also, the development of a culturing method for live feed such as polychidae may provide a good supplemental food.

As for value addition, improvement in produce quality may be possible. Majority of the aquaculture farms are small to medium sized. Since their ponds are smaller and easier to manage, they have potential to produce higher quality produce and obtain higher prices for their shrimp. However, there is little or no negotiation power with buyers when a farm is small. Small and medium sized fish farmers need to cooperate to achieve their goal. The Fisheries Department and MPEDA have a proposal to cluster the fish farmers. Organised farmers will be able to use Aqua Food Park to process their shrimp for export. Inviting Japanese food manufacturing companies to produce end products (such as cooked shrimp for sushi, ready to cook shrimp tempura, ready to cook fried shrimp, etc.) would be also considered for promotion of Japanese foods in India.

6.5.3 Freshwater Fish Culture

Freshwater fish production is mainly a cultured Indian major carp (catla, rohu, and mrigal). Increasing the productivity of water bodies by stocking fish fry is an ongoing activity of the Fisheries Department. In order to further increase the productivity, intermediate culture of fry to fingering by fishermen's association is a good approach in order to increase the survival rate of stocked fish.

Another option for increasing production and improving the livelihoods of fishermen is through cage culture of tilapia in large water bodies. Although fishermen's associations have the right to use water bodies for fishing, it is a yearly leasing contract. The water is ultimately under control of WUA and DoWR. Conflict of interest between farmers and inland fishermen exist and a win-win situation should be sought out. In order to establish a steady income through scheduled uses of water bodies for both farmers and fishermen, a long term planning and leasing agreement of the irrigation tank may be considered.

Regarding value addition in freshwater fish produce, there is little demand for processed fish such as fileted catfish except in large cities in India. To educate consumers to buy processed fish is a challenging but necessary passage to increase fish consumption in India. Inviting Japanese food manufacturing companies with established brand names that have a vision to develop a food supply network in India and neighboring countries would be ideal.

6.5.4 Future Aquaculture Species

Various organisations have been making efforts to introduce new aquaculture species such as mud crab, seabass, cobia, algae, etc. Improvement in productivity of Nile Tilapia and Giant Freshwater Prawn by selective breeding seems to have shown good results and potential to introduce in Andhra Pradesh State. Mud crab culture seems to have good potential in Andhra Pradesh State too. As for open water cage culture and algae culture, there seems no appropriate sites or environment in the coastal area of Andhra Pradesh State.

Besides aquaculture technology, production costs, market demand, and international competition are always a concern when considering new aquaculture development.

6.6 Value Chain of Selected Crops

6.6.1 Overview of the Site Visits

Andhra Pradesh State is one of the leading states in agriculture and horticulture produce and has a good potential to become a hub of agribusiness. For sustainable development of agricultural sector in the state, it is important to enhance efficiency of the total value chain from production to marketing through strengthening competitiveness of agriculture produces and build capacity of farmers. From this view point, the Survey Team selected crops which have high potential for upgrading its value chain and conducted site visits as shown below for the first survey. (Details are described in Attachment 6.6.1)

Table 6.6.1 Overview of the Site Visits

Crop	District	Major Organisations Visited
Mango	South and Central Region: Chittoor, Krishna,	District Agriculture Department, Horticulture Department, APEDA, NABARD, Chamber of Commerce, APMC, FPOs, Processing Units, Food Park, Export Companies, Pack house, Ripening Chamber, Cold Storage
Tomato	South Region: Chittoor, Kadapa, Kurnool	
Chili	Central Region: Guntur, Prakasam	
Cashew	North and Central Region: Vishakhapatnam, Vizianagaram, East/West Godavari	
Maize	North and Central Region: Vizianagaram, West Godavari, Krishna	
Coconuts	Central Region: East Godavari and West Godavari	
Groundnuts	South Region: Chittoor	
Banana	South Region: Kadapa	

Source: JICA Survey Team

6.6.2 Observation and Findings

While each crop has different strength and challenges with its respective production and processing patterns in the value chain, several common issues lie across the selected crops as observed during the site visits. The general issues observed in the value chain of selected crops are summarised in the below Table 6.6.2.

Table 6.6.2 General Observation of the Value Chain

Production	- Andhra Pradesh has good agro climatic conditions and production bases for many agriculture and horticulture crops - Productivity of many crops is low due to lack of proper cultivation practices well as shortage of water resources - Low quality and low safety due to improper cultivation as well as postharvest practices - Many farmers face agricultural labour shortage - Pre-harvest contract is prevalent - Substantial amount of raw materials of some crops is imported while Andhra Pradesh has good production capacity
Postharvest Management	- Improper postharvest handling at farm level due to lack of knowledge, information, and necessary infrastructure cause damage of produce - Postharvest infrastructure at farm level such as proper storage is in shortage - Collective marketing activities of farmers groups are weak, while some active FPOs initiated marketing

	activities
Processing	- There is agglomeration of large-scale processing units in Andhra Pradesh - Most processing units face difficulty in stable procurement of quality produce - Some processing units stay idle during non-harvest season due to shortage of raw materials
Product Marketing	- Ensuring food safety and building proper certification system are required to further expand and reach to export and hi-end markets and to establish Andhra Pradesh products' brand

Source: JICA Survey Team

(1) Production

Andhra Pradesh has very strong production base of various agriculture and horticulture crops thanks to its favourable natural conditions. It is the largest producer of maize, mango, tomato, and other horticulture crops such as papaya, and ranks second for paddy and groundnut production in India. However, productivity of most crops is much lower than the national average. Maize is the only exception as it has the highest yield in India. The major reason for low productivity is water shortage. For instance, productivity of tomato doubles in most case if irrigation is available. The planned irrigation projects will contribute in improving farming conditions of the farmers. Another reason of low productivity is improper cultivation practices. For cashew cultivation, for example, there is little management for aged orchard such as pruning, weeding, or mulching which results in yield as low as half of the global average. One of the reasons for improper cultivation practice is that farmers are not motivated to improve their practice as there is no incremental price difference for quality improvement. This is closely related to the present marketing practices of farmers as explained in item (4). Fear of natural disaster such as drought or flood is another reason for low motivation of farmers to improve farming practices. As in the case of groundnut shows, the farmers are not willing to invest in fertilizer or pesticide since they will lose all the investment if drought or flood happens. Introduction of social security system such as crop insurance or credit system might be necessary.

Severe scarcity of agricultural labor is another challenge the farmers are facing as many young people do not want to work in agriculture. Most of the farms are dependent on external labor such as sawing, weeding, and harvesting. However, the fact that many laborers cannot work for agriculture after National Rural Employment Guarantee Act (NREGA) was introduced and farm mechanisation has not progressed well aggravated the problem. This is one of the reasons why many farmers sell their produce to pre-harvesting contractors. In addition, hiring labour increases the cost of production and it partly causes improper cultivation practice as their wage is based not on quality but on hours of work.

(2) Postharvest Management

Poor postharvest handling is another reason for low quality of agricultural produce in Andhra Pradesh State. Since there is no incremental price difference for quality of produce, farmers are not motivated to do extra works. In addition, postharvest infrastructure is generally poor. There is no storage, drying yard, and other necessary infrastructure at the farm level. More multi-purpose storage facility is necessary at the farm level to store harvested produce for a certain period to sell them when the market price is high. As price fluctuation is quite large with some crops like tomato, which makes the income of farmers unpredictable and unstable, more storage facility will help to devise countermeasures. The general lack of motivation coupled with poor infrastructure has resulted in low quality, high wastage, and low return for farmers.

Poor postharvest handling becomes an issue for export to developed markets. Export of dried chili or maize to developed countries such as the United States (US) and Japan has been rejected due to high level of aflatoxin caused by improper drying. Improper handling of mango causes damage on fruits which increases the cost of processing for export. Agrochemical residue can be another problem for export. Artificial ripening of fruits such as mango, banana, and guava using calcium carbide, which poses threat to human health, is still prevalent although it is banned. As awareness amongst consumers increases not only in the export market but also in the domestic market, applying proper postharvest handling and ensuring traceability will definitely increase comparative advantage of agricultural produce in Andhra Pradesh State.

(3) Processing

The strength of value chain in Andhra Pradesh State is an agglomeration of large-scale integrated

processing units such as Srini Food Park and Jain Irrigation for mango and tomato, ITC and Synthite for chili, Olam for cashew, and Bio-tech for maize and coconuts. Those units are equipped with advanced facilities like aseptic plants, Individual Quick Freezing (IQF) or refinery to meet the quality and volume requirement for export. They have enough capacity to absorb local production for value addition and have well established linkage with both domestic and international market.

It is observed, however, that most processors have difficulty in procuring good quality produce as large proportion of produce are damaged due to poor postharvest handling. The processors also face difficulty of procuring it in an organised way. Some processors provide training and assistance to farmers to produce good quality materials and try to strengthening their relationship. Generally, there is little mutual understanding and trust between processors and farmers. To fill the gap, India is importing substantial amount of raw material of processing products such as tomato and cashew from overseas. It is an enormous missed opportunity for local farmers since the state has good production potential to meet the demand. Thus, information on necessary requirements and specification of target market and availability of technical support such as IPM, ICM, GAP, and so on must be disseminated to the small farmers in order to enhance their produce yield and quality.

Some crops such as mango have seasonality and processing units operating only in the harvest season between April and July. Utilisation of the facilities by processing other crops such as tomato during idling period is an issue, but it does not work well due to lack of stable supply of quality raw materials which leads processors to import from overseas.

In general, domestic market for processed food is not yet matured, and most of the existing processed foods are traditional one with low value addition. Majority of processing units in Andhra Pradesh State are small scale. Consequently, modernisation and installation of new technology in these small units are slow. It also makes production cost high compared with competitors in other advanced states in India and overseas.

(4) Product Marketing

Andhra Pradesh State is one of the leading states that amended their existing APMC legislation and it is ahead of other states in terms of allowing direct procurement from farmers and promoting contract farming. GoAP has also promoted setting up farmers' market ("Rythu Bazar" for local term) where farmers' directly market to consumer in order to ensure remunerative prices by removing intermediaries. In practice, however, contract farming is not officially practised and traders and commission agents are selling the produce instead of the farmers at Rythu Bazar. In addition, most of the trading for major commodity is carried out outside the APMC markets as the number of APMC functioning markets is not sufficient to cover all trading.

Another salient issue observed in the value chain of the selected crops is the little existence of aggregated marketing practice by farmers. As a result, farmers are unable to get benefits of economies of scale such as lowering transaction cost, access to credit or governmental subsidies, linkage with industry and so on. Since farmers market their produce individually, the only channel which farmers have is through traders except the case where there is a nearby APMC market. Farmers have to sell produce to traders at whatever price offered to them. However, recent government initiative to FPOs facilitates the formation of groups of farmers and started collective activities. The JICA Survey Team observed several active FPOs handling chilli and coconuts and they conduct activities for improving efficiency of value chain. FPOs are expected to play active role for collective marketing.

For marketing agro produce to high-end domestic market or overseas market, despite the favourable position of the state in terms of production capacity and natural quality of produces, Andhra Pradesh State fails to prove its competitive edge. It is mainly due to lack of practice to ensure food safety for many potential crops as many importing countries have strict food safety standards and traceability requirements. There are needs for full-fledged testing laboratories and capacity development in major production areas. In the states, there are many crops grown naturally organic such as cashew. Since there is no proper system to certify organic produces in the state, farmers miss to tap the potential of acquiring a premium price. Therefore, there is a possibility to expand high-end markets and establish brands of certain products by interventions for ensuring food safety and proper certification system.

6.7 Community-based Organisations

6.7.1 Water Users Associations (WUAs)

(1) Maintenance

Elections toWUAs of all irrigation schemes in Andhra Pradesh State took place in the second half of 2015. Therefore, the functions expected from the WUAs have not been started and most of the maintenance works have been carried out by the department itself including maintenance of minor feeder channels and supply channels. Some emergent works have been carried out by concerned farmers in an unorganised manner. Minor maintenance works have also been done by WUA members to some extent. It seems that in many cases, the department has borne the cost of works apart from minor maintenance up to the tail end. In case of an emergent repair work that requires to be done, WUA members themselves pay from their pocket for the works and subsequently get reimbursement from the department out of O&M grant. In some cases, maintenance works have been done through the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) Scheme as a financial source. In the scheme, once works are done by the farmers, bills are sent to the department and payments are being arranged by the government.

Even though WUAs are entitled to generate revenue for O&M of irrigation schemes from other sources such as fisheries, trees, brick manufacturing, tank bed farming, ground water utilisation, and supply of drinking water to towns, Gram Panchayats are not permitting them to take control over these forms of revenue in many cases. Some WUAs get their revenue through fee for leasing of the tank for fishing (annually about INR 20,000).

Most of the WUAs have been not collecting any fee or do not have any revenue source of their own. It is observed that WUA members do not have motivation of collecting further fee and revenue from members or making other revenue sources as they believed that the maintenance works requiring monetary expenditure are under the department's responsibility.

Water tax cess is the only earmarked financial source for O&M for most of WUAs apart from schemes and budget allocated by the government. Since WUAs have been defunct, cess ploughed back, however, has not been realised. Furthermore, the level of water tax collection has been too low for any effective resourcing of the WUAs for O&M. In the absence of WUAs, water cess has been collected by the village revenue officer with the help of Gram Sarpanch (Village Head) for mobilisation. Therefore, farmers are not aware of the amount collected though cess. As stated by some of the new WUA members, the level of cess collection differs that would range from 60% to 90%. It needs to be confirmed further from reliable sources that less than 60% of the water cess is collected against the demand in 2005-06. This is further being complicated by the Revenue Department by taking enormous time to plough back the collected water tax to WUAs. A WUA takes up repairs, in case of emergency, with the guidance of the Department of Water Resources (DoWR) engineers. During emergency cases, WUA consults Assistant Executive Engineer (AEE) for contingency grant and AEE reports to the department for allocation of budget. The department assesses the situation and bears the cost of works from cess allocation.

(2) Water Management

Water management has been done by WUAs with the lead from Gram Panchayats even during absence of managing committees. In most cases, WUAs have appointed one operator to operate the sluice gates of the tank which are the only regulatory structures of the tank. To regulate the water flow, they put some sort of obstruction to block water flow to change direction. Once the crop season starts, farmers discuss amongst themselves and decide. A minimum of three meetings in a crop season are conducted to discuss water distribution and operation schedule. Water distribution is decided based on the amount of water available and the crops to be cultivated. The operator releases water through sluice gates at certain interval of time based on the requirement, e.g.; on an average they release water every seven to ten days depending on the stage of crop growth. When water is not enough, farmers change their cultivation from paddy to ID crop.

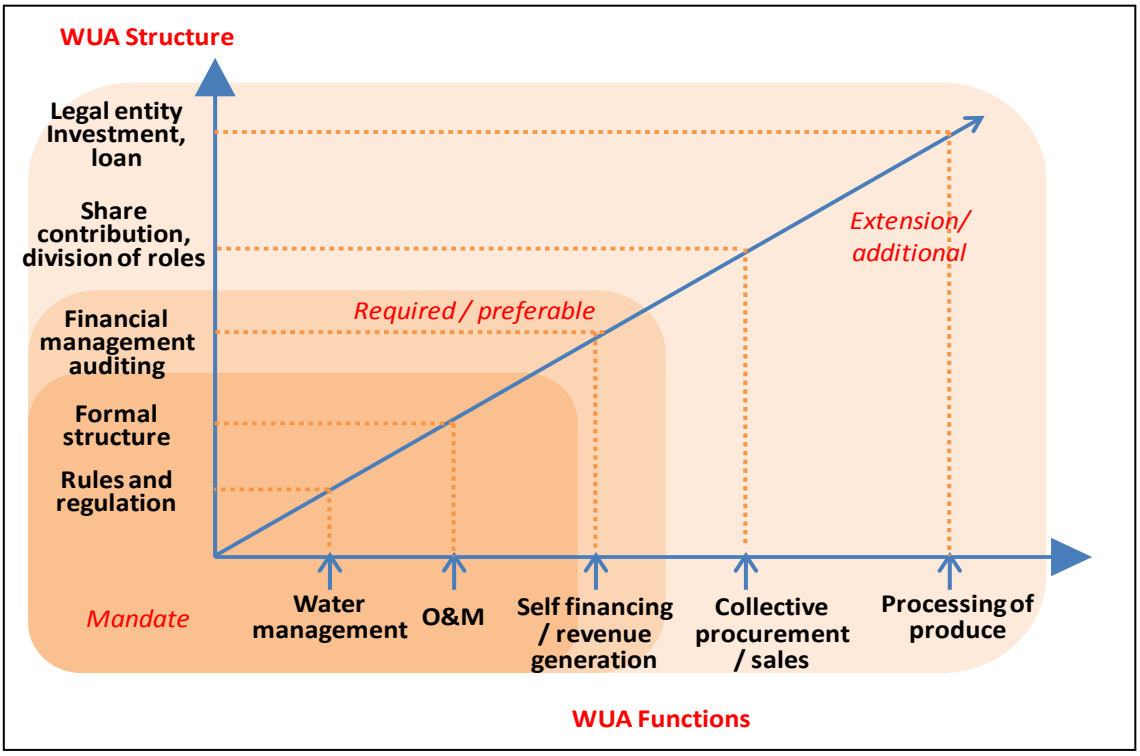
Table 6.7.1 summarises the current situation of O&M-related issues and opportunity existing to improve the situation.

Table 6.7.1 Present Situation and Issues Observed in O&M of Irrigation Schemes

Issues Regarding O&M	Present Situation	Opportunity
Water Distribution	Tail reach is not adequate This results in poor cess collection at the tail end	Improvement of water availability through proper maintenance.
Maintenance of Feederand Supply Canals	Partially done by farmers	Strengthening WUAs roles and responsibilities.
Maintenance of Major Structures	DoWR has been undertaking maintenance	Improvement of WUAs involvement.
Maintenance Cost	Cess collection done by the Revenue Department Cess is not fully collected and utilised. Since the government provide subsidies, the user charges collected do not recover the O&M costs.	WUAs involvement in cess collection. Realisation of 100% plough back of the CESS for O&M to WUAs and PRI after reestablishment of WUAs. Further revenue generation by WUAs.
WUA Structure	Very few women involved.	Collaboration with empowered women through SHGs.

Source: JICA Survey Team

Since WUAs have been reformed recently, possibility of further development of WUA is still open. The following figure indicates possible WUA structure depending on the level of roles expected of WUAs. For sustainable O&M of irrigation schemes, water distribution and management, maintenance of structures and self-financing through revenue generation are required. Whether WUAs take up further tasks or not depends on productive activities and relation with other community-based organisations. Possibility of WUAs taking uproles in agriculture-related activities are mentioned even in the Act. Programmes, such as the Andhra Pradesh Community Based Tank Management Project (APCBTMP), encourage expanded roles of WUA. However, DoWR is currently taking a stance on limiting WUAs function to the required level without extending to any productive activities. DoWR does not yet have a clear way forward on WUAs roles and necessary support after the recent re-establishment of WUAs. DoWR is currently preparing a WUA model that suits Andhra Pradesh context. Further analysis shall be made in the second field survey on WUAs role with regard to government policy, production in command areas, and other existing community organisations.



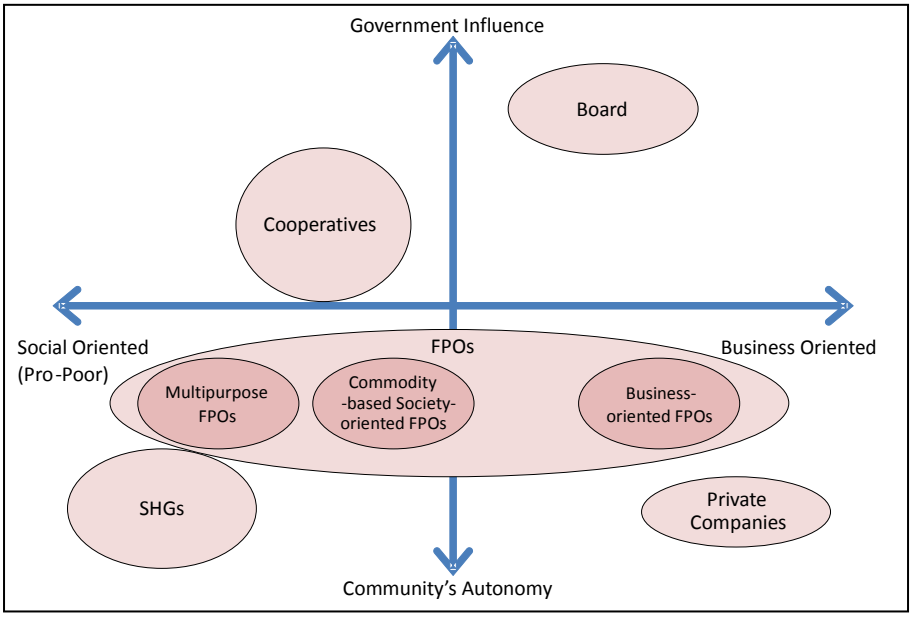
Source: JICA Survey Team

Figure 6.7.1 Structural Development Stages of WUAs

6.7.2 Agriculture and Horticulture-related Farmers' Organisations

(1) Observation and Analysis of Current Farmers' Producer Groups and Organisations

There have been several small farmers group formed and supported. Collective farming has not been successful while mutual help within their informal groups have been working. Benefit of scale has been one of the proved approaches to improve productivity and profit, while management of larger organisation requires higher capacity. Learning from the experience of Priority Agriculture Cooperative Society (PACS), Mutually Aided Co-operative Society (MACS), and Self Help Groups (SHGs), Farmer Producer Organisations (FPO) formation is one of potential ways of improving agriculture and horticulture practice and their profitability as well as bringing profit to small and marginal farmers. Considering the situation that different institutions support in different ways in formation of FPOs, different types and views of developing FPOs can be considered. Figure 6.7.2 shows the different types of farmers' organisations plotted based on its orientation and operation, in comparison with other farmers' organisations.



Source: JICA Survey Team

Figure 6.7.2 Characteristics of FPO in Comparison with Other Farmer's Organisations

The following are different approaches and possibilities of FPO observed through field surveys.

Table 6.7.2 Comparison between Different Types of FPOs

Model	Multipurpose FPO	Social-oriented Commodity-based FPO	Business-oriented FPO
Target	Farmers in a particular area	Small and marginal farmers with common commodity	Farmers of particular commodity
Scale	Ayacut area/village level	About 500 farmers	1,000-5,000 farmers
Objective	Meeting multiple needs of the members	Improving income of small and marginal farmers mainly through collective procurement and marketing and by eliminating intermediators	Promoting cluster based commodity by primary producers Developing value addition through processing
Formation	Based on existing community-based organisation or those interested in the area	Aggregation of existing Common Interest Groups (CIGs), or mobilising those growing particular crops	Mobilising those growing a particular strategic crop
Produce/Products	Multiple commodity for business, multiple service	Target commodities to maximise economy of scale but deal with other	Limited target commodity with different value addition

Model	Multipurpose FPO	Social-oriented Commodity-based FPO	Business-oriented FPO
	to the members	commodities to reduce risk and improve sustainability	
Business Style	Mainly for marketing of primary produce with fair price to a secured buyer	Mainly for marketing of primary produce with fair price to a secured buyer	Value addition and high quality products
Advantage	Multiple function meeting multiple needs Self-sustainable	Pro-poor, equality, collective activity to benefit small and medium (S&M) farmers	Economy of scale
Challenges/Issues	Different stakeholders (multi-sector, different interest of members) More social-oriented (less economic benefit)	Sustainability as social and business entity (requires business skills) Less advantage/benefit in the crops with less intervention of intermediators	Higher risk in success of business

Source: JICA Survey Team

The following part describes the observed situation of FPO formation in different types of FPOs.

(a) FPO for Collective Benefit

The major objective of FPOs categorised in this type is improving profit of the primary producers through collective procurement and marketing of the primary produce. The benefit from economy of scale is obvious in the situation where intermediators are taking a large part of the marketing transaction. However, there is no appropriate environment to promote the concept before mainly due to initial cost for establishment of such a large organisation and cost for searching a certain market. Currently, with the government's strategy to delegate responsibility to reliable non-governmental organisations (NGOs) as resource institutions, establishment of Resource Support Agencies (RSAs) and Producer Organisation Promoting Institutions (POPIs), and making available fund for establishment, the initiative to establish FPOs has taken off. With a certain support in formation and market opportunity, some FPOs have also started functioning.

Many of the FPOs have been formed based on the small community-based organisations such as SHGs, farmers clubs, and common interest groups. Organisations that have been working in collaboration with the departments and government organisations have been identified as POPIs. Since these POPIs have been working for so long in the community, they have deep insights in and relationship with the community. POPIs mobilised the small farmers' organisations to federate as a FPO seeking for a possible market and buyers to tie up with. Once a market is assured to some extent, without intermediators' charges, the farmers can make profit immediately with minimum investment. This is a great motivation for the farmers to develop FPOs. Furthermore, one of the significant features of FPOs that is different from other private companies is equal right to vote irrespective to their landholdings and share of equity. This assures equal rights to small and marginal farmers in decision making avoiding domination by larger farmers. In this context, this type of FPO has high potential in improving livelihood of small and marginal farmers.

The most remarkable benefit the FPO members gain, according to the field observation, is fair price from the tied-up buyers without commission and exploitation by middlemen. Many members also realised that other organisations including government, banks, and buyers are now approaching FPO, while it was a reversed situation before the formation of FPO where farmers approached the institutions and stakeholders largely in vein. Even though sustainable operation is still challenging for FPOs, this is one of potential options for small and marginal farmers to improve their livelihood through their current agriculture production.

For further development of this type of FPOs and enhancing their success rate, issues, and additional needs require to be addressed. Handholding support term of three years, which is the current available supporting fund by major funding agencies, is not enough to establish a stable management system of newly established FPOs. Secondly, quality of the POPI is a critical point of success for FPO, as it

requires strong mobilisation of producers, comprehensive and in-depth capacity building, and feasible and reasonable market linkage. Thirdly, capital investment opportunity is still limited for the FPOs to step forward to self sustained operation. Since the FPOs might not have enough capacity to apply for the same loans and schemes as private companies, it is necessary to provide earmarked schemes such as subsidies and credit schemes for relatively young FPOs.

(b) Business-oriented FPOs

Some FPOs have been formed on the basis of business orientation. The idea is to generate larger benefit to the producers by incorporating value addition and processing units. A larger number of farmers (around 5,000 farmers) are federated into an FPO to maximise the benefit of scale. Aggregation of a large number of farmers enables larger investment through their share capital to start processing units. This type of operation can bring higher returns; although, launching the processing unit takes time and has some risks. Some of this type of FPOs have been supported by strong higher level institutions such as national level boards (such as Coconut Board, Spice Board, etc.), and some others are promoted by private business consulting firms. Even though only a few FPOs have started their profitable business, other FPOs still make profit by aggregating farmers and securing market for their primary produce. Successful FPOs have potential of being involved in the major value chain development of a particular commodity in a larger scale.

(2) Potentials for Supporting Agriculture-related Farmers' Organisations as Business Entities

FPOs in theory have huge potential to improve the livelihood of the poor through economic activities. However, it is a challenging task to make them succeed. Through the current situation and constraints they face, unmet needs and opportunities are identified for further necessary intervention. The following summarises the current situation of FPOs, challenges they are facing, and their potential opportunity to develop further.

Table 6.7.3 Observation, Challenges and Potentials in Supporting Formation of FPOs

Observation	Challenges	Opportunity/Potential
Some FPOs have started functioning (with realised benefit)	Capacity of POPI highly influence the establishment of FPOs	There are some well established NGOs to support FPOs although they might be limited
Different POPIs support FPO formations with different approaches and forms of support.	Processing activities are weak in FPO activities (relying on facilities of other organisation or private units)	Congregation and collaboration of departments, RIs, and relevant institutions can replicate good practice
Processing activities are weak in FPO activities (relying on facilities of other organisation or private units)	Opportunity/possibility for capital investment for the established FPOs to extend their activities seems to be limited or insufficient so far.	FPOs can collectively access subsidised schemes for setting up their infrastructure
Marketing by making linkage with a certain market such as wholesale and companies	Marketing and value chain needs to be well organised once many FPOs try to produce similar produce/products in a certain area	Business can be established through a step of business consultation

Source: JICA Survey Team

Even though business development is guided in the guideline, the major weakness observed in the newly established FPOs is entrepreneurship and planning. Even if the FPO's fundamental purpose is to eliminate poverty, it should have a strong business planning strategy to make the organisation sustainable to benefit the members. Support of business planning shall be considered in the project activities.

6.7.3 Potentials for Developing Farmers' Organisation in Irrigation Area

In consideration of the proposed Yen Loan project focusing on irrigation development, possibility of developing farmers' organisations shall be taken into consideration. Development of WUAs is inevitable for sustainable O&M of irrigation projects. On the other hand, further expansion of roles of WUAs is not in the current view of the DoWR, although it is provided for in the Andhra Pradesh Farmers. Management of Irrigation Systems (APFMIS) Act. In line with the value chain strengthening, support for agriculture production and marketing should also preferably be included in the project scope.

However, development of FPO can be difficult in irrigated area as majority of the farmers in these areas cultivate paddy and cereals which have less advantage in establishing FPO compared with horticulture produce. There is a possibility to establish multipurpose FPO of farmers in certain command areas following the concept of federating SHGs. In the area where farmers are eager to develop production activities through value addition and quality improvement, business oriented FPO might be an option. Table 6.7.4 summarises the possibility and difficulties of each type of famers' organisations to be developed in relation with irrigation support. Further analysis shall be made through the second field survey.

Table 6.7.4 Possibility and Difficulties in Formation of FPOs with Irrigation Based Support

Model	Multipurpose FPO	Social oriented commodity based FPO	Business oriented FPO
Possibility	Area specific involving different stakeholders bound by the Ayacut area	Crop based FPO if the majority cultivates a certain crop with advantage for collective works.	Developing high value added products from the major crop in the irrigated area (e.g., paddy, maize)
Concerns/ Difficulties	Less advantage in uniformity due to different interests and crops amongst members	Less advantage of collective marketing for paddy Not enough economy of scale for other ID crops	Possible only on the pilot basis (difficult to apply as generalised model)

Source: JICA Survey Team

6.8 Findings of the Household Questionnaire Survey

The JICA household survey employing questionnaires was carried out in order to collect information and data regarding the current status on agriculture-related items as well as farm economy of farmers in the selected areas of Andhra Pradesh State. Number of samples, their distribution, and coverage are presented in Table 6.8.1.

Table 6.8.1 List of Sample*:* Irrigation Schemes for Household Survey

Target Region	Target District	Medium Irrigation	MI Tank Irrigation (1)	MI Tank Irrigation (2)	MI Tank Irrigation (3)
Northern Region (North Andhra)	Vizianagaram	Votitigeda	Dora (Kudama)	Pratapasagaram (China Merangi)	Chinni (China Merangi)
	Visakhapatnam	Raiwada	Krishnasagaram (Chowduvada)	Raju (Tenugupudi)	Sarvakala (Srungavaram)
Central Region (Coastal)	West Godavari	Tammileru	Pedda (Koppaka)	Venkatadri (Raghavapuram)	Vemanakunta (Narasannapalem)
	Prakasam	Mopadu	C.S.Puram (C.S.Puram)	Sakavaram (Sakavaram)	Bonthavaripalli (Bonthavaripalli)
Southern Region (Rayalaseema)	Chittoor	Kurishnapuram	Katherapalle (Katherapalle)	Lakshmipuram (Lakshmipuram)	Chokkamadugu (Chokkamadugu)
	Anantapur	Upper Pennar	Peruru Big (Peruru)	Peruru Small (Peruru)	Nallagutta (Thumucherla)

Note: Upper column indicates the name of MI tank and the lower column shows the name of village in parenthesis.

The number of survey samples in each irrigation scheme is 360 samples as shown in Table 6.8.2.

Table 6.8.2 Sample Size Chosen for Household Survey

Target Region	Target District	Medium Irrigation	MI Tank Irrigation (1)	MI Tank Irrigation (2)	MI Tank Irrigation (3)	Total
Northern Region	Vizianagaram	30	10	10	10	60
	Vishakhapatnam	30	10	10	10	60
Central Region	West Godavari	30	10	10	10	60
	Prakasam	30	10	10	10	60
Southern Region	Chittor	30	10	10	10	60
	Ananthapur	30	10	10	10	60
Total		180	60	60	60	360

Note: Upper column indicates the name of MI tank and the lower column shows the name of village in parenthesis.

Survey data was collected through the interview using questionnaire forms and those data were deteted into an excel file for further analysis as well as for interpretation. These outputs are shown in Attachment 6.8.1, and summarised as follows:

6.8.1 Questionnaire Interview Survey on Situation of Households

(1) Nature of the Households (HHs)

More than 95% of the surveyed households were Hindus with minor variations across the three regions. About 70% of the households reported farming or working on farms as labour constituting their prime engagement and source of income for their families. More than 95% of households has electricity supplied from the main grid. Nearly 80% of the households in central, northern, and southern regions get safe drinking water. Households will have easy access to all sources of drinking water (less than 50 metres).

Northern Andhra has issues in meeting the drinking water needs of families. In the northern region medium irrigation area, all households surveyed stated that water is inadequate throughout the year, whereas 50% households were not getting sufficient water to meet their basic drinking needs. In most households, either the family head or their family members maintain participation/membership in cooperative societies and groups.

(2) Land Holding

In the central region, average land holdings ranges from 1.5 to 2 ha. In the northern region, the average size of land holding is from 4 to 5 ha, while in the southern region, the average land holding varies from 1 to 2.85 ha. Medium and minor figures are 2.85 ha and 1 ha, respectively. Grasslands as well as orchards are figuring in the landholdings but on a very smaller scale for the households. The average size of land holding is around 2 ha in the irrigation scheme area.

(3) Seasons and Crop Productivity

Cropping and cultivation practices in crops vary in the three regions. There are three seasons, namely: *Rabi, Kharif*, and summer and a variety of grains, vegetables, and fruits are being raised. Sugarcane, lemon, paddy, maize, tobacco, etc. are being produced inside and outside of the irrigation scheme. However, crops and crop sequences vary across the three regions.

(4) Postharvest and Marketing

In general, the farmer households do not practice significant postharvest activities for crops. Mostly, they dispose the produce at the farm gate or in the village or local market, although there are few reported progressive farmers that market the crops outside the state. But mostly, the agri-value chain ends at the farm gate due to lack of knowledge about markets, inability and in-experience in marketing techniques, and poor stock holding facilities and capacity.

(5) Household Income and Expenditure

The Central Andhra Medium Irrigation Scheme recorded the highest household average income (INR 183,000) and expenditure (INR 147,500). This is followed by the Northern Andhra Minor (INR 155,700) and Southern Andhra Medium (INR 118,800). The Central Medium Scheme has the highest (INR 35,500) surplus reported for the reporting year. The North and South Medium Regions also have surplus of income over their expenditure despite the fact that their average incomes are comparatively lower than the Central Medium which is an indicative of relatively lower expenditures.

(6) Social Environment

In general, agricultural activities continue to be dominated by males. In the study area, most of the activities are done jointly by male members alone. Work dominated by females are mainly transplanting, weeding, watering, processing, and housekeeping. Seasonal migration is not a significant phenomenon in any of the families included in the study. Migration of labourers to cities is common in the southern and northern Andhra to earn for their livelihood.

(7) Household Assets

Amongst the reported households, motorcycles, pumpsets, and bicycles are the main assets held by most of the households in the surveyed regions. In general, the ownership percentage of agricultural and transportation equipment by households in the surveyed area is low. Farmers have no joint use of farm machinery with other farmers. The main items in the consumer items owned by the households are televisions (TVs), mobile phones, and TV dish antenna. Livestock is not a major asset category for most of the households. Amongst those who owned any type of livestock, buffaloes are the preferred assets.

(8) Natural Disasters and Land Conservation

Major disasters reported are droughts and floods (67%) followed by rodents (33%). Untimely rains, floods, and heavy cyclonic storms during harvesting time cause heavy damage to the crops, lives, and properties. Many farmer households experienced and expressed the non-availability of irrigation water as a major constraint in their farming plans and dreams. Crop diversifications, farm productivity, and farm incomes are being affected by having insufficient water supply and underdeveloped irrigation facilities.0

(9) Needs Regarding Livelihood

In all three regions, aside from cultivation of different crops, farmers lay emphasis on dairying (cows, buffalos) as it is the sure source of family income due to uncertainties in agriculture. Farmers in villages are trying to educate their children in convent schools spending huge amount of money with a hope to see their children having good jobs. It is observed that the youth in villages do not show interest in farming as they feel that farming is not profitable. In all village households that were surveyed, farmers share their opinions about the availability of high yielding crop varieties, provision of irrigation facilities, regular supply of electricity, and good market prices which they believed are essential for sustaining agriculture and profits.

6.8.2 Questionnaire Interview Survey on CBOs

(1) Outline of the Survey on CBOs

Questionnaire survey was conducted to existing CBOs such as Agricultural Cooperatives, SHGs, FPO and WUAs to grasp and analyze situation of the existing organisations. The survey result is to supplement information from field survey to develop possible interventions for those CBOs in the project. The samples of the survey was randomly identifies in the HHS target village and surrounding area in case there is no relevant organisation in the sample area. The sample size of each organisation studied is summarised below.

Table 6.8.3 Sample Size of Questionnaire Interview Survey on CBOs

District	Medium Irrigation (6 in total)				Minor Irrigation (18 in total)	
	WUA	SHG	FPO	COOP	WUA	SHG
Vizianagaram	3	3	1	1	3	3
Vishakhapatnam	3	3	1	1	3	3
West Godavari	3	3	1	1	3	3
Prakasam	3	3	1	1	3	3
Chittoor	3	3	1	1	3	3
Anantapur	3	3	1	1	3	3
Total	18	18	6	6	18	18

Source: JICA Survey Team

(2) Agricultural Cooperative Societies

Questionnaire interview survey was conducted to one Agriculture Cooperative in each sample survey area. Results can be utilized to understand different status of agriculture cooperatives instead of drawing averaged data for generalization due to the small sample size. Through the survey, it was concluded that there are huge disparity in activities and level of functions of Agricultural Cooperatives in the area. The following are the major findings on agriculture cooperatives.

Both single and multi-purpose societies exist in the study region. Number of years in operation for the

cooperatives varies from 25 years to just 2 years. There is no uniformity in respect of collection of membership fees. Seeds and fertilizers have been the major items under sale of Agricultural Inputs for most of the cooperatives, followed by pesticide and agriculture materials/implements. Only two cooperatives are engaged in procuring agricultural outputs/produce. Major Problems faced by Cooperatives are over dues or violation of loan norms, cited as a serious problem by three cooperatives, while one cooperative has indicated marketing and yet another has cited lack of agriculture land as a major problem.

(3) Farmer Producer Organizations

Since the promotion of establishment of FPO by the AP government is still early stage, not many FPOs have been identifies within the sample areas and their surrounding area. Sample size was less than expected and some are did not represent any sample. Furthermore, some organisations answered as FPOs are small community based group that are different from FPO concept of the AP government. The following summarise the remarks drawn from the survey result on FPO.

Five out of the seven FPOs studied were formed by organizing farmers. No FPO was formed through aggregation of farmer groups/organizations. Most of the FPOs surveyed are at initial stage, not borrowing any funds from financial institutions. Activities of the FPOs vary without any tendency drawn possibly due to variety of the organisations studied as FPOs. Sharing of labour, processing of produce, provision of loans are the few major activities indicated by the surveyed FPOs. No women representation in Equity Holders category, though in two FPOs, women memberships are reported. Constituents of FPOs and their activities

(4) SHG

Even though there are some tendencies between sample areas observed from the data collected, it shall not be significant to conclude as specificity of the area due to small sample size and possible interviewer biases. The followings are the major findings regarding SHGs.

Except for West Godavari, all SHGs studied have been functional for more than 7 years. The combined average age of SHGs is 11 years. On an average there are about 29 SHGs per village in the villages where these SHGs are located. Except Prakasam district, in all the other 5 districts, the sampled SHGs were conducting regular meetings on monthly basis. The SHGs have received and maintained at least one Fund (Revolving or CIF). No SHG has reported defaults on loans made to the SHG members. SHGs practice different rate and terms for inter group loans. Usually it varied from Rs.1 to 1.5 /100. For loans out of bank loans standard interest rates ie 12% plus one to two per cent are being charged. All the SHGs studied in the 6 districts have been maintaining bank linkage and they have availed credit from formal financial institutions

As major advantages of membership in SHG, SHG members felt that it offered them an opportunity to access loans, support each other, participate in community activities, and improvements in their livelihoods/agricultural activities. No significant disadvantage has been reported by the Group members.

(5) WUA

Sample size consisted of 36 WUAs equally sampled from medium and minor irrigations projects in 6 districts. There are some tendencies deduced from the survey results. However, similar to the SHGs, differences observed between districts may not be concluded as regional difference. Activities of the WUAs could not be clearly studied due to transitional situation of WUA with recently elected management committee members. The following summarise notable tendencies observed.

No WUAs surveyed have reported any major income. No WUA in the 6 districts surveyed by this study, reported as to having any kind of assets they possess. The WUAs do not meet regularly except in West Godavari and Prakasam districts. Except Vizianagaram and Prakasam districts to great extent, no other WUA studied reported having attempted making water budgets or any regulation system for water use. Some of the major highlighted problems faced by WUAs are poor access to government support, lack of knowledge on water budgeting, lack of maintenance fund, difficulties in mobilizing people for community development initiatives and difficulties in collecting subscriptions from members.

6.9 Food Park and Private Sector

6.9.1 Preliminary Evaluation of Mega Food Park Schemes

During the first field survey, the JICA Survey Team visited three mega food parks, namely: 1) Srini Food Park, 2) Indian Food Park, and 3) Godavari Aqua Food Park. Amongst the three food parks, Srini Food Park and Indian Food Park have already started operation and Godavari Aqua Food Park has been under construction yet. Although it is still too early to evaluate those food park schemes due to a very short period in operation (Srini Food Park opened in July 2012, Indian Food Park in September 2014, and Godavari Aqua Food Park not yet in operation), the team implemented a preliminary evaluation for the food parks based on the secondary data and interviews with persons concerned. The summary of the evaluation is shown in Table 6.9.1 below.

Table 6.9.1 Comparison amongst Existing Mega Food Parks

	Srini Food Park	Indian Food Park	Godavari Aqua MFP
			
Present Status			
Established	July 2012	September 2014	Under Construction
Address	Chittoor, Andhra Pradesh	Tumkur, Karnataka	West Godavari, Andhra Pradesh
Land	147 acre	110 acre	70 acre
Plot (alloted/total)	4/22	1/20	1/30
Infrastructure (Power/Water/Sewage)	provided	provided	provided
Common Facility (Cold Storage, IQF, etc.)	provided	provided	provided
PPC/CC	4/14	6/-	2/9
Target Market	Export (100%)	Domestic (100%)	Export (>99%)
Advantages			
Geographical Location	Raw-materials Oriented - Easy access to mango, tomato, papaya, etc.	Market Oriented - Developer has strong retail network in India	Raw-material Oriented - Developer is a dominant in shrimp production
Forward Linkage	Export fresh mango to Japan with VHT facility	Developer (future group) has strong retail network in India	Export shrimp and fish to EU, USA, Hong Kong, etc.
Challenges	Limited number of tenants CPC not utilized during off-season	Limited number of tenants Backward linkage is under development	Poor access road to food park, waiting public works

Source: JICA Survey Team

(1) Advantages of Food Park

Srini Food Park is located in Chittoor, one of most production areas of fruits such as mango, tomato, and papaya and the park has a big advantage in accessing raw materials with direct connection with specific farmers. The park also establishes a forward linkage to export market and has unique market for fresh mango to Japan since the park has Vapour Heat Treatment (VHT) facility to conform with the requirement of Japanese standard.

Indian Food Park is located in Tumkur Industrial Area about two hours away from Bangalore, Karnataka State. This park is newly opened in 2014 and the land size is 110 acre. The developer is a subsidiary of Futune Group, which has multi-business including retail function. The park enjoys the group's strong retail network; therefore, a tenant is also able to sell their own product to the same market.

Godavari Aqua Food Park is located in West Godavari District, one of the biggest areas of inland aquaculture for shrimp around Bheemavaram. The developer is Ananda Group, which is a dominant producer and exporter of shrimp in the area. Ananda Group have their own food processing unit in Bheemavaram, which installs state of the art facility to meet strict food standards in the European Union (EU) and the United States of America (USA).

(2) Major Challenges

All of the three food parks face difficulty to find a tenant. Srini has four tenants in the park and has some potential tenants under discussion. The Indian Food Park found one tenant last year. Godavari Aqua has not opened yet but has found one tenant. According to the "Report on Evaluation of the Impact of the Scheme for Mega Food Park of the Ministry of Food Processing Industries" ICRIER, July 2015, it is observed that limited number of tenants is a common issue amongst the parks.

Other than the tenant issue, there are several issues observed. In Srini Food Park, the Central Processing Centre (CPC) is not fully utilised especially during off season of fruits. Another reason is that CPC is not utilised by tenants since their products, such as noodles and pomegranate seeds packs, do not require the use of the facilities. The Indian Food Park, in turn, has its backward linkage but is still underdeveloped. According to the developers, they have put efforts to formulate farmers' groups but argued that it would take time for the education of farmers. Godavari Aqua Food Park has another challenge regarding poor condition of access road connecting the park and the main road. According to the developer, GoAP has already committed to repair the road but has been delayed due to shortage of budget.

6.9.2 Comparison amongst Food Park, Industrial Area and Food Processing Unit

The JICA Survey Team investigated not only the mega food parks but also industrial areas and individual food processing units. Table 6.9.2 explains the result of comparison amongst different schemes.

Table 6.9.2 Comparison amongst Food Park, Industrial Area, and Food Processing Unit

	Mega Food Park (e.g Srini Food Park)	Industrial Area/SEZ (e.g Sri City)	Individual Food Processing Unit
Location	Fixed	Fixed	Customized
Land Acquisition	Not necessary (Lease)	Not necessary (Lease)	Necessary (Purchase)
Clearance and Approval	Support from developer	Support from developer	Own cost
Infrastructure	Provided (water, electricity, road)	Provided (water, electricity, road)	Own cost
Expected Tenant	Dedicated in food industry	Multi sectors	No (single company)
Common Facilities	Available (eg. pulping, packing, cold store, IQF, QC lab, logistics, etc.)	N/A	N/A
Backward Linkage	Provided (if required)	N/A	N/A
Forward Linkage	Provided (if required)	N/A	N/A
Land Size per plot	Smaller (1-4 acre/plot)	Larger	Customized
Tenant/Investor Foreign company Indian company	 Chaudhary group Sam Agritech, Nwp6	 Pepsi, Kellogg's, Lavazza, etc -	 Fuji Oil (JV w/ 3F Industries) etc. Jain Irrigation
Potential investors	Small and medium food manufacturers	Larger food manufacturers (preferably for foreign companies)	Larger food manufacturers (Preferably for foreign/Indian JV companies)

Source: JICA Survey Team

For tenant or investor, mega food park and industrial area have a big advantage to find land since there is land ready to start up their business. Those like Srini Food Park and Sri City also provide necessary support for clearance, approval procedure, and infrastructure such as water, electricity, and road. Furthermore, mega food park has common facilities like pulping, packing, cold storage, etc., and also has backward and forward linkages. Tenants can enjoy the benefits in utilising these facilities and services.

For the Individual Food Processing Unit, its location can be selected and land size can also be customised according to the requirement of business (e.g., easy access to raw material, port, and/or market). However, it is often a difficult task to search for an aggregated land to meet the requirement. The investor

also needs to negotiate with the land owner to acquire the land and allocate a lot of time and cost for clearance, approval, and infrastructure.

Actual tenants in mega food park like Chaudhary Group and Sam Agritech are relatively smaller sized companies compared with the tenants in the industrial area like Pepsi and Kellogg's since the land size per plot in mega food park is smaller (1-4 acre/plot) than that in the industrial area (150 acre for Pepsi). Therefore, mega food park is one of the ideal options to setup a factory for small and medium companies, not for larger companies. Industrial areas like Sri City is an ideal option for larger companies especially foreign companies. Individual unit is a possible option for Indian companies and JV of foreign companies and Indian companies. Those options will be investigated further through the second field survey.

6.9.3 Potential Japanese Investors and Challenges Observed

(1) Types of Potential Japanese Investors

The JICA Survey Team categorised potential Japanese investors into four types as shown below.

- Developer/Promoter
- Food Manufacturer
- Agricultural Machines/Food Processing Machines/Freezer Manufacturer
- Trading/Distribution Company

Developer/promoter is defined as a company which has an interest to develop and/or operate a food park or industrial area. Food manufacturer is a company to be setup and operated into a food factory and sell products to domestic and export markets. Agricultural machines/food processing machines/freezer manufacturer is a company that sell and install machinery or plant to a farmer or food manufacturer. In some cases, other companies may setup and operate their factory in India. Trading or distribution company is a company that trade and export raw materials and food stuff in and around India.

(2) Potential Investors and Challenges Observed

As shown in Table 6.9.3, 13 companies have participated in the business matching session held on 2nd December 2015 in Vijayawada.

Table 6.9.3 Potential Investors and Challenges Observed

Potential Investor	General Interest	JP Companies Participated on 2nd Dec 2015 Vijayawada	Challenges
1. Developer/Promoter	Development and operation of food park/industrial park	• JGC • Mizuho CB	•Find potential food manufacturers to invest
2. Food Manufacturer	Build/operate a food factory Sales of products to domestic/export market	• (no company)	•Adopt food standards •Exploring market in India •Find Indian partner company
3. Agricultural Machines/ Food Processing Machines/Freezer Manufacturer	Sales of machinery/ plant to farmer/food manufacturer (with O&M supporting system) Build/operate a factory	• Yanmar, •Kubota • Shibuya •Mayekawa • Fujitsu •Yokogawa •ITE • Taisei Oncho	Awareness of Indian market and its requirement Mismatch between technology and requirement
4. Trading/Distribution Company	Trade/export of raw material/food stuff Develop/operate a cold chain logistic system	• Mitsui & Co. • Mitsubishi • Marubeni	Pesticide residues Food sanitation (aflatoxin, etc.) Access to required raw material (quality, quantity, price)

Source: JICA Survey Team

There were 8 companies from machines and freezer manufacturers and those companies had individual business meetings with food processing companies in Andhra Pradesh state. On the other hand, no meeting was held between Japanese food processing company and food processing company and/or

food park developer in Andhra Pradesh state since there was no company participated from Japanese food manufacturer.

Even though food industry in India has big potential as a huge domestic market, the number of Japanese food manufacturers in India is still small. According to the interview with several Japanese food manufacturers, there are many challenges to start a food processing business in India; adoption of food standards in India, exploring of market in India, finding an Indian partner company especially in distribution business. In Chapter 8.7.2, current issues preventing Japanese investments are investigated through a questionnaire survey, and necessary countermeasures for future investment promotion are proposed in Chapter 15.

7. SELECTION OF TARGET IRRIGATION PROJECTS AND TARGET AGRICULTURAL PRODUCES

7.1 General

This study aims to assess the proposed irrigation projects through detailed survey of sample irrigation projects and to explore potential of developing food value chain of selected agricultural produce. For the detailed survey of those sample irrigation projects and selected agricultural produce for value chain, target selections were performed. The selection criteria, process, and results were explained to and agreed with the relevant government departments. This chapter explains the selection criteria, including the concept and procedures of the selections.

7.2 Target Irrigation Projects

7.2.1 Selection of Proposed Projects by DoWR

The Department of Water Resources (DoWR) proposed in April 2015 for the Andhra Pradesh State Irrigation Livelihoods Improvement Project-II (APILIP-II), a Japan International Cooperation Agency (JICA) Loan for modernisation of 21 medium and 485 minor irrigation projects in the document stated below.

- Project Concept Note - Andhra Pradesh State Water Management and Postharvest Investment Promotion Project (AP-IQMPHIP) to be financed by the JICA under Phase II (2015-2020)

The criteria of selection are as follows:

- Projects of more than 20 years are selected (Projects which have not been dealt with major renovation works for the last two decades are selected).
- The tanks located near the medium irrigation projects are selected and are given consideration in the APILIP-II proposal. These tanks are not included in any other schemes for renovation.

In February 2016, DoWR withdrew three medium irrigation projects out of 21, and proposed an additional three. The JICA Survey Team reviewed the three newly proposed projects and concluded that two were acceptable but the remaining one was dismissed because its command area was overlapping with the one that was originally-proposed as a medium irrigation project.

Moreover, another project was proposed in April 2016 as an addition; however, this was not included in the proposal list because the command area was vast at 120,000 ha and is categorised as a major irrigation project and has a preliminary estimated cost of INR 1,160 million, which was too high to be included in the list.

As for the minor irrigation projects, some original projects were taken back and some were newly proposed instead of February 2016.

As a result, the projects to be proposed are 20 medium and 472 minor irrigation projects. The comparison of the original and final proposal lists are presented in Attachment 7.2.1.

7.2.2 Selection Criteria for Target Irrigation Projects

The selection of the target projects is carried out in the following steps.

Step-1: Minor irrigation projects are grouped into one of the proposed medium irrigation projects nearby, designated “parents”, approximately within 30 km from the dam, headworks, or command area. The minor irrigation projects which are far from any proposed medium irrigation projects are categorised as “isolated”.

Step-2: Medium irrigation projects are examined in accordance with the selection criteria and ranked in order of marked points.

Step-3: Minor irrigation projects are subordinate to the rank of their “medium irrigation project”. Amongst the minor irrigation projects of the same “medium irrigation” family, these are ranked for internal comparison.

Top priority is given to the highest ranked medium irrigation project and its surrounding minor irrigation projects. Amongst those minor ones, priority is given individually in accordance with their scores. The "isolated" minor irrigation projects are given the lowest priority.

This idea is based on the premise that the integral development in a limited zone will create more synergistic effect and lead to local activation than scattering investments over the entire Andhra Pradesh State.

(1) Selection Criteria of Target Medium Irrigation Projects

To select medium irrigation projects which are technically sound and economically feasible, the following factors are considered for project selection (priority ranking).

- Status of Project

  Advanced progress of the technical report preparation such as DPR and project note are considered as advantageous indicators as to how mature and ready the project is for early implementation.

- Water Availability

  It is considered that high water allocation per unit command area may lead to more secured water supply. Also, a larger dam storage capacity enables more flexible water distribution to the command area.

- Irrigation Practice

  For an aged project, modernisation is likely to be more effective to improve the present deteriorated condition of irrigation facilities. By the similar reason, the higher the gap ayacut is, the lower the water use efficiency is, therefore, the more improvement the modernisation may create.

- Farmers' Organisation

  The activeness and willingness of farmer's organisation are the key points whether or not the project operation will be successful.

- Others

  Land acquisition has been a major hindrance to the smooth implementation of APILIP-I. It is conditioned that no land is needed to be acquired in APILIP-II.

  The economic index such as benefit/cost (B/C) ratio is employed as a scoring parameter to estimate the economic viability of the project.

For more details, the employed criteria and the distribution of scoring points are presented in Table 7.2.1 below.

Table 7.2.1 Selection Criteria of Target Medium Irrigation Projects

SN.	Items		Max	Allocation of Points
C1	Critical	Land Acquisition	-	[Excluded] Required / [Included] Not required
C2		Benefit (BC Ratio)	-	[Excluded] < 1.0 / [Included] ≧1.0
S1	Status of Projects		10	[10] DPR has been prepared./ [5] Project Note has been prepared./ [0] Except above cases.
S2-1	Water Availability	Water Allocation (per ha)	5	[5] ≧1,200mm / [Proportional] ＜1,200mm
S2-2		Live Storage Capacity (per ha)	5	[5] ≧1,200mm / [Proportional] < 1,200mm
S3-1	Irrigation Practice	Construction Year	2	[2] ≧20 years / [Proportional] < 20 years
S3-2		Gap Ayacut	4	[4] 100 (%) / [Proportional] < 100 (%)
S3-3		Efficiency	4	[4] < 40% / [Proportional] ≧ 40%
S4-1	Famers' Organization	Water Cess Collection	5	[5] 100 (%) / [Proportional] < 100 (%)
S4-2		Willingness	5	[5] Confirmed / [0] Not confirmed
S5	Benefit (BC Ratio)		10	[10] ≧ 3.0 / [Proportional] < 3.0
Total			50	

Source: JICA Survey Team

(2) Selection Criteria of Target Minor Irrigation Projects

For selection of target minor irrigation projects, similar criteria are adopted as follows:

- Status of Project

  DPR is adopted as an indicator to measure the readiness of project implementation.

- Water Availability

  The same criteria adopted for medium irrigation project is applied for minor irrigation project as well. In addition, the number of months when the tank is full of water storage is added to judge water availability.

- Irrigation Practice

  The same criteria adopted for medium irrigation project is applied for minor irrigation project.

- Farmer's Organisation

  The same criteria as adopted for medium irrigation project is applied for minor irrigation project.

- Others

  The same factors adopted for medium irrigation projects regarding land acquisition and B/C ratio are maintained for minor irrigation projects.

  The original requirements for the proposed project are kept such as minimum size of command area and independency from other major or medium irrigation projects.

More detailed criteria together with the point distribution are given in Table 7.2.2 below.

Table 7.2.2 Selection Criteria of Target Minor Irrigation Projects

SN.	Items		Max.	Allocation of Points
C1	Critical	Command Area	-	[Excluded] < 40ha / [included] ≧40ha
C2		Independence	-	[Excluded] A part of medium/ [Included] Independence
C3		Land Acquisition	-	[Excluded] Required / [Included] Not required
C4		Benefit (BC Ratio)	-	[Excluded] < 1.0 / [Included] ≧1.0
S1	Status of Projects		10	[10] DPR has been prepared./ [5] Project Note has been prepared./ [0] Except above cases.
S2-1	Water Availability	Water Allocation (per ha)	3	[3] ≧1,200mm / [Proportional] ＜1,200mm
S2-2		Live Storage Capacity (per ha)	2	[2] ≧1,200mm / [Proportional] < 1,200mm
S2-3		Full water period (per year)	5	[5] ≧5 months / [Proportional] < 5 months
S3-1	Irrigation Practice	Construction Year	2	[2] ≧20 years / [Proportional] < 20 years
S3-2		Gap Ayacut	4	[4] 100 (%) / [Proportional] < 100 (%)
S3-3		Efficiency	4	[4] < 40% / [Proportional] ≧ 40%
S4-1	Famers' Organization	Water Cess Collection	5	[5] 100 (%) / [Proportional] < 100 (%)
S4-2		Willingness	5	[5] Confirmed / [0] Not confirmed
S5	Benefit (BC Ratio)		10	[10] ≧3.0 / [Proportional] < 3.0
Total			50	

Source: JICA Survey Team

7.2.3 Result of Evaluation

It is noted that for the final selection or ranking, available data and information are not yet sufficient and further studies are required to be carried out. Nevertheless, trial selection results are presented hereinafter.

(1) Trial Selection of Target Medium Irrigation Projects

The data for the scoring is as follows and summarised in Attachment 7.2.2.

a) Availability of DPR and project note, b) command area, c) water allocation, d) live storage capacity of dam, e) original construction year of the project, f) gap ayacut, g) water use efficiency, h) willingness

of farmer's association, i) water cess collection rate, j) necessity of land acquisition, and k) B/C ratio

Most of the data were obtained through requests to DoWR; however, h) construction cost and i) B/C ratio have been estimated by the JICA Survey Team. The estimated cost, expected benefit, and B/C ratio are described in Chapters 13 and 14.

Thus, the medium irrigation projects have been examined through the abovementioned selection criteria, and all the 20 projects have cleared the critical conditions. The top-ranked project is Upper Pennar with 42.7 points and the results of all the 20 medium irrigation projects are listed in Attachments 7.2.3 and 7.2.4.

(2) Trial Selection of Target Minor Irrigation Projects

The data used for selection of minor irrigation projects are:

a) Availability of DPR, b) command area, c) water allocation, d) live storage capacity of tank, e) average period of full storage in tank, f) original construction year of the project, g) gap ayacut, h) water use efficiency, i) willingness of farmers' association, j) water cess collection rate, k) necessity of land acquisition, and l) B/C ratio

Similarly to medium irrigation projects, all data were obtained from DoWR except for l) B/C ratio which was calculated by the JICA Survey Team. The results showed that 23 minor irrigation projects out of the 472 proposed projects have been discarded because they could not satisfy the critical conditions. Finally number of the target minor irrigation projects is 449 projects. The data employed for selection, scoring results, and summary by district and by "cluster" are given in Attachments 7.2.5, 7.2.6, 7.2.7 and 7.2.8, respectively.

7.3 Target Agricultural Produce for Value Addition

7.3.1 Two Levels of Food Value Chain Assistance

The planned project subject to this survey can be divided into two components, namely: modernisation of medium and minor irrigation projects including participatory project management, operation and maintenance, and sector reform including agribusiness infrastructure and marketing support services. The food value chain assistance falls into the latter component.

Based on the discussion with various stakeholders in the Government of Andhra Pradesh (GoAP), the JICA Survey Team came to a conclusion that assistance for food value chain should be provided in two levels, namely: strategic level and project level. While the assistance in the irrigation project level aims to improve livelihood of beneficiary farmers, upgrade their capacity for farm management, and improve efficiency of value chains at the grassroots level, the assistance at the strategic level will focus on developing a successful model, which is effective in competing in the global food market and can be replicated to other produce and other areas. Once the model is developed and replicated, the benefits will be spread to farmers growing other produce and in other areas. Those beneficiary farmers in the irrigation project will be in a better position to adopt a new model as their capacity is supposed to be developed through the support from the irrigation project.

In this way, the assistance at both levels can complement each other and contribute to the future development of agricultural sector in Andhra Pradesh State.

The target products for strategic assistance were decided based on the findings of the first field survey. The following sections explain the concept of strategic food value chain assistance, selection criteria for target products and result of evaluation.

7.3.2 Concept of Strategic Food Value Chain Assistance

The objective of strategic food value chain assistance is to develop a successful model which is effective in increasing competitiveness of agricultural produce in Andhra Pradesh State in order to realise sustainable food value chain development in the state. As the previous JICA study entitled 'Data Collection and Confirmation Study on Agricultural Value Chain in the Republic of India' identified, low quality, low safety, and low image of agricultural produce in Andhra Pradesh State as the biggest

bottlenecks for sustainable development of agriculture sector in the state. Unless the quality and safety of produce are improved, it is impossible for the Andhra Pradesh State agricultural sector to maximise the benefits from the growing but increasingly competitive global demand as well as domestic food market. The biggest challenge in improving the quality and safety of agricultural produce is improving farmers' farming techniques and practices as most of the farmers do not follow modern cultivation techniques.

With this understanding, the JICA Survey Team proposes a concept of food value chain assistance which utilises the pressure as well as remunerative price from the markets as leverage to motivate farmers to improve the quality and safety of the produce. The prime target market is the export market to advanced countries where the requirements for quality, safety, and traceability for food produce are high while offering relatively higher prices.

Source: JICA Survey Team

Figure 7.3.1 Concept of Value Chain Assistance

There are several produce such as mango or pomegranate that have successfully explored export markets in advanced countries. However, most of the farmers involved in such value chains are large farmers or progressive farmers who have had enough resources and capacities on their own, while majority of small farmers are left behind. Aggregating and involving the farmers who are willing to improve their techniques but deprived of resources will be crucial for improving efficiency of food value chains and increasing competitiveness of agricultural produce in Andhra Pradesh State while distributing its benefits to a wider population.

The JICA Survey Team proposes to conduct a pilot project on specific produce which have strategic importance on improving efficiency of food value chains in Andhra Pradesh State. The pilot project will support the value chain of specific produce targeting export market in advanced countries. The project taskforce will be formed for respective produce consisting of selected farmer's groups, processors, exporters, government departments, and related supporting industries. They work together to explore the target market. Exporters and processors instruct farmers the market requirements. The government provides assistance by applying existing schemes or devising and testing new schemes. Farmers, as a group, collaborate with governments, processors and exporters, and upgrade their techniques and capacity to grow safe and quality produce which satisfy the requirements of the target market.

Source: JICA Survey Team

Figure 7.3.2 Value Chain Assistance Pilot Project

Good practices and lessons will regularly be reviewed, shared, and reflected to the policy and system. The tasks and responsibilities of government departments will be reviewed and redefined through the pilot project. Based on the outcomes of the pilot project, the government structure and system should be transformed from the current production-oriented system to the market-oriented system.

The proposed pilot project is considered important not only for increasing competitiveness of agricultural produce in Andhra Pradesh State but also in demonstrating an attractive model for future development of the food industry in the state which combines the agricultural sector with the manufacturing sector in an optimal manner to attract participation of youth entrepreneurs as well as prospective investors. If the model is successful to attract the interests of entrepreneurs and investors, their contribution will further enhance the potential of food industries in Andhra Pradesh State and thus contribute to the sustainable food value chain development in the state.

7.3.3 Selection Criteria for Target Produces

In order for the pilot project to be effective enough to impact on the agricultural sector in Andhra Pradesh State while minimising risks of failure, the target produce to be selected should be competitive in various aspects.

The JICA Survey Team proposes five criteria for target produce selection, namely: production capacity, possibility for value addition, market trend, and access to existing processing industries and export markets, and possible linkage with irrigation project. The points for consideration for each criterion are explained below.

Table 7.3.1 Selection Criteria for Target Produces

Selection Criteria	Points for Consideration
1. Production capacity	➢ Established production capacity both in terms of production volume and quality ➢ Scope for further productivity/technical improvement
2. Possibility for value addition	➢ Variety of processed produce ➢ Possibility for upgrading VC in the future
3. Market trend	➢ Sufficient size and growth of market ➢ Potential for further growth in the future
4. Access to processing industries and export market	➢ Existence of well-functioning processing units ➢ Existence of experienced exporters to advanced countries
5. Possible linkage with irrigation project	➢ Possibility of produce to be grown in the catchment area of the planned irrigation project

Source: JICA Survey Team

The principle of selecting target produce is to utilise the existing strength unless the produce has comparative advantage in the global market, the pilot project which targets export to advanced countries will not be feasible. In this sense, existing production capacity (1) and access to processing industries and export market (4) are necessary as it is not easy to develop processing industries from scratch. What is especially important for the target produce, however, is that it should have a potential for upgrading farmer's skill and capacity which leads to improving quality and increasing safety of the produce. For

this purpose, scope of productivity and technical improvement (1) as well as possibility of value addition (2) are assessed. Besides considering that the production volume of target produce continue to increase through the pilot project, its market should be expanding (3). Lastly, possible linkage with irrigation project (5) is added to ensure synergy between the irrigation project and the food value chain assistance. If the target produce is grown in the catchment area of the planned irrigation project, the effects of food value chain assistance will be enhanced because of improved availability of irrigation water.

7.3.4 Result of Evaluation

(1) Agriculture and Horticulture Produce

Eight produces, namely: mango, chili, cashew, tomato, maize, coconut, groundnut, and banana were evaluated by applying the criteria explained above. These produces were selected for evaluation based on the recommendation from concerned departments in the GoAP. Geographical distribution was also taken into consideration. Respective produce were evaluated in five grades for each criterion based on data and information collected through the desk survey and observation and interviews in the site visits. All grades are agreed by the three members of the JICA Survey Team in-charge of the food value chain. The details of evaluation are shown in Attachment 7.3.1. The result of evaluation is shown below.

Table 7.3.2 Result of Evaluation for Agriculture and Horticulture Produces

Crop		Mango	Chili	Cashew	Tomato	Maize	Coconuts	Groundnuts	Banana
Area		South	Central	North	South	Central	North and Central	South	Central and South
Product		Fresh & processed mango	Dry chili and Oleoresin	Cashew kernel	Tomato paste	Starch and other value added products	Various processed products	Groundnut oil	Fresh and processed banana
Market		Export	Export	Export	Domestic	Export	Export	Export	Export
Production capacity	Existing capacity	5	5	5	5	5	4	5	3
	Potential for improvement	4	3	4	3	1	2	2	2
Possibility of value addition		5	5	3	3	4	4	2	2
Market demand		4	4	5	4	3	5	2	2
Access to processing and export		5	5	4	4	3	3	1	2
Possible linkage with irrigation project		2	3	2	3	4	1	3	3
TOTAL		25	25	23	22	20	19	15	14

5: Excellent 4: Good 3: Average 2: Poor 1: Very poor

Source: JICA Survey Team

Mango, chili, cashew, tomato, maize, and coconut are considered to satisfy the criteria and worthy to conduct a detailed survey while potentials of groundnut and banana are low and thus dropped from the list. The overall evaluations of selected produce is shown in Table 7.3.3 below.

Table 7.3.3 Selected Target Produces (Agriculture and Horticulture)

Produce	Overall Evaluation
Mango	➢ Excellent track record for exporting processed mangoes ➢ Possibility of upgrading VC for both fresh and processed mangoes ➢ A successful model case of export-oriented processing industry
Chili	➢ Guntur chili has good reputation in and outside India ➢ Potential for high-value added produce like oleoresin ➢ IPM and aflatoxin are the issues
Tomato	➢ Basic ingredient of Indian cuisine. Processed tomato has huge potential for domestic market as Indian lifestyle is modernised ➢ Producing tomato paste reduces wastage and saves foreign exchange ➢ Success of tomato could be a model for contract farming
Maize	➢ Potential for high value processing industry ➢ Possibility to impact on beneficiaries of irrigation project

Produce	Overall Evaluation
Coconut	➢ Export market of coconut produce drastically increased in recent years ➢ Good potential of developing small scale and community-based processing industries

Source: JICA Survey Team

Technical support for value chain development of those target products has a great potential to contribute for promotion of entire food processing industry in the Andhra Pradesh State. For example, support for cultivation techniques such as land preparation, grafting, pruning, grading etc. for mango and tomato can be fully applied for other horticulture crops such as pomegranate and papaya which are suitable for processing. Also, technical assistance for quality management such as kaizen and 5S can be utilized for any other food products which target overseas and high-end markets.

Support for Good Agriculture Practice (GAP) and Integrated Pest Management (IPM) are particularly important for value chain promotion of chili, as exporting chili to the target market requires strict chemical residue and fungus control. These practices are also very much applicable to other export oriented crops which are facing strict chemical standards. The Andhra Pradesh State is indeed producing crops with high potential for export such as herbs and spices, thus it will help expansion of contract type farming.

Lastly contract farming to be introduced in the pilot projects will be the model for contract farming for any other crops. The guidelines for contract farming will be developed based on the experience of pilot projects. This will enhance the efficiency of VC and become a basis of quality backward linkage which is prerequisite for supplying raw materials to global companies.

(2) Fishery and Animal Husbandry

For fishery and animal husbandry, the overall sector was reviewed first. Selected produce, which are considered to satisfy the criteria, were further evaluated. As Table 7.3.4 shows, shrimp, tuna, and dairy were selected as target produce. While shrimp and tuna were selected for their strategic importance as explained in Chapter 6.5.1 and 6.5.2, dairy was selected upon the request of the Andhra Pradesh State government as there is an urgent need to cope with excess supply issue. In order to tackle this issue in a sustainable manner, not only in short term but also a comprehensive and long-term strategy is required.

Table 7.3.4 Selected Target Produces (Fishery and Animal Husbandry)

Produce	Overall Evaluation
Shrimp	➢ Excellent track record for export ➢ Strong possibility of expanding farming areas ➢ Potential to further improve the quality of the produce by small- and medium-sized farms
Tuna	➢ Nearly untapped resource is abundant in the Bay of Bengal area ➢ High demand in global market ➢ Strong possibility to add value in capture as well as processing stage ➢ High potential to improve traditional fishermen's livelihood
Dairy	➢ Andhra Pradesh State is the sixth largest producer of milk in India ➢ Milk is an important source of income for small farm households ➢ Milk supply far exceeds its demand within the state. As the farmers have already aggregated, there is a potential to upgrade the value chain

Source: JICA Survey Team

Selected target produce were surveyed in more details during the second field survey in order to examine the feasibility and modality of assistance. Details are explained in Chapter 8.

In order to expand the export Good Aquaculture Practices (GAP) will be emphasized to prevent diseases outbreak in shrimp culture pond as well as to prevent water pollution. It will also prevent the excessive use of antibiotics. Residue of antibiotics and antioxidant in shrimp will be disaster for export market. Exercise of GAP may be applied other aquaculture species such as fresh water shrimp, mangrove crab, catfish.

Shrimp processing may need to shift to produce ready to cook products such as shrimp tempura and flitter. Technology to prepare ready to cook shrimp can be used to prepare other fisheries products using

fish and squid.

Fishing technology to be introduced for catching tuna efficiently can be used to catch marine, sailfish, dolphinfish, and other large pelagic fishes. Freshness testing equipment can be used for other fishes so that quality assurance will enhance competitiveness of India's fresh and frozen fish in high end export market.

Quick freezing and vacuum packing method used for fileted tuna (saku) and block will also be utilized for above species and increased value for export.

8. DETAILED FIELD SURVEY

8.1 General

JICA Survey Team surveyed 3 sample medium irrigation projects and 6 clustered minor irrigation projects in Vizianagaram District (during Jan 26-30, 2016), West Godavari District (during Jan 31 to Feb 4, 2016), and Chittoor District (during Feb 5-11, 2016). The objective was to survey detailed conditions of medium and minor irrigation projects to review the DPRs.

Regarding agriculture and horticulture, based on information obtained from the site visits as well as secondary data, the current situation in the three sample Districts that is Vizianagrama, West Godavari, and Chittoor Districts were clarified. Further typical crop budgets of major crops as well as cropping patterns under present and proposed conditions were also confirmed.

In addition to irrigation system and agriculture and horticulture above, the current conditions on animal husbandry and fishery, farmer organization, food value chain, food park, environmental and social conditions in and around sample projects were also clarified.

8.2 Irrigation System

8.2.1 Irrigation Projects for Sample Survey

(1) Criteria for Selection of Projects for the Sample Survey

As it is not possible to survey all the proposed projects in a limited time available in the survey period, a sample survey method has been adopted. The method takes into consideration the efficiency of the survey works and the accuracy of the cost estimates in relation to project size.

Step-1: Selection of Sample Medium Irrigation Projects

- One medium irrigation project in each region of the state
  Considering that the climatic and hydrological conditions and irrigation practices have different characteristics amongst geographical regions of the state such as north, central, and south, one medium irrigation project in each region is selected as sample projects to represent the entire Andhra Pradesh State.
- Medium irrigation projects of which the detailed project report (DPR) is already available and has the most details.
  It is considered that the preparation of DPR is indispensable for sample survey. It is desired that the DPR describes the engineering parameters as detailed as possible. After scrutinising the DPRs available, one in each region is selected through comparison of their descriptions in engineering viewpoints.

Step-2: Selection of Sample Minor Irrigation Schemes

- Minor irrigation tank projects close to sample medium irrigation projects
  Taking into consideration the easy access[1] to the sites, minor irrigation projects nearer to the selected sample medium irrigation projects are chosen as sample projects.
- Minor irrigation projects of which the command areas are greater than 40 ha (100 acre) as Water User Associations (WUAs) are not organised for minor irrigation projects with a command area less than 40 ha. It is considered that the involvement of a WUA is an important factor for successful operation of an irrigation project. Thus, DoWR has agreed to exclude minor irrigation projects with command area less than 40 ha (100 acre) from the proposal for the JICA loan assistance.
- Two minor irrigation schemes in each region
  Considering the limited survey period available, two minor irrigation projects in each region are selected for sample survey. As DPR is not prepared so far for any of the 472 proposed minor irrigation projects, it is difficult to select sample minor projects from technical

[1]The distance of easy access from the medium irrigation project site to the minor irrigation project sites is not defined; however, considering the limited time of survey, it is desirable that they are located closely.

viewpoints. To estimate the overall project costs, it is considered necessary to arrive at the costs of hundreds of minor irrigation projects based on the correlation between the command areas and construction costs. Therefore, amongst the minor irrigation projects filtered through a criteria cited at (a) and (b) above, the largest and the smallest ones are selected for sample survey.

(2) Projects Selected for Sample Survey

In accordance with the criteria cited above, three medium irrigation projects have been selected for sample survey. Out of the ten medium irrigation projects for which DPRs are originally available, one in each region has been selected resulting into a sample of three projects as summarised in Table 8.2.1.

Table 8.2.1 Medium Irrigation Projects with Completed DPR

Region	District	Project	CCA		Minor Irrigation Tanks			Comparison of DPR (Ranking)
			(ha)	(acre)	Total	Larger than 40 ha	Smaller than 40 ha	
North	Vizianagaram	Peddankalam	3,113	7,695	7	7	0	3
		Vottigedda	6,746	16,682	29	8	21	1
		VengalrayaSagaram	9,996	24,700	3	3	0	2
Central	East Godavari	Torrigedda	5,998	14,821	16	9	7	3
	West Godavari	Tammileru	3,711	9,266	20	18	2	1
	Prakasam	Mopadu	5,147	12,718	20	12	8	2
South	Chittoor	Krishnapuram	2,479	6,103	16	15	1	1
		Araniar*	2,226	5,503	21	20	1	2
	Anantapur	Upper Pennar	4,066	10,047	4	3	1	3
		Pennar Kumudvathi	2,479	6,126	10	9	1	4

*Note: * The 46 MI tanks are grouped into 21 system tank groups.*
Note: Underlined projects are selected for sample survey.
Source: JICA Survey Team

Next, the two minor irrigation projects near to each of the three medium irrigation projects have been selected resulting into six minor irrigation projects in total as shown in Tables 8.2.2, 8.2.3, and 8.2.4.

North Region

Table 8.2.2 Minor Irrigation Schemes for Sample Survey (Northern Region)

Medium Irrigation Project	Vottigedda Medium Irrigation Project, Vizianagaram District		
Mandal	Village	MI Tank	Command Area (acre)
J. M. Valasa	Kudama	Tamara	128
J. M. Valasa	Kudama	Dora	286
J. M. Valasa	China Merangi	Pratapasagaram	165
J. M. Valasa	China Merangi	Meda Banda	115
J. M. Valasa	Singanapuram	Garnika	114
J. M. Valasa	Chinamerangi	Chinni	110
J. M. Valasa	Gavarampeta	Gowrisagaram	235
J. M. Valasa	Parajapadu	Jagannadhasagaram	279
Substitution			
Garugubilli	Dalaivalasa	Konkamayya	376
Garugubilli	Ullibhadra	Tamara	114

Note: Underlined projects are originally selected for sample survey substituted by the two in the lowest row.

Source: JICA Survey Team

When the JICA Survey Team visited the sites, it was informed that selected Dora and Chinni tanks (underlined) were system-fed tanks of Vottigedda Medium Irrigation Project. It is considered that these tanks should be part of the medium irrigation project, thus, they were ruled out from the sample irrigation projects. Instead, the two schemes, Konkamayya and Tamara tanks, were selected as sample minor irrigation projects.

Central Region

Table 8.2.3 Minor Irrigation Schemes for Sample Survey (Central Region)

Medium Irrigation Project	Tammileru Reservoir Medium Irrigation Project, West Godavari District		
Mandal	Village	MI Tank	Command Area (acre)
Lingapalem	Ayyaparajugudem	Talla	116
Lingapalem	Narasannapalem	Vemanakunta	105
Lingapalem	Konijerla	Ura	285
Lingapalem	T.Ch.R.Palem	Pedda	500
Lingapalem	Konijerla	Kamaraju	218
Lingapalem	Chandrannapalem	Pula	110
Lingapalem	Sivapuram	Bendadi	196
Chintalapudi	Ganijerla	Ura	165
Chintalapudi	Raghavapuram	Venkatadri	467
Chintalapudi	Mallayagudem	Nadikattu	248
Chintalapudi	Pothunuru	Pedda	127
Chintalapudi	Mallayagudem	Panakala	179
Chintalapudi	Chintalapudi	Kopulakunta	150
Chintalapudi	Recherla	Edula	127
Chintalapudi	Settivarigudem	Medavarapu	411
Pedavegi	Muttanaveedu	Perumallakunta	131
Pedavegi	Koppaka	Pedda	1,054
Pedavegi	Koppaka	Chinna	159

Note: Underlined projects are selected for sample survey.
Source: JICA Survey Team

Southern Region

Table 8.2.4 Minor Irrigation Schemes for Sample Survey (Southern Region)

Medium Irrigation Project	Krishnapuram Medium Irrigation Project, Chittoor District		
Mandal	Village	MI Tank	Command Area (acre)
Karvetinagaram	K.P.Agraharam	K.P.Agraharam	205
S.R.Puram	Thungamitta	Thungamitta	246
Karvetinagaram	Kunchuvaripalle	KunchuvaripalleEguva	181
Karvetinagaram	Kunchuvaripalle	KunchuvaripalleDiguva	181
S.R.Puram	Mudikuppam	MudikuppamEguva	173
S.R.Puram	Mudikuppam	MudikuppamDiguva	175
Karvetinagaram	Lakshmipuram	Lakshmipuram	213
Karvetinagaram	Sekuvaripalle	Sekuvaripalle	216
Karvetinagaram	Battuvaripalle	Battuvaripalle	178
Karvetinagaram	Chokkamadugu	Chokkamadugu	118
Karvetinagaram	Krishnapuram	KrishnapuramDiguva	226
Karvetinagaram	Katherapalle	Katherapalle	326
Karvetinagaram	Kothur	Epili	148
Karvetinagaram	Annur (Padirikuppam)	AmmagariCheruvu	186
Karvetinagaram	Gopichettypalle	Naidu	326
Substitution			
Narayanavanam	Narayanavanam	Erikambattu	593
Narayanavanam	Thumbur	Thumbur	341

Note: Underlined projects are originally selected for sample survey, substituted by the two in the lowest row.
Source: JICA Survey Team

By the same reason as in the case of the north region, the sample minor irrigation projects selected (underlined) have been replaced by two other minor tanks (Erikambattu and Thumbur).

In summary, the projects listed in Table 8.2.5 have been selected and surveyed in the second stage of the survey work.

Table 8.2.5 Selected Sample Irrigation Projects

Region	District	Medium Irrigation		Minor Irrigation			
		Project Name	Command Area (ha)	Mandal	Village	Tank	Command Area (ha)
North	Vizianagaram	Vottigedda	6,751	Garugubilli	Dalaivalasa	Konkamayya	152
				Garugubilli	Ullibhadra	Tamara	46
Central	West Godavari	Tammileru	3,750	Pedavegi	Koppaka	Pedda	421
				Lingapalem	Narasannapalem	Vemanakunta	42
South	Chittoor	Krishnapuram	2,470	Narayanavanam	Narayanavanam	Erikambattu	240
				Narayanavanam	Thumbur	Thumbur	138

Source: JICA Survey Team

8.2.2 Sanction Procedure of Irrigation Projects

For major and medium irrigation projects to be approved for implementation, the following guidelines[2] are to be followed in India:

- Guidelines for Submission, Appraisal, and Clearance of Irrigation and Multipurpose Projects, (2010) issued by the Ministry of Water Resources, Government of India.
- Guidelines for Preparation of Detailed Project Reports of Irrigation and Multipurpose Projects (2010) issued by the Ministry of Water Resources, Government of India.

The guidelines stipulate (a) the procedures in obtaining clearance for irrigation projects and (b) procedures for submission of information to be described in the DPR.

For minor irrigation projects, state governments are empowered to sanction the projects by following the Indian Codes of Practice issued by the Bureau of Indian Standards, Government of India (GoI) from time to time.

The necessary procedures are different depending on whether or not the major or medium irrigation projects have inter-state issues as described hereunder.

i) Non Inter-State Project

The State Government obtains a certificate from the CWC to the effect that such project / scheme does not have any inter-State ramifications / implications. The State Governments are empowered to accord administrative approval for the major and medium irrigation projects which do not have inter-State ramifications. The State Government shall obtain all required statutory clearance(s) form the Ministry of Environment, Forests and Climate Change (MoEF), Ministry of Social Justice and Empowerment (MoSJE) and all other relevant Central Ministries. The State Governments shall send the copy of the administrative approval accorded by them to the NITI, MoWR / CWC and all the Central Ministries / Organisations concerned. Shortly speaking, the sanction can be made only by the state government.

ii) Inter-State Project

In this case, CWC is involved in all stages of procedures.The preliminary report is prepared and submitted to the Project Appraisal Organisation (PAO) of CWC, New Delhi in case of major projects, and to the regional CWC in case of medium projects. A checklist for the preliminary report is established in the guidelines.

After the review by the abovementioned institution and exchange of comments, revisions, and discussions, an ‘in-principal consent’ is given to the state government if the proposed project satisfies the requirements. With this consent, the state government is allowed to proceed to the next step. Obtaining the ‘in-principal consent’ would take 18 weeks. The ‘in-principal consent’ has a validity of three years. Unless the final sanction is obtained within this term, the ‘in-principal consent’ becomes invalid and the procedures have to be re-started.

[2]http://www.cwc.nic.in/main/webpages/Guide%20lines_&_Guide%20books_%20publications.html

The state government prepares DPR in accordance with the applicable Indian Standards and Guidelines after relevant surveys and investigations. All required sanctions such as environmental impact assessment (EIA), forest, resettlement, and rehabilitation (R&R) should be obtained from concerned institutions and appended to the DPR together with cost estimates. The report shall be submitted to PAO, CWC in New Delhi in case of a major irrigation project, and to the regional CWC in case of a medium irrigation project.

If the state has Design and Planning Organisation (Central Design Organisation (CDO) in the case of Andhra PradeshState) with sufficient competency to design, the said institution is authorised to furnish a certificate to the project. CWC shall examine only the inter-state aspect, basic planning, hydrology, and economic viability.The project authority shall submit the concurrence of the state finance.Once the project is accepted by CWC, investment clearance is to be obtained from NITI Aayog, GoI.

In case CDO certifies the project proposal, the appraisal will be completed within sixmonths, otherwise, it will take 12 months if the response to the observations of central agencies is received within three months. In case the estimated cost of major and medium irrigation projects has increased by more than 15% without price escalation, or the scope has been changed, revised DPR shall be submitted for examinationbased on the new scheme.

In the guidelines, the definition of 'inter-state' is not clearly stated; however, DoWR of Andhra Pradesh State interprets that all irrigation projects proposed for Andhra Pradesh Irrigation and Livelihood Improvement Project-II (APILIP-II) are not inter-state projects because of the following reasons:

- The sites of dams, headworks, and pumping station are within the state territory including the foreshore reservoir areas.
- The projects are modernisation of the existing project facilities and, as suchno change will occur regarding water allocations.
- Andhra Pradesh State is located at the tail end portion of inter-state rivers such as the Godavari and Krishna rivers. The projects do not affect other states in the upstream stretch.

The Guidelines for Preparation of Detailed Project Reports of Irrigation and Multipurpose Projects consist of the following five parts:

i) Guidelines for Preparation of Detailed Project Reports of Irrigation and Multipurpose Projects
ii) Guidelines for Preparation, Appraisal and Clearance of Flood Management Schemes
iii) Guidelines for Preparation of Detailed Project Reports of Modernisation of Irrigation Projects
iv) Guidelines for Preparation of Detailed Project Reports of Command Area Development Projects
v) References

For medium irrigation projects proposed for APILIP-II, Part-III shall apply. It requires detailed information in various areas such as hydrology, water resources, land potential, cropping pattern, crop water requirement, impact of modernisation, canal system, land acquisition, water management, on-farm development, construction programme, construction organisation, environmental aspects, economic evaluation, operation and maintenance. The guidelines contain checklist, items to be described as salient features, contents of report, and necessary annexures.

The important procedures for project sanction clearance are arranged in Attachment 8.2.1.

(3) Sanction Status of Irrigation Projects for APILIP-II

DoWR has prepared, as of April 2016, 12 so-called DPRs out of 20 proposed medium irrigation projects for APILIP-II. Out of the 12, eight DPRs have been sent to CWC, Delhi in 2013 and 2015 and it was verified that all of them were intra-state projects, not inter-state. DoWR have not taken further action to obtain technical and administrative sanctions so far. The status report given by DoWR in April 2016 is listed in Attachment 8.2.2.

As for the other 12 medium irrigation projects proposed for APILIP-II, no official proceedings have been made.

8.2.3 DPR Checklist based on CWC Guidelines

The DPRs received from DoWR are officially unapproved by CWC. The JICA Survey Team reviewed those DPRs based on the guideline (Government of India, Ministry of Water Resources, "Guideline for Preparation of Detailed Project Report of Irrigation and Multipurpose Projects 2010"). The guideline consists of four parts. Part-1 is "Irrigation and Multipurpose Project", Part-2 is "Flood Management Scheme", Part-3 is "Modernisation of Irrigation Projects", and Part-4 is "Command Area Development". Part-3 (Guidelines for Preparation of DPRs for Modernisation of Irrigation Projects) is appropriate for the target medium irrigation projects because the purpose of the projects is modernisation and rehabilitation.

According to the guideline, the DPR consists of three sections, namely: Section-1 is "Checklist", Section-2 is "Salient Feature", and Section-3 is "Report". In view of the technical points, Section-3 (Report) is the main part of the DPR. Section-3 includes hydrology, land, cropping pattern, interstate aspect, canal system, power, groundwater, and land acquisition.

Comparing the DPRs of the target medium irrigation projects and the guideline, the main part of DPRs is the cost estimates. Therefore, DoWR would prepare further studies to apply the DPRs to CWC in the future.

The JICA Survey Team reviewed the DPRs collected from DoWR based on the results of the field survey in view of technical points. The summary is shown in Table 8.2.6 and details are shown in Attachment 8.2.3.

Table 8.2.6 Summary of Review of DPRs Based on the Guidelines

Table of Contents		Medium irrigation Projects		
		Vottigedda	Thammileru	Krishnapuram
1.	Introduction	Insufficient	Insufficient	Insufficient
2.	Hydrology	Insufficient	Insufficient	Insufficient
3.	Reservoir	No mention	No mention	No mention
4.	Dam/Barrage/Weir	Insufficient	Insufficient	Insufficient
5.	Land Potential	Insufficient	Insufficient	Insufficient
6.	Cropping pattern and crop water requirement	Insufficient	Insufficient	Insufficient
7.	Pisciculture	No mention	No mention	No mention
8.	Horticulture	No mention	No mention	Insufficient
9.	Others	No mention	No mention	No mention
10.	Demand Table	No mention	No mention	Insufficient
11.	Impact of modernization proposal on existing, ongoing and proposed projects in the basin.	No mention	No mention	No mention
12.	International/interstate aspect	No mention	No mention	No mention
13.	Canal System	Insufficient	Insufficient	Insufficient
14.	Power	No mention	No mention	No mention
15	Navigation	No mention	No mention	No mention
16.	Ground Water	No mention	No mention	No mention
17.	Drainage and land reclamation	No mention	No mention	Insufficient
18.	Land acquisition, rehabilitation and resettlement	No mention	Insufficient	No mention
19.	Water management and maintenance	No mention	No mention	Insufficient
20.	On farm development	No mention	No mention	No mention
21.	Construction programme	No mention	No mention	No mention
22.	Construction organization	No mention	No mention	No mention
23.	Environment, Ecology and Forest aspects (details as per Para 17 Section-3 Part-II)	No mention	Insufficient	No mention
24.	Economic Evaluation	Insufficient	Insufficient	Insufficient
25.	Administrative and legislative provisions	No mention	No mention	No mention
26.	Facilities for training the operational and maintenance personal	No mention	No mention	Insufficient

Source: JICA Survey Team

8.2.4 Review of Medium Irrigation Projects

(1) Outline of Sample Medium Irrigation Projects

(a) Vottigedda Medium Irrigation Project

1) Outline

The Vottigedda Reservoir Medium Irrigation Project was constructed across the Vottigedda River from 1967 to 1976. The project covers 38 villages. Water for irrigation comes from the Vottigedda River which has tributaries to the Nagavali River in the northern part of Andhra Pradesh. Water is stored in the Vottigedda Reservoir. The canal system consists of two main channels i.e.,the right main canal and the left main canal.

The project area is made of stepped fields with moderate slopes seldomly exceeding 5%. Drainage lines are fairly defined with slopes. Thus, there is no problem on drainage or soil erosion. The command area lies between the Nagavari and Vottigedda rivers.

The main objectives of the project are: to utilise limited water resources efficiently and equitably in order to mitigate water deficiency in the project area especially in the lower reaches, to rehabilitate and improve the existing irrigation systems to the design standards in order to ensure equitable water supply to the designed command areas, to improve water management by introducing rotational water supply and training farmers ad operation and maintenance staff, and to improve the living standards of farmers in the project area.

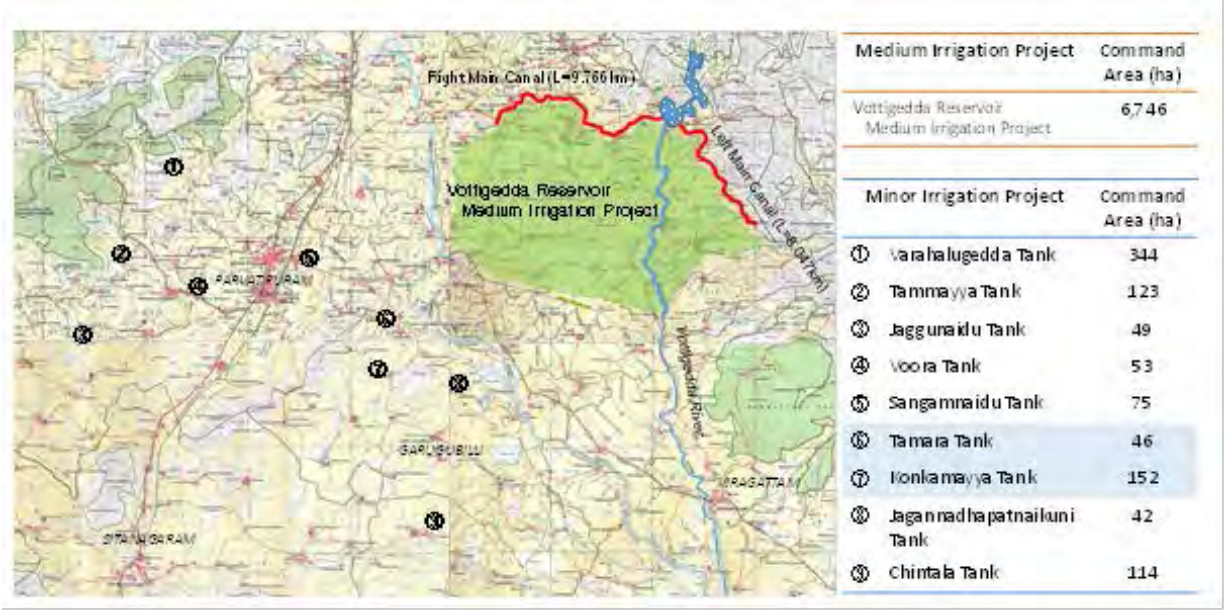
2) Location

The project is located near Raiwada Village in J.M. Valasa Mandalam of Vizianagaram District.

3) Command Area

The project command area is 6,746 ha.

4) Layout Map



Medium Irrigation Project	Command Area (ha)
Vottigedda Reservoir Medium Irrigation Project	6,746

	Minor Irrigation Project	Command Area (ha)
①	Varahalugedda Tank	344
②	Tammayya Tank	123
③	Jaggunaidu Tank	49
④	Voora Tank	53
⑤	Sangamnaidu Tank	75
⑥	Tamara Tank	46
⑦	Konkamayya Tank	152
⑧	Jagannadhapatnailuni Tank	42
⑨	Chintala Tank	114

Source: JICA Survey Team

Figure 8.2.1 Location Map of Vottigedda Medium Irrigation Project

5) Dimension and scope of works

Table 8.2.7 Scope of Works of Vottigedda Medium Irrigation Project

Facilities		Work Quantity		Facility Dimension		Contents of Civil Works
Dam	Live Storage	V=25.14x10^6	(m^3)			
	Catchment Area	A=285	(km^2)			
	Bund of Dam	L=2.152	(km)	Levelling and		Repair
	Chute Drains	L=2.152	(km)	Reshaping		Repair
	Parapet Wall	L=1.0(left side)	(km)	Downstream Slope		New construction
	Electrification					
	Lighting	N=1	(set)	Concrete		Reconstruction
	Generator	N=1	(set)	75kVA		Replacement
		N=1	(set)	75kVA		Recommendation
Spillway	Flood Discharge	Q=1507.6	(m^3/s)			
	Spillway (Gate)	N=4	(nos.)	B=12.2 H=6.1	(m)	Gate size
	Spillway Length	L=48.8	(m)			
	Spillway (Civil)					
	D/S Aprons	V =788	(m^3)	Concrete Wall		Reconstruction
	andTraining Wall					andextension
	Refreshing of	L=48.8	(m)	Surface of		Recommendation
	Surface	N=4	(nos.)	Concrete		
	Spillway Gate	L =200	(m)			Replacement
	Wire Ropes	L=200	(m)			Replacement
	Rubber Seals	N=12	(nos.)			Replacement
	Rollers	W=6000	(kg)			Replacement
	Stiffeners	L=48.8	(m)			Repair
	Painting			Host Platform and Gates		
Intake	Design Discharge	Left Side Q=1.70	(m^3/s)	B=1.2 H=1.2	(m)	
	Intake (Civil)	Right Side	(m^3/s)	B=1.8 H=1.8	(m)	Reconstruction
	Left Side	Q=6.40				Repair
	Right Side	N =1	(nos.)	Concrete		
	Intake (Gate)	V =123	(m^3)	Concrete Surface		Replacement
	Left Side	N=1	(nos.)			Replacement
	Right Side			B=1.2 H=1.2		Recommendation
	Reservoir	N=1	(nos.)	B=1.8 H=1.8		
		N=1	(nos.)	Desilting		
		V=		Excavation		
Canal	Design Discharge	Left Main Canal		Q=1.70	(m^3/s)	
		Right Main Canal		Q=6.40	(m^3/s)	
	Canal Length	Left Main Canal		L=8.047	(km)	
		Right Main Canal		L=9.756	(km)	
	Main Canal	C.C.Lining Canal		L=17.8	(km)	Reconstruction
		Earth Canal		L=0	(km)	
	Distributary	C.C.Lining Canal		L=7.0	(km)	Reconstruction
		Earth Canal		L=15.5	(km)	Repair

Source: JICA Survey Team

(b) Tammileru Medium Irrigation Project

1) Outline

The Tammileru Reservoir Project is a medium irrigation project constructed across the Tammileru River. The Tammileru River is one of the major rivers falling into Kolleru Lake. The river originates in the hills near Pothuvarigudem Village of Khammam District. The construction period commenced in 1969 and completed in 1980.

The project constructed a long back and canal system that is functioning for more than 32 years. The head works of the project like earth bund, chutes, spillway, and head sluices of the right main canal, left main canal, and the Mankollu Main Canal are totally damaged and require repairs. The entire canals and the Monkollu Main Canal systems are in a deteriorated condition and badly silted up and the ayacut is not getting adequate supply of water. With this condition, Ayacutdars are facing a lot of suffering.

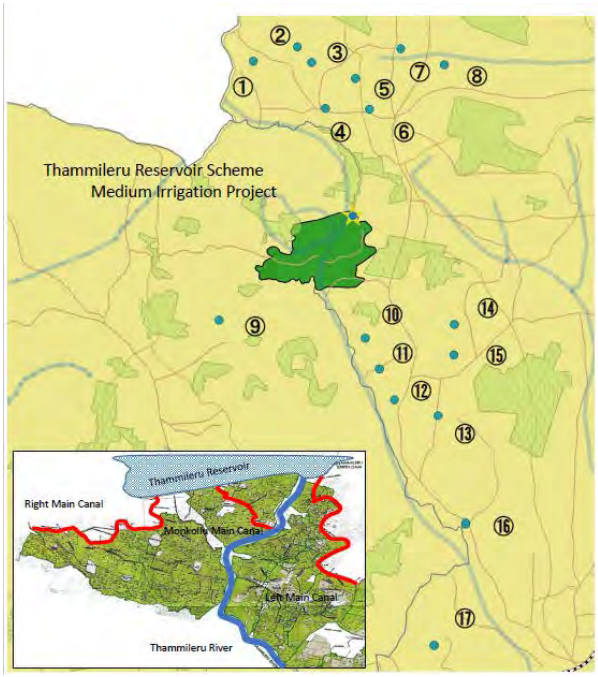
2) Location

The project is located in Nagireddigudem Village in Chintalapudi Mandal in West Godavari District

3) Command Area

The project command area is 3,711 ha.

4) Layout Map



Medium Irrigation Project	Command Area (ha)
Thammileru Reservoir Scheme	3,711

	Minor Irrigation Project	Command Area (ha)		Minor Irrigation Project	Command Area (ha)
①	Bendadi Tank	79.35	⑩	Pedda Tank	202.40
②	Venkatadri Tank	189.08	⑪	Ura Tank	115.34
③	Ura Tank	66.69	⑫	Rachappa Tank	32.38
④	Nadikattu Tank	100.44	⑬	Talla Tank	46.88
⑤	Panakara Tank	72.42	⑭	Vemanakunta Tank	42.55
⑥	Kopulakunta Tank	60.78	⑮	Pula Tank	44.50
⑦	Medavarapu Tank	166.43	⑯	Perumallakunta Tank	53.10
⑧	Edula Tank	51.25			
⑨	Rammana Tank	88.53	⑰	Pedda Tank	426.38

Source: JICA Survey Team

Figure 8.2.2 Location Map of Tammileru Medium Irrigation Project

5) Dimension and scope of works

Table 8.2.8 Scope of Works of Tammileru Medium Irrigation Project

Facilities		Work Quantity		Facility Dimension	Contents of Civil Works
Dam	Live storage	V=75.6x 10^6	(m^3)		
	Catchment area	A=611.24	(km^2)		
	Bund of Dam	L=6.4	(km)	Levelling &	Repair
	Chute drains &	L=6.4	(km)	reshaping	Repair
	toe drain &			Downstream	
	berm	L=(partly)	(m)	Slope	Repair
	Parapet wall				
	Electrification	N=1	(set)	Concrete	New construction
	Lighting	N=1	(set)		Replacement
	Generator	N=1	(nos.)	75kVA	New construction
	Maintenance room				
Spillway	Flood discharge	Q=736	(m^3/s)		
	Spillway (Gate)	N =3	(nos.)	B=12.9 H=4.6 (m)	Gate size
	Spillway length	L=38.7	(m)		
	Rubber seals	L=69.2	(m)	Host platform & gates	Repair
	Painting	L=38.7	(m)		Repair
Intake	Design discharge	Left side Q=5.097	(m^3/s)		
		Right side Q=2.55	(m^3/s		
		Mankollu Q=0.72	(m^3/s)		
	Intake (Gate)				
	Left side	N=1	(nos.)	B=1.22 H=1.8 (m)	Replacement
	Right side	N=1	(nos.)	B=0.91 H=1.52 (m)	Replacement
	Monkollu	N=1	(nos.)	B=0.91 H=1.52 (m)	Replacement

Facilities		Work Quantity	Facility Dimension		Contents of Civil Works
Canal	Design discharge	Left Main canal	Q=5.097	(m^3/s)	
		Right Main canal	Q=2.55	(m^3/s)	
		Mankollu Main canal	Q=0.72	(m^3/s)	
	Canal Length		L=11.985	(km)	
		Left Main canal	L=6.508	(km)	
		Right Main canal	L=3.38	(km)	
		Mankollu Main canal			
	Main Canal	Side wall canal	L=2.47	(km)	Reconstruction
		Earth canal	L=21.865	(km)	Repair
	Distributary	Side wall canal	L=2.00	(km)	Reconstruction
		Earth canal	L=21.206	(km)	Repair
	System Tank		N=10	(nos)	Repair

Source: JICA Survey Team

(c) Krishnapuram Medium Irrigation Project

1) Outline

The Krishnapuram Project is constructed across the Lava River. The project consists of construction of an earthen bund and vertical gates as well as right main canal and left main canal. Main canals were constructed to provide irrigation facilities to ayacut through the system tanks and also through the channelsdirectly pertaining to the villages both in Karvetibagaram and S.R.Puram mandals of Chittoor District.

As the canals are under the dilapidated condition, it is necessary to modernise the right and left canals for their entire length and also the distributary system and system tanks of left and right side canals of the Krishnapuram Project.

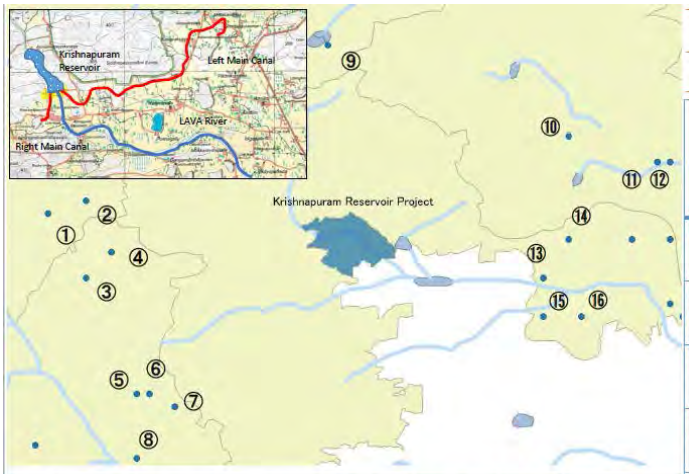
2) Location

The project is located in Krishnapuram Village in Karvetinagaram Mandal in Chittoor District.

3) Command Area

The project command area is 2,479 ha.

4) Layout Map



Medium Irrigation Project	Command Area (ha)
Krishnamuram Reservoir	2,479

Minor Irrigation Project		Command Area (ha)	Minor Irrigation Project		Command Area (ha)
⑤	Ellapalle Tank	50.52	⑪	Ayanambakan Tank	142
⑥	Pedda Tank	40.32	⑫	Thumbur Tank	138
⑦	Hissa Tank	45.61	⑬	Satrawada Tank	137
⑧	Rathi Tank	66.93	⑭	Netteri Tank	152
⑨	Rayala Tank	329	⑮	Mudipalli Tank	302
⑩	Erikambattu Tank	240	⑯	Netham Kandriga Tank	137

Minor Irrigation Project		Command Area (ha)	Minor Irrigation Project		Command Area (ha)
①	Ramalinga Samudram Tank	87.82	③	Hissa Tank	109.23
②	Pedda Tank	52.80	④	Pedda Tank	45.60

Source: JICA Survey Team

Figure 8.2.3 Location Map of Krishnapuram Medium Irrigation Project

5) Dimension and Scope of Works

Table 8.2.9 Scope of Works of Krishnapuram Medium Irrigation Project

Facilities		Work Quantity		Facility Dimension		Contents of Civil Works
Dam	Live storage	V=4.87.6x 10^6	(m^3)			
	Catchment area	A=61.9	(km^2)			
	Bund of Dam	L=445.4	(m)			
Spillway	Flood discharge	Q=1069	(m^3/s)			
	Spillway (Gate)	N =3	(nos.)	B=12.2	(m)	Gate size
	Spillway length	L=36.6	(m)	H=6.0		
	Spillway (Civil)					
	D/S apron	L=	(m)	Concrete		Repair
	D/S guide wall	L=	(m)	Concrete		Extension(New)
Intake	Design discharge	Left side Q=2.78	(m^3/s)			
		Right side Q=8.46	(m^3/s)			
	Intake (Gate)					
	Left side	N=1	(nos.)	B= H=	(m)	
	Right side	N=1	(nos.)	B= H=	(m)	
Canal	Design discharge	Left Main canal		Q=2.78	(m^3/s)	
		Right Main canal		Q=8.46	(m^3/s)	
	Canal length	Left Main canal		L=7.0	(km)	
		Right Main canal		L=4.05	(km)	
		Left tail end distributary		L=6.7	(km)	
	Main canal	Side wall canal		L=1.03	(km)	Reconstruction
		C.C.Lining canal		L=8.935	(km)	Reconstruction
		Earth canal		L=0	(km)	
	Distributary	C.C.Lining canal		L=23.2	(km)	Reconstruction
		Earth canal		L=0	(km)	
	System Tank			N=16	(nos)	Repair

Source: JICA Survey Team

The detailed field surveys of three sample project are shown in Attachment 8.2.4.

(2) Review of DPRs

The JICA Survey Team and DoWR reviewed the DPRs of three sample projects at the project sites. The contents of the DPRs are not generally based on the guideline as abovementioned. Hence study items mentioned in DPRs were reviewed. The DPRs of three sample projects are almost same components and mainly cost estimates. The JICA Survey Team conducted a review by checking DPRs, surveying at the project sites, and interview. The results of the review are shown in Table 8.2.10.

Table 8.2.10 Summary of Checklist for Medium Irrigation Project

Contents of DPR		Evaluation by JICA Team		
		Vottigedda (Vizianagaram)	Thammileru (West Godavari)	Krsihnapuram (Chittoor)
1. Hydrology	1.1 Water availability	OK	OK	No mention
	1.2 Inflow data	OK	No mention	No mention
	1.3 Upstream utilization	OK	No mention	No mention
	1.4 Maximum flood discharge	OK	OK	No mention
	1.5 Sedimentation	OK	OK	No mention
2. Farming	2.1 Present cropping pattern	OK	OK	OK
	2.2 proposed cropping pattern	OK	OK	OK
3. Water balance	3.1 Water resources	Recommendation (1)	Recommendation (2)	Recommendation (5)
	3.2 Water requirement		OK	
	3.3 Water balance		Recommendation (3)	
4. Facility design	4.1 Dam*	OK	OK	OK
	4.2 Spillway	OK	OK	OK
	4.3 Intake	OK	OK	OK
	4.4 Canal	OK	OK	OK
	4.5 Drip irrigation	OK	Recommendation (4)	Recommendation (6)
	4.6 Road	OK	OK	Recommendation (7)
5. Others	5.1 Land acquisition	OK	OK	OK
	5.2 Resettlement	No mention	OK	OK
	5.3 Data of crops	No mention	OK	No mention

**: Regarding dams including other sample medium projects, those repair and improvement are minor. Main improvement such as raising dam height is not required. It is confirmed with CE, CDO Hyderabad. This opinion coincides with the dam guideline in Japan.*

Remarks: Recommendation

(1) The JICA Survey Team could not collect the water balance report. The team recommends to prepare the documents and to confirm the balance.

(2) The JICA Survey Team confirmed at the kickoff meeting the following: Water availability is calculated by using the data.

(3) The JICA Survey Team recommended the following: The water balance should be evaluated based on the water availability and water requirement.

(4) The JICA Survey Team confirmed at the kickoff meeting thefollowing: It is possible to promote the drip irrigation in the project. Drip irrigation is proposed in and around Tammileru Project by the team.

(5) The JICA Survey Team recommended after the wrap up meeting the following: Command area is different between the existing and proposed project. Therefore, the water balance should be confirmed by calculating water requirement.

(6) The JICA Survey Team confirmed at the kick off meeting thefollowing: It is possible to promote the drip irrigation in the project. Drip irrigation is proposed in and around Krishnapuram Project by the team.

(7) The JICA Survey Team confirmed at the kick off meeting thefollowing: DoWR will discuss with other departments regarding road development.

Source: JICA Survey Team

8.2.5 Review of Minor Irrigation Projects

(1) Outline of Sample Minor Irrigation Projects

The JICA Survey Team visited Vizianagaram, West Godavari, and Chittoor District. The team surveyed six sample minor irrigation projects as shown in Table 8.2.11. All those projects are clustered around the medium irrigation projects.

Table 8.2.11 Outline of Sample Minor Irrigation Projects

Name	Location			Command Area
	District	Mandal	Village	(ha)
Konkamayya	Vizianagaram	Garugubilli	Dalaivalasa	152.29
Tamara	Vizianagaram	Garugubilli	Ullibhadra	46.22
Pedda	West Godavari	Pedavrgi	Koppaka	426.55
Vemanakunta	West Godavari	Lingapalem	Narasannapalem	42.55
Errikambatta	Chittoor	Narayanavanam	Narayanavanam	138.00
Thumburu	Chittoor	Narayanavanam	Thumbur	81.00

Source: JICA Survey Team

(2) Review of Scope of Works

Scope of works is almost the same among six sample minor irrigation projects as shown below in Table 8.2.12. The main scope of works is bund reshaping and surplus weir reconstruction and sluice reconstruction regarding tanks, supply channel reconstruction, and structures regarding canals.

Table 8.2.12 Scope of Works of Sample Minor Irrigation Projects

Items		Tank			Canal		
		Bund	Surplus Weir	Sluice	Supply Channel		Structure*
		Earth	Concrete	Concrete, Metal	Earth	Guide wall	Concrete
District	Project	(m)	(nos)	(nos)	(m)	(m)	(nos)
Vizianagaram	Konkamayya	700	1	3	800	-	-
	Tamara	700	1	4	1,650	-	-
West Godavari	Pedda	2,850	2	1	8,168	-	16
	Vemanakunta	1,150	2	3	4,500	-	4
Chittoor	Errikambatta	1,250	1	1	-	3,000	-
	Thumburu	1,250	1	1	-	2,900	-

*Remarks:*Bridge,aqueduct, etc.*

Source: JICA Survey Team

8.2.6 Water Balance Study

(1) Objective

The objective is to presume present cropping pattern by evaluating water resources and proposed cropping pattern by using water resources created by the modernisation projects.

(2) Methodology

The water balance is roughly calculated during the copping period by using monthly rainfall data.

(3) Command Area

The command area is based on the DPRs prepared by DoWR. The present gap ayacut is average in the region (north, central, and south) based on the abstract prepared by DoWR. Proposal gap ayacut is zero because irrigation efficiency improves after the rehabilitation project.

(4) Water Resources

The water resources are based on the water allocation allocated by Andhra Pradesh State government. Evaporation from the reservoir surface is based on an existing study report (Evaporation, Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India). Rainfall is based on statistics data (India Water Portal, average; 1901 to 2002 and 2009 to 2013). Live storage volume and return flow rate are based on the DPRs prepared by DoWR. Seepage from the reservoir is based on Japanese standards.

(5) Cropping Pattern

The cropping pattern is prepared based on the detailed field survey by the JICA Survey Team and the DPRs are shown below.

Table 8.2.13 Basic Approach of Cropping Pattern

	Vottigedda	Tammileru	Krishnapuram
Present	Crops during the Kharif season are paddy and pulses. This cropping area is decided by adjusting the paddy cropping area because water requirement of paddy is more than the other crops.	Crops during the Kharif season are paddy and pulses. This cropping area is decided by adjusting the paddy cropping area because water requirement of paddy is more than the other crops.	A yearlong crop is sugarcane. Crops during the Rabi season are paddy and groundnut. This cropping area is decided by adjusting the paddy cropping area because water requirement of paddy is more than the other crops.
Proposal	Thecrop planted during the Rabi season is pulses based on the DPR. Crops during the Kharif season are paddy and pulses. Those cropping areas are decided by adjusting the paddy cropping area because water requirement of paddy is more than the other crops.	Crops during the Kharif season are paddy and pulses. Thiscropping area is decided by adjusting the paddy cropping area because water requirement of paddy is more than the other crops.	Proportion of sugarcane cropping is same as present. Crops during the Rabi season are paddy and groundnut. This cropping area is decided by adjusting the paddy cropping area because water requirement of paddy is more than the other crops.

Source: JICA Survey Team

(6) Water Requirement

The water requirement is based on a guideline (A Guideline for Estimating Irrigation Water Requirements). Conveyance efficiency of canals is prepared based on KC Canal records by the JICA Survey Team.

(7) Effective Rainfall

The effective rainfall is based on the guideline (A Guideline for Estimating Irrigation Water Requirements).

The water balance is evaluated based on above studies. The gap ayacut becomes zero (0%) by improving conveyance efficiency (from 35% to 60%) and by reducing paddy cropping area and introducing water saving crops. The summary of the studies is shown in Table 8.2.14 and the details of the studies are shown in Attachment 8.2.5.

The cropping pattern is prepared based on the detailed field survey conducted by the JICA Survey Team

and the DPRs as basic approach as shown below.

Table 8.2.14 Summary of Water Balance Studies

Items		Vottigetta		Tammileru		Krishnapuram	
		Before	After	Before	After	Before	After
Command Area	(ha)	6,746	6,746	3,711	3,711	2,479	2,479
Gay Ayacut	(%)	14	0	28	0	61	0
Actual Irrigated Area	(ha)	5,802	6,746	2,762	3,711	744	2,479
Canal Conveyance Efficiency	(%)	35	60	35	60	35	60
Cropping Pattern							
Sugarcane	(ha)					503	1,289
[Kharif] Paddy	(ha)	1,915	4,115	775	2,041		
[Kharif] Pulses	(ha)	3,887	2,631	1,897	1,670		
[Rabi] Paddy	(ha)					164	198
[Rabi] Pulses	(ha)		2,024				
[Rabi] Maize	(ha)						
[Rabi] Groundnut	(ha)					300	992
Total (Kharif+Rabi)	(ha)	5,802	8,770	2,672	3,711	967	2,479

Source: JICA Survey Team

8.3 Agriculture and Horticulture

8.3.1 Production and Farming Practices of Major Cereals and Pulses

(1) Rice

(a) Production and Productivity

Rice (paddy) is the main staple food of Telugu people. The crop is cultivated throughout the year due to its photo-insensitive nature. Out of 6.4 million ha of total cultivated area, 2.4 million ha of land is under rice cultivation in Kharif (1.7 million ha) and Rabi (0.7 million ha) seasons with an annual production of 8.1 million tons of paddy (Productivity 3.40 tons per ha). Ideal soils for rice are medium to heavy black soils (Vertisols), redloams (Alfisols), alluvial silt loams (Entisols) and laterites (Oxisols).

(b) Seedling Preparation, Varieties, and Transplanting

In 95% of the farming situations, 30 kg paddy seed is shown in 250 sq meter nursery area (sufficient for one acre). Major varieties are MTU-1010and MTU-1121 in Rabi, while BPT-5204 and Swarna in Kharif.

Seedlings pulled out at 35-40 days after sowing (DAS) and transplanted manually. Planting density is around 33 seedlings per m^2 in Kharif, while around44 seedlings per m^2 in Rabi.

(c) Application of Fertilizer and Plant Protection

Fertilizer and pesticide application, weeding, harvesting, threshing and winnowing are carried out manually. However, farmers ought to be trained on dose, time and method of application of fertilizers and pesticides to avoid excessive use of these inputs and to reduce the cost of cultivation.

(d) Water Management

On puddling, water dept with 2 to 3 inches are kept. After that water is drained and shallow water is controlled for transplanting, while water is completely drained for direct sowing. After transplanting and sowing, water with 3 inches is kept until 10 to 15 days before harvesting. Especially, water is required at heading stage.

(e) Harvesting and Post-harvest

Manual harvesting and threshing by tractor, bagging and marketing to middle man, IKP (Indira Kranthi Pathakam) or Food Corporation of India.

(2) Maize

(a) Production and Productivity

Maize is a versatile C-4 crop with high productivity levels of 8-10 tons /ha in central region. Maize is mostly grown as an ID crop cultivated both in Kharif and Rabi due to its wide adoptability.

(b) Varieties and Sowing:

Single cross hybrids such as Pioneer, Siri, DHM, Laxmi and Kaveri-50 are popular with the farmers.

In central and northern regions, it is grown in Rabi after Rice as a direct-sown crop or zero-tillage Maize in Rice-fallows. Traditionally, pulses like blackgram or green gram are grown after Kharif rice in costal Andhra Pradesh State.

However, because of severe problem of yellow mosaic virus (YMV) disease transmitted by the vector white fly in pulses, farmers now replaced pulses with high yielding maize hybrids. Usually, farmers dibble the maize seed on ridges and herbicide is applied to control weeds.

Introduction of Mechanization, seed treatment with Captan, ridge sowing, thinning, drip / fertigation, raising intercrops like Pulses are recommended.

(c) Application of Fertilizer and Plant Protection

Urea: 175 kg, SSP: 200 kg, MOP: 50 kg and ZnSO4: 20kg/ha are applied. IPM practices help in pest management. Pre- and post emergence weedicides are commonly applied.

Protecting in the crop from pest, disease, birds, wild boars and monkeys will boost the yield levels and net profits.

Shoot borer is a problem and can be controlled by spraying Monochrotophos at 1.6ml/ltr 10 days after sowing.

(d) Water Management

Six times of furrow irrigations are given during 90 days crop period. Drip irrigation not only saves water but also provides water at the root zone for proper growth of plants. Critical stages for irrigation are 15, 30, 45 and 60 DAS.

(e) Harvesting and Post-harvest

Harvesting is carried out manually. Cobs are dried and shelled in shelling machine and bagging. It has multiple uses as food, fodder, feed, seed and industrial crop for extraction of starch.

(3) Groundnut

(a) Production and Productivity

Groundnut (Peanut) is an important oil seed crop in Southern region in both Kharif and Rabi seasons. In Coastal Andhra 0.87 million ha of area is under groundnut cultivation with the annual production of 0.51million tons/annum, the mean productivity being 1700 kg/ha.

(b) Varieties and Sowing

Khadiri-6, Narayani and Anantha. For rain fed crop in kharif a spacing of 30X10cm and 22.5 X 10cm for irrigated groundnut in Rabi is recommended. Seed treatment with Mancozeb and Imidacloprid, proper spacing (22.5 x 10 cm), ridge-sowing,

Application of NPK, Zinc, Borax and Gypsum at right time and Rhizobium inoculation of seed will double the pod yield kernel size.

(c) Application of Fertilizer and Plant Protection

Pest and disease are responsible lower yields in all the three regions. For Rabi groundnut, SSP@100kg/acre and 33kg MOP is apply in the last ploughting along with 20kg Urea. 10kg Urea is apply at 30 DAS in furrows and irrigated. Gypsum @200kg/acre is allied at flowering time.

Tikka leaves spot and Kalahasthi maladies are major threats to groundnuts cultivation. Seed treatment with 3g Manacozeb and 2ml of Imidacloprid per kg seed will control the pest and diseases.

(d) Water Management

6 to 8 times of furrow irrigations are given during 100 days crop duration.

(e) Harvesting and Post-harvest

When the leaves dry up at 100 DAS, the pods are ploughed out and dried till the moisture content is 12%. Then the pods are bagged in 40kg bags for market.

(4) Sugarcane

(a) Production and Productivity

Sugarcane is a tropical crop with high photosynthetic efficiency due to its C-4 path way and consequent higher productivity of 80-100 tons/ha. In AP Sugarcane is successfully cultivated in heavy black soils (Vertisols) red loams (Alfisols), alluvial silt loams (Entisols) and Laterites (Oxisols). In Coastal Andhra 0.87 million ha of area is under groundnut cultivation with the annual production of 0.51million tons/annum, the mean productivity being 1700 kg/ha.

(b) Varieties and Sowing

Co-6907, Co-8014, Vishwamitra, Vasudha and Bharani ser sowing is commonly practiced. Set-planting on ridges is commonly practices.

Seed treatment with carbendazim and malathion, bud-chip method of nursery raising, leaving 4-feet space between two rows is proposed.

(c) Application of Fertilizer and Plant Protection

250kg N, 100kg P2O5, 120kg K2O /ha is followed. Total P&K are applied in final ploughing, while N is given in three equal splits. Wooly aphids, scale insects and red rot are major pests and diseases which can be managed by IPM.

Fertilizer placement, mulching with cane straw, earthing up, propping, tieing the plants, irrigation at fortnightly intervals are proposed.

(d) Water Management

Conventional furrow irrigation is practised. Drip irrigation saves water and gives higher yields.

(e) Harvesting and Post-harvest

Harvesting manually. The harvest cane is transported to sugar factory within 24 hours of cutting. Machine for harvesting is urgently required to save labour and time, in order to harvest at correct stage of maturity, applying brix meter. Meanwhile, it is proposed in field to check color changing of stem or drying bottom leaves as a simplified method.

At present, sugar factories offer Rs.2,200/- to Rs.2,400/- ton of sugarcane.

(5) Black Gram (Phaseolus mungo)

(a) Production and Productivity

Next to pigeon-pea and chickpea, black gram (Mung bean) is an important pulse rich in proteins. In all the three regions of AP, black gram is mostly grown in rice-fallows in Rabi and it comes up with the conserved soil moisture. The productivity levels are low ranging from 500 to 600 kg/ha which is un-economical. With the introduction of high yielding Lam black gram varieties and YMV resistant PB-31, it is now possible to get 1,500-2,000 kg/ha.

(b) Varieties and Sowing

LBG-365, LBG-736 and PU-13 are popular. Sowing seed @40kg/ha is done by broadcasting in standing rice crop just before harvesting. Further, use of YMV resistant varieties like PU-31 is proposed, optimum seed rate, one irrigation at 30 DAS, weed control and Rhizobium inoculation of seed will double the

yields and net profits.

(c) Application of Fertilizer and Plant Protection

Usually no fertilizer is applied to the crop in rice fallows. Insects Maruca (chlorpyriphos @ 2.5ml/Ltr), Powdery mildew (Sulphur@3g-Ltr) and YMV are major pests and diseases. Growing YMV resistance variety PU-31 is suggested.

(d) Water Management

Generally, black gram comes up with the conserved soil moisture in rice-fallows and as such , no irrigation is given. For Rabi direct-sown Black gram, one irrigation at 30 DAS is recommended.

(e) Harvesting and Post-harvest

Black gram is harvested manually when the plant dry and threshing is done with tractor and the produce is bagged is bagged and marketed.

(6) Sesame

(a) Production and Productivity

Sesame (Gingelly) is an edible oil crop cultivated in rice-fallows and the crop comes up with the conserved soil moisture. The yield range from 500- 600 kg/ha which is very low.

(b) Varieties and Sowing

High yielding YLM-17 and local varieties are cultivated. Sowing is done using 7kg / ha of seed by broadcasting in rice-fallows.

It is proposed to use optimum seed rate, seed treatment with captan and Imidacloprid, and maintain spacing 30 x 15 cm.

(c) Application of Fertilizer and Plant Protection

No fertilizer is applied for the crop in rice-fallows. One spray of Monocrotophos @ 2ml/L is given to control the sucking pests and pod-borer.

(d) Water Management

No irrigation is given during crop growth period in rice-fallows. It is proposed that irrigation be done soon after sowing, at flowering and fruit development (Up to 70 DAS),

(e) Harvesting and Post-harvest

The Crop is harvested manually at 90 DAS and dried in open sun. The plants are threshed with tractor and seed is bagged and marketed.

8.3.2 Farming Practices for Horticulture Crops

(1) Tomato

(a) Production and Productivity

Deep, well-drained, sandy loam surface soil and a clayey subsoil with a pH of 5.5 – 6.8 is ideal for tomato cultivation. It is a day neutral plant and can be grow at any season of the year. However, the Tomato yields are low due to traditional methods of cultivation (10 tons/ha[3]). Earthing up and propping with bamboo poles improves the plant stand and higher yields (20 to 30 tons/ha). Crop rotations with Pulses and Legumes will break the life cycle of the pests and reduces the pest menace.

(b) Varieties and Sowing

Avinash-2, Naveen, Rupali, Meenakshi, Vaisali, Arka, Vikas, Pusa Ruby and All Rounder. Tomato seed @ 500g / ha is sown in a nursery and 25 days aged seedlings are planted in main field, following a spacing of 60cm X 45cm, planting on ridges and furrows during October.

[3]: Site visit data by JICA Survey Team

(c) Application of Fertilizer and Plant Protection

SSP @ 300 kg and MOP @100kg / ha are applied in last ploughing. Urea at 220 kg / ha is applied in three equal splits at 30, 45, and 60 DAP.

Thrips, fruit borer, Fusarium and Bacterial wilt can be managed by IPM schedules and by growing trap crops like Marigold and Maize.

(d) Water Management

Ten furrow irrigation are given during 150 day crop duration. Irrigation during establishment flowering, fruit setting are the critical stages for irrigation of tomato. Drip irrigation is common. Higher temperature during April, May and June inhibit the flowering and fruit-setting

(e) Harvesting and Post-harvest

Fruits are harvested when they turn red, graded and sold in the market. For transport, the fruits are kept in plastic trays and send them to markets through trucks.

(2) Chilli

(a) Production

In Coastal Andhra, 0.14 million ha of area is under chilli cultivation. With the annual production 0.53 million tons of dry chilli. The average productivity is 3750 kg/ha of dry chillie. Green chillie is 30 tons/ha while it is 3 tonnes/ha in case of dry chilli. The crop grows well in warm and humid climates and temperature ranging from 20 – 25℃ and in all the three regions, chillie is propagated by seed.

(b) Varieties and Sowing

Tulasi, Swathi, Venus, Nagma, Tejaswini, and Pusa-Jwala, are popular hybrids besides local varieties G-4 and G-4. Chilli seeds @ 500g/ha is sown in an elevated nursery beds for 45 days and planted in very finely prepared fields.

A seed rate of 500g/ha is used and nursery bed size of 20m x1m x 0.15m is prepared by mixing compost and sand. The seed is sown on raised beds. The seed germinates in 7 days time and seedlings are pulled out at 45 days after sowing (DAS) and planted in the finely prepared land at a spacing of 60cm x 45cm on ridges followed by irrigation. The crop duration is 150 – 180 days and vegetative stage extends up to 75 – 80 days and 75 – 85 days is the reproductive phase. Flowering starts at 45 DAP. Fruit setting is a problem during April to June due to high prevailing temperatures.

(c) Application of Fertilizer and Plant Protection

Total Phosphate @ 300kg SSP/ ha is apply in last ploughing. Urea @ 250 kg / ha and MOP @ 100 kg /ha are applied in four equal splits i.e. at planting, 30, 50 and 70 DAP followed by furrow irrigation.

Farmers use heavy doses of fertilizers, Irrigation, and chemical pesticides and fungicides leading to heavy pesticide load in the green and dry chillie causing often export rejections. Thrips, fruit borer, Fruit rot, Die-back and Bacterial wilts are the major pests and diseases causing considerable crop loss.

(d) Water Management

Ten irrigations are given during 150 days crop duration.

(e) Harvesting and Post-harvest

Harvesting at full-ripe stage and sun-drying to maintain 8 – 10% moisture in the dry fruit and Post Harvest Product Management (PHPM) would sustain good prices and higher net returns.

Usually, chillie harvesting is done manually four times and sold in the market as green chillie. In case of dry chillie, the fruits allowed to fully ripe on the plant, harvested and dried in open sun and stored in gunny bags for sale.

(3) Mango

(a) Production and Productivity

Generally mango varieties like Bangenapalli, and Rasaalu in central region, Suvarna Rekha and Panukula Manu in Northern region and Totapuri, Neelam and Alphanso in Southern region are extensively cultivated with low productivity levels of 10 – 15 tons/ ha. Economic yield starts after 6 years of planting and will continue to give yield up to 25 years of age.

(b) Varieties and Sowing

Totapuri and Neelam in south, Rasaalu and Bangenapalli in central region and SuvarnaRekha and Panukula Manu in northern region are most popular varieties cultivated. Healthy grafts developed from seeds are planted.

The low yield levels are mainly due to wider spacing (10m x 10m), low density of population (50 – 60 plants /ha), neglected management of water, nutrient, pest and diseases and absence of trimming and pruning. Introduction of high yielding, pest and disease resistant varieties, adoption of high density of population (a spacing of 2.5 m x2.5 m) to accommodate 1,600 plants / ha, regular nutrient, pest and disease management and use of Growth Regulators like Kalthar, would double the yield, fruit size and quality.

(c) Application of Fertilizer and Plant Protection

Fertilizers @ 2 kg Urea, 4 kg SSP and 2 kg MOP / bearing tree are applied in two equal splits first during June-July and second time during December-January. Fertilizers are applied in basins covered with soil and furrow irrigation is given. Monocrotophos @ 2 ml/L to control mango hoppers and wettable Sulphur 3g/L to control powdery mildew are applied.

(d) Water Management

Flood irrigation of basins is practised at fortnightly intervals.

(e) Harvesting and Post-harvest

Ripe fruits are harvested, graded and marketed to middle men. Pickle varieties are harvested at mature stage and processed for pickle-making.

Post Harvest Product Management (PHPM) for quality control and adding value to the product through processing will go-a-long way in sustaining the crop on a long term basis.

(4) Coconut

(a) Production

Coconut is a perennial plantation crop extensively cultivated in all the three regions of AP. Generally, a healthy palm gives 10,000 – 12,000 nuts / ha / annum. At present, nut and copra yields are low ranging from 5,000 – 6,000 nuts / ha / annum. Economic yield starts after 6 years of planting and will continue to give yield up to 50 years of age.

(b) Varieties and Sowing

East-Coast Tall, Gouthami-Ganga, Double Century and Kalpa Prathibha are popular varieties cultivated by farmers in all the three regions of coastal Andhra. One year old seedlings raised in nursery are planted in the main field the economic yield starts from 6th year onwards.

Traditionally, a wider spacing of 7.5m x 10m is adopted to accommodate 125 plants per ha. In Coastal Andhra, Coconut palm is an essential component of homestead farming system.

Closer spacing of 7.5m x 7.5m accommodating 175 plants / ha, intercropping with legumes/ Cocoa, adopting IPM, INM and water management practices will improve the nut and copra yields and profits.

(c) Application of Fertilizer and Plant Protection

One kg Urea, 2kg SSP, and 2.5kg MOP / tree are applied in two equal splits, first during June-July and the second during December- January months followed by irrigation of the basin. Monocrotophos @ 2

ml / L by root -feeding to control the mite and caterpillars'.

The low yields are mainly due to low yielding varieties, low plant population, wider spacing, poor nutrient and water management, pests like Eriophid mite, black and red- headed hairy caterpillars and diseases like Ganoderma and bud rot.

Eriophid mite, red and black headed hairy caterpillars and bud rot are major pest and diseases causing damage to nut yield and quality of copra. Bio control methods and IPM practices developed by Coconut Research Station, Ambajipeta will help in pest and disease management in coconut gardens.

(d) Water Management

Irrigation is given by flooding the basins at monthly intervals. Green manure crops are grown in the basins to conserve water and to improve the soil fertility.

(e) Harvesting and Post-harvest

The ripe nuts are removed manually and dried in sun and marketed. Tender nuts are harvested and sold as coconut drink which works as an electrolyte and sugar and potassium supplement to human body. Coconut oil extracted from dried copra serves as anti-oxidants and nutrient supplement when applied to head and human body.

(5) Banana

(a) Production and productivity

The average productivity levels of banana in coastal Andhra is 30tons /ha while it is just half of it (15 tons/ha) in the world.

(b) Varieties and Sowing

Tella Chakera Keli (TeKeli), Karpura Chakera Keli (K.C Keli),Amruthapani, Poovan, Rasthali, Dwarf Cavendish and Grand Naine are very popular with the farmers.

Banana propagated through suckers, rhizomes and tissue culture plantlets in three regions.

Furrow, pit or trench methods of planting are practised by the local farmers. The suckers/rhizomes are planted in pits of size 45cm x 45cm x 45cm at a spacing of 1.8m x 1.8m accommodating a plant population of 3000 plants/ha in case of T.C. Keli. In case Dwarf Cavendish, a spacing of 1.5m x 1.5m is followed accommodating a plant population of 4,400 plants/ha. For K.C. Keli, a spacing of 2.1m x 2.1m accommodating around 2,300 plants/ha is followed.

(c) Application of Fertilizer and Plant Protection

Besides 25kg FYM, a fertilizer dose of Urea @ 440g and MOP @ 680g/plant is applied in six equal splits at monthly intervals. The total P dose of SSP @ 312g/plant is applied as basal at planting. Rhizome weevil, nematodes and bunchy top are the major pests, while leaf spot is major disease that cause considerable yield loss which can be managed by IPM practices.

(d) Water Management

Banana is a water loving plant and the crop requires 30 – 40 weekly irrigations during the crop growth period of one year.

(e) Farm Management

Weeding is done manually at quarterly intervals. Thrashing by removing dried leaves and earthing up is carried out at half yearly intervals.

(f) Harvesting and Post-harvest

Banana bunches will be ready to harvest after 12 months of planting. Propping with bamboo are wooden poles is essential to prevent the plants from falling due to strong winds.

Mature fruit bunches are harvested and smoke-cured in curing chambers for 24 hrs till yellow colour appears. The fruit bunches taken out from the chambers and sold in the market as bunches or hands.

Vegetable banana variety Kovvuru Bontha is harvested mature and green stage and used as a vegetable curry.

Yield is estimated at around 30 ton/acre.

8.3.3 Constraints and Countermeasures

Constraints and countermeasures in agricultural activities in Andhra Pradeshare described in Attachment 8.3.1 and summarised as follows:

(1) Labour Scarcity

At present, timely availability and higher wages of labour force are serious problem faced by farmers. Further due to migration of labour to nearby towns and cities and lack of interest in farming by rural youth, scarcity of labour is encountered. Considering the current situation mentioned above, promotion of farm mechanisation would be helpful to overcome the labour scarcity, and to complete the work in short time at lower cost. Proposed farm machinery is shown as follows:

Table 8.3.1 Crop-wise Proposed Farm Machinery

Crop	Farming Practices	Farm Machinery
Rice	Tilling/Puddling	Power Tiller
	Direct Sowing	Drill seeder
	Transplanting	Transplanter
Maize	Sowing	Seeder
	Weeding	Power weeder
	Harvesting	Harvester
Pulses	Weeding	Power weeder
	Harvesting	Harvester
Groundnut	Ridging	Ridger
	Sowing	Seeder
	Harvesting	Harvester
Sugarcane	Ridging	Ridger
	Weeding	Power weeder
	Harvesting	Harvester

Source: DOA, DOH, and JICA Survey Team

(2) Vagaries of Weather (Droughts, Floods, and Cyclones)

Since the rainfall is uncertain and availability of water resources are limited, it is imperative to convince the farmers to grow ID crops viz. maize, groundnut, pulses, and sunflower in the Kharif season in place of rice in the project area in order to conserve water and to produce other food crops and simultaneously reducing the cost of cultivation and to get more net profits. Critical stages against climatic condition are summarised as follows.

Table 8.3.2 Crop-wise Critical Stages against Climatic Conditions

Crop	Heat Stress (Higher Temperature)	Heavy Rainfall/Drought
Rice	Reduction division stage	Panicle initiation stage Reduction division stage Heading Graining filling Milking stage
Maize	Sowing stage Flowering stage Tasseling stage	Sowing stage Silking stage Tasseling stage Grain formation stage
Pulses	Flowering	Sowing stage Flowering

Crop	Heat Stress (Higher Temperature)	Heavy Rainfall/Drought
Groundnut	Flowering Pegging Pod formation	Sowing stage Flowering Pegging Pod formation
Sugarcane	Flowering	Planting stage Flowering
Tomato	Flowering stage	Planting stage Flowering stage Establishment stage Fruiting
Chilli	Flowering stage	Planting stage Flowering stage

Source: DOA, DOH, and JICA survey team

(3) Indiscriminate Use of Agro-chemicals

Lack of awareness on application of agro-chemicals resulting to indiscriminate use. Balanced and integrated use of fertilisers and pesticides is recommended. Meanwhile, too less or too excessive use of fertilisers and pesticides can adversely affect the environment and the crop health so rational use of these chemicals is advocated. Rational and need-based agro-chemical use will reduce the cost of cultivation while effectively controlling the pests and diseases. Optimum use of chemicals on need- basis is suggested for sustaining high yields and pest management. Accordingly, IPM and crop rotations are required for insect and pathogen management.

(4) Insufficient Storage Facilities for Farm Produce (Go-downs and Warehouses) in Villages

Public and private agencies should build sufficient go-downs and warehouses at production sites in villages. For tomatoes, loss due to fruit damage is very high. Farmers are advised to grow tough-skinned tomato varieties like Arka and Rakshak to withstand transport shocks.

Dry chilli needs go-downs and warehouses for storage. In Guntur, the Centre of International Trade, a number of airconditioned go-downs are used for storing dry chillis. Farmers would store the produce in go-downs and sell the chillis when the market prices are high and get higher profits.

8.3.4 Cost and Profit per Crop and Region-wise Cropping Patterns

Based on the findings as well as information through field survey and other relevant secondary data, crop budget of major crops in the project area under present and proposed conditions are shown in Attachment 8.3.2 and summarised as follows.

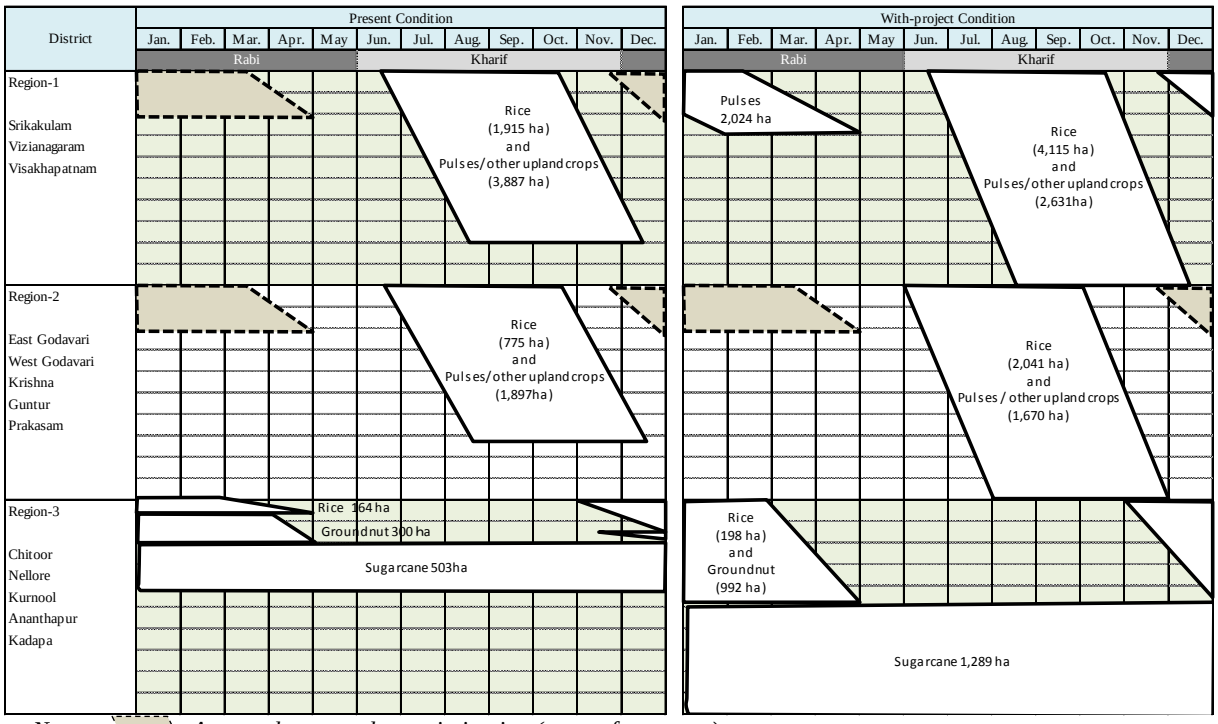
Table 8.3.3 Cost and Profit per Crop

(Unit:INR/ha)

Crop	Present Condition			Proposed Condition		
	Gross Income	Cost	Net Income	Gross Income	Cost	Net Income
Rice (Rabi)	81,500	38,300	43,200	95,100	43,500	51,600
Rice (Kharif)	68,000	39,600	28,400	81,500	43,400	38,100
Maize	89,000	42,300	46,700	103,800	44,900	58,900
Groundnut	74,100	41,800	32,300	98,800	44,000	54,800
Black Gram	37,100	13,300	23,800	64,900	18,600	46,300
Sugarcane	163,100	101,500	61,600	190,300	106,000	84,300

Source: JICA Survey Team, based on field visit, secondary data from DoA and Package of Practices (POP)

Meanwhile, present and proposed cropping patterns by regions are shown in Figure 8.3.1.



Note: Area under groundwater irrigation (not surface water)
Source: JICA Survey Team

Figure 8.3.1 Region-wise Cropping Patterns under Present and With-project Conditions

8.3.5 Extension and Research Agencies

(1) Agricultural Technology Management Agency (ATMA)

The Agricultural Technology Management Agency (ATMA) works as a link between the Department of Agriculture and farmers at the district level. The ATMA at the district level would be increasingly responsible for all the technology dissemination activities at the district level. It would have linkage with all the line departments, research organisations, non-governmental organisations, and agencies associated with agricultural development in the district. Research and extension units within the project districts such as Zonal Research Station (ZRS) or sub-stations, Krishi Vigyan Kendras (KVKs), and the key line departments of agriculture, animal husbandry, horticulture and fisheries would become constituent members or key stakeholders of ATMA. Each researchextension(R-E) unit would retain its institutional identity and affiliation but programs and procedures concerning district-wise R-E activities would be determined by ATMA Governing Board to be implemented by its management committee (MC).

This scheme was approved on March 29, 2005. The scheme has made the extension system farmer driven and farmer accountable. Two hundred thirty-sevenATMAs at the district level have been set up to operationalise the extension reforms with active participation of farmers/farmer groups, non-governmental organisations (NGOs), Krishi Vigyan Kendras, Panchayati Raj institutions, and other stakeholders operating at the district level and below. The release of funds are based on Strategic Research and Extension Plan (SEWP)/State Extension Work Plans (SEWPs) prepared by the state governments. State level extension plans have been developed keeping in mind the strategic extension needs of the farmers. Two hundred fifty-twodistricts across all the states/UTs in the country were covered under the scheme during the tenthplan.

i) Objectives of ATMA

- To strengthen research – extension – farmer linkages.
- To provide an effective mechanism for coordination and management of activities of

different agencies involved in technology adaption/validation, and dissemination at the district level and below.

- To increase the quality and type of technologies being disseminated.
- To move towards shared ownership of the agricultural technology system by key shareholders.
- To develop new partnerships with the private institutions including NGOs.

ii) Salient Features of ATMA

- Creating a Farmer Advisory Committee to improve feedback.
- Using NGOs to organise farmers.
- Encouraging private sector involvement in technology transfer.
- Validation and refining technologies through research units in the district.
- Bottom up planning procedure.
- Increased use of information technology (ARIS, WWW)
- In-service training to increase staff competence.
- Developing new public-private partnerships.
- Formation and strengthening of farmer's interest group.

(2) Krishi Vegyan Kendras (Farm Science Centres)

The Indian Council of Agricultural Research (ICAR), New Delhi has started the Krishi Vigyan Kendras (KVKs) in all the districts of the country with the following mandate. In the state of Andhra Pradesh, there are 13 KVKs in all the districts.

i) Mandates

- Conducting on-farm testing to identify the specific location of agricultural technologies under various farming systems.
- Organising frontline demonstrations to establish production potential of various crops and enterprises on the farmers' fields.
- Organising need based training for farmers to update their knowledge and skills in modern agricultural technologies related to technology assessment, refinement and demonstration, and training of extension personnel to orient them in the frontier areas of technology development.
- Creating awareness about improved agricultural technologies among various clienteles through an appropriate extension programs
- Production of quality seeds, planting materials, livestock breeds, animal products, bio-products etc., as per the demand and supply the same to different clienteles
- Work as resource and knowledge centre of agricultural technology to support the initiatives of public, private, and voluntary sectors for improving the agricultural economy of the district.
- Each KVK is provided with 16 technical and non-technical staff headed by the programmecoordinator (associate professors cadre) and six subject matter specialists (assistant professors cadre) in the discipline of crop production, extension, horticulture, plant protection, animal sciences, home sciences, etc., are provided to assist and implement the mandated activities of KVK. Furthermore, three training assistant cadre – farm manager, programme assistant (computer) and one programme assistant in the most relevant discipline are also provided to assist the programme coordinator and his staff to carry out the functions of KVK.
- The Krishi Vigyan Kendras provide intensive hands-on training in various aspects of agriculture, horticulture, animal husbandry and so on to encourage unemployed farm youth and farmwomen to start their own agro-based enterprise in their locality. These KVKs would also conduct on-farm testing of various agricultural and allied technologies for refinement and conduct frontline demonstrations on oilseeds, cereals, and pulses.

- The Scientific Advisory Committee (SAC) is the advisory body to plan and review the activities of KVKs. The SAC is headed by the vice-chancellor as the chairman, director of extension, zonal coordinator, ICAR, and officers of the developmental departments of the district, two farmers, two farmwomen as members, and the programme coordinator of KVK as a member – secretary.

ii) Activities

- Organising training programmes
- Providing soil, plant, and water testing laboratory facilities
- Setting up of demonstration units
- Production of quality seeds, planting materials and bio-control agents
- Providing advisory and consultancy services
- Conducting need-based training programmes

Each district in Andhra Pradesh has one KVK working for transfer of proven agricultural technologies to farmers' fields in the rural areas.

(3) State Agricultural Management and Extension Training Institute (SAMETI)

The State Agricultural Management and Extension Training Institute (SAMETI) is registered as an autonomous institute with the mandate of capacity building for related agricultural extension system to promote agricultural development. It conducts courses on participatory extension management, project management, watershed management, human resources management, information technology, etc. It also provides consultancy on agricultural extension management. It has training hall facilities well-equipped with conference system and multimedia projectors.

SAMETI has linkages with state agriculture and horticulture universities and other institutes such as MANAGE Hyderabad, NIAM Jaipur, and EEI Nilokheri. SAMETI organises workshops/trainings through the use of resource universities and institutes which cover field extension management, marketing management, technical/postharvest management, information technology, organic farming management, etc.

SAMETI promotes the extension and management tools for improving efficiency in extension services which covers i) extension management skills, ii) participatory approaches and PRA tools, ii) group mobilisation and team building, iii) human resource management, iv) farming system approach, and v) market led extension and marketing management.

Since SAMETI has facilities for trainings and workshops with resource persons in various disciplines, it is understood that this institute has potential in strengthening the existing extension functions, in cooperation with the Department of Agriculture (DoA).

(4) National Institute of Agricultural Extension Management (MANAGE)

The National Institute of Agricultural Extension Management (MANAGE) is an autonomous organisation under the Department of Agriculture and Cooperation (DAC), Ministry of Agriculture (MoA), and the Government of India (GoI). The institute was established in 1987 at Rajendranagar, Hyderabad in response to the challenges of agricultural extension in a rapidly growing and diverse agriculture sector. The transformation of Indian agriculture into an increasingly commercialised and market-driven activity, and the increasing complexity of agricultural technology, called for major initiatives towards reorientation and modernisation of the agricultural extension system.

The mandate of MANAGE is to assist GoI and states/UTs to help improve delivery mechanisms in agriculture and allied sectors through need-based changes in policies and programs and also by improving the knowledge, skills, and attitude of extension personnel. MANAGE offers its services in training, research, consultancy, extension, management education, etc. and implements select central-sector schemes.

Training of extension functionaries, working in the departments of agriculture, animal husbandry, and veterinary science, fisheries in various states/UTs as well as in the private sector is an integral part of the mandate of MANAGE. As part of capacity building, MANAGE conducts training programs,

workshops, and seminars on key theme areas of current importance in agriculture and allied sectors.

The research activities of the institute focus on topics of contemporary relevance. MANAGE undertakes 'action research' to pilot-test the ideas/concepts/technologies in field situations on a limited scale and in a limited area. MANAGE also undertakes evaluation studies on the request of GoI/states/other organisations, on consultancy basis, for evaluation of various programs/projects to assess their impact.

(5) National Institute of Rural Development (NIRD)

The institute is located in Rajendranagar, Hyderabad. The main objectives of NIRD are to examine and analyse the factors contributing to the improvement of economic and social well-being of people in rural areas on a sustainable basis with focus on the rural poor and the other disadvantaged groups through research, action, research and consultancy efforts and to facilitate the rural development efforts with particular emphasis and focus on the rural poor by improving the knowledge, skills, and attitudes of rural development officials and non-officials through organising training, workshops, and seminars. NIRD is actively involved in rural development through training and extension activities in rural development in the state.

(6) Indian Council for Agricultural Research (ICAR)

The Indian Council of Agricultural Research isthe apex body for improving the productivity of different crops, animal breeds, meat, mutton, chicken, eggs, and fisheries in the country. It has over 100 research institutes, 54 agriculture institutes, 610 KVKs, and one academy for agricultural research management. These institutes conduct research for improving the productivity and reducing the cost of cultivation. The organisational structure of ICAR is given in the flow diagram (Annex-1).The mandate and activities of the institutes are briefly presented here under.

Table 8.3.4 ICAR Institutes and their Activities in Andhra Pradesh State

Institute	Location	Mandate/ Activities
Indian Institute of Rice Research (IIRR)	Rajendranagar, Hyderabad	Breeding high yielding rice varieties and developing package of practices for improving productivity and grain quality.
Directorate of Oilseed Research (DOR)	Rajendranagar, Hyderabad	Breeding high yielding varieties and development of improved package of practices for higher yields of sunflower, sesamum, castor, and safflower.
Indian Institute of Millat Research (IIMR)	Rajendranagar, Hyderabad	Breeding superior varieties and developing package of practices for obtaining high yields and superior quality in sorghum, finger-millet, and other minor millets.
Central Tobacco Research Institute (CTRI)	Rajahmundry, East Godavari Dristrict	Breeding high yielding tobacco varieties and developing package of practices for improving productivity and quality of leaf in flue-cured and non-flue-cured tobacco types in the country.
Directorate of Oil-palm Research (DOPR)	Pedavegi, West Godavari Dristrict	Breeding high yielding oil-palm varieties and developing package of practices for improving productivity and quality of oilpalm.
National Bureau of Plant Genetic Resources (NBPGR)	Regional Centre, Rajendranagar, Hyderabad	Collection, maintenance and conservation of indigenous landraces and germplasm of economic plant species.
Directorate of Poultry Research (DPR)	Rajendranagar, Hyderabad	Breeding high chicken and egg-laying poultry breeds.
National Research Centre for Meat (NRC Meat)	Hyderabad	Breeding high meat yielding sheep and goat breeds.
Central Institute for Dry land Agriculture (CRIDA)	Santhoshnagar, Hyderabad	Improving agriculture, horticulture, animal husbandry, fisheries and water resources in dry land areas.
National Academy of Agricultural Research Management (NAARM)	Rajendranagar, Hyderabad	Imparting training on agricultural management in the country.

Source: ICAR website,2016.

(7) State Agricultural Universities (SAUs)

The Andhra Pradesh State has three agricultural universities working for the development of agriculture, horticulture, animal husbandry, and fisheries. While ICAR provides financial support, the SAUs are under the direct control of the state government of Andhra Pradesh.

(a) Acharya N.G. Ranga Agricultural University (ANGRAU)

It established in 1964 in Rajendranagar, Hyderabad now shifted to Lam near Guntur in 2016 after state bifurcation into Telangana and Andhra Pradesh. The ANGRAU with its wide network of research stations, KVKs, and agricultural colleges helps in development of agriculture in the state. It released large number of high yielding varieties in cereals, pulses, oil seeds, fiber crops, and sugarcane greatly influencing the agricultural economy of the state. ANGRAU has unique distinction in breeding and releasing high yielding rice varieties like BPT-5204 and a large number of Maruteru rice varieties which give 6-8 tons/ha of yield. Similarly, in pulses, lam varieties of black gram (LBG series) green gram (LGG series), and redgram (LRG series) give very high yields of 15-20 q/ha. In chillis, ANGRAU has released a series of Guntur varieties (G1-G7) which give high yields and very good quality. The research stations: Lam, Maruteru, Anakapalli, Agricultural College, and Bapatla are the centres of excellence in agricultural research, education, and extension in the state as indicated in the following Table 8.3.5.

Table 8.3.5 ANGRAU Agricultural Research Stations (ARS) for Different Crops

No.	Name of Research Station/College	Crop	Location (District)
1	ARS, Lam	Blackgram, Greengram, Redgram, Bengalgram, Cotton, Chilli	Guntur
2	ARS, Anakapalli	Sugarcane	Visakhapatnam
3	ARS, Ragolu	Rice and Pulses	Srikakukam
4	ARS,Vizianagaram	Minor millets	Vizianagaram
5	ARS, Naira	Mesta, Jute and Hibiscus	Srikakulam
6	ARS, Butchireddipalem	Rice Research	Nellore
7	ARS, Samarlakota	Rice Research, Extension, and Training	East Godavari
8	Agriculture College, Bapatla	Agriculture Education, and Rice Research	Guntur
9	Agriculture College, Naira	Agriculture Education	Srikakulam
10	ARS, Maruteru	Rice Research	West Godavari
11	APRRS, Maruteru	Rice Breeding	West Godavari

Source: ANGRAU, 2016.

(b) Dr. YSR Horticultural University (Dr. YSRHU)

Dr. YSR Horticultural University (Dr. YSRHU) was established in 2007 at V.R. Gudem in T.P. Gudem Mandal in West Godavari District. This university conducts researchand education in horticultural crops in Andhra Pradesh. Dr. YSRHU, with its network of horticultural research stations and colleges, is providing support to farmers in growing fruits, vegetables, flowers, plantation crops, medicinal andaromatic crops, spices, and condiments. As a result of concerted efforts, Dr YSRHU in coordination with the State Horticulture Department, is able to significantly improve the yield and nutritional quality of horticultural crops in the state as indicated in the following Table 8.3.6.

Table 8.3.6 Research Stations in Dr. YSRHU for Different Crops

No.	Name of Research Station/College	Name of Crop/ Research	Location (District)
1	Dr. YSR Horticultural University, V.R. Gudem	Horticultural Education, Research and ExtensionWest Godavari	West Godavari
2	Horticultural Research Station, Kovvur	Banana Research, Yam, Colacasia, Papaya and Pineapple	West Godavari
3	Horticultural Research Station, Ambajipeta	Coconut, Oilpalm,Cocoa Research	East Godavari
4	Horticultural Research Station, Chintapalli	High Altitude Crops Research, Turmeric, Ginger, Pepper, Coffee, Rajma, and Pineapple.	Visakhapatnam
5	Horticultural Research Station, Bapatla	Cashew nut and Betelvine	Guntur
6	Horticultural Research Station, Tirupati	Citrus and Guava	Chittoor
7	Horticultural Research Station, Railway Kodur	Rice Research	Nellore
8	Horticulture College and Research Institute, Anantharajupet	Education, Extension, and Research	Kadapa
9	Horticulture College and Research Institute, Venkataramannagudem	Agriculture Education and Rice Research	West Godavari
10	Horticultural Research Station, Nuzvidu	Mango Research	Krishna

Source: Dr. YSRHU, 2016

(c) Sri Ventakeshwara Veterinary University (SVVU)

This university, established in Tirupati Town in Chittoor District, conducts research, education,and extension in veterinary sciences including cattle, small ruminants, and fisheries in the state. The university with an active collaboration with theDepartment of Animal Husbandry conducts animal health camps and promotes dairying, meat, mutton, prawns, and fish production in the state.

(8) International Crops Research Institute for Semi-arid Tropics (ICRISAT)

This international institute is located in Patancheru in Medak District of Telangana State and conducts research on five mandate crops, namely: pigeon pea, chick pea, groundnut, sorghum, and pearl millet extensively cultivated and consumed in semi-arid tropics in the world. ICRISAT varieties have high yield potential with remarkable resistance to pest and diseases and drought tolerance. ICRISAT lays greater emphasis on improving the productivity and nutritional quality of the five Semi-Arid Tropics (SAT) crops. It strives hard to produce more from every drop of water in the SAT region.

8.4 Animal Husbandry and Fishery

During the second field survey, the JICA Survey Team visited the following places (Table 8.4.1) to observe the livelihood situation of animal husbandry and fishery in the rural areas. The sites are chosen along with the pilot project sites of the middle and minor irrigations.

Table 8.4.1 Visited Places during the Survey

Area	District	Places
Northern	Vizianagaram	Pittada Village, Gajapatinagaram Mandal, Pedda Thumbali Village, Visakha Dairy Milk Cooling Center, DoAH
Middle	West Godavari	Narasannapalem Village, Lingapalem Mandal, Errampally Village, Koppaka Village, DoAH, Vijaya Dairy, Milk Production Cooperative Society, Animal Dispensary, Milk Outlet
Southern	Chittoor	Krishna Puram Village, Katherapalle Village, Chokkamadugu Village, Nagar Village, DoAH, Varverachenu Village, Rural Livestock Unit

Source: JICA Survey Team

8.4.1 Animal Husbandry

(1) Current Situation

Among those three visited districts, West Godavari has the largest number of households who owned backyard poultry and buffalo. Chittoor has the largest number of households that owned cattle and goat. In terms of production, Chittoor produces the largest volume of milk and meat. West Godavari exceeds Chittoor only with egg production. Vizianagaram ranked the lowest in all figures (Table 8.4.2)

Table 8.4.2 Basic Data of Livestock of Visited Districts

District	Number of Households Own				Production		
	Cattles	Buffaloes	Goats	Backyard Poultry	Milk (1,000tons)	Meat (tons)	Egg (Lakh no.)
Vizianagaram	116,459	46,679	19,437	206,594	414.34	28.22	3,218.49
West Godavari	43,808	182,716	19,082	233,678	832.49	29.85	19,781.70
Chittoor	286,879	23,175	31,005	169,131	948.00	65.12	15,377.14

Source: 19th Livestock census 2012 and Animal Husbandry Annual Report 2013-14

The Department of Animal Husbandry of Andhra Pradesh focuses at improving the productivity of livestock that is based on governmental policy. The state is targeting a double digit growth in gross state domestic product (GSDP) in 2015-16 financial year[4]. Based on the data of 2012, the productivity of milk of the visited districts is calculated below (Table 8.4.3).To follow the target of Andhra Pradesh government, the figures must be doubled. The efficient method to increase the productivity is needed.

[4]http://articles.economictimes.indiatimes.com/2015-09-18/news/66677502_1_gsdp-chandrababu-naidu-double-digit-growth

Table 8.4.3 Total Number of Female Cattle, Buffalo, and Milk Productivity

District	Total Number of Female			Total	Milk Production (1,000kg/Year)	Productivity (kg/day)
	Indigenous Cattle	Exotic/Crossbreed	Buffalo			
Vizianagaram	169,633	104,697	174,204	448,534	390,000	2.38
West Godavari	125,581	537,120	48,713	711,414	742,000	2.86
Chittoor	116,215	72,984	652,744	841,943	938,000	3.05

Source: livestock census 2012 andAnimal Husbandry Annual Report 2012

(2) Major Challenges and Needs of Support

The major challenges and needs of support observed during the survey are summarised in the table below (Table 8.4.4). The corresponding needs of support against the challenges also listed at the right side.

Table 8.4.4 Major Challenges and Needs of Support

Major Challenges	Needs of Supports
- Lack of fodder, lack of cultivation land. It has decreased every year due to the expansion of farming land. Farmers prioritise not fodder cultivation but other crops. - Landless farmers cannot afford to add livestock. Their main income is not from livestock. - The number of agricultural labour is decreasing due to the governmental scheme (NREGA) which employs landless workers for public projects. - Lack of marketing and processing activities by the Department of Animal Husbandry. - Lack of dairy processing unit in Andhra Pradesh due to bifurcation.	- Create incentives to increase land use and cultivation of fodder. Support private sector which produces fodder. - Organise landless farmers group and expand subsidy to purchase livestock for them. - Amend the governmental scheme (NREGA) to secure agricultural workers. - Support of processing and marketing of dairy products. - Construction of dairy processing unit in bifurcated Andhra Pradesh State.

Source: JICA Survey Team

One of the main challenges the interviewees raised the most during the survey is the lack of fodder and cultivation land. The problem was mentioned in most of the villages where the JICA Survey Team visited (detailed findings are consolidated in Attachment 8.4.1). The department's activities to encourage fodder cultivation were not observed in the villages. Farmers know more or less that proper feed management increases milk production, yet, it is not practised because they do not know concrete method. The farmers do not prioritise cultivate fodder because their income from milk is not high enough to invest.

The survey revealed that, above all, the income from livestock is small for the general farmers. According to the interviewed farmers, their main income is not from the livestock but mostly from agriculture. Even for the landless farmers, their main income is from seasonal works. In fact, the results of the statistical survey implemented by the project showed that the portion of income from livestock ranges from 0.0% in the north minor irrigation area to 9.6% in the south minor irrigation area as maximum (Table 8.4.5). Fodder cultivation should be encouraged by providing government support so that the productivity would increase.

Table 8.4.5 Income of Livestock/Dairy in Irrigation Areas

	Central Medium		Central Minor		North Medium		North Minor		South Medium		South Minor	
Source	Average Farmer		Average Farmer		Average Farmer		Average Farmer		Average Farmer		Average Farmer	
	INR	%	INR	%	INR	%	INR	%	INR	%	Rs.	%
Agriculture	145,083.3	79.3	81,900.0	63.9	61,541.7	51.8	114,786	73.7	61,541.7	51.8	37,208.3	36.7
Livestock/ Dairy	6,533.3	3.6	10,783.3	8.4	9,766.7	8.2	0.0	0.0	9,766.7	8.2	9,750.0	9.6

Source: Interview Survey of Community-based Organisations and Farmers under the JICA Data Collection Survey on Agriculture Food processing and Distribution in Andhra Pradesh

Another key challenge is that farmers cannot afford to purchase new or additional livestock especially for the landless farmers. In addition to their limited budget, the "owning land" is the condition to use common financial services. Although the government has a scheme to provide backyard poultry, it is not implemented as planned due to lack of financial resources.

The Department of Animal Husbandry is not mandated to process or market (the department in- charge of those areas is Andhra Pradesh Food Processing Society (APFPS)). To respond to the increased

production, marketing support is needed. Besides, the department provides generous veterinary support to the farmers and most of the farmers showed their content with the services that they have been receiving to the JICA Survey Team.

8.4.2 Fisheries Livelihood

(1) Current Situation

Fishing and aquaculture activities are only possible when sufficient water is available. Unlike agriculture, fishing, and aquaculture do not consume water but use water to produce fish and shellfish. Unless the water bodies such as reservoirs and irrigation tanks are dedicated to drinking water, fishing, and aquaculture activities increase the productivity of water bodies as well as generate income for the rural economy.

Earthen captive nursery tanks outside of minor irrigation tank

Fishing communities are the poorest communities in India. They belong to a scheduled or a tribal caste that have been fishing in the rivers, lakes, and ponds before irrigation systems were constructed. Members of fishing caste do not live in the farmers' village but formed their own hamlet that is not directly connected to the farmers' village. They cannot sustain their life with only fishing. So people in this fishing caste often work as farm laborers and construction workers. Women in the fishing caste sell fishes that are being caught by men in fish markets in towns or peddling. A woman may sell 10 kg to 20 kg of fish per day and makes 200 to 400 rupees. When there is not enough fish from their own fishing community, the women go to different towns to purchase fish and sell at their marketing spot or conduct peddling.

The Fisheries Department of the state of Andhra Pradesh has been making efforts to enhance the productivities of water bodies by stocking artificially produced fish seedlings (fry), thus supporting improvements of the living standard of fishing communities. Besides this fish seedling stocking program depends on the natural feed for the growth of fish. The Fisheries Department implements more aquaculture-like activities such as captive nursery that rear fry into fingerling and advanced fingerlings.

Cage culture facility with watchman

Storage house

To develop fishing communities as their own initiatives, the Fisheries Department encourages fishing communities to form or strengthen the Fishermen Cooperative Societies (FCS) and stock fish seedlings by themselves (please see the table in the next page). The Fisheries Department matches the number of fish seedlings that were stocked by Fisheries Cooperative Societies. Three major Indian carps are usually used for this program.

The Fisheries Department and the Fishermen Cooperative Societies have also started cage culture projects in medium irrigation tanks and reservoirs where water is available throughout the year. Genetically enhanced (produce only male fish whose growth rate is superior) Nile Tilapia (Oreochromis niloticus) is used for cage culture trials.

Some women's groups have started ornamental fish (goldfish) backyard aquaculture projects with the assistance of the Fisheries Department. Women are trained at the School of Fisheries in Kakinada in culturing goldfish. Handmade rectangular aquarium tanks are shown on top of small round shaped backyard fish culture tanks as shown in the photo on the left.

Table 8.4.6 shows the number of Fisheries Cooperative Societies and membership in each district. Inland Fishermen Cooperatives have the largest number of members. More detailed information is available in Attachment 8.4.2.

There are 1,326 Inland Fishermen Cooperative Societies, 424 Marine Fishermen Cooperative Societies,

12 Brackish Water Fishermen Cooperative Societies, 509 Fisherwomen Cooperative Societies, and 4 Fishermen Marketing Cooperative Societies in Andhra Pradesh. Total of 2,275 primary FCSs forms 13 District level FCSs and one state level FCS. Total number of membership is 252,174.

District level Fisheries Department assist formulation and strengthening fisheries societies and implement various development activities such as aquaculture development and marketing support utilizing national and state budget.

Table 8.4.6 Number of Fisheries Cooperative Societies by District

	Name of District	Inland Fishermen Cooperative Societies		Marine Fishermen Cooperative Societies		Brackish Water Fishermen Cooperative Society		Fisherwomen Cooperative Society		Fishermen Marketing Cooperative Society	
		No of FCS	No of Members	No of FCS	No of Members	No of FCS	No of Members	No of FCS	No of Members	No of FCS	No of Members
1	Srikakulam	68	7,573	57	13,926	0	0	14	673	0	0
2	Vizianagaram	55	6,597	12	2,908			9	947	0	0
3	Vishakapatnam	25	2,089	70	10,996	0	0	39	3,831	0	0
4	EastGodavari	249	24,840	112	17,404	2	115	197	10,116	0	0
5	WestGodavari	217	21,922	16	1,042	4	194	28	2,318	1	2,000
6	Krishna	222	18,332	42	8,501	5	417	86	9,109	1	99
7	Guntur	106	10,829	26	5,855	1	36	19	1,142	0	0
8	Prakasam	49	5,338	39	10,450	0	0	19	1,155	0	0
9	Nellore	88	16,351	50	10,239	0	0	71	7,514	2	235
10	Ananthapur	90	7,195	0	0	0	0	4	261	0	0
11	Kurnool	80	4,583	0	0	0	0	8	373	0	0
12	Kadapa	34	1,763	0	0	0	0	2	52	0	0
13	Chittoor	43	2,527	0	0	0	0	13	327	0	0
	Total	1,326	129,939	424	81,321	12	762	509	37,818	4	2,334

Source: Fisheries Department, Andhra Pradesh

(2) Fisheries Livelihood Issues

The Fisheries Department is shifting from stocking of fry to stocking fingerlings and advanced fingerings to improve the survival rate of the fish and shorten the culture period, which will increase fisheries production and continue to be the top of the inland fisheries production in India (See Attachment 8.4.3). However, there are not enough nursery or aquaculture tanks/ponds and the cost of production is expensive. Although the Fisheries Department encourages FCSs to conduct captive nursery and ultimately progress into aquaculture practices, fishermen are not used to culture fish that need daily attendance and caring for the environment as well as feeding fish. FCSs do not usually have sufficient funds to purchase fish feed. Since the fishing community experiences insufficient water during the dry season, these irrigation tanks do not contain water continuously. Fishermen in Chittoor have commented that there has not been water in the tank for the last seven years.

Marketing activities of fisherwomen are often unhygienic as they do not use clean containers and ice. Without these things they are unable to maintain the quality of fish. There is a lack of permanent fish market outlets for sale of fish and fish products in some towns. There is a lack of landing site infrastructure for boats and fishing gear as well as for marketing activities at the medium irrigation tank area. There is a need to develop a comprehensive plan for the improvement of farmers' and fishermen's livelihood along with irrigation system rehabilitation and development. The Fisheries Department does not have sufficient staff to provide much needed services for the fishing community in the rural communities. (Please see Attachment 8.4.4)

8.5 Farmers Organisations in the Sample Survey Areas

Farmers organisations operating in the sample area studied were the water utility associations (WUAs), Self-help groups (SHGs), Primary Agriculture Cooperative Society (PACS), and a few Rythu Mitra Groups (RMGs). The findings of each category of groups are summarised below.

8.5.1 WUAs in the Sample Survey Areas

The WUA is a group of water users, i.e., irrigators, who pool their financial, technical, material, and

human resources for the operation and maintenance of the water system. The WUA usually elects leaders, handles disputes internally, collects fees and implements maintenance. The WUA membership depends on one's relationship to a water source i.e., canal or groundwater. The Andhra Pradesh Farmers Management of Irrigation System (APFMIS) Act was passed in the legislative assembly on March 27, 1997. Creation of an institutional structure for the user of water for irrigation, as a basic element, was proposed in the above Act. Acrossthe state of Andhra Pradesh, all WUAs were revived in October 2015. WUA's elections had taken place after a decade. During this period, in few projects, irrespective of medium and minor classifications, previous WUA continued with their roles and responsibilities. However, in few medium and minor irrigation projects, from 2012 onwards up to October 2015, the deputy executive engineer (DEE) had assumed the role of WUA President. This was observed and noted across three districts that the JICA Survey Team had visited.

In case of minor irrigation (MI) tanks and medium irrigation projects, WUAs have been in place since October 2015. The revived WUAs have their six members Management Committee (MC) in place. As the WUAs are a few months old, the newly elected members have some ideas on their roles and responsibilities as well as various sub-committees (SC). The following issues were identified during the focus group discussion (FGD) with key stakeholders.

(1) Tenant Farmers

In West Godavari District, percentage of sharecroppers was found to be notable. According to the farmers in the group discussions, almost half of the households are landless in the study area. Most of the tenant farmers are landless and are dependent on tenant cultivation for livelihood. Even though tenant farmers are entitled to be members of WUAs, most of them have been excluded. This is mainly because most of the tenant farmers tenure the land without official procedure but with informal mutual understanding with landowners. In the understanding of the WUA members interviewed in the survey, landholders automatically become members of the WUA. In this case, landholders shall take the position and voting right of the WUA.

(2) Poor Representation of Women in WUA

Membership of women in WUAs is limited since the WUA membership is given to landholders and most of the land is under the names of their husbands. Across three districts visited, it was observed and evident that more than 30% of cultivators under the studied command area were women landholders, while their representation in WUAs is almost nil in West Godavari and Viziagnagaram District. However, in case of Chittoor District, women had contested elections of WUA MC and won. In Krishnapuram Medium Irrigation Project in Chitthoor, there are four women elected as WUA representatives. Due to poor representation of women in WUA, as elected representatives or as active members, it was noticed or found that there are imbalances in access and control of water resources. Nil participation was observed when it came to women in water management, in decisions on use, and allocation of water resources across the project sites visited.

(3) Unregistered Command Area

Over the three districts in the project sites visited, unregistered command area in upland catchment area was noticed. Due to large number of acreage under unregistered command area, the tail end farmers are not receiving water for their crop. The irrigation officials and newly elected WUA representatives and members are in conflict concerning with unregistered command area. In the three districts, it was observed that misutilisation of water was found to be high, as many farmers in unregistered command areas have been illegally pumping water through oil engines and pump sets to irrigate their farm lands. Water men, who operate the sluice gates at the system tanks, play a key role of supplying water to tail end farmer during the drought periods or when the availability of water was found to be less.

(4) Rights and Entitlements of Different Water Users in a Given Command Area

In the three districts, rights and entitlement of different water users are in place, as many of the different caste groups are continuing with their traditional livelihood. However, in case of fisheries community, it was noted that fishermen community had to take prior permission from irrigation officials to undertake any fishing activity in either MI tanks or medium irrigation projects. It was stated that in most cases, irrigation for agriculture is the first priority of the use of tank water and fishery activities are performed

in the water remaining after agriculture activities.

(5) Water Tax/Cess

The scenario across three districts is familiar in water tax collection. In Chittoor District, water tax was lastly collected in year 2001. Since then the district has been experiencing recurring droughts, and as a result, the concerned district authorities did not initiate any tax collection. As per the APFMIS Act, collection of water tax can be carried out only when there is "six months of assured water supply" to the farmers. Therefore, water tax collection could not be initiated when water supply was less than sixmonths. Even in West Godavari and Vizianagaram District, there have been recurring drought situations and as a result, the demand for tax collection has not been initiated by the district collector officials.

(6) Operation and Maintenance of Structures:

The situations were found to be similar at all sites visited across the three districts. The infrastructure was found to be in degraded or dilapidated conditions. The farmers stated that due to poor operation and maintenance (O&M) there have been lowered benefits from irrigation investments. The WUA managements were recently formed, and as of the time of visit, they do not yet have adequate O&M system. During the absence of WUA management earlier, WUA did not take up O&M works due to poor water tax collection and non-payment of plough back amount. One of the key constraints/challenges that emerged from field visits is that irrigation bureaucracies are inhibiting effective O&M works where there is neither strong initiative from a particular party nor an effective coordination among relevant departments.

(7) Crop Planning and Water Budgeting:

In all the project sites visited, the findings were similar. There has hardly been crop planning and water budgeting. The reasons stated are as follows: a) prevalence of drought; b) poor O&M structures; and c) intensification in paddy cultivation. It was noted that the flood irrigation/intense irrigation was the first priority taken up by the farmers under the command area. Water scarcity and high preference on paddy cultivation cause unequal water distribution.

8.5.2 Primary Agriculture Cooperative Society (PACS) in the Sample Survey Areas

Cooperatives have been mainly concerned with agricultural credit, marketing of agricultural produce, and distribution of fertilisers, pesticides and other essential commodities. PACSs have been continuing to some extent to hold their promise of helping to solve a host of problems of rural masses. Across the three districts, in the project villages, some particular PACSs were found to be functional and active. The PACSs are continuing to provide agricultural credit to farmers, mainly land owners. Apart from agricultural credit, the PACSs are also distributing fertilisers, pesticides, and other essentials. The following key issues/challenges were identified in the visited sample sites.

(1) Agriculture Credit

It was found that farmers and sharecroppers are not often availing agriculture credit from PACSs but are availing credit from Nationalised Banks and also from private money lenders at a higher interest rate. This is mainly due to lengthy and exhaustive procedures of PACS to avail credit, while farmers require timely loan to invest for their cultivation. Furthermore, PACS's efficiency as a financial intermediary is constrained both by internal and external factors. One of the major internal factors is the financial discipline of members such as poor recovery of loan amount dispersed and utilisation of loans dispersed to other purposes. External factors might be natural calamities, political interferences, and policy and legal procedures outside the control of PACS.

(2) Pesticides/ Fertilisers/Seed Input Supply

In few PACS visited, it was noted that farmers were forced to purchase seeds (input supply) from private dealers, as PACS only provided the farmers with 4kg of seeds, irrespective of their land holding size, which is not sufficient input supply.

(3) Paddy and Maize Procurement Centre

Across the studied villages, it was noted that few PACS are procuring paddy and maize. In some centres, farmers stated that they need to bring crop produce to the procurement centre on their own transportation cost. Thus, farmers who cannot afford to or those who do not have means sell their crop to middlemen in distress. Even though purpose of PACS was to help farmers from clutches of exploitation by moneylenders, none of the PACSs in the visited areas is providing such comprehensive services.

8.5.3 Self-Help Groups (SHGs) in the Sample Survey Areas

An SHG is a village-based financial intermediary committee comprising10-20 local women and members that make small regular savings contributions over a few months, until there is sufficient capital in the group to begin lending. Many SHGs have been linked to banks for delivery of micro-credit. The findings have been the following across project sample sites visited.

Most of the SHGs are caste-based and there are several SHGs in different parts of the villages. The major function of the SHGs is availing credit from both formal and informal institutions for pursuing individual livelihood activity. There has been no group-based livelihood activity observed or noted in any of the project villages visited. Even though many of the SHG women are involved in agriculture allied livelihood-based activities, most of them preferred taking activity at the individual level. One of the very limited opinions raised as possible activities to be done collectively as a group is backyard poultry. Through bank linkages, SHGs are availing skill-based training. Poultry units are being promoted by District Rural Development Agency (DRDA) for landless women through SHG groups. There are a few women who expressed positive answer on taking up agriculture-related activities as a group. Apart from those few cases, most of the loans availed from SHG were used for individual activities of women such as operation of grocery shops, tailoring business, basket making, spice powder processing, leaf plate making, goat rearing, and backyard poultry. These imply that the loans from SHG availed by women can be use with their own decision.

According to a government order, the Indira Kranthi Pathakam (IKP) procurement centre of paddy isrun by Village Organisations (VOs). West Godavari is a progressive district on this matter. However, the situation has been taking a step backwards, as the Government of Andhra Pradeshhas withdrawn the payment on commission basis. In some IKP centres it has taken up by private traders. Decreased rice production due to drought situation in some area is making the situation worse. This result in an inefficient function of IKP and thus farmersin distress are forced to sell their crop produce to private traders. In one IKP Paddy Procurement Centre (PPC) visited, it was noted that PPC is catering to the needs of private players.

8.5.4 Rythu Mitra Groups (RMG) in the Sample Survey Areas

As the experience of the state in developing women's SHGs have been very positive, RMGs were formed (G.O. No., 167 dated June25, 2003) on the same line. The Department of Agriculture organised RMGs mainly consisting of small and marginal farmers including tenant farmers. The RMGs' objective was to serve their common interest regarding technology transfer, access to market information, self-reliance in financial needs, etc., marching towards sustainable economic development. Across the three districts visited, the following situations were observed.

RMGs mostly consist of men. Since one person cannot avail public loan from two different sources, SHG members who avail loans from SHG through public source cannot apply for another loan. This automatically excludes women who are SHG members. The number of existing RMGs depends on the area. However, most of the RMGs have not been functioning since just after their formation or just after availing loans from the government at the beginning. Most of them do not function as an interface between the agri-extension system and farmers for sharing of market information and transfer of technology, to take into various developmental activities like soil testing camps, animal health camps and to formulate an optimal, resource-based and market-driven farmer's strategy.

8.5.5 Issues of Tenant Farmers

As mentioned above, there are many tenant farmers cultivating in the command area. In Chittoor and

Viziagnagaram District, percentage of sharecroppers was found to be around 20%. Most of the tenant farmers had poor accessibility to formal financial institutions, lack of legal mechanism and assurance from government towards protection of tenant farmers rights. It was noted that the tenant farmers have an additional expenditure for taking land on lease, which is ranging from INR 7,000/- to INR 20,000/- per acre. The large chunks of tenant farmers are not able to avail any loans from formal institutions. This is mainly due to prevalence of "Absentee Landlordism" as there is no legal binding between the land owner and the tenant farmer. Secondly, it was observed that land owners are availing crop loans from banks, keeping the tenant farmers out of the loop. As a result, many of the landless, with no option left, are resorting back to private money lenders. In Viziagnagaram District, it was noted during a group discussion, that a group of tenant farmers (five in number) had Loan Eligibility Cards (LEC) with a legal mandate through the Licensed Cultivators Act (2011) and they had availed loans from formal banking institutions for two consecutive years. Later, without any reasons stated, they could not avail loans from formal banking institutions. One of the key challenges, tenant farmers across the three districts stated that bank officials asked the tenant farmers to submit "pattadar" (land title deed) passbook of the land owner, in order to avail loan or at least obtain a consent letter from the land owner. As a whole, the non-cultivator land owners are obtaining crop loans and formal institutions are lending loans to absentee land owners rather than the tenant farmers.

8.6 Food Value Chain

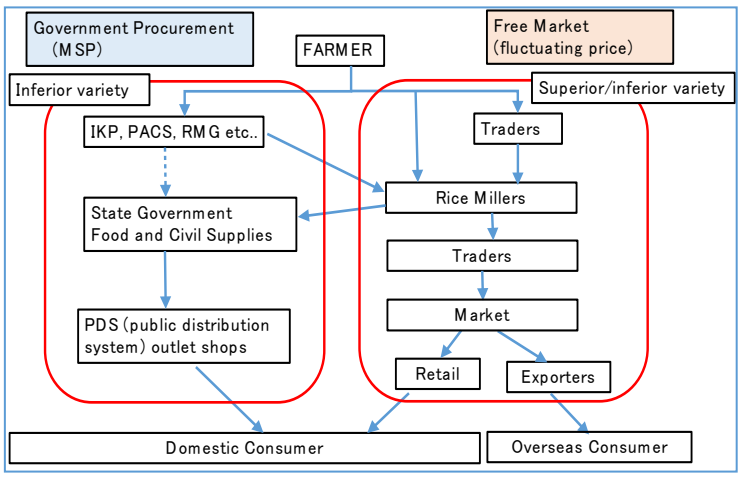
Based on the observation and findings of the first field survey described in Chapter 6, the JICA Survey Team visited three sites in the medium irrigation projects to collect detailed information on value chains of irrigated crops to identify needs for interventions. The JICA Survey Team also visited several sites where the strategic crops, which were selected based on the criteria described in Chapter 7 are intensively cultivated. The results of the detailed survey of the two selected major irrigated crops, paddy, and maize, and the strategic crops are summarised in this section.

8.6.1 Irrigated Crops

(1) Paddy

(a) Current Status of Paddy Farmers

Paddy in Andhra Pradesh is cultivated under irrigated conditions in the command areas of tanks and canals, and under tube wells in rainfed areas. Average yield of rice in Andhra Pradesh is 3,172 kg per ha, which is much higher than the average of entire India but lower than the high yield states like Punjab and Haryana.The JICA Survey Team conducted focus group interviews with paddy farmers in the command areas of the medium irrigation in the three districts. (Summary is in Attachment 8.6.1) The situation is different in each district, but there are many similarities observed across the state. The majority of the farmers growing paddy in the survey area are small and marginal farmers and there is substantial level of landlessness. Most of the farmers in the survey area are taking loans from local money lenders to meet the input requirement for cultivation with very high interest rate. The farmers are being forced to sell their products to those money lenders cum traders at a lower price than government minimum support price (MSP). The net income of farmers is in the range of INR12,000-30,000 per ha and sometimes even runs deficit when yield is low mainly due to water shortage. The paddy famers are spending on an



Source: JICA Survey Team

Figure 8.6.1 Overview of Paddy Value Chain

average of INR 25,000-35,000 per ha including pesticides, fertilisers, hiring machineries, and labour. Labour shortage is particularly serious and wage is increasing sharply during the peak period, which leads to large demand for mechanisation.

(b) Overview of the Paddy Value Chain

Value chain of paddy in the state has roughly two channels, i.e., government procurement system and free trade channel as indicated in Figure 8.6.1. The state government (Food and Civil Supply Department) procures major food grains including paddy through procurement arrangement utilising IKP, PACS, or RMG[5] under MSP[6], stores and distributes it through the public distribution system (PDS) with very low price in order to secure access to essential commodities for low income segment of the population. The price support policy is also directed at providing insurance to farmers against any sharp fall in farm prices. The MSP is fixed beyond which the market price cannot fall. Paddy farmers are free to sell in the open market or to the government at the MSP depending on what is more advantageous to them. However, according to the field observation, most farmers have no choice other than to sell at lower price than MSP to traders who lend the loan to them. Overall field observation revealed that profitability of paddy cultivation is low even if farmers can sell at the MSP due to low yield and high cultivation cost. Storage facilities in the village are found to be short but most farmers have no financial capability to store the products until the price is high. Therefore, providing better access to credit to farmers is necessary to reduce their dependence on the money lenders. Organising farmers' groups and arranging finances for holdings, processing, and selling paddy collectively for better price realisation is also needed.

(2) Maize

(a) Current Status of Maize Farmers

Andhra Pradeshhas the highest total production volume and yield of maize in India. The main cultivation areas are in the central districts such as Guntur and West Godavari. Most farmers cultivating maize generally grows paddy in the Karif season, and maize in the Rabi season but in some areas where seed maize cultivation is popular, maize is grown in two seasons. Due to labour shortage, cultivation cost is becoming high, and it promotes utilisation of combine harvesters at hiring basis. Profit of maize cultivation is found to be higher than paddy, but it is more susceptible to international market situation as the percentage of industrial use is higher and government procurement volume is lower than paddy.

(b) Overview of the Maize Value Chain

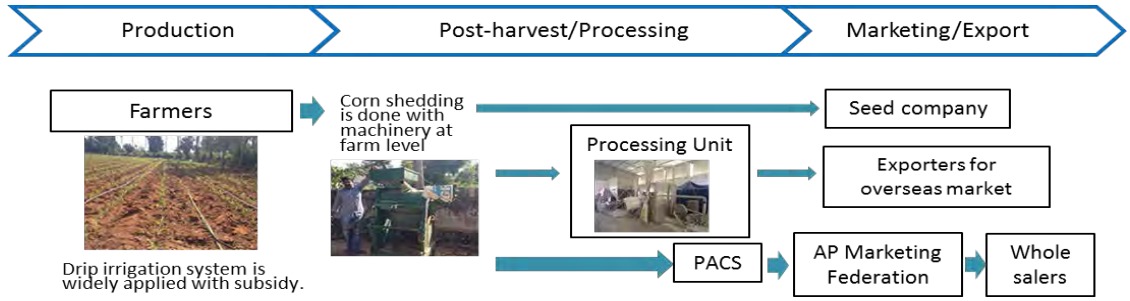
Maize was used more for direct human consumption but recently commercial demand from animal feed and starch industry is increasing and it is leading to higher famer realisation. In most parts of Andhra Pradesh, maize is dried in the field for ten days after harvesting and shelling cob is done at farm level. It is procured through traders, directly by seed companies or processing units of feed and starch. The Andhra PradeshMarketing Federation under the Department of Agriculture procures maize at MSP through PACs aiming at price stabilisation and protection of farmers. The procured maize is sold to wholesalers through on-line auction system.

In Andhra Pradesh, there are four large-scale starch processing units, several ethanol processing units and many feed processing units. Procurement price of maize by industries is fluctuating in the range of INR 13-17 per kg. If farmers can store the products at farm level and wait for good price, farmers will be able to have better return. The major destination of Indian maize export is in Southeast Asian countries, but the price and quality of Indian starch is not competitive in the global market. New technologies and yield improvement are necessary to strengthen the industry. Under the current

[5] The state government entrusted Indra Kranthi Patham (IKP) program run by SHGs, Primary Agricultural Cooperative Societies (PACS) and Rythu Mithra Groups (RMG)(farmers groups promoted by DOA) for the governmental paddy procurement. Regulations and payment modes are different for each organisation. Currently, IKP is the lead procurement organisation in Andhra Pradesh. Procurement was conducted by Food Corporation of India (FCI) at the national level to secure buffer stock, but the management was transferred to each state government in 2014.

[6] MSP of paddy and maize is changed every year based on production volume, market price, etc. Refer to Attachment 8.6.1.

condition of Andhra Pradesh, increase production is more important for the farmers than improving the quality.



Source: JICA Survey Team

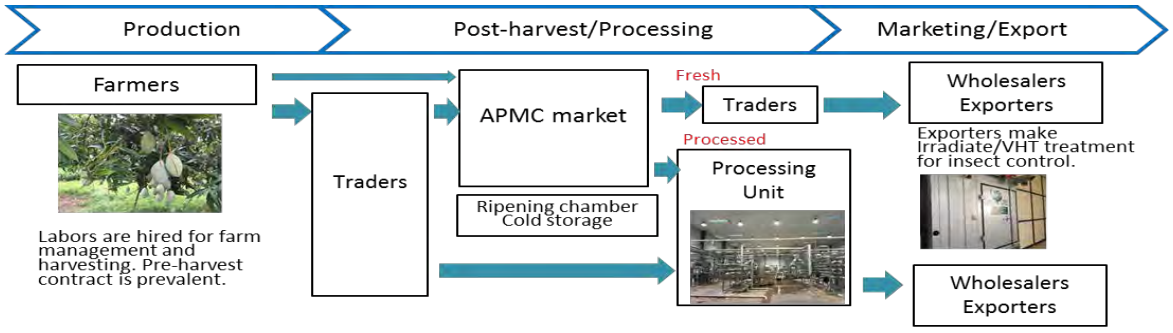
Figure 8.6.2 Value Chain of Maize in Andhra Pradesh

8.6.2 Strategic Crops

Overview and analysis of the value chain of the identified strategic crops are summarised below. The results of field observation of price structure at each stage of the value chain, stakeholder analysis, and market situation are in Attachment 8.6.2.

(1) Mango

India is the largest mango producing country and Andhra Pradesh is the second largest producer in India. Despite the high production capacity, Andhra Pradesh mango has yet tapped its marketing potential in global market. Below figure depicts an overview of the typical mango value chain in Andhra Pradesh. Various varieties are cultivated in the state including processing variety (Totapuri) and many other table purpose varieties (Banganapalli, Neeram, etc). Mango farmers in the region commonly sell their products to traders or pre-harvest contractors as many farmers take advance-payment or loan for the cultivation inputs from them. Since farmers usually face problem of labour shortage for orchard management and harvesting, pre-harvest contract is also an easy option for farmers, although the turnover the farmers can get becomes lower. Some farmers who lived near the Agriculture Produce Marketing Committes (APMC) market bring their products to the market by themselves and some farmers have direct linkage with processors or exporters. Those farmers can get higher return as there is no need to pay commission for middlemen (traders and commission agents). Fresh mangoes are delivered from the markets to various types of retailers. It is usually difficult for organised retailers to form their own supply chain for mangoes, so most of them obtain it through the traditional supply chain. Exporters make hot water or vapor heat treatment for pest control. The treated mangoes are exported by air. Despite the huge volume of mango trade transaction, there are few exporters in the state, and most of them are stationed in Mumbai and Chennai.



Source: JICA Survey Team

Figure 8.6.3 Value Chain of Mango in Andhra Pradesh State

The current situation, challenges, and needs observed at the field survey are summarised below.

Table 8.6.1 Value Chain Analysis of Mango

Process	Current Situation	Challenges/Needs
Production	-India is the world's largest producer of mangoes and Andhra Pradesh is the second largest producer in India after Uttar Pradesh with total volume of 2,737,008 tons. -The average productivity of mango in the state is 9.0 tons per hectare; this is higher than the national average of 7.2 tons per hectare, but much lower than 16 tons per hectare in Uttar Pradesh.[7]	-Productivity is low and has potential for further improvement if proper cultivation practice is introduced. -Production cost is high (hiking labour and inputs cost). <Needs> -Technical intervention for Good Agriculture Practice (GAP), Integrated Pest Management (IPM)/Integrated Crop Management (ICM) and organic farming. -Support for micro irrigation and fertigation. -Support for cultivation and harvesting technique. -Promotion of intercropping.
Postharvest/ Processing	-There are 66 processing units in Chittoor. -Several major players have established relation with big buyers such as Pepsi or Coca Cola. -Companies such as Jain Irrigation and Srini Food Park established procurement network with farmers. Japanese companies buy processed mango from them.	-For fresh mango, improper postharvest handling, artificial ripening, weak linkage between farmers and exporters, and lack of aggregation is an issue. -For processed mango, weak linkage between farmers and processors, and reduced price for existing products. Need to explore higher value added products. <Needs> -Support for farmers collective marketing and linkage between farmers and processors/exporters.
Marketing/ Export	-World fresh mango imports increased by 16.7% from 2010 to 2013, 47.9% since 2003. -India' is the second largest mango exporter although its share stagnated around 15% in recent years from 20% before 2010. -World mango pulp production increased by 18.6% from 2010 to 2013, 38.8% since 2003. [8] -India' is the world biggest mango pulp producer with the share of more than 60% and it is increasing its share in recent years.	-Brand image of Indian mango is not established. -Competition with other countries such as Kenya, Thailand, and the Philippines has increased. -There is no traceability. <Needs> -Support for identifying necessary specifications for target markets and introduce standards and certificates. -Promote local packaging industry. -Development of skill and knowledge hub/incubator of mango products. -Development of branding and marketing strategy. -Development of mango promotional body.

Source: JICA Survey Team

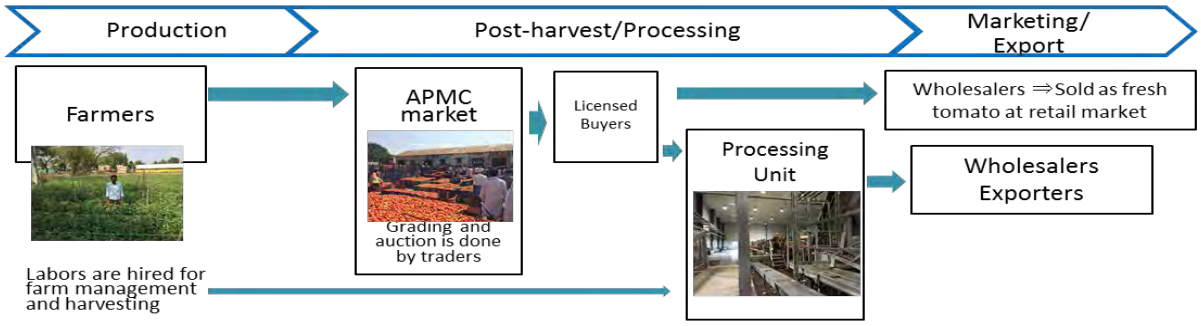
(2) Tomato

Andhra Pradesh is the largest tomato producer in India. Madanapalle Market in Chittoor deals around 100,000 tons of tomatoes annually which is one of the largest in Asia. Processing companies import tomatoes from China or the United States (US) to meet increasing domestic demand due to difficulty of stable procurement of local tomatoes. Farmers are reluctant to cultivate processing varieties as the procurement price of processing companies is lower than the market price of normal varieties.

Below figure depicts an overview of the typical tomato value chain in Andhra Pradesh. Farmers in the major tomato growing areas in Andhra Pradeshharvest tomatoes three times, i.e., Rabi (winter), summer, and Kharif (monsoon) season, a year. Farmers usually take their tomatoes to APMC markets by themselves or through traders for auction. Farmers generally do not sell their tomatoes to processing companies, as purchase prices of processing companies are lower than the market price most of time. Traders deliver most of the fresh tomatoes to large-scale wholesalers all over the country. Farmers and wholesalers often engage in grading and packing. There are several processing companies which process tomato to paste in Andhra Pradesh. They obtain fresh tomatoes from traders, as their linkage with tomato farmers is weak. Since there are difficulties for stable supply of fresh tomatoes for processing throughout the year, processing companies in the region do not process tomatoes in large scale.

[7] Indian Horticulture Database 2014
[8] FAO STAT (http://faostat3.fao.org/home/E)

Fresh tomatoes are delivered to various types of retailers. Most of them procure tomatoes through the traditional supply chain.



Source: JICA Survey Team

Figure 8.6.4 Value Chain of Tomato in Andhra Pradesh State

The current situation, challenges and needs observed in the field survey are summarised as below.

Table 8.6.2 Value Chain analysis of tomato

Process	Current Situation	Challenges/Needs
Production	-India is the second largest tomato producer next to China and Andhra Pradesh is the largest tomato producer in India. Andhra Pradesh produces 3,354,470 tons which accounts for 18% of tomato production in India. -Average yield in Andhra Pradesh is 20 tons per hectare, which is almost the same as the national average, but only half of Uttar Pradesh which is 40.6 tons per hectare.[9] -Processing variety is rarely cultivated.	-Productivity is low due to water shortage and cost of external labour is high. <Needs> -Micro irrigation and fertigation, new cultivation technique to reduce cost. -Support to identify variety suitable for processing and demonstrate new varieties. -Introduction of farm management technique.
Postharvest/ Processing	-There are 15 processing units located in Chittoor capable of processing tomatoes. -Several big firms such as Srini Food Park and Global Green started contract farming of tomato. -There are 14 tomato auction markets in Chittoor, and Madanapalle is the largest dealing market at around 100,000 tons a year.	-Price fluctuation is high and farmers dump harvest when price is too low. -Cost of processing is high as farmers do not cultivate processing variety. - The large aseptic companies do not produce paste on large scale as there is difficulty in getting a stable supply of fresh tomato. -There is no traceability which hinders import by foreign buyers. <Needs> -Promote linkages between processors and farmers, whereby processors buy tomato at pre-determined prices and farmers comply with the promise to sell to the processor. -Training for processors for upgrading and standardising food processing operation such as contract farming, material handling, 5S, Kaizen, and food safety.
Marketing/ Export	-Tomato paste market in India has grown by 43.4% between 2010 and 2013, and 144.4% between 2003 and 2013. Although tomato paste production increased by more than 10% since 2010, it is not very stable. Consequently, India is importing tomato paste to satisfy 30% of its demand every year.	

Source: JICA Survey Team

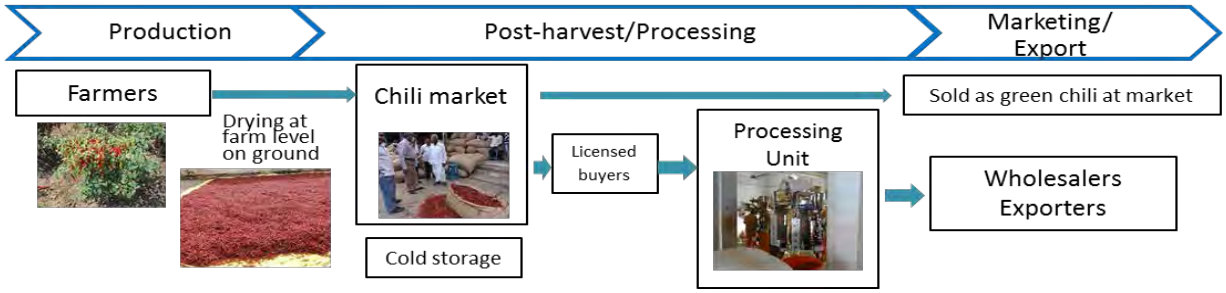
(3) Chili

Andhra Pradesh is the largest chili producer in India and it accounts for 40 percent of total chili production in the country. The Guntur chili market is known as the largest chili market in Asia. Guntur chili brand is famous with its pungency nationwide. The average productivity of chili in the state is 4.58 tons per ha, ten which is the highest in India, and more than double the national average of 1.93 tons per ha.

Below figure depicts an overview of the typical dry chili value chain in Andhra Pradesh. Some 10-25% of chili is sold as fresh green chili. The remaining chili is harvested after the color of the pod turns red.

[9] Indian Horticulture Database 2014

The harvested red chili is dried under the sun at farm level for about 10-15 days and brought to the APMC market either by the farmers themselves or local traders who procure dried chili by farmers. Once farmers bring their chili to the market, Control Atmospheres (CAs) received the product and sell it to buyers. Some processors, wholesalers, and exporters purchase dried chili directly from farmers, but the volume of the direct purchasing is limited. Indian chili has an issue of chemical residue and toxic fungus (aflatoxin) in exporting to high-end market which has strict regulations. (See Attachment 8.6.2)



Source: JICA Survey Team

Figure 8.6.5 Value Chain of Red Chili in Andhra Pradesh State

The current situation, challenges, and needs observed in the field survey are summarised as below.

Table 8.6.3 Value Chain Analysis of Chili

Process	Current Situation	Challenges/Needs
Production	-India is the world's largest chili producer and Andhra Pradesh is the largest producer of chili in India by producing 40% of chili production. -Guntur chili is famous and popular for its pungency and quality. -Productivity of chili in Andhra Pradesh is the highest in India.	-Lack of IPM/ICM causes issue of aflatoxin and chemical residue which hinders export to advanced countries. -High dependency on external labour leads to high cost of production. -The pesticide price is hiked when pest outbreak as no government price control of farm inputs. -Farm management remains at low level. <Needs> -Technical intervention for IPM/ICM. -Support for harvesting technique.
Postharvest/ Processing	-Postharvest handling (drying) is done at farm level. -Linkage between farmers and processors is limited. -Some Farmers Producer Organisations (FPOs) are formed for collective activities in support of NABARD Consultancy Services Pvt. Ltd. -There are several global companies like Tobacco Company of India (ITC) and Synthite which provide assistance to farmers and procure chilli from them.	-Improper drying methods generate toxin such as aflatoxin and chemical residues resulted torejection of Indian chili import in EU or Japan. -There is no traceability. <Needs> -Postharvest infrastructure at farm level (Proper drying facility) -Technical support for proper postharvest handling.
Marketing/ Export	-Chilli market in Guntur is the biggest in Asia with the well-established network of traders, processors, and exporter. -Dry chili and pepper export increased to 8.9% between 2010 and 2013, and 57.1% between 2003 and 2013. India's share also grew from 23.2% in 20013 to 50% in 2013.[10] -India controls 60% of the 13,500 tons global spice oleoresins market even as China has emerged as a strong contender in paprika oleoresin, the most in-demand spice oil.[11]	-Indian chili has negative reputation in certain countries due to the product being unsafe. <Needs> -Development of a platform converging all related stakeholders to promote high quality Andhra Pradesh chili both at domestic and overseas market. -Proper quality test laboratory. -Branding of Andhra Pradeshchili and marketing strategy development.

Source: JICA Survey Team

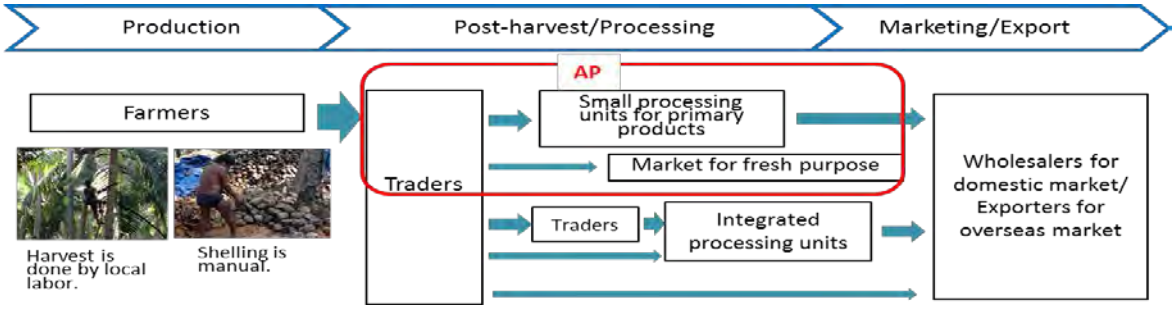
[10] FAOSTAT

[11] Reported in the Economic Times on July 27, 2013
http://articles.economictimes.indiatimes.com/2013-07-27/news/40833605_1_paprika-oleoresin-geemon-korah-synthite-industries

(4) Coconut

The coconut crop provides ample opportunities of income generation to the state because of its multiple uses and various products. India is one of the major coconut producers in the world and Andhra Pradesh accounts for about 12% of the total production of India. Coconut is an important plantation crop of Andhra Pradesh grown along the coastal belt and adjoining districts which provides livelihood security to major segments of population in the area. Coconut related industries like coir de-fiber unit are also common in this area.

Below figure shows an overview of the typical value chain of coconut in Andhra Pradesh. As there is no integrated processing unit in the state, nuts are either traded as tender/mature nut for domestic consumption or exported to other states for processing to oil, cream, powder, etc. Although there is one APMC coconut market in Ambajibet, East Godavari District and supposed to trade at auction system, it has been defunct for long time and used merely as warehouse for traders. Traders play a big role for coconut trade in the state with its well interlinked and organised network nationwide.



Source: JICA Survey Team

Figure 8.6.6 Value Chain of Coconut in Andhra Pradesh State

The current situation, challenges, and needs observed in the field survey are summarised as below.

Table 8.6.4 Value Chain Analysis of Coconut

Process	Current Situation	Challenges/Needs
Production	-India is the third largest producer (17%) in the world after Indonesia and the Philippines. -Andhra Pradesh's total cultivation area of coconuts is 121,9171ha with annual production of 1,828,755 tons which is the fourth highest in India. (After Tamil Nadu, Karnataka and Kerala) -Average yield of Andhra Pradesh is 10.3 tons/ha (16,100 nuts/ha) which is much higher than Indian average of 7.3 tons/ha.[12] -Intercrop of banana and cacao is promoted in coconut plantation. -Nuts are harvested by skilled local labour.	-Occasional outbreak of pests and diseases is observed in the region at controllable level. -Labour for harvesting is in shortage and labour cost is increasing. <Needs> -Development of nursery at the farm level. -Development and dissemination of sustainable preventive measures for pest and disease such as bio-agents. -Promotion of intercropping of income generation. -Mechanisation and new technology for harvesting.
Postharvest/ Processing	-Some FPOs are formed to conduct collective activities supported by the Coconut Development Board. -There is one large-scale integrated processing unit in Vizianagaram (under construction). -There are many (more than 200) small-scale processing units (coir and primary processing).	-There is no aggregate marketing practice and only one marketing channel for farmers is selling to traders. -There is not enough postharvest and processing facility in the region for value addition. <Needs> -Postharvest infrastructure at farm level (drying facility for making copra, primary processing for taking shells). -Aggregation for direct selling to processor to increase profit for farmers. -Technology for producing new value added products. -Development processing industry.
Marketing/	-There is one coconut market in Ambajipet. -Volume of coconut products exported from India has increased from 5,120 tons in 2007 to	-The coconut market is not functional. -Direct marketing of the value added products are not conducted by local stakeholders as there is no

[12] Coconuts Development Board

Process	Current Situation	Challenges/Needs
Export	102,236 tons in 2013. -Total volume of global trade of coconuts has increased from 343,904 tons in 2000 to 837,720 tons in 2013.[13] -Rope made by coconuts coir is exported mainly to China. Other high value products such as oil are not produced in the state.	processing unit of high value added products in the state. <Needs> -Market platform of coconut trade. -Support for facilitating linkage between farmers group and processors/exporters. -Market intelligence study of domestic and overseas coconut market. -Development branding and marketing strategy of Andhra Pradeshcoconut.

Source: JICA Survey Team

(5) Shrimp

(a) Current Situation

According to the press release of the Marine Product Export Development Authority (MPEDA) in 2016, shrimp aquaculture has recorded a tremendous growth (30.64%) and achieved the highest production figure of 434,558 tons in 2014-2015. Production of L. vannamei increased by 41% to 353,413 tons. Highest production was recorded in Andhra Pradesh with 279,727 tonsand 31% growth from the last year. Majority of the shrimp production in Andhra Pradesh are cultured L. vannamei. The second most shrimp producing state was Tamil Nadu with 32,785 tons.

The export of L. vannamei recorded a growth of 26.90% in quantity and 18.98% in USD terms. The United States of America (USA) is the top destination for L. vannamei with 42.77 % of total export in quantity, followed by south east Asia with 20.46%, European Union (EU) with 17.45%, Middle East with 4.55%, and Japan with 4.18 %.

(b) Issues

The USA and EU markets have very strict regulation on antibiotic residue in the product. MPEDA has developed strict laboratory and on site testing and certification process that function well.

In the case of the other high-end markets, there are a number of additional requirements although antibiotic issue is the most important requirement. Those requirements include standardised size (mixture of different sizes in a packet is not acceptable), freshness, no damage on tail. It has also been indicated that L. vannamei reared in low salinity water has inferior texture and color when cooked. (Refer to Attachment 8.6.3)

(6) Tuna

(a) Current Situation

India has abundant yellow fin tuna resources in Exclusive Economic Zone (EEZ) and target to yield 80,000 tons while the current yield is around 35,000 tons. Tuna and billfishes landing in Andhra Pradesh is about 22,000 tons of which yellow fin tuna consists of 34% (7,480 tons). Active fishing for tuna is generally done for six months (October through March) in a year.

MPEDA has been leading the development of tuna fishery for the last ten years by assisting the conversion of mechanical boats to equip longline fishery capability as well as providing technical training to fishermen to improve fish quality such as on board handling techniques. There are two mechanised boats that have been converted to longline gears in India now.

(b) Issues

During the interview of tuna processor/exporters in Kochi in Kerala State, they expressed their frustration of not getting good quality tuna. Although they purchased the best mechanised boats that were converted to longline and MPEDA trained, only 25% of the tuna were good for export.

Fishermen on the other hand, expressed their frustration for the low price of tuna even though they follow the on board handling procedures. Some longline boats do not care about cumbersome on board

[13] FAOSTAT

handling procedures as they can sell the tuna with relatively satisfactory price (INR 40/kg) in the local market.

Fresh tuna obtained the highest price athigh-end market (at times, INR 850/kg) but the price fluctuates a lot at the auction market depending on the quality of fish as well as the daily market situation. Even a high quality fish will not yield a high price if the fish has exterior damages and scratches. (Refer to Attachment 8.6.4)

8.7 Food Park and Japanese Technology

8.7.1 Investigation of Potential Food Park Site

(1) Survey Method

Food park shall be planned with consideration of the current movement of investors and necessity examined from the viewpoint of food value chain. However, there were still lots of vacancies in the existing food parks and even there was a limited interest on investment in Andhra Pradesh state by Japanese food manufacturers. Under the current condition, it is not possible to design a new food park based on the demand of Japanese investors. Therefore, JICA survey team investigated the potential sites for food park in order to assess the future possibility of development by Japanese investors.

The potential sites for food park were investigated per each geographical zone; north area (Srikakulam, Vizianagaram and Vishakhapatnam districts), central area (Godavari, West Godavari, Krishna, Guntur and Prakasam districts), and south area (Nellore, Chittoor, Kadapa, Anantapur and Kurnool districts). The list of the potential sites was prepared based on the following information provided by Andhra Pradesh Industrial Infrastructure Corporation Ltd. (APIIC) and Andhra Pradesh Food Processing Society (APFPS).

(a) Food Park

8 food parks are developed and/or planned in Andhra Pradesh state. Out of 8, Srini food park is the sole developed food park in the state, and other 7 food parks are under development and/or planning. All 8 food parks were investigated in the survey.

(b) Special Economic Zone (SEZ)

47 SEZs are developed and/or planned in Andhra Pradesh state. Out of 47, 10 are developed by APIIC and 37 are developed and/or planned by private developers or APIIC Joint Ventures. 6 SEZs were investigated in the survey.

(c) Industrial Park (IP)

Andhra Pradesh state has Industrial Parks (IPs) ranging from 15 acres to 2500 acres. IPs are basically equipped with approved layouts, internal roads, water supply and power supply. 7 IPs were investigated in the survey.

(d) Land Bank

According to the State Industrial Development Policy 2015-2020, Andhra Pradesh state has an identified land bank of 3 lakh acres and is further in the process of consolidating an additional industrial land bank of approximately 7 lakh acres to invite the investors. 7 land bank locations were investigated in the survey.

Table 8.7.1 List of Investigated Potential Sites for Food Park

Area	Name	Category
North	Chinarapalli	Land Bank under APIIC
	Peddaraopalli	Land Bank under APIIC
	Katakapalli	Land Bank under APIIC
	Kottakki	Land Bank under APIIC
	Bobbilli Mega Food Park	Food Park
	APSEZ : Rambilli	SEZ
	Grouth Center Bobbilli	Industrial Park
	IP Kantakapalli	Industrial Park

Area	Name	Category
Central	Bayyaram	Land Bank under APIIC
	Vatlru	Land Bank under APIIC
	Ramasingavaram	Land Bank under APIIC
	Godavari Mega Aqua Food Park	Food Park
	Krishna Mega Food Park	Food Park
	Peddapuram Food Park	Food Park
	GMR Food & Agri Processing Park	SEZ
South	Bodduvaripalem Food Park	Food Park
	Pogurupalli Food Park	Food Park
	Srini Food Park	Food Park
	Sri City	SEZ
	IFFCO SEZ	SEZ
	Naidupet Multi Purpose SEZ	SEZ
	Krishnapatnam SEZ	SEZ
	Thamminapatnam IP	Industrial Park
	Naidupet IP	Industrial Park
	Attivaram IP	Industrial Park
	Mambattu IP II	Industrial Park
	Piler IP	Industrial Park
	Jain Ultra Mega Food Park	Food Park

Source: JICA Survey Team

The investigation was conducted by site reconnaissance, interview and questionnaire and the result is shown in Attachment 8.7.1.

8.7.2 Survey to Japanese Companies about Business Operation in India

(1) Outline of the Survey

JICA survey team conducted the questionnaire survey to Japanese agriculture and food related companies about current business operation and interests of future business development in India. Objective of the survey is to identify the issues and conditions for Japanese companies to develop the agriculture and food related business in Andhra Pradesh state. Target companies of the survey are the companies in agriculture and food industry, such as agriculture production, food processing, agriculture machinery, equipment and IT, logistics, distribution, wholesale and retail, food services, trading and consultant and services in allied sector. Survey method was distribution of a questionnaire to Japanese food related companies from South Asia Department, JICA and survey period was from 1st February to 11th March, 2016. Number of replied companies was 19.

(2) Summary of Survey Result

Out of 19 companies, 13 companies answered operating in overseas countries. 7 companies have already advanced in India and 10 companies show interests in operation in India in future.

(a) Current Situation of Business Operation in India

Out of 17 companies operating and/or having interest in operation in India, 7 companies answered food processing and sales, 6 companies for sales of agriculture machine and equipment, 3 companies for agriculture productions (Question 3). Main reasons to choose India as business operation were “2. Expectation to market expansion” (14 companies, 82%) and “1. Expectation to high economic growth” (9, 53%), Japanese companies show expectation on Indian market in terms of market size and stable growth. Some companies also has expectations on “7. High potential of agricultural production” (7, 41%) and “5. Easy access to raw materials ” (3, 18%) (Question 4). However, there are problems and constraints on business in India (Question 6). Many companies indicated “2. Law and regulations (frequent reforms, complicated procedures, etc)” (13 companies, 68%) and “5. Infrastructure (insufficient transportation, cold chain, power, water supply, etc)” (11, 58%) as major problems and constraints on business in India.

(b) Direct Trade with India

Regarding business area of trading in operation/ with interests (Question 8), agriculture machinery and equipment companies show their high interest in export of their own products to India. On the other

hand, only one company has interest to export of agricultural produces/ food products to India. The main reasons of trading with India were "1. High potential of agricultural production" and "3. Expectation to market expansion" (Question 9). Problems and constraints on trading with India were that "2. Law and regulations (frequent reforms, complicated procedures, etc)" (8 companies, 42%) was highest followed by "7. Profitability (high cost, etc)" (5, 26%). Some companies complains about complicated import procedures and high tariff on import of machine and equipment.

(c) Expected Public Support for Business Development in India

Regarding expected information, highest demand was "1. Information regarding investment environment and regulations" (14 companies, 74%), even though many Japanese companies still demand broad information about Indian companies, materials and its suppliers and agricultural produces of India (Question 11). Regarding expectation of support and information from Government of Japan/ India (Question 12), highest answer was "4. Smooth clearance by local government" (11 companies, 58%) as the expected support from government of India/ Japan, followed by "3. Extension of business support in India" (10, 53%), "6. Funding support for feasibility study and pilot project to advance India" (10, 53%), and "1. Information about investment environment" (9, 47%). The details of survey result are shown in Attachment 8.7.2.

8.7.3 Identification of Japanese Technologies and Machineries with Comparative Advantages in India

(1) APFPS Delegation to Japan

(a) Outline of the Program

Andhra Pradesh State Food Processing Society (APFPS) formulated a delegation team represented by Secretary of Food Processing to visit Japan for the invitation of MAFF, Japan. The delegation consists of the representatives from Government of Andhra Pradesh (APFPS and APIIC) and food allied companies in Andhra Pradesh state. The objectives of the delegation were to attend the meeting of Indian chapter of the Public-Private council for promoting Global Food Value Chain organised by MAFF and to attend Foodex Japan, which is the international food and beverage exhibition in Japan. During visit of the delegation, JICA survey team joined the program to collect the information from Japanese companies regarding their interests on business development in India in order to analyse the possibility of introduction of Japanese technologies in India.

(b) Result of the Program

The delegation visited Japan from 7th March to 12th March, 2016. During the visit, the delegation members attended the following program.

Table 8.7.2 APFPS Delegation to Japan

Date	Site	Agenda / Activities
8/March	MAFF, Tokyo	- The meeting of Indian chapter of the Public-Private council for promoting Global Food Value Chain - One on One Session among companies of Andhra Pradesh state and Japan
9 and 10/March	Makuhari, Chiba	- Site visit to FOODEX Japan 2016
11//March	Chiba City, Chiba	- Site visit to Chiba Food Industrial Complex

Source: JICA Survey Team

(c) The meeting of Indian chapter of the Public-Private council for promoting Global Food Value Chain, MAFF

The meeting of Indian chapter of the Public-Private council for promoting Global Food Value Chain was held at conference hall at MAFF on 8th March. From Indian side, total 38 persons participated on the meeting, though the registered number of participants from Japanese side was 94.

Table 8.7.3 Number of Participants at the Meeting in MAFF

	No. of Participants Registered	No. of Private Companies	No. of Government/ Public institutes
Japanese side	94	46 (65persons)	12 (29persons)
AP state's side	38	26 (32persons)	2 (6persons)

Source: JICA Survey Team based on the material from MAFF and APFPS

The agenda of the meeting includes the presentations from MAFF, JICA, JICA survey team and Andhra Pradesh state government followed by one on one session among companies of Andhra Pradesh state and Japan. On the one on one session, the participants from both countries were divided into 4 groups per industries such as fruits and vegetables, fishery, rice based products, and food park. They exchanged the idea about business opportunities and challenges on regulations and infrastructures.

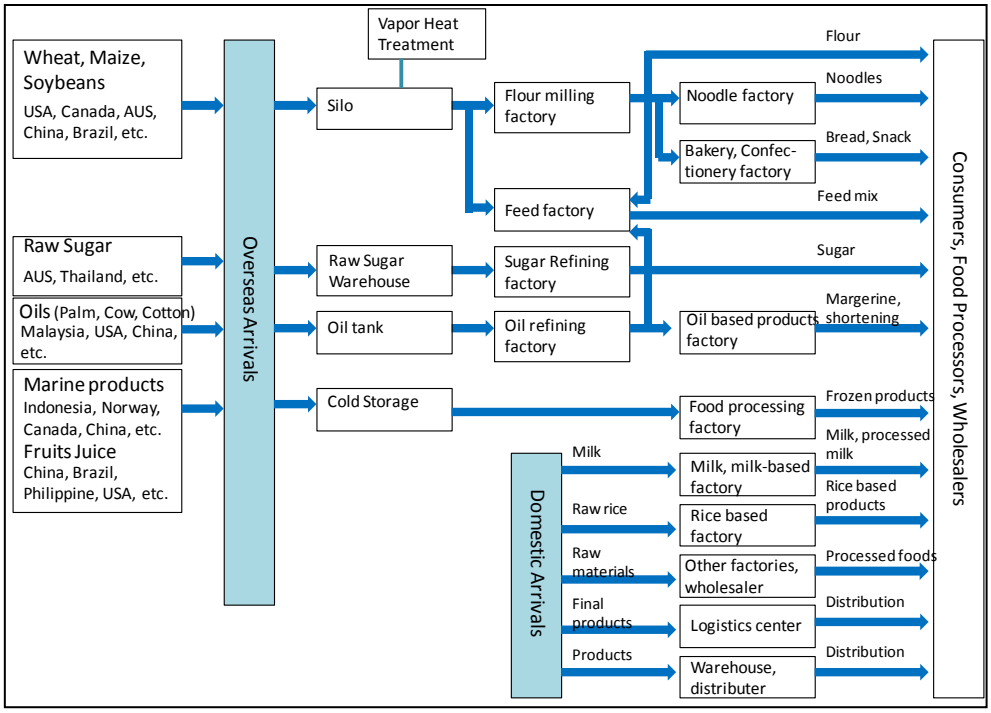
(d) Foodex Japan 2016

Foodex Japan is one of biggest international food and beverage exhibition in Japan and the number of exhibitors were about 3200 from 78 countries. Annexed with Foodex Japan, two exhibitions, namely asian seafood and frozen food fair and food pack and logistics, were also held at same days. Andhra Pradesh state delegation members visited Foodex Japan 2016 in Makuhari for two days 9th and 10th of March. The participants inquired the food products and machines exhibited by food manufacturers and machinery companies. The members from Andhra Pradesh state government also attended on a business matching event between Japanese and overseas companies on 10th March. The number of registered participants were 107 from Japanese and 29 from overseas countries. The members from Andhra Pradesh state introduced Andhra Pradesh state as the desirable business destination in India and exchanged business opportunities in India.

(e) Chiba Food Industrial Complex (CFIC)

CFIC located in Chiba city is the first and largest food industrial park in Japan. CFIC was constructed in 1964 in order to achieve the modernization of the food industry. Out of 610ha of reclamation land of central block of Tokyo Bay Chiba port, the land of 99ha was allotted for CFIC.

Currently, CFIC has about 30 tenant companies, such as raw material importers, manufacturer and shippers. The coastal area in CFIC has silo tanks and warehouses to unload the arrivals, such as grain, corn, oils, raw sugar and frozen marine products from abroad. Adjacent to the silo tanks, food basic materials industries, such as flour milling, sugar and oil refinery companies are placed to produce flour, sugar, fat and oil products, etc. Behind those food basic materials industries, food processing companies are placed to manufacture the products such as bakery, confectionery, noodles, ready-to-eat foods, frozen foods. CFIC also contributes the development of the industry as well as local communities with guideline of MAFF, Chiba prefecture and Chiba city.



Source: JICA Survey Team

Figure 8.7.1 Products Flow in CFIC

CFIC is one of the model of "Food park", and the concept and structure can be a good example for the food park development in AP state. Therefore, the delegation planned a site visit to CFIC with coordination of CFIC Association on 11th March. The members visited Chiba Flour Milling Co., a CFIC company, to have a brief introduction about CFIC and see the facility and infrastructure in the factory such as jetty, silos, wheat milling machines. The members inquired about the products, applied technologies and operation system.

(2) Collaboration Fair for Andhra Pradesh State's Agricultural Products and Japanese Technology

(a) Objective

Andhra Pradesh state is one of the most desirable state in India for fruits and vegetables production. Those products will promote Andhra Pradesh state to establish high value added food value chain in AP state by developing food processing industries and improving cold chain network. However, as Japanese companies do not have much chance to know about Andhra Pradesh state's agricultural products, they do not have the privilege of considering collaboration with their own technology and agricultural products.

Hence, a collaboration fair was planned in Tokyo to create an occasion to introduce agricultural products of Andhra Pradesh state and food processing situation in order to encourage both Andhra Pradesh state's companies and Japanese companies to match agricultural products with Japanese technology.

(b) Outline

The outline of the collaboration fair is below.

- Date : 6th of June, 2016
- Venue : Embassy of India, Tokyo
- Sponsor : Embassy of India, Tokyo
- Co-Sponsors : APFPS, Agricultural and Processed Food Products Export Development Authority (APEDA)
- Partners : MAFF, Andhra Pradesh State Commission for the Public and Private Sectors, JETRO, JICA
- Invitees : Indian food processing companies (10 companies), officials from Andhra Pradesh state (5 staff)
  Japanese food processing companies, wholesalers and retailers (30 companies)
- Agenda : Welcome speech by Ambassador, Embassy of India, Tokyo
  Introduction of Food Industry and investment environment
  Introduction of Agricultural Products and Food Processing situation in Andhra Pradesh state
  Introduction of Japanese Processed Foods
  Interaction with AP companies and Japanese companies

(c) Preparation Activities

In order to organize the fair smoothly, JICA survey team requested APFPS to make necessary arrangements as follows;

Table 8.7.4 Plan of Operation for the Collaboration Fair

Activity	Apr				May				Jun	Responsible
	1w	2w	3w	4w	1w	2w	3w	4w	1w	
Nomination of person in charge of EOI		x								EOI
Confirmation of Date and time		x								EOI/APFPS
Confirmation of Venue at EOI		x								EOI
Draft of Agenda and invitation letter		x								JICA Team
Nomination of invitees and guests from Japan		x	x							JICA Team/ JICA HQ
Request of presentation to PISA			x	x						JICA HQ
Send of Invitation letter-1			x							JICA HQ/ MAFF

Activity	Apr				May				Jun	Responsible
	1w	2w	3w	4w	1w	2w	3w	4w	1w	
Nomination of participants from AP states		x	x	x						APFPS
Confirmation of exhibit items			x	x						APFPS
Sending invitation letter-2						x				JICA HQ/ MAFF
Confirmation of participants						x	x			JICA Team
Logistic arrangement for export/import						x	x	x	x	APEDA
Logistic arrangement for VISA, air ticket, hotel for participants from AP					x	x	x	x		APFPS
Pre-meeting (confirmation of agenda, venue, set-up details)								x		EOI/ JICA JICA Team
Printing of papers/documents									x	JICA Team
Set-up of venue (includes catering of foods and drinks)									x	EOI
Promotion Fair Day									x	

Note: EOI: Embassy of India, APFPS: AP Food Processing Society, APEDA: Agricultural and Processed Food Products Export Development Authority, JICA HQ: JICA Head office in Tokyo, MAFF: Ministry of Agriculture, Forestry and Fishery, Japan

Source: JICA Survey Team

Based on the discussion with APFPS, the following agricultural produces and processed foods were identified to be displayed at the collaboration fair in Tokyo.

- Fresh Fruits: Mango, Pomegranate, Guava, Papaya
- Processed Fruits: Mango, Guava, Papaya Pulp, IQF Fruits, other processed fruit products.
- Fresh Vegetables: Beans, Baby corn, Lime, Lemon, Green Chillies, Okra
- Processed Vegetables: Processed Gherkins; IQF vegetables; pickled vegetables
- Spices: Chillies, Turmeric
- Spice processed: Pure spice powders, spice mixes, oleoresins, natural colours
- Coconut products: tender coconut water, desiccated coconut, virgin coconut oil, etc.,
- Rice Bran Oil
- Groundnut: groundnut seeds, groundnut snacks and other spice coated nuts
- Coffee: Speciality Beans and Powder

(d) Result of the Collaboration Fair

JICA survey team prepared the collaboration fair, in the meantime, the Cyclone Roanu originated in south of Sri Lanka caused severe damages to the crops in Andhra Pradesh state and several companies were forced to cancel the travel to Japan. Considering this situation, Government of Andhra Pradesh instructed Secretary of Food Processing, who was the representative of the state for the fair, not to travel abroad in this period. In view of the above stated problems, it was decided to postpone the fair.

8.8 Environmental and Social Considerations

8.8.1 General View

Based on the proposed activities, the situations of the environmental and social considerations were confirmed through interview with government officials and field reconnaissance during the second survey period on February 3-April 2, 2016. Related to the proposed project, legal requirements for the environmental study and also overview of the legislations regarding resettlement and land acquisition were analysed byreviewing relevant legislations and interviewing governmental officials ofimplementation bodies. The results were compiled in the report.

JICA funded projects should follow the JICA Guideline for Environmental and Social Considerations. At the data collection survey stage, the preliminary information for serving the project categorisation was confirmed through interview with implementation agency and also field reconnaissance.

The relevant secondary information was collected by a consulting authority. Environmental study here intended to find information relevant to project categorisation/screening at data collection survey. Major activities are the following:

(1) Review and Analysis of Legislation Related to Environmental and Social Considerations

Related to the proposed project components, confirmed the situation of environmental study on the currently proposed projects and applicable legislations are confirmed for items, which have the potential impact, irrigation projects and food park development. Also, consulting with the environmental authority, State Pollution Control Board, relevant legislations and general situation of the environment in the state were confirmed. The land related legislations and their processes were confirmed withthe authority, commissioner for resettlement, and land acquisition for water resources.

(2) Collecting and Reviewing Secondary Information Related to Project

Relevant information in the state such as natural environment, social environment, and pollution control are collected from the authorities of the state. The collected informationwere compiled in Chapter 12.

(3) Field Reconnaissance and Interview in the Project Sites Selected as Sample Survey Projects

To grasp the current situation of the environment of the proposed projects, field reconnaissance to the selected sample irrigation projects and interview with responsible engineer for the project were conducted.

i.) Site observation in Vizianagaram
- Medium Irrigation: Vottigedda Medium Irrigation Scheme
- Minor Tank: 1. Dora Tank (J.M.Valasa Mandal, Kudama Village)
  2. Chinni Tank (J.M.Valasa Mandal, Chinamerangi Village)

ii.) Site observation in W-Godavari
- Medium Irrigation: Tammileru Medium Irrigation Scheme
- Minor Tank: 1. Pedda Tank (Pedavegi Mandal, Koppaka Village)
  2. Vemanakunta Tank (Lingapalem Mandal, Narasannapalem Village)

iii.) Site observation in Chittoor
- Medium Irrigation: Krishnapuram Medium Irrigation Scheme
- Minor Tank: 1. Katherapalle Tank (Karvetinagaram Mandal, Katherapalle Village)
  2. Chokkamadugu Tank (Karvetinagaram Mandal, Chokkamadugu Village)
- Field reconnaissance and interview in the project sites which are covered by the protected area
- Siva-Basham Medium Irrigation Scheme in Kurnool District

iv) Interview with theenvironmental authority in the districtsofsample survey projects
- Seshachalam Hills Biosphere Reserve in Chittoor District
- Kolleru Lake Wildlife Sanctuary

8.8.2 Results of the Survey

Due to time constraints, aquick site observation was made though field reconnaissance as mentioned above and the results are summarised below.

(1) Regarding Irrigation Scheme

Table 8.8.1 Observation of the Sample Projects in Chittoor District

Location	Description
Krishnapuram Medium Irrigation Scheme	- The scheme is one medium irrigation reservoir and 16 system tanks in the command area. - Although the main reservoir dam (H=21m, L=488m) in the scheme remained in good condition without damage, some parts of the facility have been aging. The new project includes reparation of the downstream apron, extension of the guide wall,and reconstruction of main canals. There is no major works related to the dam. - General condition, the dam and irrigation canals were constructed about 35 years ago. Water in the medium dam is connected to the 16 system tanks in the downstream. - For management, the surrounding area in the catchment area upper part of the water line is protected. Any activities are not permitted in the area of 100m in slope distance from the full water level (based on technical sanction at the design stage). Also, in case of the minor tanks, the area is reduced up to 10m from FWL in minor tank area equal/less than 10 ha of the catchment area and 30 m from FWL in minor tank area over 10 ha.
Katherapalle Minor	- The tank is one of the system tanks for the Krishnapram Medium Irrigation Scheme. The new

Location	Description
Tank (Karvetinagaram Mandal, Katherapalle Village)	project involves replacement of off take sluice, supply via slope protection of the bund and social forestry at the catchment protection area (buffer zone). - The tank is located adjacent to the village. Dam bund has been utilised as a village road connecting between communities in Katherapalle Village. Currently, the road requires some improvement and some facilities for irrigation should be improvement accordingly.
Chokkamadugu Minor Tank (Karvetinagaram Mandal, Chokkamadugu Village)	- The tank is located at the end of the medium irrigation project of the 16 minor system tanks in the area. Because of water shortage in the reservoir, water supply to the tank has not been stable. Some parts of the earthen irrigation canal were damaged by farming activities. Also, parts of the tank were used for cultivation by farmers. The length of the damaged canal accounted for 60% of the total length.

Source: JICA Survey Team

Table 8.8.2 Observation of the Sample Projects in West Godavari District

Location	Description
Tamileru Medium Reservoir	- The reservoir dam is located on the Tamileru River which borders between West Godavari and Krishna. The reservoir hastwo reservoirs:one main reservoir on the Tamileru River and another reservoir in Krishna District and connecting canal has a length of approximately 2.5km. There are three main canals from the reservoir and those are right canal L=6.5km, Mankol canal L=3.38km, and left canal L=11.9km. Major activities for the scheme are:sluices, regulator, under terminal, spill passage, siphon, and desilting of canals drainage for the reservoir bund. - The reservoir does not have buffer area from the water catchment and some farmlands are located very close to the water body. As a problem, some farmers are connecting their water tanks to the reservoir to fetch water for their own use in the dry season,however, this practice is not officially allowed. - The reservoir has been used by fishery association for fishing purpose. Although water storage in this year (2015-2016) is very low under dead water level they still can use the reservoir throughout the year.
Vemana Kunta Tank(Lingapalem Mandal, Narasannapalem Village)	- The tank located closely to the Tamileru Medium Reservoir area but this is a individual tank and not connected to the reservoir. However, this connected to the several tanks in the area as one of chaining tanks. In general, even the tank is fully filled, water last only fro three months and it is difficult to contribute to two crops. A part of the area of the tank is being used for cultivation seasonally when the surface water is end. As major construction works, surplus weir x2 ,sluices x 3, guide wall for feeder canal are proposed. A part of the tank was already conducted desilting under the “Neeru Chettu(Water and Tree)” program.
Pedda Tank(Pedavegi Mandal, Koppaka Village)	- The tank is an individual tank at west side of the Tamileru River. Currently just adjacent to the tank, Polavoran Right Canal is under construction. Similar to the Vemana Kunta Tank, in general, the water last only threemonths and it is not enough for two crops even it is fully filled. Majority area of the tank is being used for cultivation seasonally when the surface water is end. Also, the tank is used for water storage tank pumping from outside of the tank. Reconstruction of sluice x2, resectioning and reconstruction of the feeder Canal, Improvement of the bund to gravel top for transport, are proposed as major construction works.

Source: JICA Survey Team

Table 8.8.3 Observation of the Project in the Protected Area in Kurnool District

Location	Description
Siva Bhashyam Sagar Medium Irrigation Scheme (Kurnool, Department of Water Resources)	- Siva Basham Medium Irrigation Scheme partly fell into the area of the Nagarjunna Sagar Srisailam Wild Sanctuary (Tiger Reserve). Current situation and contents of the proposed project were confirmed though interview with responsible engineer and site visit in Kurnool District. - The proposed project may contain some maintenance works for the facilities. Those are road improvement(part of the current 4km maintenance road), additional field office(approx.5mx5m in 2F) on top of the dam body serving as store shed on the ground floor, solar system illumination, 0.7km of canal lining and standby generator installation.
Assistant Chief Conservator Forest, Atmakur Camp Office, Forest Department, Kurnool District	- The project can be permitted if applied. The impact of the work is very limited, however, adequate permission should be taken from the Forest Department. As long as it does not require additional land in the sanctuary area and also works are only limited to rehabilitation/maintenance of the existing facilities, it is not difficult to obtain permission and it might be not complicated. The details should be discussed with the Divisional Forest Office in Kurnool. - As the current situation of the sanctuary, the census of tiger population is planned to take this year (2016). Based on the previous census, the number of tigers was 62 in total including Telangana State area and it can be estimated approximately 31 tigers in Andhra Pradesh area.

Location	Description
	Besides tiger, Samber, Nirgil Spot dear and wildboar are found in the sanctuary. But near the dam area, crocodiles can be seen in the reservoir due to water availability and other may be difficult to find especially in the rainy season.

Source: JICA Survey Team

(2) Regarding Economic Zones Related to Food Park Development

Table 8.8.4 Observation of the Existing Economic Zones Related to Food Park Development

Location	Description
Kisan SEZ, IFFCO, Nellore	- Visiting Kisan SEZ, IFFCO located in the northern part of Nellore City, current situation of the ongoing projects of SEZ was observed. (Approximate location: 14°37'33.42"N, 79°58'48.48"E) - There are three areas in the SEZ and those are No.1 approx. 900 acres, No.2 800acres and No.3 93 acres. No major operation has been done. Coca-Cola and GAMESA, respectively, has approximately 150 acres each, which are under construction to be operated in 2016. The SEZ is well connected to transportation such as highway, railway, and ports. The fundamental infrastructures provided by SEZ are electricity, water, and general sewage system. - The area previously belonged to the government. The land is a barren land before. No land acquisition from private owner is required/made. Partly adjacent to the forest land, and those are not involved in the project area due to governmental restriction. Also, some grazing activities are allowed to the villagers in the area. The companies obtained the right for 33 years lease hold and later can be extended. - Environmental clearance was obtained for the entire area by IFFCO; and for the companies consent for establishment (CFO) and consent for operation (CFO) are required. This process isgenerally conducted in the District Pollution Control Board, i.e; Nellore Pollution Control Board.
Krishnapatnam Port (KPCT) and Menakuru SEZ, Nellore	- Visiting APIIC, Krishnapatnam Port (KPCT), Krishna Industrial Park organised by APIIC located in the east of Nellore City (coast), current situation of ongoing projects of SEZ was observed. - General View for Food Processing - There are some potentials in the area related to food processing. These are: 1) shrimp, 2) pulses, 3) spices, and 4) cashew (groundnut, onion) - In case of shrimp, although certain amount of the products can be expected in the area, due to shortage of cold facilities, producers should wait for vacant containers for shipping. If the cold facilities will be available, the amount of the product may increase (500 containers/month currently and it may increase to 1,000 containers/month as twice). With those activities, the employment opportunities may increase in the area. - About pulses, the amounts for import and also export are very high. This can be established in some processing facilities aiming for domestic consumption shipping from the port. - Spices are major products from India. Especially, chili is one of the best products in the region. - Cashew comes from Kerala and other regions to the port and it may increase the amount for export. - Besides those food processing facilities, food safety facilities may require intargeting export such as quarantine and other laboratories. - About the industrial park (Menakuru SEZ): Approximate location(13°53'43.20"N, 79°49'19.38"E) - The land belongs to the government. EIA process for the existing area was already processed and the new area is under process. In case of the industrial area(industrial estate), the environmental clearance is processed in the central level(MoEF). In case of this park, the environmental study was taken for threemonths because the area has been already developed as existing (only for expansion). Anenvironmental study may take if it is anew project. As long as anenvironmental clearance is issued for the whole industrial area, the companies will not be required to conduct environmental study individually.
Sri City(Industrial Park) Nellore and Chittoor, Andhra Pradesh	- Visiting Sri City located in the south of Nellore District and east of Chittoor District, the current situation of the ongoing project of industrial park was observed. - Approximately 4,000ha of the land area (first phase 7,500acre, second phase 2,000ha) - The industrial park accommodates multiple production companies targeting domestic and international markets and it is divided by: 1) Special Economic Zone (SEZ), 2)Free Trade andWarehouse Zone, 3)Domestic Manufacture Zone, and 4)Electric Manufacture Zone. Sixteen Japanese companies are already located and majority of them are automotive industries. Besides electricity, water and sewerage plants as common facilities for the industry, residence, schools, leisure, and recreation facilities are under development. The city is planned to accommodate “environmental friendly industries” which are expected to create less impact to the environment.

Location	Description
	- Some questions and answers are the following: - About the Land - Around 30-40 % of the land belonged to the government and the other 60-70% of the area had been acquired from private owners (mainly those lands are used as farm land). - The land will be used for lease by companies for 99 years. - About Environmental Work - Meeting with the governmental policy, solar power generation has been applied. - Solid waste management is conducted by outsourcing company "Ramkey Environment", one of the governmental approved agencies. - About Tax - Although the park is located closely to Karnataka State as it main access from abroad, the state border tax (interstate tax) is still applicable. However, it may be improved if the central government will apply goods and service tax (GST) in the future.

Source: JICA Survey Team

(3) Regarding Environmental Authority

Table 8.8.5 Opinion of Expert in the Field Related to Environmental Conservation

Location	Description
Chief Conservation Forest(CCF), Tirupati, Chittoor District, Andhra Pradesh State	- There is a biosphere reserve in the United Nations Educational, Scientific and Cultural Organisation (UNESCO) (covering the area of Venkateswara Wildlife Sanctuary) in Tirupati in Chittoor District. According to the CCF, there is no majorproblems related to the current irrigation activities and it may give less impact compared with mining and others. - About the biosphere reserve, currently, the conservation of genetic resources isfocused and bio lab was established in the area. Biosphere reserve, Seshachalam Hills was designated in 2010, by UNESCO (4755.997ha). The area is covered by transition zone, buffer zone, and core zone. The total area for the biosphere reserved spreads to two districts i.e., Chittoor and Kadapa.There are some endemic species such as Cycas species and Red Sander tree species.
Wildlife Management Division Eluru , Divisional Forest Office, West Godavari	- In West Godavari District, Kolleru Lake Wildlife Sanctuary, the biggest natural fresh water lake in India, the only one Ramsar site in India, confirmed the current situation to the management authority. No particular impact will be concerned about irrigation if it is only for rehabilitation. - About Kolleru Lake, the area is the one of the Ramsar sites in India and only site in Andhra Pradesh State. The area approximately 900km^2 was originally bounded the area of 10 ft AMSL. At the time of 1954, about 3,000 nesting spot bill pelicans were observed. Major significance in the sanctuary was the bird and it was firstly notified as the bird sanctuary. However, no physical demarcation on the ground. There are people's residences and some areas are still owned by the public.The area was once almost totally encroached for fishpond use. At that time, the endangered specie, spotted pelican was also fully displaced without any nesting ground. In 2006, the authority tried to demolish the fishpond in the area, and artificially made a mound for nesting. Then the bird population has increased to approximately 8,000 birds currently.
Assistant Chief Conservator Forest, Atmakur Camp Office, Forest Department, Kurnool District	Please refer table above-

Source: JICA Survey Team

9. PROJECT OUTLINE

9.1 General

This chapter is an introductory part in the formulation of the proposed Andhra Pradesh Irrigation Livelihoods Improvement Project-II (APILIP-II), dealing with the project descriptions and summary of project scope designs based on field visits and discussions with the Department of Water Resources (DoWR) and other relevant departments. The details of the project scope by component are discussed in Chapter 10 for core programmes and Chapter 11 for pilot programmes.

9.2 Project Development Objectives

The development objective of APILIP-II is to improve the livelihood of farmers in the command areas of old irrigation projects by increasing agriculture productivity and actual irrigated area through (i) modernisation of old irrigation systems for the improvement of irrigation efficiency, (ii) participatory irrigation management (PIM), (iii) promotion of farmers producer organisations (FPOs), and (iv) support for local poor in animal husbandry and fishery communities leading to integrated farming system and viable livelihoods of beneficiary farmers as core programme.

The challenges toward sector reform in the state focusing on food value chain development for strategic crops and farm mechanisation on a pilot basis are also objectives as well.

It is expected that the pilot programme will make a successful model of advance agriculture development in Andhra Pradesh State, which could expand to the project medium irrigation clusters as well as whole the state in future.

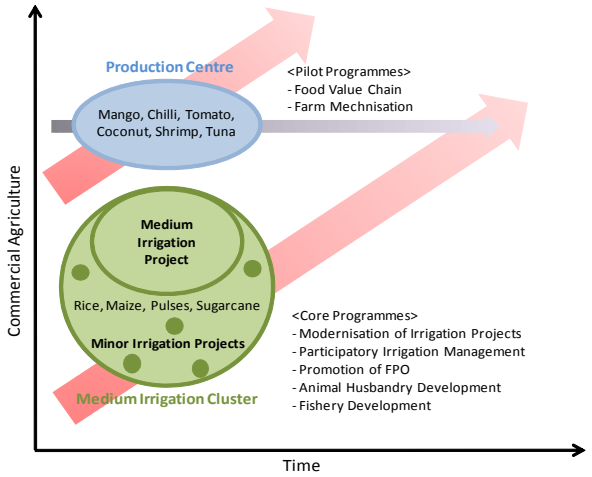


Figure 9.2.1 Image of Core and Pilot Programmes

9.3 Necessity and Priority of the Project

(1) Consistency with the National Plan and Development Strategy

The National 12th Five-Year Plan emphasises that the growth must not only be rapid but also more inclusive and environmentally sustainable to: (i) reduce poverty; (ii) improve regional equality across states and within states; (iii) improve conditions of SCs (Scheduled Castes), STs (Scheduled Tribes), OBCs (Other Backyard Castes), and minorities; (iv) close the gender gap; (v) generate attractive employment opportunities for the youth; (vi) resource usage efficiency and technology to ensure sustainability of natural resources; and (vii) adaptation to climate change and improvements in total factor productivity.

Besides, the current Government of India has laid a five-point agenda to enhance agriculture development, i.e.: (i) to give agriculture technology to farmers from laboratory to land by farm mechanisation; (ii) to use digitised multimedia for training progressive farmers; (iii) to promote water conservation by coordinating the weather and water cycle 'per drop, more crop'; (iv) to promote allied sectors animal husbandry and fisheries 'have a blue revolution.'; and (v) to develop herbal medicines. In addition, farmers and commodity interest groups need to be linked to the global market for "smaller land, shorter time, and more productivity".

Taking the above into account, it can be said that the proposed APILIP-II coincides with the national plan and strategy.

(2) Consistency with the State Development Policy and Strategy

The Government of Andhra Pradesh (GoAP) has put top priority on primary sector mission out of seven missions launched as a part of long-term vision. A strategy paper for Mission on Primary Sector - Agriculture Transformation in Andhra Pradesh - published in October 2014 attempts to design a strategy to transform the agriculture and allied sector, and then to operationalise it in a phased manner. The focus is essentially on (a) increasing productivity of the primary sector; (b) mitigating the impact of droughts through water conservation and micro-irrigation; (c) postharvest management to reduce wastage; and (d) establishment of processing, value addition capacity, and supply chain of identified crops. As adaptation measures for climate changes, GoAP has initiated various projects and programmes for water conservation and management in the state including modernisation of medium and minor irrigation projects as shown in Table 12.5.4. Thus, the proposed APILIP-II, which is consistent with the state development policy and plan, is noteworthy to be implemented.

(3) Necessity of Irrigation Modernisation in Andhra Pradesh State

Andhra Pradesh State has about 42,000 tanks covering over 0.966 million ha of farmlands of which about 6,200 tanks are considered as minor irrigation tanks. The gap ayacut of the minor irrigation projects is estimated at roughly 40% on average against the irrigation potential created (1.037 million ha) to date. Meanwhile, the same major and medium irrigation projects is assessed at around 25% on average against the irrigation potential created (2.789 million ha) so far. The main reasons for increasing gap ayacut (over 1.1 million ha) are lack of proper maintenance of head works and canals and inadequate control and regulation on irrigation structures. Accordingly, such irrigation projects need to be improved to reduce the gap ayacut by raising water use efficiency along with institutional development and capacity building of WUAs/farmers by the proposed APILIP-II.

(4) Necessity of Participatory Irrigation Management (PIM)

Irrigation schemes have deteriorated due to lack of proper management and ownership. To maximise the benefit of modernisation of the irrigation schemes, capacity development of WUA, as well as establishment of supporting system for adequate O&M, is crucial. Even though the GoAP has been trying to develop participatory irrigation management (PIM) since the 1990s, WUA's functions were interrupted during the previous government scheme. It is a critical time to revive PIM by reformation of WUA and enhancement of WUA's capacity by establishing a strategy in a newly established GoAP.

(5) Necessity of Farmers Producer Organisations (FPOs)

The concept of farmer producer organisation (FPO) has been promoted all over the country in recent years. FPO has a potential to improve situation of small and marginal farmers by reducing risk and expenses of farmers and enhancing marketing power through collective practices. The GoAP takes strong initiatives to promote FPOs and has started several programmes. In line with the government policy, it is effective to support their initiatives. To actually make FPO promotion benefit the farmers in the target area, adequate steps and approach are required. Project intervention in FPO promotion including comprehensive support from the foundation setting through agriculture extension activities can help the government develop a suitable approach of FPO support in irrigated areas.

(6) Necessity of Livelihood Programme in Andhra Pradesh State

There are thousands of tanks developed in Andhra Pradesh State providing water to local people not only for domestic and irrigation uses but also for inland fisheries and animal husbandry. Some of the traditional governance systems (caste/kinship-based, with geographical origin, and also being important in case of migrant/settler community) are still in place to provide governance in agriculture, fisheries, and animal husbandry communities at the local level. Those who belong to historically disadvantaged groups are officially designated as scheduled castes (SC) in India. Some measures have to be taken up for unbenefited local groups living in and around the proposed irrigation projects. Such social consideration shall be built in the project design of APILIP-II.

(7) Necessity of Food Value Chain for Strategic Crops in Andhra Pradesh State

Andhra Pradesh State is one of the leading states in agriculture and horticulture produces and has a good potential to become an agribusiness hub in Southeast India. Among others in Andhra Pradesh State, the

crops selected by the JICA Survey Team (mango, tomato, chilli, coconut, shrimp, and tuna) are the most prospective produces for international market as well as domestic market. However, there is still a big room to improve the total food value chain in Andhra Pradesh State such as enhancement of productivity, motivation of producers, awareness in quality, food safety and traceability, agribusiness infrastructure and private investment, and close coordination and linkage among producers, transporters, processing companies, traders, and also government officials in charge. Thus, development of food value chain coincides with national and state policies and needs to be incorporated into the proposed APILIP-II.

(8) Necessity of Farm Mechanisation in Andhra Pradesh State

There are three major reasons to promote farm mechanisation: (i) severe shortage of agriculture labour in the peak seasons of transplanting/planting and harvesting, (ii) steep rise in labour wages due to increasing migrant workers under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), and (iii) aging of farming communities and issues of their successors. To overcome these problems, farm mechanisation attracting the educated youths in farming communities needs to be introduced by the proposed APILIP-II.

(9) Consistency with the JICA's Policy and Development Assistance Plan to India

It also coincides with the JICA's country analysis paper for India stating that poverty alleviation and food security are the main issues of agriculture sector in India, which can be overcome by means of (i) countermeasures for water shortage, (ii) development of rural infrastructure, and (iii) investment on research and development of agriculture technology. Moreover, the JICA's development assistance plan to India puts emphasis on eradication of poverty and improvement of environment. Income and employment generation of the local poor is top priority. Thus, the proposed APILIP-II can be justified to apply for the Japanese official development assistance (ODA).

9.4 Executing Agency

The executing agency of the project will be the Department of Water Resources (DoWR), GoAP, who has overall responsibility for project implementation.

GoAP will set up the project steering committee (PSC) and project management unit (PMU) at the state level, and district project implementation unit (DIU) at the district level. In principle, the departments of planning (DoP), water resources (DoWR), agriculture (DoA), horticulture (DoH), animal husbandry and fisheries (DoAHF), mines and geology and food processing (DoMGFP), finance (DoF), and also Andhra Pradesh Food Processing Society (APFPS) will be the members of these committees and units.

9.5 Project Locations

The project will cover all 13 districts of Andhra Pradesh State, namely; Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasham, Kurnool, Anantapur, Kadapa, Nellore, and Chittoor as shown in the map of Andhra Pradesh.

9.6 Project Components

The project comprised the following eight components, of which the top seven components will be financed by JICA with terms and conditions set forth in the loan agreement, and the rest shall be funded by the GoAP as shown in Table 9.6.1.

Table 9.6.1 Major Project Components

Component by the JICA Survey Team	Name of Component by the JICA Survey Team	Component in Project Concept Note*
Component 1	Modernisation of Medium and Minor Irrigation Projects	
1.1	- Medium Irrigation Projects	Component A
1.2	- Minor Irrigation Projects	Component A
Component 2	Participatory Irrigation Management (PIM)	Component B
Component 3	Promotion of Farmers Producer Organisations (FPOs)	Component C
Component 4	Livelihood Support Programme	
4.1	- Animal Husbandry	Component C

Component by the JICA Survey Team	Name of Component by the JICA Survey Team	Component in Project Concept Note*
4.2	- Fishery	Component C
Component 5	Pilot Programmes	
5.1	- Food Value Chain for Strategic Crops	Component C
5.2	- Farm Mechanisation	Component C
Component 6	Project Management	
6.1	- Support to PMU/DIU	Component D
6.2	- Capacity Building	Component D
6.3	- Monitoring and Evaluation	Component D
6.4	- Thematic Study and Action Research	Component D
Component 7	Consulting Services	Component D
GoAP Share	Project Administration, Taxes and Duties, Interest during Construction, Front End Fees	GoAP Share

*Note: *) Project Concept Note for APILIP-II (2016-17 to 2020-21), DoWR/GoAP*
Source: JICA Survey Team

Table 9.6.1 shows the different numbering of components between the JICA Survey Team and DoWR/ GoAP.

9.7 Project Scope

The scope of works of each component is discussed in detail in Chapter 10 except for Component 5 which is examined in Chapter 11, and briefly in Table 9.7.1.

Table 9.7.1 Major Project Components and Scope of Works

No.	Component	Scope of Works
1	Modernisation of Medium and Minor Irrigation Projects	1. Medium Irrigation Projecst: 20, A= 104,594 ha 2. Minor Irrigation Projects: 449, A= 56,966 ha
2	Participatory Irrigation Management (PIM)	a) Revision of guideline and capacity building of government officers b) Equipping supporting organisations c) Capacity development of WUAs (minor irrigation projects) d) Capacity development of PCs and WUAs (medium irrigation projects)
3	Promotion of Farmers Producer Organisations (FPOs)	a) Agriculture extension programmes b) Preparation for FPO formation c) Support for establishing FPOs
4	Livelihood Support Programme	1. Animal Husbandry a) Development of livelihood plan b) Enhancement of productivity of animals c) Promotion of livestock-based income generation activities 2. Fishery a) Development of livelihood plan b) Support for fish production activities c) Support for marketing activities
5	Pilot Programmes	1. Food Value Chain for Strategic Crops (mango (fresh and processed), tomato, chilli, coconut, shrimp, and tuna) a) Development of mechanism to assist entire value chain b) Capacity development of government officers, producers, producer groups, and other stakeholders c) Development of marketing and brand strategy 2. Farm Mechanisation a) Establishment of agricultural mechanisation and technology Centre (AMTC): 2 AMTCs b) Establishment of workshop: 10 units b) Training of custom service units (CSUs): 107 CSUs c) Procurement of farm machinery for training purpose: 2 units each for rice and ID crops.
6	Project Management	1. Support to PMU/DIU a) PSC/PMU advisors

No.	Component	Scope of Works
		b) PMU/DIU consultants- individual c) PMU/DIU consulting firms / NGOs d) Equipment and furniture 2. Capacity Building a) Exposure visits and study tours (domestic) b) Seminars c) Workshops d) Publication of information, education, and communication materials e) Andhra Pradesh State training and research institute f) WUA facilities (multi-purpose communication centre, etc.) 3. Monitoring and Evaluation a) Environmental monitoring b) Benchmark survey c) Water benchmarking and water audit d) Management information system (MIS) 4. Thematic Study and Action Research a) Value chain analysis b) Private sector leadership analysis c) Analysis of storage, transport and other regulations, and procedures for global standards d) Andhra Pradesh agriculture promotion video film
7	Consulting Services by Project Management Consultant (PMC)	PMC will assist PMU/DIU in the overall project management as follows: a) Guidance for the overall project monitoring and management, b) Inter-departmental coordination and close communication, c) Development and review of annual work plan and monitoring of the work progress at the state level, d) Facilitation of convergence among the departments concerned at the state level, e) Construction management, technical guidance and monitoring, f) Fund management, g) Technical support (training and awareness programme, etc.), and h) Liaison between PMU and JICA.
8	GoAP Share	a) Project administration b) Taxes and duties c) Interest during construction (1.4%) d) Front end fees (0.02%)

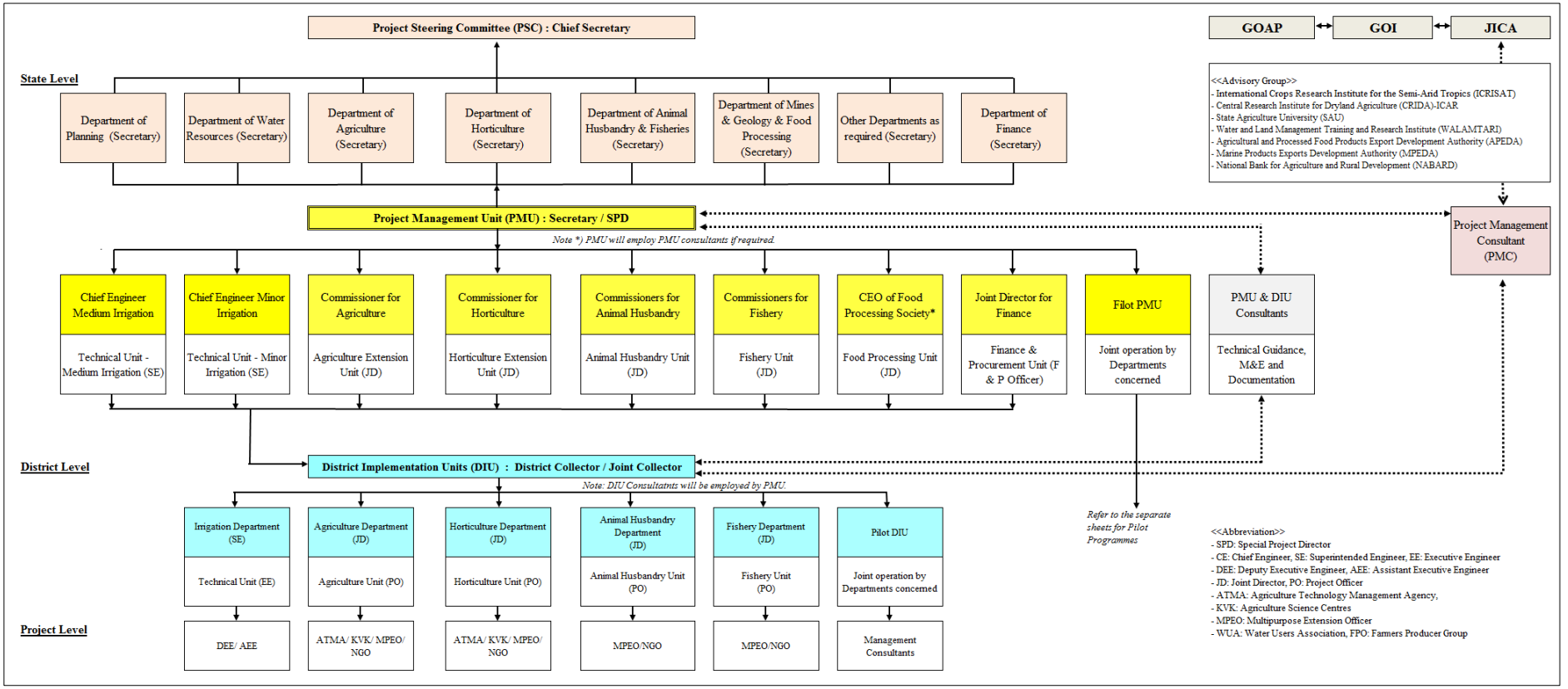
Source: JICA Survey Team

In the Project, convergence with the government programmes shall be actively promoted. In principle, the JICA loan will not be provided for individual subsidy. Therefore the government programmes shall be first considered for such subsidy if applicable.

9.8 Project Organisation Structure

9.8.1 Overall Project Organisation

The project organisation structure is discussed in detail in Chapter 10 except for Component 5 which is examined in Chapter 11, and briefly in Figure 9.8.1.



Source: *JICA Survey Team*

Figure 9.8.1 Organisation Structure for APILIP-II

Major roles and functions of the project organisation structure are described in Table 9.8.1. The Project Steering Committee (PSC) will be chaired by the chief secretary of GoAP, while the Project Management Unit (PMU) by the secretary of DoWR, and the District Implementation Unit (DIU) by the chief engineer of DoWR in the respective districts.

Table 9.8.1 Major Roles and Functions of Project Organisation

Organisation	Members	No.	Major Functions
Project Steering Committee (PSC)	Secretaries of Planning, Water Resources, Agriculture, Horticulture, Animal Husbandry, Fisheries, Mines and Geology and Food Processing, Industries, Finance and others as required.	1	Decision making body at the state policy level
		2	Provide strategic direction and define enabling policy
		3	Approve the annual work plan and fund allocation proposed by PMU
		4	Review the annual work progress
		5	Establish appropriate convergence platforms and institution arrangement
Project Management Unit (PMU)	SE - Water Resources, Joint Directors - Agriculture, Horticulture, Animal Husbandry, Fishery, Finance, CEO-APFPS and others as required.	1	Management body at the state level
		2	Develop and review the annual work plan, and monitor the work progress at the state level
		3	Facilitate convergence among the departments concerned at the state level
		4	Provide technical guidance
		5	Fund management
District Implementation Unit (DIU)	SE/EE (Tech unit), JD/DD - Agriculture, Horticulture, Animal Husbandry, Fishery, and others as required.	1	Implementation body at the district level
		2	Monitor and evaluate the work progress at the district level
		3	Troubleshooting
		4	Ensure capacity building support system
		5	Facilitate convergence at the field level

Source: JICA Survey Team

9.8.2 Project Management Consultant

The project management consultant (PMC) will be employed from an international consulting firm with national consultant(s) in compliance with the 'Guidelines for the Employment of Consultants under Japanese ODA Loans', April 2012. The PMC will play an important role for proper/effective assistance to the state project director (SPD) of PMU and smooth and efficient project management of APILIP-II. Since APILIP-II covers the main scope such as modernisation of irrigation projects, institutional development and capacity building, livelihood support programme and pilot programmes with various departments concerned, it is essential to grasp the project implementation and give proper/prompt guidance to PMU for intimation of necessary decisions and actions.

The scope of services of PMC is to assist and advise PMU on the overall project management and implement efficiently and properly the following components:

- Modernisation of irrigation projects,
- Participatory irrigation management (PIM)
- Promotion of farmers producer organisations (FPOs),
- Livelihood support programmes, and
- Pilot programmes (Food Value Chain (FVC) for strategic crops and farm mechanization.

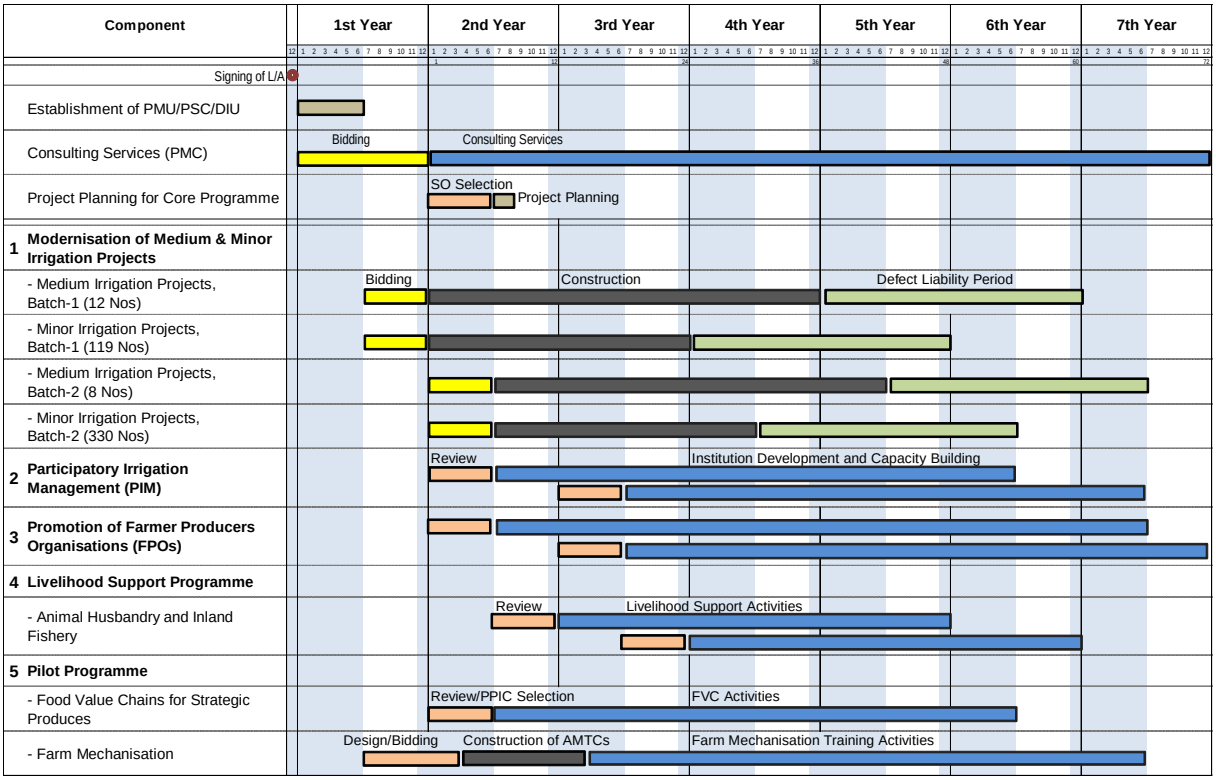
The major activities of PMC are as follows:

- Guidance for overall project monitoring and management;
- Inter-departmental coordination and close communication;
- Development and review of the annual work plan and monitor the work progress at the state level;
- Facilitation of convergence among the departments concerned at the state level;
- Construction management, technical guidance, and monitoring;
- Fund management;
- Technical support (training and awareness programme, etc.) and,
- Liaison between PMU and JICA

The assignment schedule of PMC experts is shown in Attachment 9.8.1, and the terms of reference (TOR) for PMC is given in Attachment 9.8.2.

9.9 Overall Implementation Schedule

Overall implementation schedule of the project is shown in Figure 9.9.1. The total implementation period is estimated at seven years including one year for procurement of the consulting services (PMC) in compliance with the JICA guidelines. The detailed implementation schedule of each component is discussed in Chapter 10 except for Component 5, which is examined in Chapter 11.



Source: JICA Survey Team

Figure 9.9.1 Overall Implementation Schedule

10. IMPLEMENTATION PLANS OF CORE PROGRAMMES

10.1 General

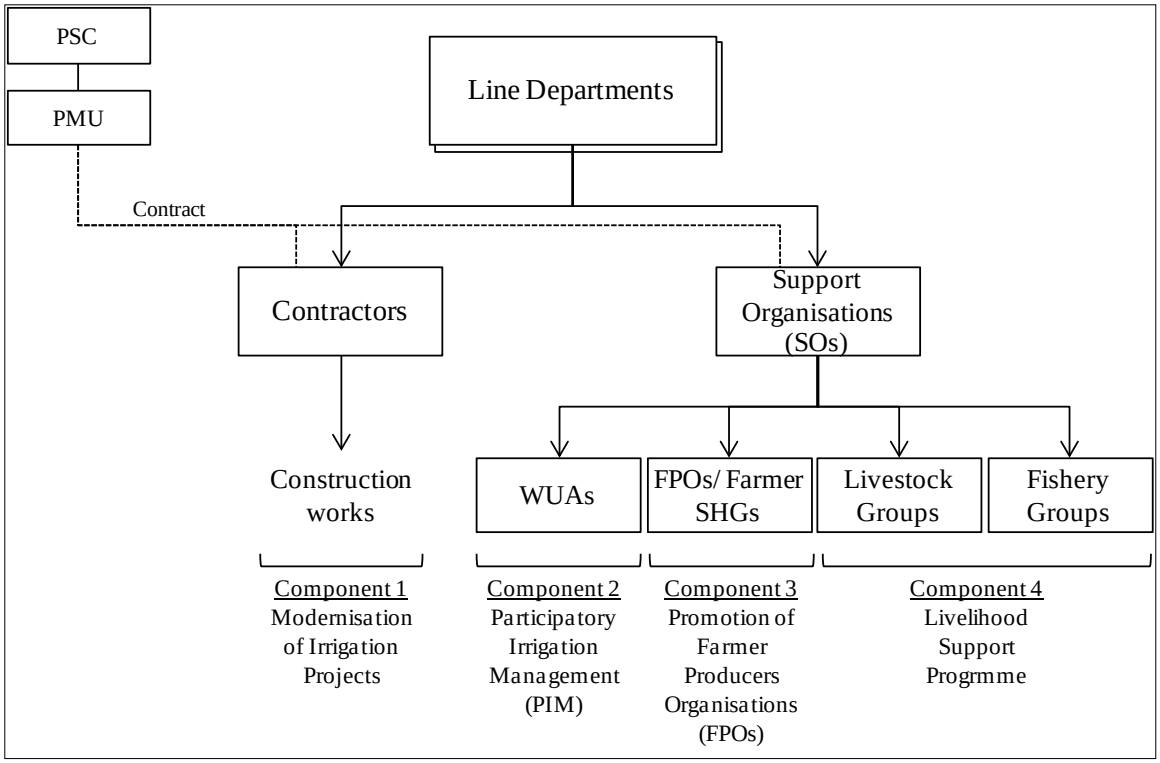
Components of the core programme consist of 'Modernisation of Medium and Minor Irrigation Projects', 'Participatory Irrigation Management (PIM)', 'Promotion of Farmers Producer Organisations (FPOs)' and 'Livelihood Support' as mentioned in the Chapter 9. In order to make the project activities people-oriented and a part of their own development activities, project planning and monitoring shall be supported based on the project management cycle throughout the project implementation. Prior to the commencement of the project, orientation workshop shall be conducted to introduce the project and make common understanding of the situation and issues to be handled. Baseline survey will be conducted by Support Organisations (SOs) in charge of PIM, with participation of the farmers in the area. Further planning and monitoring shall be conducted through implementation of the project activities in each component. The outline of the activities and implementation of the core programme are as follows.

Table 10.1.1 Outline of Activities and Implementation of the Core Programme

Timeframe	Project Planning (before commencement)	Implementation (during construction period)	Operation and Monitoring (after construction)
Component 1 Modernization of Irrigation Projects	Each Irrigation command area - Orientation Workshop : Introduction of the project and understanding on issues to be tackled - Baseline survey（Questionnaire survey, Group Discussion, PRA） - Selection of the target groups of the livelihood improvement component	Each Irrigation command area Construction plan and monitoring	Each Irrigation command area O&M plan Monitoring of the irrigation performance
Component 2 Participatory Irrigation Management		WUA Training for planning of water management Implementing agency Support on water management planning	WUA Monitoring of water distribution & water tax collection Review of water management plan Implementing agency Support on monitoring by WUA
Component 3 Promotion of Farmers Producer Organisations		FPO Formation of farmers SHGs (groups) and selection of group leaders Crop planning /cultivation plan Implementing agency Orientation for FPO Production plan support Extension plan	FPO Crop planning and review Business planning Marketing research External learning opportunities Monitoring of production and marketing activities Implementing agency Review of FPO activity support Review of extension plan Review of cropping plan
Component 4 Livelihood Support Programme		Target village Activity planning Implementing agency Support on activity planning	Target village Trainings, Monitoring of activities Review of the plan Implementing agency Monitoring, Review of the plan

Source: JICA Survey Team

Implementation of the core programme shall be organised as shown in the Figure 10.1.1.



Source: JICA Survey Team

Figure 10.1.1 Summary Implementing Structure of the Core Programme

Activities shall be implemented by the concerned line departments of each component in collaboration with contractors or Supporting organisations. Supporting organisation will be the coordinating party in each area, which could handle interdisciplinary activities in their area in charge. Details of the activities of each component with implementing structure and activity plans are explained in the following sections.

SOs are assigned for support in Component 2 'Participatory Irrigation Management (PIM)', Component 3 'Promotion of Farmer Producer Organisations (FPOs)', and Component 4 "Livelihood Support Programme". One SO can be appointed to handle all the components in the assigned area if the capacity of the SO is enough to meet the requirement of works and staffs to be assigned that are specified in the respective section of each component. Different SO may be assigned for FPO promotion is necessary in case the SOs' specialities and capacity requires so.

10.2 Modernisation of Irrigation Projects

10.2.1 Organisation for Modernisation of Irrigation Projects

Under the PMU, the district implementation unit (DIU) is to be organised headed by the Joint Collector of respective District Office consisting of district offices of concerned line departments. As for the modernisation of irrigation projects, a district level organisation is shown in Figure 10.2.1.

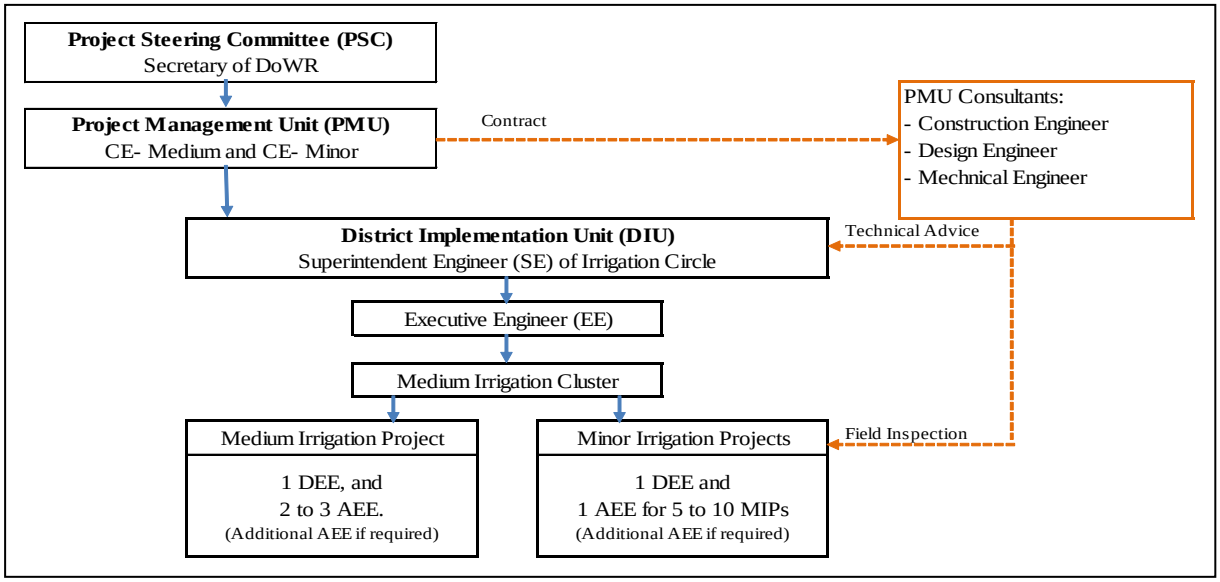
A Superintendent Engineer (SE) of irrigation circle (district) office of DoWR is a member of DIU. Under SE, one Executive Engineer (EE) will appoint for a medium irrigation cluster with a Deputy Executive Engineer (DEE) and Assistant Executive Engineers (AEEs). In principle, 2 to 3 AEEs are appointed to a medium irrigation project and 1 AEE for 5 to 10 minor irrigation projects, which may be adjusted in accordance with scale and work quantities of respective irrigation projects. In addition, PMU consultants will supervise the work performance of modernisation works at field and irrigation circle office time to time, and report their findings and advice to PMU.

AEEs will play an important role at field level, with the following tasks:

- Construction supervision at the project site,
- Monitoring and evaluation of the work progress, quality control and safety control,

- Troubleshooting,
- Reporting,
- Facilitation of convergence at the field level, and
- Ensuring capacity building support system.

The district level organisation chart is illustrated in Figure 10.2.1.



Source: JICA Survey Team

Figure 10.2.1 Organisation at the District Level for Modernisation of Irrigation Projects

The budget and human resources of DoWR/GoAP for the last five years are summarised in Table 10.2.1.

Table 10.2.1 Budget and Human Resources of DoWR, Andhra Pradesh State

Item	Unified Andhra Pradesh (INR million)		Bifurcated Andhra Pradesh (INR million)		
	2012-13	2013-14	2014-15	2015-16	2016-17
(1) Total Annual Budget for Projects	146,959	136,950	31,968	46,659	73,102
(2) Total Annual Budget for Externally Aided Projects	11,142	12,588	7,370	10,150	3,733
(3) Number of Engineers (AEEs and above)	6,742	6,700	3,724	3,724	3,724*
(4) Total Annual Budget (1) per Engineer	21.798	20.440	8.58	12.529	19.630
(5) Total Annual Budget (2) per Engineer	1.653	1.879	1.979	2.726	1.002

*Note: * as of April 22, 2016*
Source: DoWR, Andhra Pradesh State

As seen in the above table, the total annual budget for projects per engineer is estimated at INR 21.121 million on the average of two years in unified AP state, and INR 13.581 million on the average of three years in bifurcated AP state. Further, the peak annual funds requirement for the project components 1 and 2 (DoWR portion) of APILIP-II is estimated at INR 5,618 million, which accounts for 7.7% only against the total annual budget for projects 2016-17. Furthermore, two on-going externally aided projects; namely the Community-based Tank Management Project (World Bank) and APILIP-I (JICA) are scheduled to be completed in July 2016. Taking the above into account, it can be said that the capacity of DoWR/GoAP would be good enough to implement the proposed APILIP-II.

10.2.2 PMU Consultants for Modernisation of Irrigation Projects

For the supervision of construction works for modernisation of irrigation projects, PMU consultants will be employed to assist the DoWR staff of responsible irrigation circles. The PMU consultant will consist of Indian nationals selected through concerned Indian regulations. The required PMU consultants for APILIP-II will be as follows.

Table 10.2.2 Requirement of PMU Consultants for Modernisation of Irrigation Projects

Region	District	Position		M/M	Major Tasks
North	Srikakulam Vizianagaram Visakhapatnam	1. Construction Engineer 2. Mechanical Engineer 3. Design Engineer	3 Engrs x 4 years x 7 months 1 Engr x 4 years x 7 months 1 Engr x 4 years x 7 months	140	- Overall progress and quality control - Supervision and advice for mechanical work - Design change during construction stage
Central	East Godavari West Godavari Krishna Prakasam	1. Construction Engineer 2. Mechanical Engineer 3. Design Engineer	3 Engrs x 4 years x 7 months 1 Engr x 4 years x 7 months 1 Engr x 4 years x 7 months	140	- ditto -
South	Chittoor Kadapa Anantapur Kurnool Nellore	1. Construction Engineer 2. Mechanical Engineer 3. Design Engineer	3 Engrs x 4 years x 7 months 1 Engr x 4 years x 7 months 1 Engr x 4 years x 7 months	140	- ditto -
		Total		420	

Note: Construction Engineer will be appointed one for each region (North, Central and South).
Source: JICA Survey Team

10.2.3 Packaging Plan for Modernisation of Irrigation Projects

The construction works for the modernisation of irrigation projects under APILIP-II will be carried out for 20 medium and 449 minor irrigation projects. APILIP-II is planned to be completed within seven years from 2017 to 2023. The tendering may commence in July 2017 in advance of PMC assignment because DoWR has a good experience in tendering procedures of 75 sub-projects under APILIP-I.

(1) Major Scope of Works of Modernisation of Irrigation Projects

The major scope of modernisation works is prepared based on the results of reviewing available DPRs and Project Notes, field survey of sample projects and discussion with the engineering staff of DoWR. The details are available in Chapter 8.2.4 and 8.2.5, and Attachment 13.3.5.

Table 10.2.3 Major Scope of Works for Modernisation of Irrigation Projects

Medium Irrigation Project	
1. Dam Body	1) Dam body 2) Toe drain
2. Spillway	1) Gate 2) Downstream protection
3. Head Regulator	1) Structure
4. Headworks	1) Gate and related works 2) Off-take regulator
5. Main Canal	1) Earthwork 2) CC lining 3) Side-wall lining
6. Distributory	1) Earthwork 2) CC lining 3) Side-wall lining
7. Miscellaneous	1) Other works

Minor Irrigation Project	
1. Tank	1) Bund (Earthworks) 2) Surplus weir (Concrete) 3) Sluice (Concrete and Gates)
2. Supply Canal	1) Earthworks 2) Guide wall
3. Structure	1) Concrete works

Source: JICA Survey Team

(2) Construction works by Batch

In order to execute an efficient/smooth implementation of APILIP-II based on APILIP-I experience, it is proposed that construction works should be implemented in two batches as follows:

Batch-1: Twelve (12) medium and 119 minor irrigation projects, and

Batch-2: Eight (8) medium and 330 minor irrigation projects (including 231 isolated minor).

The construction of Batch-1 is proposed to commence in January 2018 and will be completed in December 2020 and Batch-2 from July 2018 to June 2021 with two years of defect liability period.

The locations of the 20 medium and 449 minor irrigation projects are shown in the location map of APILIP-II, and their abstracts are listed in Table 10.2.4.

Table 10.2.4 Project List by Construction Batch

Medium Irrigation Project			Minor Irrigation Project			Total	
Project	Command Area (ha)	Construction Cost (INR in million)	No.	Command Area (ha)	Construction Cost (INR in million)	Command Area (ha)	Construction Cost (INR in million)
Batch-1							
Peddankalam Anicut	3,113	395	8	672	44	3,785	439
Vottigedda Reservoir	6,746	442	10	1,046	65	7,792	507
Vengalraya Sagaram	9,996	500	2	509	29	10,505	529
Torrigedda Pumping Scheme	5,998	312	16	2,515	149	8,513	461
Thammileru Reservoir Scheme	3,711	225	19	2,008	125	5,719	350
Mopadu Reservoir System	5,147	425	1	186	11	5,333	436
Krishnapuram Reservoir	2,479	274	9	829	53	3,308	327
Araniar Reservoir	2,226	367	26	3,132	192	5,358	559
Upper Pennar	4,066	316	5	391	26	4,457	342
Pennar Kumudavathi	2,479	155	11	3,287	185	5,766	340
Muniyeru	6,648	666	12	1,669	100	8,317	767
DR & DM Channels	10,117	429	0	0	0	10,117	429
Subtotal	62,726	4,506	119	16,244	979	78,970	5,486
Batch-2							
Peddagedda Reservoir	4,858	704	4	299	20	5,157	724
Andra Reservoir	3,603	345	22	1,710	113	5,313	457
Veeraraghavani Kota Anicut System	2,267	56	7	599	39	2,866	95
Buggavanka	3,926	667	8	941	58	4,867	725
Maddigedda Reservoir	1,214	168	9	564	39	1,778	207
Narayanapuram Anicut	14,995	1138	18	1,919	120	16,914	1,258
Raiwada Reservoir	6,111	709	31	2,114	143	8,225	853
Siva Bhashyam Sagar	4,894	318	0	0	0	4,894	318
Isolated Minor Irrigation	0	0	231	32,576	1,956	32,576	2,665
Subtotal	41,868	4,105	330	40,722	2,488	82,590	6,593
Total	**104,594**	**8,611**	**499**	**56,966**	**3,467**	**161,560**	**12,078**

Source: JICA Survey Team

(3) Tender Packaging Plan

Assuming that one tender package covers one medium irrigation project, and similarly one to nine minor irrigation projects, the total number of tender package is 30 for Batch-1 and 45 for Batch-2 as shown in Table 10.2.5.

Table 10.2.5 Tender Packaging Plan by Construction Batch

District	Medium Irrigation Cluster	Batch-1			Batch-2		
		Medium	Minor	Total	Medium	Minor	Total
Srikakulam	1) Narayanapuram Anicut	-	-	-	1	2	3
Vizianagaram	1) Peddankalam Anicut	1	1	2	-	-	-
	2) Vottigedda Reservoir	1	2	3	-	-	-
	3) Vengalraya Sagaram	1	1	2	-	-	-
	4) Peddagedda Reservoir	-	-	-	1	1	2
	5) Andra Reservoir	-	-	-	1	3	4
Visakhapatnam	1) Raiwada Reservoir	-	-	-	1	4	5
East Godavari	1) Torrigedda Pumping Scheme	1	2	3	-	-	-
	2) Maddigedda Reservoir	-	-	-	1	1	2
West Godavari	1) Thammileru Reservoir	1	2	3	-	-	-

District	Medium Irrigation Cluster	Batch-1			Batch-2		
		Medium	Minor	Total	Medium	Minor	Total
	Scheme						
Krishna	1) Muniyeru	1	2	3	-	-	-
Prakasam	1) Mopadu Reservoir System	1	1	2	-	-	-
	2) Veeraraghavani Kota Anicut	-	-	-	1	1	2
Chittoor	1) Krishnapuram Reservoir	1	1	2	-	-	-
	2) Araniar Reservoir	1	3	4	-	-	-
Kadapa	1) Buggavanka				1	1	2
Anantapur	1) Upper Pennar	1	1	2	-	-	-
	2) Pennar Kumudavathi	1	2	3	-	-	-
Kurnoor	1) Siva Bhashyam Sagar	-	-	-	1	0	1
Nellore	1) DR & DM Channels	1	0	1	-	-	-
-	Isolated Minor Irrigations	-	-	0	0	24	24
	Total	12	18	30	8	37	45

Source: JICA Survey Team

10.2.4 Process of Pre-Construction Activities for Modernisation of Irrigation Projects

The pre-construction activities shall be completed by the end of the first year so that the construction works for Batch-1 could commence in January 2018. The pre-construction activities will be executed with the following process:

Table 10.2.6 Flow of Pre-Construction Activities for Modernisation of Irrigation Projects

Step	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Process	Preparation of DPR	Check and Review of DPR*	TAC Clearance*	Administrative Sanction	Technical Sanction	Tender	Contract
Responsible Person(s)	SID Consultant	EE→SE→CE of respective Irrigation Circle Office, SPD at CADA Office	Secretary to Water Resources, CE-Hydrology, CE-Medium, CE-Minor at CADA Office	Secretary to Water Resources	ENC, CE-Medium, CE-Minor at CADA Office	Document preparation by CE-Medium, CE-Minor at CADA Office, and Evaluation and approval by COT	SE of respective Irrigation Circle Office

Note-1: SPD= State Project Director, SID= Survey, Investigation and Design, TAC= Technical Advisory Committee, ENC= Engineer in Chief, COT= Commissionerate of Tenders, CADA= Command Area Development Authority
*Note-2: *) In case of interstate projects, CWC check and approval are required.*
Source: JICA Survey Team

The countermeasures mentioned in the items (1) to (3) in Table 4.6.2: Lessons learned from similar Yen loan projects implemented in Andhra Pradesh State shall be referred to in the following discussion.

(1) Preparation of DPR

The DPRs have been prepared for 12 medium irrigation projects by the end of March, 2016 and DPRs for the balance 8 medium irrigation projects are expected complete soon. It is however none of the DPRs has obtained the administrative and technical sanction yet. The DPR will be prepared by the Survey, Investigation and Design (SID) consultants. The process and procedures for preparation of the DPR is as follows.

- Detailed topo-survey with geological survey: Dam site, weir, canals and structures.
- The design drawings are prepared by SID consultants.
- The design is adopted as per the guidelines issued by CWC or GoAP.
- Bill of Quantities will be prepared based on the above design.
- The cost will be estimated based on the current Standard Schedule of Rates (SSR) published by DoWR.

25 DPRs of the total 449 minor irrigation projects have been prepared by April 2016. The balance DPRs should be prepared as soon as possible.

(2) Check and Review of the DPRs

The available DPRs are reviewed by the JICA Survey Team. Attention is given to the desired functioning

of the irrigation facilities, water balance, scope of construction works, and financial soundness. The overall site survey was executed by the JICA Survey Team for the 12 medium irrigation projects and 20 minor irrigation projects from November to December 2015. The detailed site inspections as well as study/analysis of the proposed project works were carried out in February 2016 for the selected three sample medium irrigation projects and nearby six minor irrigation projects.

The dams, canals, and their related structures were investigated in detail in the sample project sites by the JICA Survey Team attended by DoWR engineers. Interviews with WUA members and farmer leaders were also carried out for their demands on repair and improvement of project structures. The results of the site survey by the JICA Survey Team are described in Chapters 6 and 8.

(3) Clearance of Technical Advisory Committee

The technical advisory committee (TAC) will be formed under the Secretary to the Government, DoWR. The members are the top management officials such as CEs for hydrology, medium and minor, CE of CWC-Hyderabad, etc. The DPRs are presented to TAC for technical clearance.

(4) Administrative Sanction

Before the commencement of tender procedures, an administrative sanction has to be obtained from the state project coordinator (Secretary to Government, DoWR) after preparing the cost estimates for individual medium and minor irrigation projects as per GoAP norms.

(5) Technical Sanction

Technical sanction for individual irrigation projects should be accorded by the CE for medium irrigation and minor irrigation concerned. The technical matters and cost estimates are reviewed and sanctioned. The estimated contract value (ECV) for the irrigation project is thus prepared. There are no land acquisition problems in APILIP-II as it is modernisation/rehabilitation works for the medium and minor irrigation projects.

Only after administrative and technical sanctions, it becomes ready to proceed to the tender stage.

(6) Tender

(a) Tender Process

The construction works will be executed by applying tender process for selection of contractors. The tender procedures for all 20 medium and 449 minor irrigation projects will be executed by applying e-tender system with two-bid forms: technical bid and price bid.

(b) Tender Documents

The tendering process for the APILIP-II will be executed by the project offices under the guidance of SPD and PMC. The tender documents for construction works of APILIP-II will be prepared by CE for medium and minor irrigation. The model tender documents will be modified to the project by CE for medium and minor irrigation with the assistance of PMC experts if assigned during this time. The model tender documents for medium and minor irrigation projects will be prepared and sent to JICA for his perusal and approval. After the approval of the model tender documents by JICA, the tender documents for all the other APILIP-II projects will be prepared accordingly.

(c) Tender Procedure by E-procurement System

The tenders for the 20 medium and 449 minor irrigation projects will be executed based on the local competitive bidding (LCB). The tender information will be uploaded in the internet website of DoWR/GoAP with two systems of technical bid and price bid.

- The technical bid can be viewed on the computer of the CE for the medium irrigation projects and the CE for the minor irrigation projects at the CADA Office with the presence of key staff of the irrigation circle offices, agencies, and PMC experts, if assigned. The evaluation of the technical bid will be executed based on the criteria laid down in the bid document. The evaluation report of the technical bid will be prepared and sent to the Commissionerate of Tenders (COT) for scrutiny and approval.

- The price bid will be opened after obtaining the approval for the technical bid from COT. The price bid will be viewed on the computer of the CEs for medium and minor irrigations at the CADA Office. The evaluation report on the price bid will be prepared and sent to COT for scrutiny and approval.

The results of the technical bid and the price bid are disclosed to JICA for information and comments, if any.

(d) Evaluation Team

The Bid Evaluation Team will be organised by EE under SE in the respective Irrigation Circle Office when the Bid documents are prepared. The Bid Evaluation Team will be consisted of EE, DEE, AEE (or AE) and supporting staff.

The bidding works such as preparation of bid document, bid opening and preparation of bid evaluation report are executed by the Bid Evaluation Team. The PMC will assist and guide the Bid Evaluation Team for smooth process.

(e) Tendering System

Two parts of the tendering system, technical bid and price bid will be adopted for the bids as follows:

1) Technical Bid: Technical Bid Document Containing Invitation for Bid (IFB):
   - Instruction to Bidders (ITB),
   - Form of Bid and Qualification Information and Form of Securities,
   - Conditions of Contract,
   - Contract Data, and
   - Specifications.
2) Price Bid
   - Price Bid containing Bill of Quantities, and
   - Forms of Letters of Acceptance.

(f) Evaluation of Technical Bid and Price Bid

1) Evaluation of Technical Bid

The evaluation of the technical bid will be made on the bids received to examine whether they conform to the requirements of the bid documents. For the evaluation, the technical bid will be opened to examine the bidders compliance with the requirements in the bid. The detailed bid evaluation will be made for 11 key items based on qualification information in Section 2 of the bid document.

The evaluation report of the technical bid, after approval of the SPD, will be sent to COT for perusal and approval.

2) Evaluation of Price Bid

The price bid will be opened only for the qualified bids in the technical bid evaluation. The price bid will be opened after getting COT's approval on the technical bid evaluation. The evaluation on the price bid will be made in accordance with Clause 27 of ITB: Computation Checking.

3) Ranking of Bidders

After the approval of the SPD, the evaluation report of the price bid will be sent to COT for perusal and approval.

(g) Evaluation Report to JICA

The evaluation reports of the technical bid and the price bid will be sent to JICA for perusal and comments.

(7) Contract

After the approval by COT and JICA for the technical bid and price bid evaluation reports, the contract

will be signed by the SE of the respective irrigation circle office and the contractor concerned. After signing the contract, the SPD will send the signed contract document to JICA for perusal and approval. Once the contract becomes effective, DoWR shall organise an orientation meeting to explain the outlines of the project for getting understanding of and cooperation from the beneficiaries.

10.2.5 Construction Process

Immediately after the contract, the contractors will mobilise their resources to the site, and commence the works in the following process.

Table 10.2.7 Flow of Construction Works

Step	(1)	(2)	(3)	(4)	(5)	(6)
Process	Pre-construction Meeting	Review of Work Plan	Standard Forms and Check Manual	Drawings and Cerificates	Work Progress Control	Quality and Safety Control
DoWR (The Enginner)	Executive Engineer (EE) appointed by the Chief Engineer (CE) of the respective irrigation cercle acts as the Engineer of the projects. The Engineer has a full responsibility for the project management from the Items (1) to (6).					
PMU Consultants	PMU consultant team appointed by PMU, which is comprised of three Construction Engineers, one Mechnical Engineer and one Design Enineer, will support the Engineer in the project management at field level.					
PMC	PMC will monitor and guide the staffs of DoWR and PMU consultants in overall project management and, if necessary, give advice to them. PMC will report overall work progress, and problems and measures if necessary, to PMU at state level.					

Source: JICA Survey Team

The countermeasures mentioned in the items (4) to (7) in Table 4.6.2: Lessons learned from similar Yen loan projects implemented in Andhra Pradesh State shall be referred to in the following discussion.

(1) Pre-construction Meeting

At the mobilisation of the contractor, DoWR will hold a well-planned pre-construction meeting. The objectives will be to ensure that the contractor fully understands the important items on organisation, the standard operating procedures to be used for the project, requirements concerning quality control activities, progress schedules, preparation/processing of the contractor's payment certificates, proper construction methods to be followed.

(2) Review of Work Plan

Prior to the start of the construction work, the contractor has to prepare and submit the work plan which shows his proposed methods and procedures for the execution of the construction work in accordance with the contract. The contractor's work plan is to present details of the contractor's mobilisation, construction schedule, safety measures, construction methods, temporary works including construction method and compensation for land, quality control plan, method of procurement and storage of materials, utilisation of construction equipment, work organisation, sub-contractors (if proposed), documentation system, claim system, and etc. The work plan will continue to be reviewed during the construction period and up-dated as required.

Special attention shall be placed on construction method for the works in dam and canals during irrigation period if applicable.

(3) Standard Forms and Check Manual

Standard forms to be used during construction supervision will be prepared by DoWR. The construction records, quality control and check manuals shall be based on these forms. These standard forms, which will be explained to the contractor, and the field staff of DoWR. In addition, DoWR will provide a draft of the standard forms and quality control manuals to the contractor for discussion and finalization.

(4) Review of Drawings

(a) Review and finalization of design to meet the site condition

Some revisions of the existing design will be inevitable in the course of construction works due to changes in design conditions, geological conditions, design values, or other unforeseen changes. The DoWR will modify and revise the existing design, technical specifications, related calculations, and estimates, as the necessity arises. On the basis of the modified/revised design, the PMC will make

recommendations on the changes in plans, specifications, and bill of quantities to DoWR for further action with respect to the construction contract.

(b) Contractor's working/shop drawings

The contractor shall prepare working/shop drawings based on the construction drawings issued by DoWR. DoWR will review, check, and approve the working/shop drawings prepared by the contractor or supplier. The time required for the preparation, checking, revision, and approval of the working/shop drawings can be considerable and if not carefully controlled, can cause significant delays to the progress of the works. Being aware of this, the PMC will set up a schedule for getting the working drawings prepared and approved in a timely manner.

(5) Work Progress Control

DoWR will review and approve the contractors' detailed work schedule which shall, in general, be prepared in critical path method and network diagram for construction of the major project facilities. DoWR will monitor the progress of the works in relation to the approved construction schedule, and instruct the contractor to update the network diagram for each project component from time to time as necessity arises. In this connection, the DoWR will instruct the contractor in construction management to make necessary arrangements to maintain the progress of critical works.

(6) Quality and Safety Control

(a) Quality control

The DoWR will place high importance on the quality control aspects of the project and will provide the services for the quality control of the contractors' work as presented below:

- Setting out and survey reference controls
- Site inspections
- Field and laboratory tests

(b) Safety control

The safety program to be prepared by the contractor should consider the following major items:

- Emergency communication networks;
- Emergency measures in accidents;
- Transportation over public roads;
- Traffic control in the construction area;
- Construction works in water (rivers and canals);
- Construction works by use of a crane;
- Construction works during heavy rainfall and floods;
- Lighting for night work;
- Security of offices and living quarters, and etc.
- First-aid and fire extinguish;

In addition to the above, special safety control is required in respect of the following works for Yen loan projects.

Table 10.2.8 Specific Works required Special Safety Control by JICA

No.	Specific Works
1	Long span bridge, multi-lane toll bridge, high level bridge with more than 1,000 m span.
2	Suspension bridge, declaimed bridge, extra-dosed bridge or any other bridge with a span of more 100 m.
3	Special construction works, under water tunnel, dam including sand dam, harbour, excavation relating to surface and underground river closing work, construction work relating to large scale temporary work, large scale foundation work, caisson work, etc.
4	High rise construction works (construction works at more than 20 m elevation).
5	Embankment protection works and breach closing works where embankment foundation movement will affect important structures such as railway and road bridge.

No.	Specific Works
6	Traffic accident, dropping of materials, dropping of public persons other than the construction staff and workers, temporary works aimed at public transportation; special attention is required towards public / general disasters.
7	Other construction works where major accidents are anticipated.

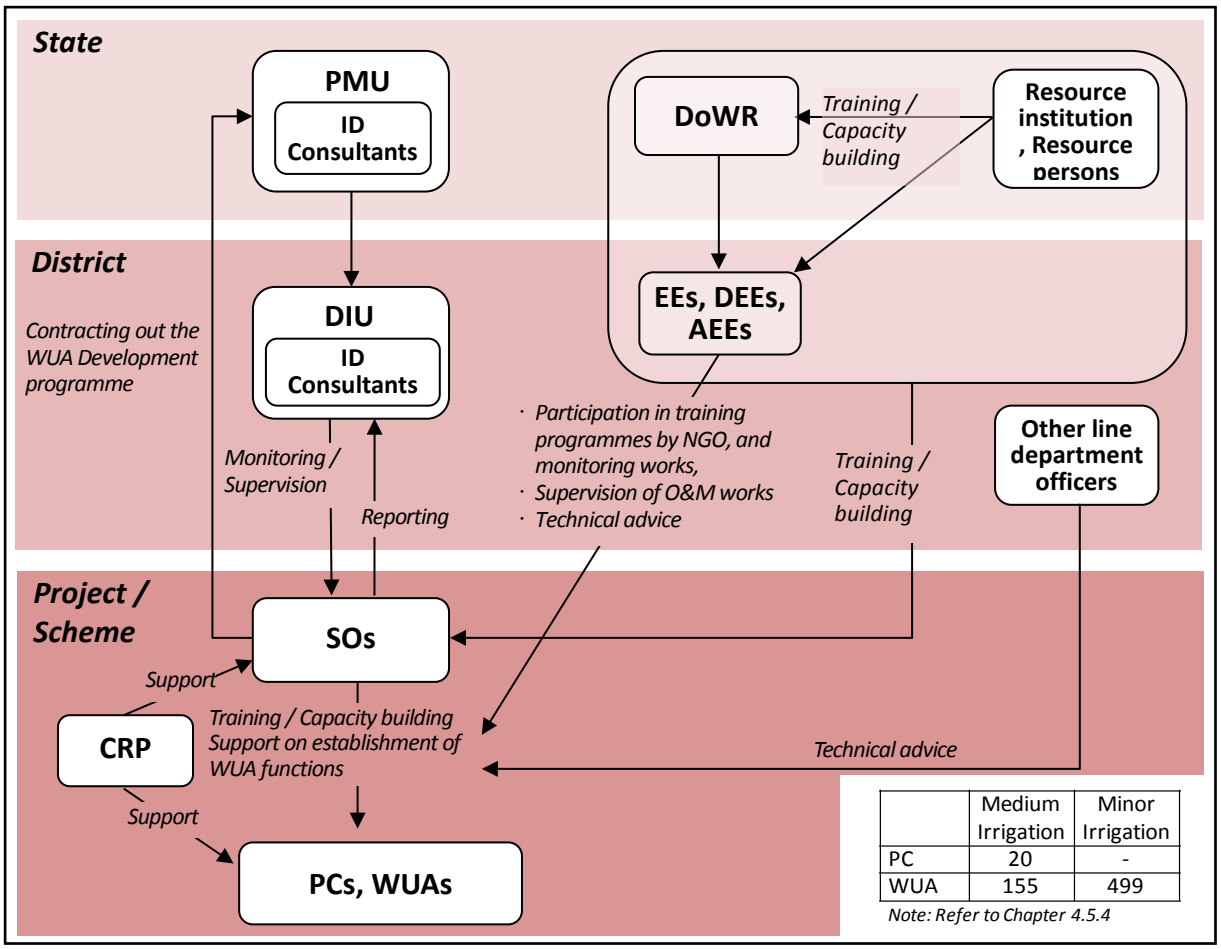
Source: JICA Survey Team

10.3 Institutional Development and Capacity Development Programme

10.3.1 Participatory Irrigation Management (PIM) and Water Users Association

(1) Organisation for Implementation of PIM Support

The following is the proposed institutional structure for O&M based on PIM.



** The DoWR has a plan to develop a Water University as a training institution. in AP. Since it will take several years to establish it, currently the DoWR is subletting training implementation to 'Engineering staff Collage of India' and 'AP Human Resource Development Institution'. In the project, the institution that take up the work of revising training module will support training as resource institutions, possibly with support of the above institutions, which can contribute to future establishment of the training institution*
Source:JICA Survey Team

Figure 10.3.1 Implementation Structure of PIM and WUA Capacity Development

One of the important aspects of the project is to establish sustainable irrigation management base on the concept of Participatory Irrigation Management (PIM) through Farmers Organisations / water users associations (WUAs) defined in the APFMIS Act 1997[1]. The project aims at enhancing capacity of WUAs that have been recently revive. All the activities for WUA capacity building are sub-contracted to Supporting Organisations (SOs), which shall be selected based on the selected criteria in the Box 10.3.1: 'Sample Selection Criteria for SOs' in the following section (2) 'Required human resources and SOs in implementation of PIM support'. PMU is in charge of contracting out the works to the selected

[1] The latest version was up-dated as of June 2015

SOs and supervision of their works. DoWR will collaborate with all the activities taken up by the SOs as the DoWR is to take over the role of the SOs for routine WUA support activities after the project. The underlining concept of the sustainability is that SOs support establishment and starting-up of the WUAs' activities to build the capacity up to the level where WUAs can continue their activities by themselves with periodical support by the department. In order to build enough capacity of the WUA to become self-sustainable, intensive and comprehensive hand-holding support is required.

Even though the basic concept is similar to what has been implemented, the approach and intensity of the activities shall make difference in the result. The following describe required human resources and organisations to achieve intensive intervention to attain sustainability. To achieve the improvement, close intervention and intensive activities with enough follow-up support should not be undermined. Detail interventions shall be discussed in the following Chapter 10.3.1 (3) Capacity Building Programmes of Project Committees (PCs) / WUAs for PIM, with further details in the Attachment 10.3.2.

Major structure and roles can be summarised that PMU is responsible for management of contracts with resource institute (RI) and SOs, while DoWR take charge of technical support as main competent authority, under which SOs implement activities to WUAs with support of Community Resource Persons (CRP). Roles and responsibilities of each stakeholders mentioned in the above figure in implementation of the project are as follows.

Table 10.3.1 Roles and Responsibilities of Stakeholders in Implementation of the Project

Stakeholder		Responsibility
PMU	PMU	- Appoint Institutional Development expert as local consultant - Contracting out the works to Resource Institution (RI) and SOs - Contract management of SOs sub-let works (work assessment based on the SPIU consultants' evaluation and payment)
	DIU	- Appoint one Institutional Development Expert in each District (DIU) - Monitor and Evaluate the work of SOs and report to PMU
DoWR	State office	- Preparing amendment on APMFIS Act & Issuing necessary government orders - Issuing a Guideline and training module with help of RIs - Organising training for Department officers with help of RIs
	District office	- Major Competent Authority for PIM operation and PCs/WUAs - Monitoring works of SOs and WUAs
	Field officers, DEEs/AEEs	- Major competent Authority in field level being in charge of WUA support - Training farmers as resource person and Providing advice as required - Other routine works defined in the PIM works and APFMIS Act
Other line department	Agriculture Department	- Competent Authority especially in crop budgeting and other agriculture related activities by WUAs
	Revenue Department	- Competent Authority for water tax collection
	Fishery Department	- Competent Authority in optimal tank use especially with regard to use of tanks for fishery activities
Resource Institutions / Resource person		- Preparation of Guideline and training modules - Dissemination of contents of the guideline and training modules to relevant government officers - Training of SOs
Institutional Development (ID) Consultant		- Monitoring of overall capacity development programme - Monitoring and assessment of works of RI and SOs - Monitoring the contract and payment procedure from the PMU to SOs
Supporting Organisation (SO)		- Major actor of the WUA support programme - Facilitating and coordinating activities with relevant department - Reporting to works to DIU and relevant department officers
Community Resource Person (CRP*)		- Supporting implementation of activities by SOs - Coordination and mobilisation in WUA and villages - Facilitation and communication with relevant agencies
PCs / WUAs		- Main actor of the PIM

*Note: *) Selection criteria and role & responsibilities of community resource persons are shown in Attachment 10.3.1*

Source: JICA Survey Team

For the project implementation, it is crucial to assign experts of Institutional Development in the state PMU and DIU (in each District) as consultants, as the formation stage of WUAs requires professional insights. Furthermore, since the PIM guideline shall be newly prepared and implemented, specialists' advises shall seriously help DoWR officers who are not familiar with the newly issued guideline and

training modules.

Human resources required for the implementation of the PIM and WUA capacity building is shown in the following table.

Table 10.3.2 Required Human Resources for Implementation of WUA Capacity Development

Post	Required human resources	Roles and tasks / capacity required	Number required
State PMU Consultant	Institutional Development Consultant /M&E consultant	Overall supervision of institutional development and capacity building activities. Monitoring and evaluation of capacity development activities. Assessment of progress reported by the DIU consultants.	2 senior consultants
DIU consultant (District level)	District Institutional Development Consultant	Advise on institutional development activities to SOs and WUAs. Management of SO contracts (work assessment for payment). Supervision of the SO works. Identification and preparation of case studies	1 consultant in each district (each DIU)
DoWR officers (State)	An officer to be in charge of Institutional Development	Overall supervision of the WUA and PIM related activities. Instructing field engineers to conduct ID activity support and monitoring of their duty. Ensuring enough resources (human, financial, material) for ID parts for better WUA and PIM operation.	1 senior state officer
DoWR officers (District / project level)	DEEs and AEEs who are in charge of the target medium and minor irrigation schemes in the project	Participation in the training programmes for DEEs and AEEs by the resource institutions regarding WUA and PIM. Participation in the trainings for WUA support conducted by the SO for WUAs. Providing technical advice during the WUA trainings as resource person. Providing technical advice on the O&M by WUAs in field. Continuous support to WUAs after the SO support.	All the DEEs, and AEEs in charge (currently appointed officers)
Resource institution	Resource Institution (contract base)	Revision of the training modules and preparation of the revised modules. Capacity development of Government officers and SOs.	1 high standard institution at state level

Source: JICA Survey Team

(2) Required human resources and SOs in implementation of PIM support

Learning from the past project experience, a good number of human resources and budged is required for PIM support. In total 160-200 SO staffs are required to support capacity building component. In medium irrigation scheme, one organisation, which has relatively higher capacity is supposed to handle 1 medium irrigation scheme, which covers the PC and all the WUAs under the concerned scheme. For minor irrigation scheme, three to four WUAs shall be handled by one staff of SOs. The number of SOs to be contracted depends on the capacity of SOs to assign staffs. The agreement shall be signed between PMU representative and the selected organisation. The proposed basic feature of contracts is as follows.

Table 10.3.3 Basic Salient Feature of SO Contract and TOR

	Medium irrigation scheme	Minor irrigation scheme
Target area	1 PC and all the WUAs under the concerned scheme	11 minor irrigation scheme (depending on the capacity of SO to assign staffs)
No, of staffs to be assigned	3 staffs for the scheme with 8 WUAs. (1 for PC support, 2 for WUA (1 staff/4 WUAs)	3-4 staffs (for 11 WUAs) = (1staff /3-4 WUAs)
Expected works	WUA support (***per WUA***) 17 Trainings/workshop/exposure (41days) about 70 days on-field support PC support 6 Training /workshops/exposure (20 days) About 30 days on-field support	WUA support (***per WUA***) 17 Trainings/workshop/exposure (41days) about 70 days on-field support (about 90 days on-field support /staff/year)
Contract Period	4 years	4 years
TOR / Expected activities to be implemented	- Field activities · Implementation of training programmes to WUAs/PCs (including preparation and arrangement, with help of resource person as required)	

	· Follow-up and support of the actual implementation of PIM activities by WUA through periodical field visit As per indicated in Attachment 10.3.2 Activities for Capacity Development Support – WUA All the activities mentioned in the Activity 3 and 4 of PIM support (for Minor and Medium scheme respectively) are to be organised and implemented by SO, which include preparation of the activities, conducting training, field handholding support and follow-up. - Reporting the activities conducted to DIU and PMU - Participating the trainings and monitoring meetings for SO staffs
Outputs	Baseline survey report Progress report (quarterly base) Completion report (at the end of the project)

Source: JICA Survey Team

Selection criteria of Supporting Organisations is as shown in the below box.

Box 10.3.1: Sample Selection Criteria for SOs.

- The organisation should be a local community organization or local branches of national NGOs, working in the area of Natural Resource Management (NRM)/ social development sector.
- The organisation should be registered under the Foreign Contribution Regulation Act (FCRA) compulsory in case of projects involving foreign funding).
- The organisation should be legally registered as per the local laws.
- The organisation should not have legal deficits for the last 5 years.
- The CEO or the members of the management committee should not be convicted in any criminal case.
- Audited accounts of preceding three years.
- The organisation should neither be blacklisted nor objectionable to the relevant government department.
- The organisation should have guided at least five village-level community development programmes & have maintained audited accounts.
- The organisation should have prior experience with the community towards implementation of comparable activities at the community level.
- The organisation should not have any negative reputation from the community
- The organisation can allocate enough staffs with qualification and experience to accomplish the above mentioned assigned functions (the number of staffs required depends on the number of WUA to be handled).

Even though the NGOs to be assigned for SOs are expected to have enough experience in supporting community organisations, staffs of SOs shall be trained on all the necessary support they are supposed to provide to WUAs. The detail activities for capacity building of SOs are mentioned in the Table 10.3.4 in the following section with further details in Attachment 10.3.2. Monitoring and assessment of SOs' works is also critical issue to assure quality of the works of soft component. Monitoring and assessment shall be made before each periodical payment. Payment shall be made based on the activities conducted with necessary documentation and proof.

Necessary documentation and proof to be submitted for payment assessment are as follows.

Box 10.3.2: Means of verification for monitoring of the SOs' works

- Brief report of each activity conducted,
- Participants list with signature for trainings
- Photos of each activity
- Minutes of the training programs, meetings and monitoring visit.
- Training certificates.
- Written documents for situation observation such as conflict resolution among the farmers.
- Prepared plans, monitoring records, and evaluation records of O&M activities and water budgeting/distribution and crop planning.
- Feedback book (community feedback on SO performance by farmers)
- Social audit records and Registers/Books/Vouchers of WUAs
- Work log book of the assigned staffs of SO
- Financial records and auditing records of SO

Possibility of digital monitoring system can be considered, applying from the system of revenue department where tablets have been provided to all Village Revenue Officers (VRO) and the VRO uploads details of each farmer (crop wise data, land, wet/irrigate etc) through the software, and it the data gets uploaded on the Chief Minister (CM) dash board in GoAP website.

(3) Capacity Building Programmes of PCs/WUAs for PIM

As mentioned in Chapter 4, WUAs have been revised since October 2015 after several years of transitional arrangement where the DEEs had assumed the role of WUA presidents. In addition, the DoWR has been working on the preparation of new guideline for the development of PIM through WUAs. Under this situation, where WUAs lost their experiences for several years, intensive intervention to support the establishment of foundation of the PCs/WUAs will be done.

(a) Outline of Capacity Building Programme for PIM and O&M by FOs (PCs/WUAs)

Since it is almost a fresh start for the revised WUAs in Andhra Pradesh, capacity building is required at all levels. The capacity building programme starts with the revision of the previous guideline and training modules by DoWR with the help of resource institutions. Based on the revised guideline and modules, a series of trainings shall be organised for relevant stakeholders: PMU, DoWR state officers, DoWR district and field officers, supporting organisations (NGOs), and PCs/WUAs.

The outline of capacity building activities is as indicated below. Detail activities of each component are mentioned in the Table 10.3.4. Since the process and intensiveness of the activities in implementation can make differences, activities proposed in Attachment 10.3.2 with all the process including preparation and follow-up to root the activities should not be underestimated nor omitted.

Table 10.3.4 Activities for PIM Support

Item	Activity	Responsible org.	Target	Contents
1.Capacity Development of Department officers	1.1 Development of guideline	DoWR with resource institutions	PMU, State level DoWR officers, CE, SEs at each district, Agr officers	1.1.1 Review of existing training modules of WUA and preparation of a new guideline 1.1.2 Dissemination and explanation of the Guideline and training modules to at State and District officers 1.1.3 Dissemination and explanation of the Guideline and training modules to at SEs level
	1.2 Training programmes for department officers	DoWR (State/District) with resource persons	DEE, AEE	1.2.1 Preparation of training programme for Dept officers 1.2.2 Training of DEE, AEE on WUA development and Support 1.2.3 Training of DEE, AEE on O&M and technical guidance (1) - System for water management recording 1.2.4 Training of DEE, AEE on O&M and technical guidance (2) - System for Irrigation water management planning
2.Monitoring and capacity development of SOs and CRP	2.Monitoring and capacity development of SOs and CRP	DoWR DIU Consultant	SO staffs in charge, Community Resource Persons	2.1 Pre-orientation meeting on project activities 2.2 Selection and appointment of SOs 2.3 Workshop on outline of the project and Basics about agreement, and roles of the SO 2.4 Training of SO staffs on the Training module for WUA (ToT) 2.5 Monitoring workshop 2.6 Refresher training / additional training 2.7 Experience sharing workshop 2.8 Evaluation workshop 2.9 Training of Community Resource person (CRP)
3.Support and capacity development of WUA	3.1 Baseline survey	SO		- Baseline survey of command area of tanks - Data compilation and preparation of report
	3.2 Initial awareness/preparation	SO	Villagers in target area	3.2.1 Orientation meeting on project activities 3.2.2 Awareness on Irrigation management

Item	Activity	Responsible org.	Target	Contents
	3.3 Organisational development support	SO (with resource persons and DEE AEE)	WUA MC, TC, WUA General members	3.3.1 Internal preparation for development of the support programmes 3.3.2 Training programme (Concept of PIM and WUA institutional management) 3.3.3 Follow-up monitoring handholding support after training 3.3.4 Disseminating workshop of role of water users (by WUA management committee members)
	3.4 Fund generation and financial management	SO, AEE	WUA MC, TC, women members etc.	3.4.1 Internal preparation for development of the support programmes 3.4.2 Orientation and option presentation 3.4.3 Activity material support 3.4.4 Support planning of activities by WUA 3.4.5 Skill development trainings for Fund generation activities 3.4.6 Financial management skill trainings 3.4.7 Handholding support and mentoring
	3.5 Maintenance works by WUA	SO, AEE, (RDD officer, gram panchayat)	WUA MC, TC, women members Water management sub-committee	3.5.1 Internal preparation for development of the support programmes 3.5.2 O&M Management skill training (Planning and maintenance work management) 3.5.3 Orientation and guidance on Maintenance activities by WUA to WUA general body members 3.5.4 O&M Technical skill development training (on site) 3.5.5 Handholding support and mentoring on O&M activities
	3.6 Water budgeting and Agriculture Development Plan (crop planning)	SO, AEE, AEOs	WUA MC, TC, general members	3.6.1 Internal preparation for the support programmes 3.6.2 Training programme on water budgeting and preparation of Agriculture Development Plan (Crop planning) 3.6.3 Support on actual water budgeting and planning practice
	3.7 Optimal use of tank water (collaboration with other stakeholders)	SO, AEE, Fishery Dept officers, and relevant department officials.	WUA, Fishermen society, other users of the tank	3.7.1 Internal preparation for development of the support programmes 3.7.2 Awareness and orientation workshop on optimal use of tank water 3.7.3 Support periodical meeting among stakeholders 3.7.4 Handholding support on actual operation
	3.8 Exposure and learning experiences	SO, AEEs,	WUA MC members	3.8.1 Internal preparation for experience sharing and exposure visit 3.8.2 Convergence meeting for sharing of success stories by farmers organisations. 3.8.3 Exposure to successful examples
	3.9 Introduction and awareness raising on Government schemes	SO, relevant officers	WUA general body members and villagers	3.9.1 Awareness workshop on Government schemes (Convergence meeting) 3.9.2 Support in applying for the government schemes
	3.10 Refresher training	SO, relevant officers	WUA and other stakeholders	- Refresher training / additional training
	3.11 Social Audit Boards	SO, EE, DEE	Social Auditing Board, WUA members	3.11.1 Election of Social Audit Board 3.11.2 Training of the Social Audit Board 3.11.3 Practical support of Social Audit Board 3.11.4 Consultation meeting to share audit result from Auditing board to WUA general members

Item	Activity	Responsible org.	Target	Contents
4.Support and capacity development of Project Committee of medium irrigations *(4.1-4.11 are same as 3.1-3.11 (3.12 is administration provision)*	4.13 Establishment of PC office management and O&M of medium irrigation by PC	SO, EE, DEE, AEEs	PC members and WUA presidents under medium irrigation	4.13.1 Training on Project level management, office management and O&M 4.13.2 Monthly PC meetings 4.13.3 Project level consultation meetings for water cess with Revenue for reconciliation and issue of water tax proceedings 4.13.4 Seasonal Water budgeting and Crop Planning for medium irrigation 4.13.5 Seasonal O&M planning meeting
	4.14 Social Audit Boards	SO, DEE, AEE,	Social Auditing Board, PC members	4.14.1 Election of Social Audit Board 4.14.2 Training of the Social Audit Board 4.14.3 Practical support of Social Audit Board 4.14.4 Consultation meeting to share audit result
	4.15 Exposure visit	SO, EE, DEE,	PC, and WUA MC members	4.15.1 Internal preparation for experience sharing and exposure visit 4.15.2 External Exposure visit on water management & other activities

Source: JICA Survey Team

Further details of each activity are mentioned in the Attachment 10.3.2.

(b) Issues to be emphasised in PIM support

Even though the detail activities are mentioned in the Attachment 10.3.2, the followings are further issues to be noted in each activity to be implemented for better achievement of the purpose.

Activity Component 1:

- There are existing training modules developed through different organisation and project. A new guideline and training modules are to be prepared by revising the existing ones with amendment based on the proposed programme such as fund generation, convergence meeting for optimal use of tank resources etc. Outline and samples of the training modules are listed in Attachment 10.3.3. as well as Attachment 10.3.2.
- It is intended to have training to higher level officers to familiarise them with the new PIM strategy and guideline prepared.
- Roles and responsibilities of the DoWR officials are asserted in APFMIS and existing 'Farmer Organisations' Rules'. Due to absence of WUA MC for several years, not many of the field level officers are familiar with works of WUA support. Comprehensive training focusing on PIM shall be organised. Furthermore, the officials in charge of PIM shall participate in the trainings and activities to be conducted by SOs to WUA to learn from experiences.
- The plan of the state government regarding the training institution is establishing a Water University in AP. Since it will take several years to establish it, currently they are subletting training implementation (as mentioned above, the DoWR just started some training for WUAs). The institutions that are currently taking the training activities are 'Engineering staff Collage of India' and 'AP Human Resource Development Institution'.
- In the project, an institution that take up the work of revising training module will support training as resource institutions, possibly with support of the above institutions. The training by the resource institutions shall be conducted to DoWR/PMU and to SOs. The trainings to the WUA will be organised by the SOs, with resource person if required.

Activity Component 2:

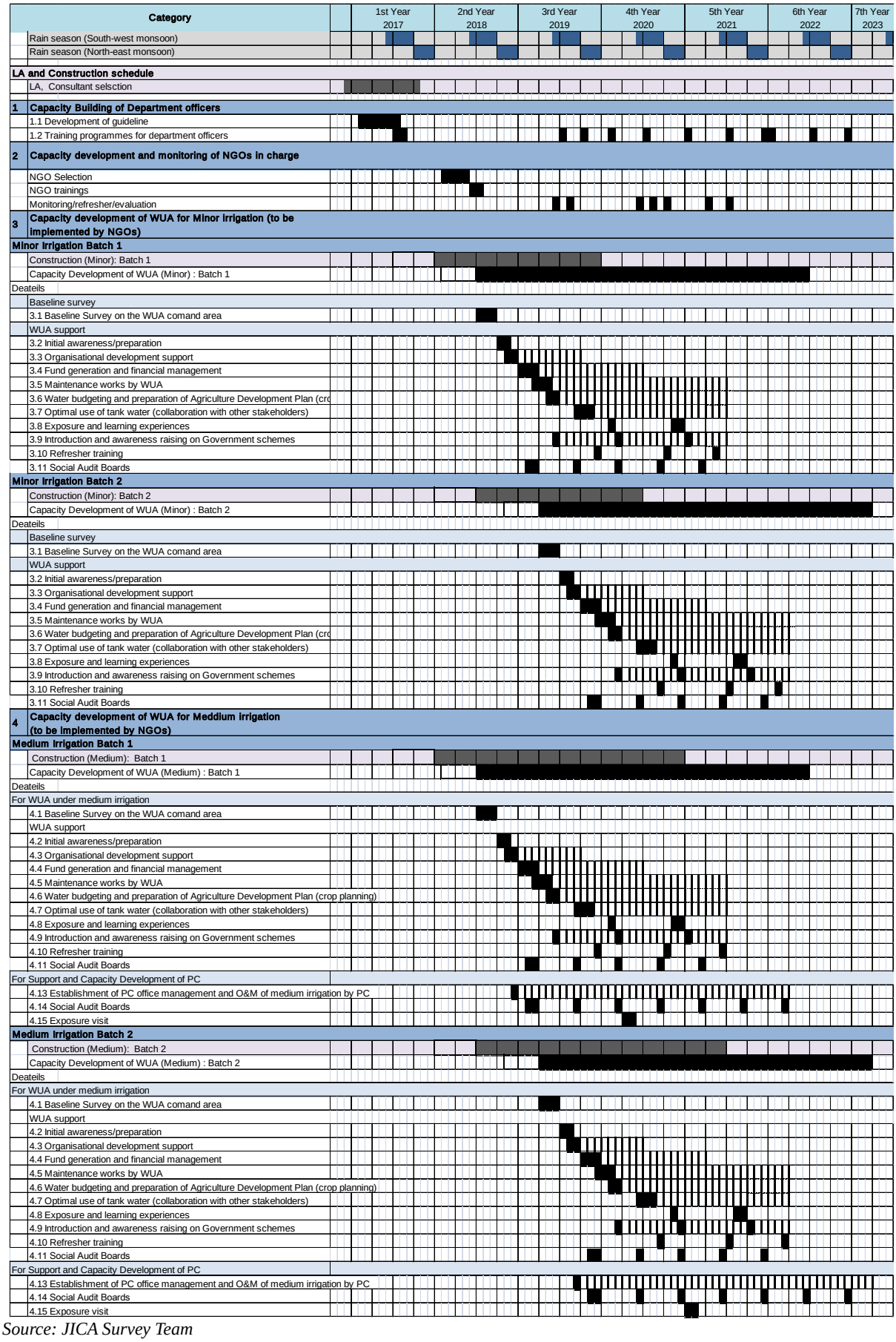
- Learning from the previous projects, success of the capacity development of PCs/WUAs are highly depending on the capacity of the supporting bodies. Development of comprehensive guideline and training modules, as well as sufficient training and clear instruction of their roles to the staff of SOs should not be underestimated.
- SOs shall organise quarterly internal monitoring and annual evaluation/experience sharing workshops among SOs. Learning through the workshops shall be reported to and monitored by the DIU and PMU. Sample monitoring indicators are shown in Attachment 10.3.4.

Activity Component 3 & 4:

- Most of the training proposed in the project shall be conducted at WUA level, involving different stakeholders. What should be emphasised in the role of SOs is not only conducting training but support in actual works. This intensive handholding support includes actual planning of O&M, implementation, support in actual water budgeting and crop planning before starting and its monitoring and evaluation, monitoring of meetings conducted by WUAs, monitoring of financial recording, periodical advices etc. in addition to organising trainings (as shown in the Attachment 10.3.2). Since intensive care is required at the beginning, support by capable SOs is necessary with enough personnel and budget.
- For sustainability, it is necessary to assign field level engineers to attend training and activities conducted by SOs.
- Convergence workshop and experience workshops shall be conducted at district level among creating interface between WUA, DoWR and other relevant departments.
- Relevant department officers are involved in the training and field monitoring. Agriculture development plan shall be prepared in collaboration with agriculture officers.
- Canal rotation system for water distribution shall be introduced or strengthened throughout the project area. Necessary technical support and minor structure for distribution system shall be provided by DoWR.
- Special provision for involvement of women in the project activities are recommended. While right of membership and management committee of WUA are proposed at policy level, it is important to involve women in the activities as women feel they are incapable lacking knowledge and skills even if their right is secured.

(c) Implementation Schedule

A summary of implementation schedule of the capacity building for PIMs and O&M are as indicated in Figure 10.3.2. Detailed schedule of each proposed programmes are shown in Attachment 10.3.5.



Source: JICA Survey Team

Figure 10.3.2 Implementation Schedule for Capacity Development for PIM

(d) Recommendation at policy / legislation level

The followings are necessary aspects to achieve effective water management by WUAs. Some of the recommendation has been considered earlier, unfortunately in vain. Strong political and administrative initiatives are required to achieve the following.

i) Water management related issues

- Involvement of women in WUA

  Recognising importance of women's participation in agriculture activities as well as social organisations, compulsory provision of a certain percentage of women in management of WUA is suggested. Clear indication of rights of membership of women landholders is also required to be mentioned in the APFMIS act or WUA rules. Furthermore, women or spouses of the members should be entitled to participate in decision making. These are aligned with PIM National Policy initiative and seen as a success in Madhya Pradesh PIM Act where equal right to women are assured.

- Right of tenant farmers

  In consideration of the high rate of informal tenant farmers, it is recommended to involve those tenant farmers in PIM operation, as they are actually using water and practising agriculture in the command area. Even though the APFMIS Act was revised to include tenant farmers as WUA members, those who are entitled are only the tenant farmers with lawful possession, which are not many in actual situation. Since the water management with adequate water use based on water budgeting and crop planning should be done through collaboration of all the water users in the area, exclusion of the tenant farmers who are actually practicing will impede effective PIM.

- Convergence with NREGS fund for minor maintenance activities

  There are huge resources available under NREGS and more than 50% of the NREGS works are related to water conservation / management in nation-wide. Considering the situation that adequate revenue cannot be mobilized through tariff and government funds, it is reasonable for WUA to access these funds for small maintenance works. In the Joint Convergence Guidelines between NREGS and programmes of water resources issued in collaboration between Ministry of Rural Development and Ministry of Water Resources, it is highly recommended to make optimal use of the NREGS fund for O&M of irrigation schemes. While some part of the irrigation O&M related activities are executed by the Panchayat, it is recommended to make further legislative arrangement for the WUA to implement through NREGS find.

  Furthermore, Collaboration between the NREGS and DoWR is inevitable for gap filling between NREGS work and those under DoWR for optimal use of fund and efficient maintenance work. There has been observed that farmers are reluctant to uptake the desilting work of tail end canal through NREGS fund because of insufficient water flow from upstream canal. This issue should be emphasised in the newly developed guideline as there is high potential to improve the situation through this arrangement.

- Authorisation of WUA in water tax collection and retaining the tax for their maintenance activities

  Delay of the plough back of water tax has been impeding O&M activities by WUA. It is proposed to amend the act or issue a government order to allow WUA retain their share of water tax after collection. Formal handover of responsibilities has happened under JICA's Rajasthan minor irrigation sub-project through government order to revenue department to handover revenue records to WUA.

- Social auditing by VO / SHGs

  Social auditing is mandated in the Act. To ensure accountability and transparency, the social audit should be done by a reliable and capable group in the community. In consideration of highly developed and systematised SHGs in AP, it is recommended to delegate the task of

social auditing to VOs/SHGs who can manage well the financial issues.

- Appointment of nodal officers for M&E of PIM activities

  In the current government structure, there is no officer in charge of PIM operation who are specialised in the institutional development or relevant subject. It is strongly recommended either to appoint nodal officers for PIM and WUA or to form appropriate committees to monitor PIM activities and WUA performance. Appointment of the nodal officers is mentioned in the PIM National Policy initiative and adopted in Madhya Pradesh PIM.

- Pilot application of Waghad model

  Waghad Model is a well-known successful model of PIM in Maharashtra State. The typical feature of the model volumetric measurement of water use and pre-paid system of the water tax. Learning from the success and contributing factors, a customised approach of the model shall be proposed to be implemented as a pilot. Since the use of irrigation water is different between AP and Maharashtra, metric water measuring method can be applied in a pilot basis. The details of the Waghad model and the customised programme for pilot is explained in the Attachment 10.3.6.

ii) Extended roles of WUAs

- Optimal use of tanks in collaboration with fishery

  As stated through the Government Order (G.O. Ms. No.60 dated 08.05.2003), all the water users are co-opted as WUA general body members. Irrigation tank is a crucial source of fishery as well as agriculture. Effective and efficient use of tank between farming and fishery can improve livelihood of the local people. The periodical stakeholders meeting of all the stakeholders including other user such as livestock rearing people, are proposed. For convergence with other tank related activities are suggested in the attached training programmes.

- Convergence meeting for introduction of government schemes

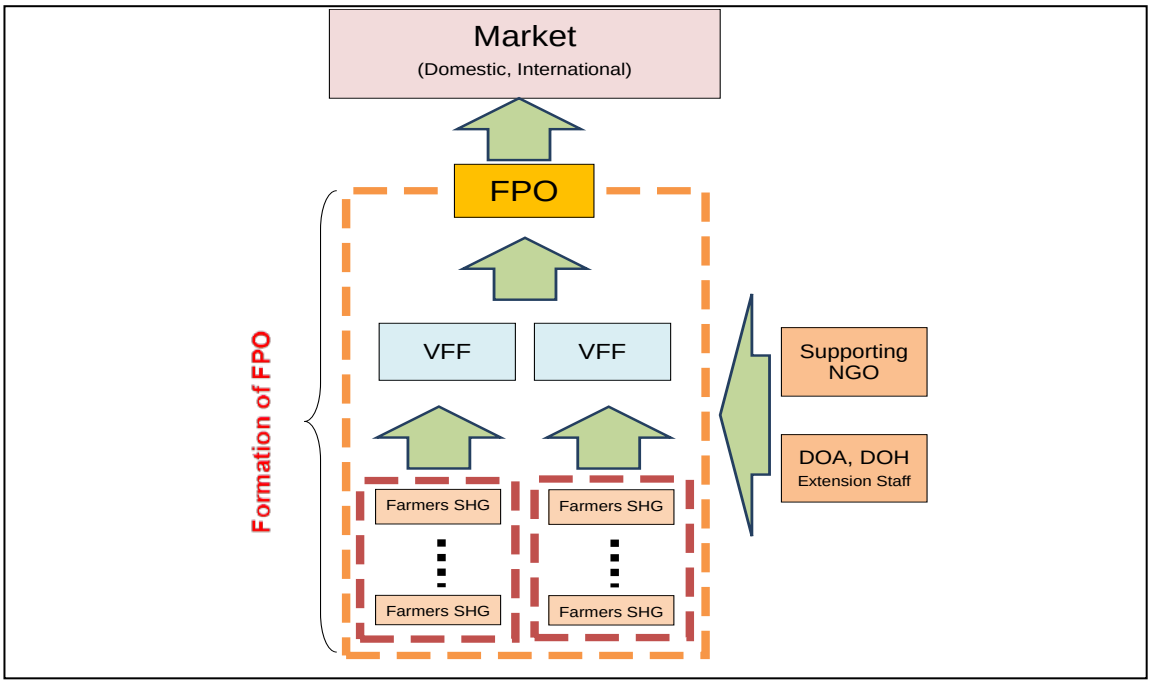
  Since the WUA is a strong body covering a good number of farmers in irrigation command area, it is preferable to utilise the unit of WUA for information dissemination and awareness raising. A proposed activity is a introduction and awareness enhancement of government schemes by different relevant departments in collaboration with existing convergence meetings. It should be carefully arranged not to exclude non-agriculture farmers or landless people in the area as they tend to be non-member of the WUAs.

10.3.2 Promotion of Farmers Producer Organisations (FPO)

(1) Outline of Promotion of Farmers Producer Organisation (FPO)

GoAP has been, as mentioned in the previous chapters, taking strong initiative in promoting FPO as one of the agricultural development policy to support small and marginal farmers. As mentioned in the previous chapters, different departments are playing parts of the promotion of FPOs in their roles.

The basic objective of forming FPO is to enhance the income and productivity at the same time also reduces risk and expenses of farmers and farming by following climate change resilient sustainable farming production practices. FPOs will be structured by 3 layers as shown in the below figure.



Source: JICA Survey Team

Figure 10.3.3 Concept of FPO in Department of Agriculture

- One FPO consists of 10 Village level Farmers' Federations (VFFs) and has around 1,000-1,500 members.
- One VFF consisits of 10 Farmers SHGs and has around 100-150 members.
- One Farmers SHG consists of 10-15 members.

Village level Farmers' Federation (VFF) will be the main implementation platform of the program at village level. The Farmers SHGs (farmer groups) form the foundation based on which FPOs are formed. FPOs provide a platform for Farmers SHGs to federate into a company or cooperative in order to access market, organic inputs, and financial services as well as to improve soil and water structures.

In line with the government policy and strategies, the project shall complement the initiative of promotion of FPOs and sustainable farm livelihood by the Department of Agriculture. The programme of the department aims to enhance resilience of agriculture to climate change and climate variability through strategies like farmers' capacity building, building farmers institutions, sustainable technology demonstrations, integrated farming systems, and natural resource management. The component of promoting farmers institutions aims to promote FPOs to achieve the abovementioned purpose.

As mentioned in the previous chapters, the FPO formation under organic farming scheme of the DoA has been under operation with Rashtriya Krishi Vikas Yojana (RKVY) programme, which covers 131 clusters (ten clusters per district while Kurnool has 11). DoA has also integrated FPO promotion in the scheme of comprehensive revival of millet that mainly targets 47 mandals of tribal areas. The proposed project is to expand these programmes in the command area of the target irrigation schemes. Therefore, basic approach of the programme shall follow the existing department's approaches of FPO promotion under existing schemes.

Basic features of the existing department's approach are as follows:

- Active potential clusters of existing agriculture clusters (such as organic farming cluster) have been identified, which were formed under different schemes such as Community Managed Sustainable Agriculture Programme implemented by the Society for Elimination of Rural Poverty (SERP) for organic farming cluster.
- The ongoing programme has been focusing on marginal farmers mostly in rainfed areas.
- The identified potential clusters/mandals are supported to form FPOs (clusters consisting of five villages or administrative mandals).

- Supporting works for formation of FPOs are to be sublet to NGOs that have been working in the target fields.

Since the project target areas do not have such foundation, the project shall start from the introduction of necessary technical skill development as well as awareness raising for formation of FPOs such as purpose of organising FPO, advantages and responsibilities. In the agriculture extension activities mentioned below, a series of activities are to be introduced to develop foundation for FPOs. Through trial and practice after introductory trainings, interested farmers shall be formed into groups to practice collective practice and learning. If there are similar existing groups such as active Farmer SHGs, those groups can be targeted for further support. Further trainings shall be conducted through master trainers from each group in a form of ToT.

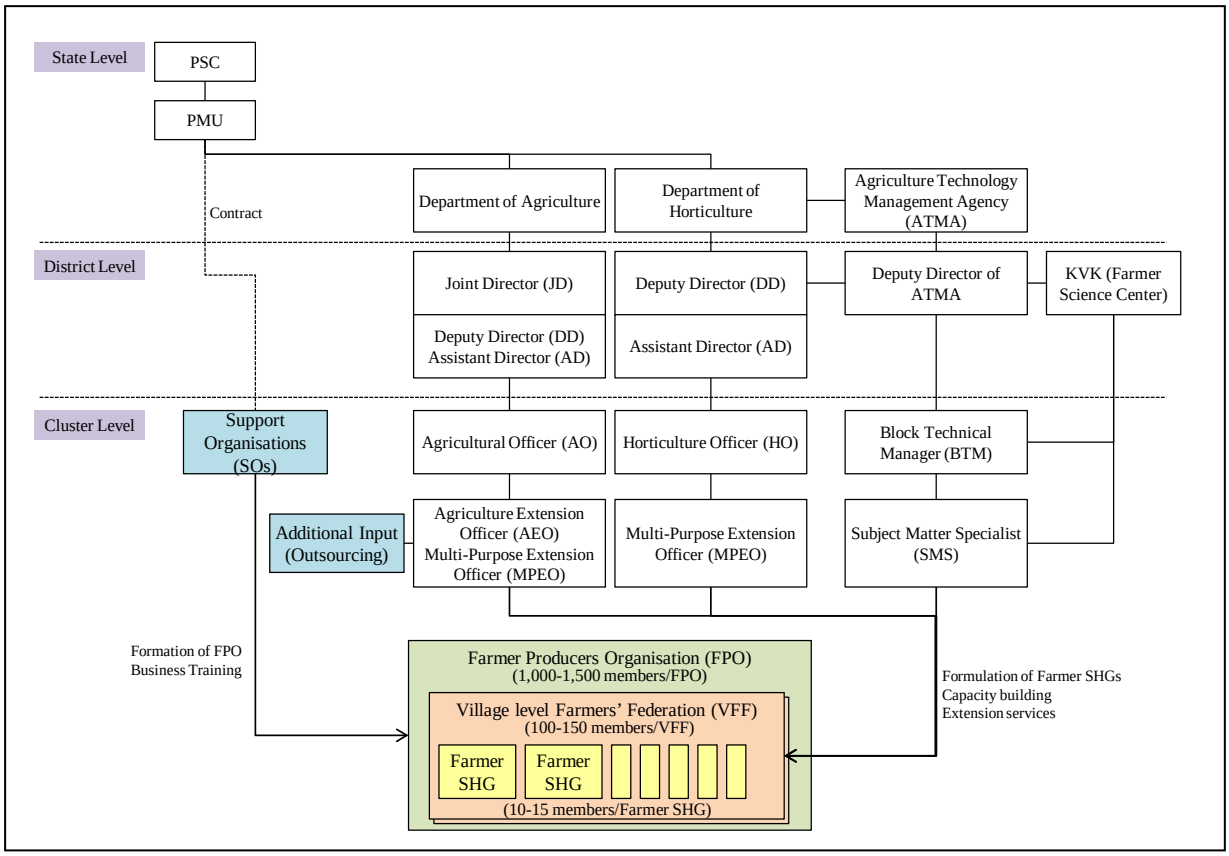
FPO promotion includes the whole process starting from foundation setting to development of business. In the proposed project, the FPO promotion support should be started from the foundation setting since the target areas do not have such basis of understanding on the collective practices in agricultural activities, sharing of skills and mutual learning of agricultural practice, and knowledge and skills in beneficial procurement and marketing. These foundations are part of crucial binding factors to establish firm and sustainable organisations. Through agricultural extension activities with a series of interventions in the target command areas, those foundations as binding factors of farmers shall be identified and developed prior to the formation of FPOs and support for their development. Furthermore, it is strongly proposed to carry out training progarmme for extension staff of DoA aas well as DoH regarding strengthening of their extension service function. Those activities are summarized as follows:

Table 10.3.5 Step-wise Promotion of FPO

Step	Category	Item	Activities
Step-1	Implementation of Agriculture Extension Programme	a) Strengthening of Extension Service Function in DoA and DoH	- Recruitment of Extension Staff - District-wise Capacity Development of Extension Staff for the Project Activities - Annual Monitoring and Evaluation - Preparation of Information, Education and Communication Materials - Capacity Development of Extension Staff - Strengthening of Research - Extension – Farmers Linkages - Joint Field Visit of Researchers and Extension Staff - Exposure / Study Visits
		b) Farmer support programme	- Initial awareness and preparatory work - Initial workshop on farm management - Training on fundamental techniques (class room training) - Demonstration and field school (hands-on training) - Exposure and learning experience - Demonstration and exposure visit on farm mechanisation
Step-2	Preparation for FPO Formation		- Preparatory stage - Identification of potential area for FPO - Employment of SO staff for FPO formation - Formation of FPO
Step-3	Support for establishing FPOs		- Support for establishing FPO / business formation

Source: JICA Survey Team

It is proposed that various activities for promotion of FPO mentioned above be conducted under the structure of DoA and DoH as shown in the following Figure.



Source: JICA Survey Team

Figure 10.3.4 Implementation Structure for Promotion of FPO

(2) Agriculture Extension Programmes

(a) Basic Conditions for Implementation of the Programmes

Agricultural extension programme consists of two components that is (i) strengthening of extension service function in DoA /DoH, and (ii) farmer support programmes. Basic conditions for implementation of these programmes are shown as follows:

- Farmer support programme has two components that is class room trainings as well as demonstrations (hands-on training). Those components start from the last one year before completion of the modernization of each irrigation scheme.
- In each irrigation scheme, class room trainings shall be carried out for 1 year, while demonstrations (hands-on trainings) be conducted for 2 years.
- Farmer support programme is conducted toward members of each WUA in irrigation scheme. Total number of WUA in 20 Medium Irrigation Scheme is counted at 155 WUAs as shown in Attachment 10.3.7. Meanwhile it is assumed that each minor irrigation scheme has one WUA. Thus total target WUAs for minor irrigation schemes are estimated at 449 WUAs. Accordingly total WUAs in the project is 604 units.
- As of March 2016, 1,302 AEOs (Agriculture Extension Officers) and 3,838 MPEOs (Multipurpose Extension Officers) of DoA are deployed as shown below. Meanwhile 500 MPEOs for DoH are deployed in 13 Districts.

Table 10.3.6 Deployment of Extension Staff in DoA and DoH as of March 2016

Position	DoA	DoH
JDA (Joint Director of Agriculture)	13	-
DDH (Deputy Director of Horticulture)	-	13
DDA (Deputy Director of Agriculture)	42	-

Position	DoA	DoH
ADA (Assistant Director of Agriculture)	27	-
ADH (Assistant Director of Horticulture)	-	26
AO (Agriculture Officer)	661	
HO (Horticulture Officer)		223
AEO (Agriculture Extension Officer)	1,302	-
MPEO (Multi-purpose Extension Officer)	3,838	500

Source: DoA and DoH

- As mentioned in the above table, it seems that number of AO, HO, AEO and MPEO (DoA) are sufficient, while 500 members of MPEO in DoH might not be sufficient.
- In the Project, it is expected that extension activities be intensively conduced for relevant WUAs or 604 WUAs. In this case, additional extension staff should be required, in order to do effective and smooth extension activities in each WUA as follows:

Table 10.3.7 Additional Requirement of Extension Staff (Tentative)

Particular	Number of Target WUAs in the Project						
	1 to 4	5 to 8	9 to 12	13 to 16	17 to 20	21 to 24	25 to 28
Additional Staff to be required	0*[a]	1	2	3	4	5	6

*Note:*a: If number of WUAs is4 or less, additional extension staff is not required.*
Source: JICA Survey Team

- Based on the above requirement, additional staff is required for implementation of promotion of FPO as shown in Attachment 10.3.8. Namely 67 additional persons, who are like agricultural extension officer in Mandal level, should be recruited for the project. They are employed as project staff, and requested to work with the existing MPEOs in each Mandal.
- Further one project coordinator, who is a state level officer, should be required. This staff has some responsibility to control work progress of promotion of FPO in 13 Districts, considering work progress of modernisation of irrigation schemes.
- For smooth implementation of class room training, it is expected that small groups (farmers' SHGs) in each WUA be formulated, and thus master farmer of each small group be selected by members of small groups. Further leader farmers are requested to disseminate subjects to be instructed in each extension activity into colleagues of their groups.

(b) Implementation Schedule for Strengthening Extension Service Function in DoA and DoH

They have to understand that agricultural development plan and extension training plan should be prepared in order to promote improvement of agricultural productivity as well as increment of farm income of the project beneficiaries. To assess the change in the cropping system, the extension staff will have to collect the information about the area, production and productivity per unit area of each crop at the end of the crop season so that the changes due to the adoption of new cropping system as well as new skills could be recorded and evaluated.

For smooth implementation of the Project, activities for strengthening of management and planning capacity of the DoA / DoH staff are required as shown as follows:

Table 10.3.8 Activities for Strengthening Extension Service Function in DoA and DoH

Particulars	Activities	Contents	Responsible Organization	Target
1. Recruitment of Extension Staff	• Recruitment of State Coordinating Officer (state level)	- Overall supervision of activities in each District		
	• Recruitment of additional persons for extension activities in the related Mandals (outsourcing)	- Implementation of extension activities for farmers in cooperation with other extension staff		
2. Capacity	• Orientation of workshop	- Introduction of components of	PMU/ PMC/	Senior

Particulars	Activities	Contents	Responsible Organization	Target
Development of Extension Staff for the Project Activities		the Project - Role and responsibilities of extension staff		Staff in State/ District
	• Training on management of extension activities	- Approach of extension activities in the Project	Senior Staff in State/ District	District Staff
	• Peer learning workshop	- Outline of extension activities	Senior Staff in State/ District	District Staff
3. Annual Monitoring and Evaluation	• Confirmation of outcome of each extension activity	- Importance on preparation of action plan for each extension activity	Senior Staff in State/ District	District Staff
	• Formulation of extension activities plan	- Importance and necessity of the plan		
	• Modification of agricultural development plan (prepared by WUA)	- Importance of planning, monitoring, and evaluation		
4. Preparation of Information, Education and Communication Materials*1	• Poster / Calendar / Banners	- each District	District	Scheme
	• Wall writings	- each WUA	District	Scheme
	• Publication of handouts and manuals	- each District	District	Scheme
	• Preparation of video programmes	- State level	State	Public
	• Displays of agricultural shows / fairs	- each District	District	Public
5. Capacity Development of Extension Staff	• Refreshing extension staff	- Dissemination of latest information as well as skills for agricultural activities	PMC/ Senior Staff in State/ District	District Staff
6. Strengthening of Research - Extension – Farmers Linkages	• Periodical discussion among them	- Exchange of their experiences - Discussion on current situation in the field	District	State/ District/ University/ Research station/ Farmers
7. Joint Field Visit of Researchers and Extension Staff	• After completion of demonstration activities	- Monitoring and evaluation on extension activities	District	/ District/ University/ Research station/ Farmers
8. Exposure / Study Visits	• Advance area / farmers in and outside the State / Districts	- Confirmation of advanced agriculture	State/ District	Extension Staff

Note: PMU= Staff of PMU, PMC= Consultant of PMC, State= State Staff of DOA/DOH, District= District Staff of DOA/DOH,
- Refer Attachments 13.3.8 to 13.3.12 for financial information of each activities
**1: only for DoA*
Source: JICA Survey Team

Especially, Capacity Development of Extension Staff and Strengthening of Research - Extension - Farmers Linkages in the above table could be conducted in cooperation with some resource persons from outside organisation, resulting in efficient implementation of capacity development as well as extension activity:

Table 10.3.9 Outline on Arrangement of Resource Persons in Strengthening of Extension Service Function

Activities	Resource Persons			
	Mandate	No. to be required	Honorarium (INR per person)	Travel and Conveyance (INR per person)
Capacity Development of Extension Staff	- Introduction of new skills as well as latest information on crop cultivation - Introduction of case study on extension activities	2	5,000	3,000

Activities	Resource Persons			
	Mandate	No. to be required	Honorarium (INR per person)	Travel and Conveyance (INR per person)
Strengthening of Research - Extension - Farmers Linkages	- Introduction of new skills as well as latest information on crop cultivation - Sharing comments on current agricultural situation	2	5,000	3,000

Note: Refer Attachment 13.3.11
Source: JICA Survey Team

(c) Implementation Schedule for Farmer Support Programmes

The Farmers Support Component is composed of the following 6 components:

- Initial awareness and preparatory work
- Farm management (class room training)
- Training on fundamental techniques
- Demonstration and field school
- Exposure and learning experience
- Demonstration and exposure visit on farm mechanisation

To support and enhance the skills of the farmers in the irrigation schemes, it must be ensured that the extension trainings and crop demonstrations be planned, considering field visit each irrigation scheme at least once a month for initial 2 years. Training activities for farmers will be carried out in sequence with the progress of the civil works as shown in Attachments 10.3.9, and summarized as follows:

Table 10.3.10 Summary of Farmer Support Programme

Particulars	Activities	Trainers	Trainers
1) Initial awareness and preparatory work	- Orientation on extension activities - Formulation of farmers'' groups and selection of master farmers - Capacity building for farmers' groups	AEO HO MPEO	Farmers of each irrigation scheme
2) Farm management (class room training)	- Training on budgeting / book keeping / monitoring	AEO HO MPEO	Farmers
3) Training on fundamental techniques (class room training)	- Water use and fertilizer application - Rain water harvesting techniques - Micro-irrigation Technology (O&M) - Promotion of organic farming - Promotion of vermi-composting - Promotion of GAP - Promotion of IPM and INM - Seed village programme	AEO HO MPEO	Farmers
4) Demonstration and field school (hands-on training)	- Demonstration on Rice - Demonstration on Upland Crops (Maize, Ground nuts, Pulses, Sugarcane) - Demonstration on Upland Crops (fodder crops , others) - Demonstration on Vegetables (Chilli / Tomato / Other crops)	AEO HO MPEO	Farmers
5) Exposure and learning experience	- IPM and Organic Pest Management - Successful examples on farming practices - Post-harvest techniques	AEO HO MPEO	Farmers
6) Demonstration and exposure visit on farm mechanisation	- Demonstration of machinery activities in farmers' fields - Exposure visit to successful examples	AEO HO MPEO	Farmers

Note: Refer to Attachment-13,3,14 and 13.3.15 for detailed cost of each activities
Source: JICA Survey Team

(d) Essential Point for Implementation of Farmer Support Programmes

1) Formulation of action plans for crop cultivation and extension activities

To bring desirable changes in crop cultivation in each irrigation scheme, the Extension Officers have to motivate farmers for a change and ensure their participation in planning on crop production as well as execution of the proposed farming activities. In order to make any farmers' action plan on crop cultivation, it is essential that they must participate and own their plans.

For the promotion of crop cultivation in irrigation scheme, it is expected that two important plans that is (i) preparation of crop cultivation plan (CCP) and (ii) preparation of extension activities plan (EAP) should be prepared by farmers as well as extension staff respectively.

It is expected that members of each WUA formulate CCP in cooperation with extension staff, fixing for the next 2 to 3 years by giving rational increment per year. It is important that its yearly increment should be modified after the results of annual actual achievements, and further discussion with the farmers. Meanwhile, extension activities for farmers in each irrigation scheme must be based on the needs and interests of the farmers, and should deal with their real problems.

Samples formatted for crop cultivation plan and extension activities plan are shown in Attachments 10.3.10 and 10.3.11.

2) Monitoring and evaluation for crop cultivation and extension activities

To assess the change in crop cultivation in each irrigation scheme, farmers and the extension staff will have to collect the information about the area, production and productivity per unit area of each crop at the end of the crop season so that the changes due to the adoption of new cropping system could be recorded (refer Attachment 10.3.10).

After monitoring with the farmers and extension staff about the performance of crop cultivation in the irrigation scheme, if the results are found beneficial, the same plans could be used in the following year. However, if the results are not encouraging, it is required to modify the plans, on the basis of needs and requirements from farmers.

(3) Support on Formation and Establishment of FPOs

As shown in Figure 10.3.2, a study shall be conducted to identify potential areas to form FPOs, to assess level of activities and functions of the groups and advantages of aggregation to form federation. Identified areas shall be supported for stepping forward to form FPO with support by Supporting Organisations (SOs) in formation and establishment of organisational function. Even though the support on formation of FPOs depends on the progress and development of farmer groups, 1 FPO per Medium irrigation cluster (in total 20 FPOs) shall be targeted for further support including business development such as market linkage, quality improvement, and quantity management. Supporting activities to be implemented by the project is summarised below.

Table 10.3.11 Proposed Interventions for Formation and Establishment of FPOs

Activities	Responsibility	Target	Activity contents
1. Preparatory stage			
1.1 Compilation of lessons from the on-going FPO formation	DoA	-	Evaluation of the on-going / preceded FPO formation Compilation of lessons from the preceding programmes Preparation of strategies based on the lessons
1.2. Formation of farmer groups (Farmer SHGs)	AEO, MPEO	Farmer Groups	Organising a meeting with farmers Formation of small groups of farmers for collective practice(15-20 farmers each) for technology dissemination, extension, information sharing Selection of master trainers from each group
1.3. Periodical monitoring meeting of the groups	AEO, MPEO	Farmer Groups, VFFs	Support in organising periodical meeting (e.g. monthly) of the groups Facilitation in the discussion and providing advice on technical and management issues.

Activities	Responsibility	Target	Activity contents
2. Identification of potential area for FPO			
2.1. Survey on potential of forming FPO	AEO, MPEO	Farmer Groups, VFFs	Identification of active progressive farmers/cluster of organic farming Analysis on expected benefit by aggregation of the groups Estimation of expected produce Identification of potential market
3. Employment of SOs for FPO formation			
3.1 Employment of SOs for FPO formation	DoA, PMU	SOs	Consensus making among farmers and groups to form FPO in the identified progressive/potential area for FPO formation Contracting out the works of supporting formation of FPO
3.2. Introductory meeting for SOs	DoA	SOs	Meeting for explaining the contract administration Workshop with the selected SOs on their expected roles, ToR Training regarding FPO formation and support
4. Formation of FPO			
4.1. Support on aggregation of organic farming group to form FPO	SOs	Farmer SHGs, VFFs	The FPO formation support shall be implemented by SOs with consultation with Dept. Organising meeting to introduce idea of aggregation and formation of FPO Training on formation of FPO and its basic administration functions
5. Support for establishing FPO / business formation			
5.1. Business training	SOs, AEO, MPEO	FPO	Support their business activities of FPO Business mind setting Business planning, Basic budgeting (cost and profit estimation) Financial and production management Business management
5.2. Follow-up support on business planning	SOs, AEO, MPEO	FPO	Support actual preparation of; business planning, financial management, production management
5.3. Marketing support	SOs, AEO, MPEO, Business consultant / resource person	FPO	Support in promoting marketing training on marketing identification of market, & linking with buyers Quality/quantity assurance support
5.4. Production development support	SOs, AEO, MPEO	FPO	Support in production development quality improvement, post-harvest technology, processing, packaging, etc.
5.5. Minor infrastructure support	SOs, AEO, MPEO	FPO	Support in initial infrastructure support for production and marketing
5.6. Organic certification	SOs, AEO, MPEO	FPO	Support in process of acquiring organic certificate procedures and documentation preparation conditions and requirement for organic quality assurance

Source: JICA Survey Team

(4) Required Human Resources and SOs in Implementation of FPO Support

SOs shall be assigned from the formation stage of FPO. One SO is expected to handle one FPO support, while capable SOs can handle several FPOs if they can meet the following requirement. The SOs for the PIM support in the area can assign competent staffs in charge of FPO support, or a different SO can be appointed if required. Required staffs are judged from the amount of expected work as input by SO to each FPO.

Table 10.3.12 Basic salient feature of SO contract for FPO Support and TOR

	Medium irrigation scheme
Target beneficiaries	1000~1500 members / FPO
No, of staffs to be assigned	2 staffs / FPO (a staff with experience of marketing of agricultural product and one with business management support)

	Medium irrigation scheme
Expected works	Mobilisation of farmers and farmer groups to form FPO Support establishment of organisation of FPO with basic structure and management system Trainings/workshop and on-field support for production and business support in cooperation with DoA/DoH officers and resource persons
Contract Period	3 years
TOR / Expected activities to be implemented	· Support on aggregation to form FPO (Formation workshops and basic organisational training in total 8 days) · Business training (5 day training with 2 staffs) · Follow-up support on business planning (periodical follow-up support of 30 man/days) · Marketing support (periodical field support for 40 man/days) · Production development support (periodical field support for 40 man/days) · Minor infrastructure support (support on application and procurement) · Organic certification (field support)
Output	· Progress report (quarterly basis) · Completion report

Source: JICA Survey Team

Formulation FPO from VFF shall be supported by SOs. SO staffs are responsible for overall management of support for each FPO, such as establishment of organisational structure and planning of FPO development, as well as handholding support mainly targeting management and BoD of the FPOs. AEOs and MPEOs in the target area shall support technically as training resource persons and field support as required. Since the business support requires special skills and experiences, exogenous resource person shall be assigned. Two AEOs and six MPEOs are expected to support an FPO, who are in charge of the extension service in the target are of the FPO. Judging from the current experience of FPO formation by DoA where one FPO cluster covers one mandal, the average number of AEOs and MPEOs assigned per mandal are 2 and 6 respectively.

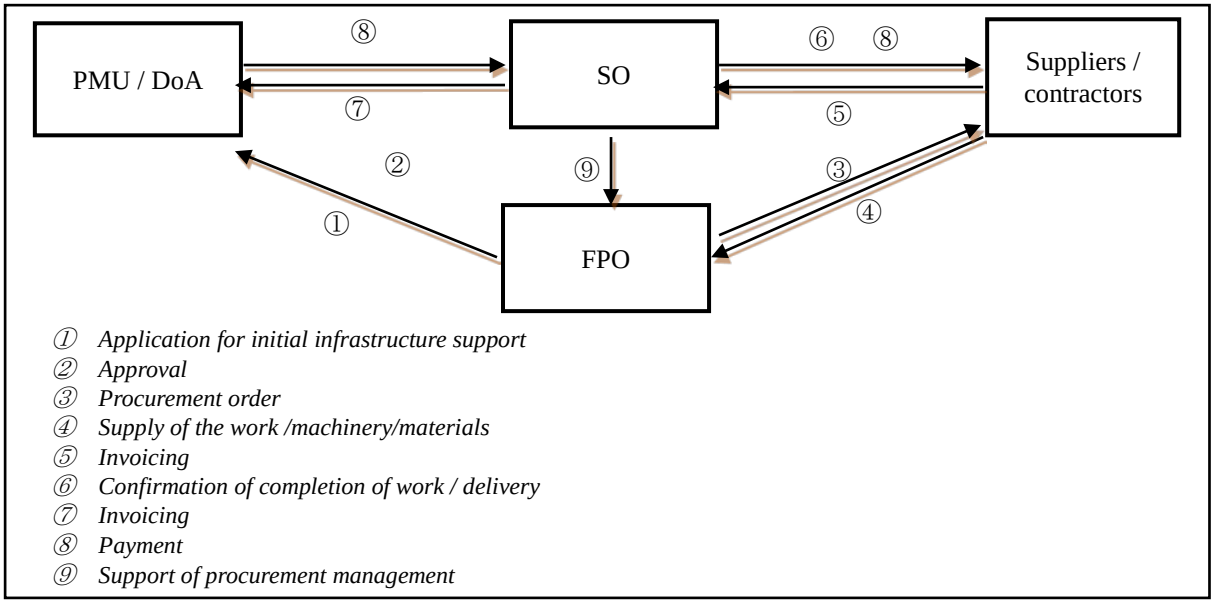
Table 10.3.13 Required Human Resources for FPO Support

Activity	Supporting human resources
VFF and FPO formation and development of FPOs	- 2 SO staffs in charge for overall field support - 2 AEOs and 6 MPEOs in charge in the target area for technical support (training resource person and in field support) - Business experts as resource person in the trainings

Source: JICA Survey Team

(5) Infrastructure Support for FPO

Production and marketing support shall be provided with initial infrastructure / material support. The support shall be provided at the stage where a FPO becomes stable with their supply of basic produce and seeking for further potentials for marketing. Anticipated initial support include construction of building for either production, storage, and marketing, machineries for processing and postharvest management, and initial investment for procurement of materials. The precondition for the infrastructure support is a) registration under a relevant government law, b) establishment of financial account and opened bank account, c) collection of share from members as their own fund source, and d) preparation of business plan with consensus of the members. The procurement and payment structure of the initial infrastructure support is as follows.

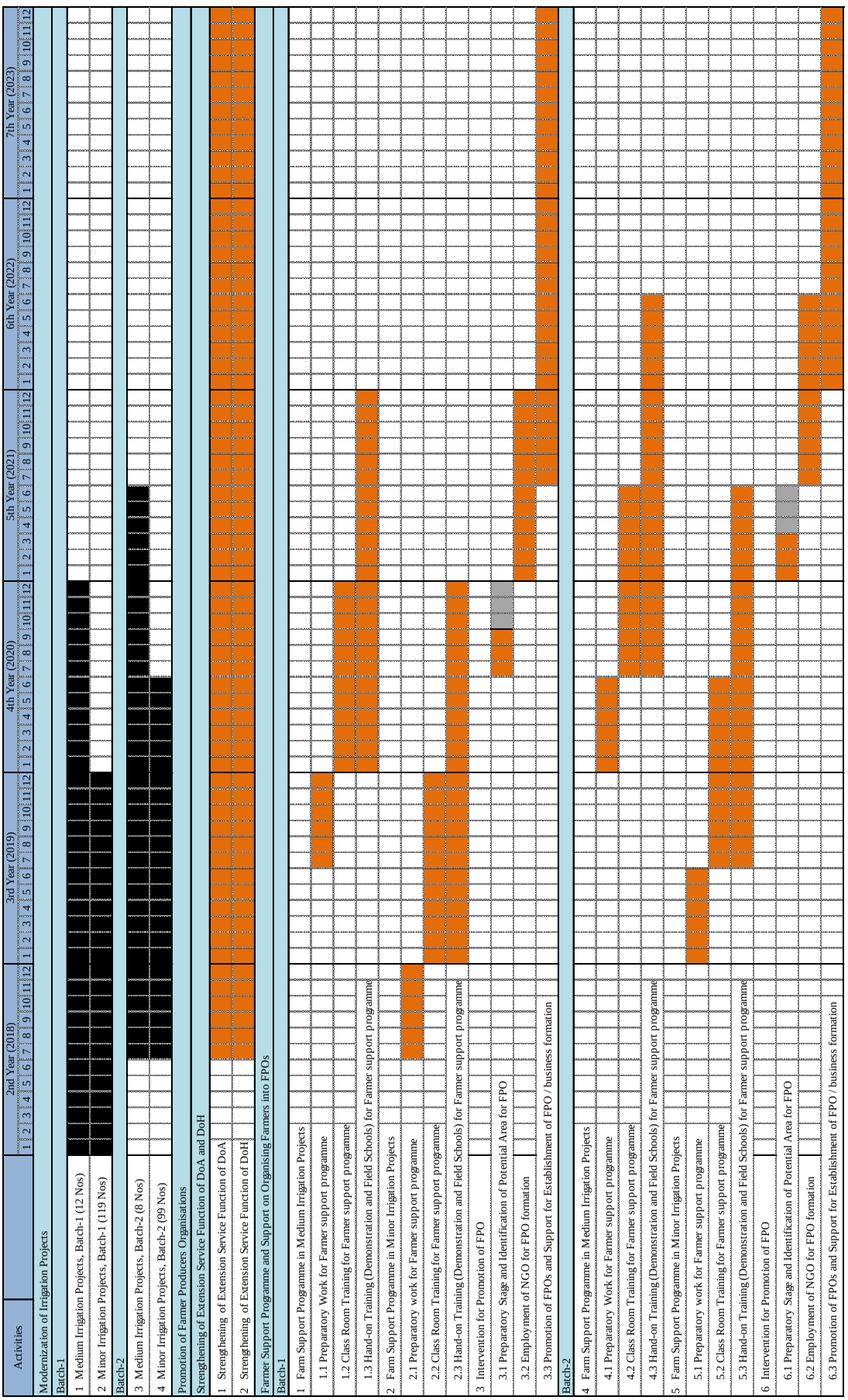


Source: JICA Survey Team

Figure 10.3.5 Fund Flow for FPO Initial Infrastructure Support

(4) Implementation Schedule

Promotion of FPO as well as agricultural extension activities as farmer support programme could be implemented as shown in Figure 10.3.6.



Source: JICA Survey Team

Figure 10.3.6 Implementation Schedule for Promotion of FPO

10.4 Livelihood Support Programme

10.4.1 Animal Husbandry Development

(1) Objective

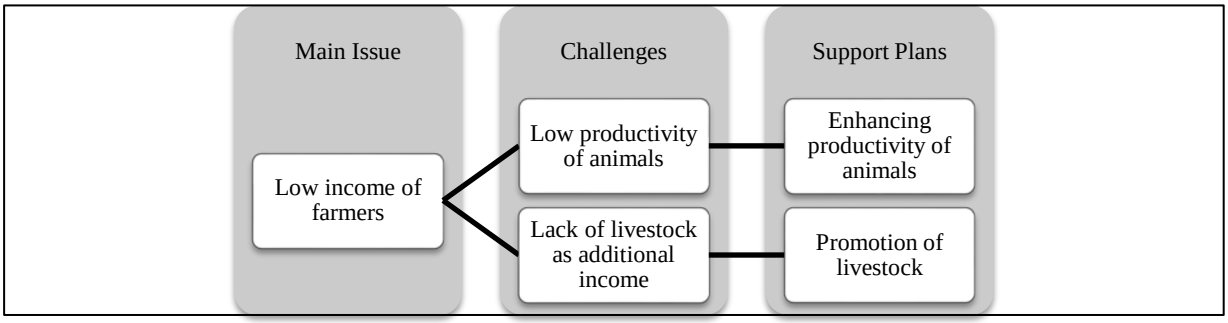
There are thousands of tanks developed in Andhra Pradesh State providing water to local people not only for domestic and irrigation uses but also for inland fisheries and animal husbandry. Some of the traditional governance systems (caste/kinship-based, with geographical origin, and also being important in case of migrant/settler community) are still in place to provide governance in agriculture, fisheries, and animal husbandry communities at the local level. Those who belong to historically disadvantaged groups are officially designated as scheduled castes (SC) or scheduled tribes (ST) in India. The main objective of the livelihood support program is to increase the income of unbenefited local groups living in and around the proposed irrigation projects. The program will support livestock activities since livestock plays an important role in supporting the livelihood systems of rural families. The percentage of the households which own livestock accounts for an average of 30.5% according to the survey.

(2) Concept

The field study revealed two major challenges on livestock of the farmers. First is the low productivity of animals and second is the insufficient income from livestock. In order to overcome those challenges, the program offers two support plans.

- Enhancing productivity of animals, and
- Promotion of livestock based income generation activities.

The concept of the program is described in Figure 10.4.1.



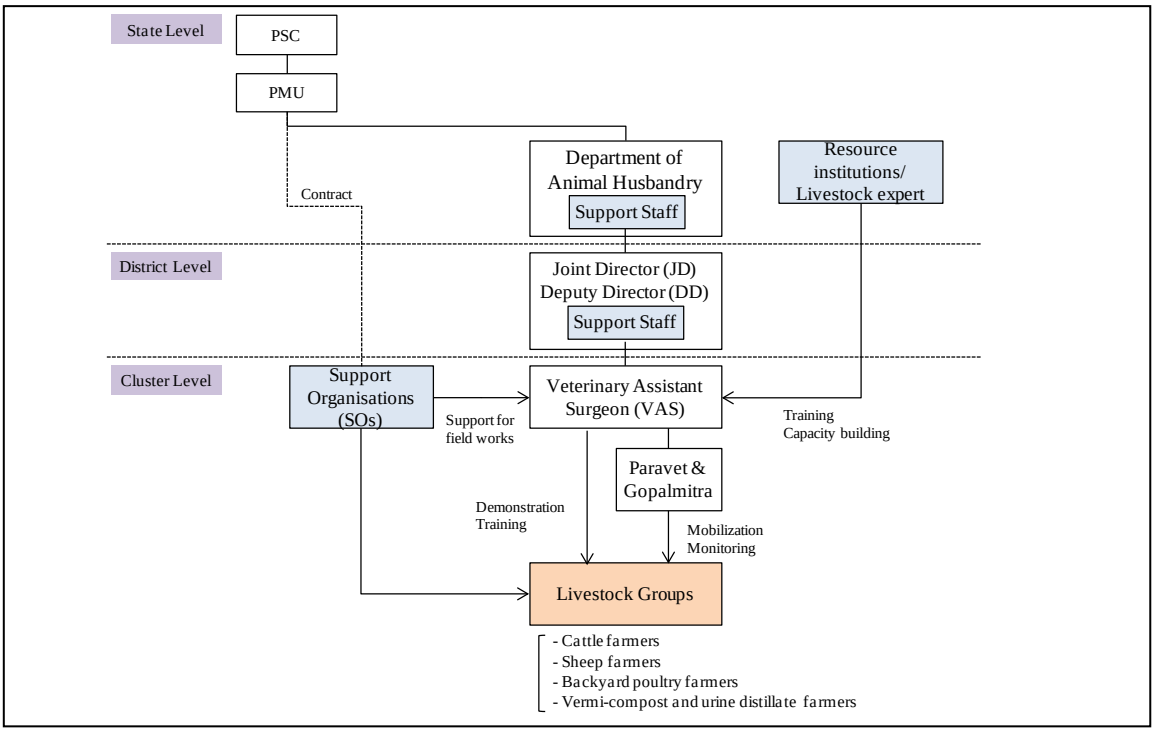
Source: JICA Survey Team

Figure 10.4.1 Concept of Livelihood Support Plan of Animal Husbandry

The first plan focuses mainly on the development of fodder cultivation by training and demonstration so that the productivity of milk per cattle will be increased. The second plan includes promotion of backyard poultry, vermin compost and urine distillate.

(3) Implementation Structure

The program will be implemented by the staff of Department of Animal Husbandry (DoAH), Andhra Pradesh state (The structure and number of staff of the department is shown in Attachment 10.4.1). The state level department has all responsibility of the program and its overall fund management. The district level departments are responsible of implementing the activities at cluster level including the fund management.



Source: JICA Survey Team

Figure 10.4.2 Implementation Structure

The department has large institutional coverage in the state and provides animal health care services for farmers not only in urban areas but also in rural remote areas. Each district has more than 100 Veterinary Assistant Surgeons (VAS) who have veterinary educational background. The survey team proposes that VAS will be the main implementer of the activities with the assistance of Paravet and Gopalmitra[2] at the village level.

The survey team proposes that the existing Paravets and Gopalmitras will act as trainers of capacity building activities in the program. As the Paravet and Gopalmitra are working at their villages, they know the village situation and are able to provide grassroots-level assistance continuously. As training of farmers are not within the mandate of their activities, they will be paid remuneration of around INR 1,000 as a trainer when they conduct training. This cost is included in the training along with cost for training materials, venue and other necessary inputs.

To supervise and coordinate all the program, one extra staff will be hired at state level by DoAH. To implement the program efficiently and to support all tasks, one extra staff will be hired at district level. To oversee technical issues and provide technical inputs for capacity building, one livestock expert will be hired at state level.

Support Organizations assigned to the target clusters will carry out the orientation activities and conduct baseline survey at the beginning of program activities.

(4) Target areas and selection criteria

The program will be implemented in total nine medium irrigation clusters in two batches. Three clusters are in the first batch and six clusters are in the second batch. The first three clusters will be selected each from North, South and Central districts. The second six clusters will be selected from those close to the first clusters.

[2] Paravets completed one or two-year veterinary course. They support all the department's activities and are officially employed by the department. Gopalmitra completed 180 day course. They are placed as community-based animal health workers whose main task is to provide Artificial Insemination (AI). They are not officially employed by the government. There are 2,718 Paravets and 2,655 Gopalmitras in the state as of April 2016.

The selection criteria for the target clusters proposed by the survey team are as followings.

-Not too far from a certain scale of market.
-Existence of relatively large number of target animal such as cows.
-Relatively high proportion of population of SC and ST.
-Farmers have high proportion of income from livestock.
-Presence of any farmer groups.

(5) Target Group and Selection Criteria

Target groups are the small, marginal, landless, and tribal farmers group. Selection criteria for target groups[3] are as follows:

- Small, marginal, landless, and tribal farmers.
- Demonstration will be extended to the group only when they are already pursuing or keen to adopt a new venture as a strategy to diversify their income.
- Well enthusiastic and coherent among themselves without much conflict on accessing resources.
- Willing to participate in the trainings and meetings, and share the responsibility with the program with respect to input for demonstration.
- Keen to learn and committed to share their experiences with another.
- Having experiences of implementing any types of activities as a group.

The scale and period are explained in Table 10.4.1. The survey team assumed that there are at least 30 villages in one cluster where the department will be able to carry out the program. As the target clusters were not decided at the time of survey, it is extremely difficult to decide the exact number of villages for assistance. Any necessary adjustment should be done at the time of appraisal.

Table 10.4.1 Scale and Length of Each Cluster (Animal Husbandry)

Activity	Survey Team Proposal		Rationale for Proposed Scale
	Period	No. of Beneficiary	
Develop livelihood plan	1st one year	600 farmers	The key to successful program depends on the VASs and their initiatives to train the farmers and to motivate beneficiaries. This activity consists of staff training, livelihood planning and exposure visit. The number of beneficiaries is 600, 20 farmers from 30 villages in each cluster. The groups will be identified by the above selection criteria. Based on the experience of other related projects, the number of group for exposure visits is decided at 20 farmers.
Enhancing productivity of animals	2nd and 3rd year (2 years)	600 farmers (300 for milk cattle, 300 for sheep)	It is well known that the most efficient and important way to increase productivity of milking animal is to improve and intake more fodder. The details of trainings and number of beneficiary are as below. - Training of fodder cultivation, use of balance feed, and productivity 300 (10 farmers/village for 30 villages), and - Training of sheep rearing 300 (10 farmers/village for 30 villages). Based on the experience of other related projects, the number of trainee is decided at 10 farmers. Those trainees are expected to be a master trainer in the village.
Promotion of livestock based income generation activities	2nd and 3rd year (2 years)	420 farmers (300 for poultry, 120 for compost)	To overcome the initial challenge (lack of livestock), direct support for the farmer by providing livestock is important. About 10% of the budget is allocated on this activity. The details of trainings and number of beneficiary are as below. - Improved backyard poultry 300 (10 farmers/village for 30 villages), - Vermin compost 60 (2 farmers/village for 30 villages), and - Urine Distillate 60 (2 farmers/village for 30 villages). For backyard poultry, 10 farmers are considered as an appropriate number of trainees per village. Those trainees are expected as master trainers in the village. Vermin compost and urine distillate, on the other hand, are new technologies for income generation activity, those are initially expected to start as the demonstration to the farmers. Therefore, only 2 farmers per village is selected for this activity.

Source: JICA Survey Team

[3] There may be a possibility of collaborating with existing SHGs in the area. During the survey, DoAH explained the survey team that SHGs are not under the purview of DoAH, but Department of Rural Development. Due to time constraint, the survey team was unable to coordinate this issue with Department of Rural Development. It is recommended that the issue should be discussed with concerned departments at the time of appraisal.

(6) Activity

The activities consist mainly of three components: 1) develop livelihood plan, 2) enhancing productivity of animals, and 3) promotion of livestock-based income generation activities. The detailed activities of each part are summarised in Table 10.4.2.

Table 10.4.2 Components and Activities for Livelihood Support of Animal Husbandry

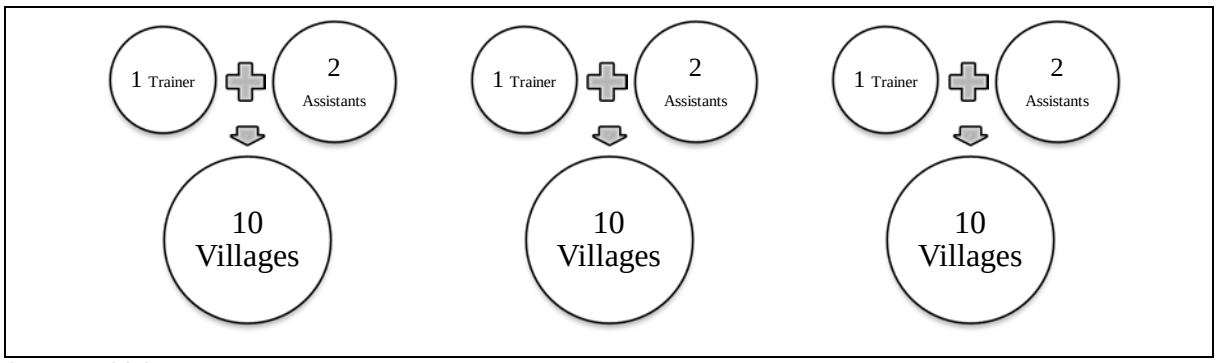
Item	Activities	Responsibility	Target	Contents
0.Project planning	0.1 Selection of target clusters and groups	PMU, DoAH	N. A	Selecting medium irrigation clusters for the support with the criteria explained above.
	0.2 Support staff selection and trainings	PMU, DoAH	N. A	<Jointly organised with Component 2&3> A support staff and a livestock expert at state level and a support staff in each cluster will be hired.
	0.3 Orientation workshop	SO	Villagers in target area	<Jointly organised with Component 2&3> Orientation meeting on project activities Awareness on livelihood support
	0.4 Baseline survey	SO	N. A	<Jointly organised with Component 2&3>
1. Develop livelihood plan	1.1 Refresher Training of trainers (VAS)	Joint Director of Animal Husbandry	3 Veterinary Assistant Surgeon	- Awareness of the program - Refresher trainings of extension works - Participatory planning - Community mobilization and facilitation
	1.2 Training of assistants (Paravet and Gopalmitra)	Joint Director of Animal Husbandry	6 Paravet and/or Gopalmitra	- Awareness of the program - Participatory planning - Community mobilization and facilitation - Monitoring activities
	1.3 Developing livelihood plan	Veterinary Assistant Surgeon	30 villages	-Develop livelihood plan
	1.4 Exposure visits for farmers	Veterinary Assistant Surgeon	20 farmers x 30 villages	-Exposure visit to other model villages
	1.5 Receive exposure visits	Veterinary Assistant Surgeon	20 farmers x 30 villages	-Receive exposure visits from other villages
2. nhancing productivity of animals	2.1 Promotion of Fodder cultivation and balance feed	Veterinary Assistant Surgeon	10 farmers x 30 villages	- Demonstration of silage making, new variety of fodder cultivation, and ration balancing activities (3units; 1 unit per 10 villages) - Training on fodder cultivation - Training on use of balance feed - Training on productivity of milk cattle
	2.2 Promotion of Sheep Rearing	Veterinary Assistant Surgeon	10 farmers x 30 villages	- Training on Good Practices in Sheep Rearing, balance feed and productivity
3. romotion of livestock-based income generation activities	3.1 Promotion of Backyard Poultry Rearing	Veterinary Assistant Surgeon	10 farmers x 30 villages	-Demonstration of chick hatchery -Training on chick hatchery -Training on rearing of improved backyard poultry -Provision of chicks
	3.2 Promotion of Vermi compost and Urine Distillate	Veterinary Assistant Surgeon	4 farmers x 30 villages	-Demonstration of vermin compost and urine distillate -Training on vermin composting -Training on urine distillate -Provision of equipment for vermin compost from dunk -Provision of equipment for urine distillate unit

Source: JICA Survey Team

(a) Develop livelihood Plan

To implement the program in 30 villages in each cluster, the district level department will choose three trainers from Veterinary Assistant Surgeons (VASs) and six assistants from Paravet and/or Goparmitla to support the trainers. One trainer and two assistants will cover ten villages each as a team (Figure 10.4.3).

The chosen trainers will participate refresher training program, organized and budgeted by the state department, to review all related skills of the program. The assistants will also take basic trainings regarding to the program.



Source: JICA Survey Team

Figure 10.4.3 Implementation team of Animal Husbandry

After having the refresher training, the trainer will develop the livelihood plans with the farmers in each village. By doing this activity, the trainer identifies the farmers or groups who are willing to contribute to the program, and select participants to the exposure visit based on the selection criteria (mentioned above).

The selected farmers will visit other site as the exposure visit to observe successful case of the planned livestock activities. With the view to realize the develop plan, the participants of the trainings will be selected in each village by the trainer in consultation with the farmers based on the same criteria.

At the end of the program, the trained groups will accept farmers from other villages, who are interested in the activities, and share their successful practices.

(b) Enhancing Productivity of Animals

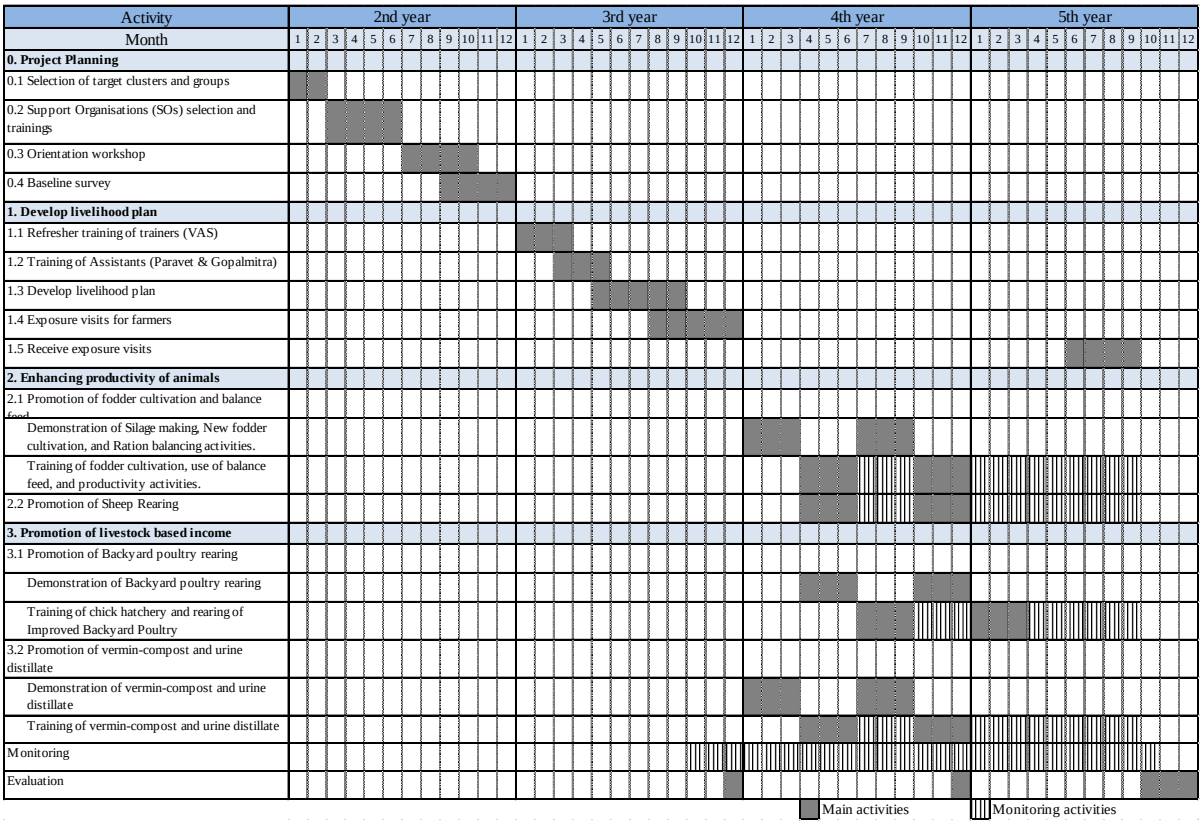
After the exposure visit, the trainer will demonstrate the planned livestock activities (silage making, new variety fodders, and ration balancing) in the targeted villages with the selected farmers. Following the demonstration, those who are selected will receive a series of trainings. For farmers who have sheep will receive training regarding the good practices of sheep rearing.

(c) Promotion of Livestock Based Income Generation Activities

Following to the activities above, the trainer will also demonstrate backyard poultry rearing, vermicompost and urine distillate. The selected farmers will be trained. Only those who receive the training on rearing backyard poultry are entitled to buy the improved type of chicks with subsidy.

(7) Implementation Schedule

The 1st year is preparation period (2nd year of whole project). The program period is three years from the 3rd year to the 5th year in the whole project. After training of trainers, the livelihood plan will be developed by the trainers. Starting from the demonstration of each activity, the training and provision of equipment follow. The beneficiary farmers will visit the other villages to see successful cases before the activity, and will receive the farmers from other villages who want to learn the activity at the end of implementation. The implementation schedule is shown in Figure 10.4.4.



Source: JICA Survey Team

Figure 10.4.4 Program Schedule of Each Cluster (Animal Husbandry)

To ensure the program sustainability, the following conditions should be explained and agreed with the beneficiary farmers at the time of project implementation:

- The equipment to be provided will be available with the contribution of beneficiaries.
- The provided equipment should be used by the selected farmers for at least five years from the provision.
- The selected farmers will sign on the term of use of the equipment which clarifies conditions.
- The monitoring staffs of PMU will evaluate and confirm the situation of the use of provided equipment.

(8) Monitoring and Evaluation

The key approach of the monitoring and evaluation are as follows:

- To use participatory monitoring with the beneficiary,
- To learn, evaluate, and review the program process, and
- To share the collected data and information among the involved parties.

The schedule of monitoring and evaluation are shown in Figure 10.4.4. The regular monitoring will be done and reported every month by the appointed department staffs. The evaluation of the program implementation will be held at the end of year by local consultants with the support of the department.

The district department is in-charge of carrying out the monitoring and evaluation. The state level department is responsible for the whole process.

The evaluation indicators of each component are listed in Table 10.4.3.

Table 10.4.3 Evaluation Indicators for Each Component (Animal Husbandry)

Component	Indicators
Develop livelihood plan	-Number of staffs trained -Number of developed livelihood plans -Number of farmers who joined in the exposure visits -Number of farmers invited to the exposure visits

Component	Indicators
Enhancing productivity of animals	-Number of silage machines installed -Number of farmers who join in the demonstration of new variety fodder cultivation -Number of farmers who join in the demonstration of ration-balancing activities -Number of farmers who join in the training on fodder cultivation -Number of farmers who join in the training on use of balance feed -Number of farmers who join in the training on productivity -Number of farmers who join in the training on good practices in sheep rearing
Promotion of livestock based income generation activities	-Number of chick hatchery installed -Number of farmers who join in the training on chick hatchery -Number of farmers who join in the training on rearing of improved backyard poultry -Number of chicks provided
	-Number of farmers who join in the training on vermicomposting -Number of farmers who join in the training on urine distillate -Number of provided equipment of vermicompost -Number of provided equipment of urine distillate

Source: JICA Survey Team

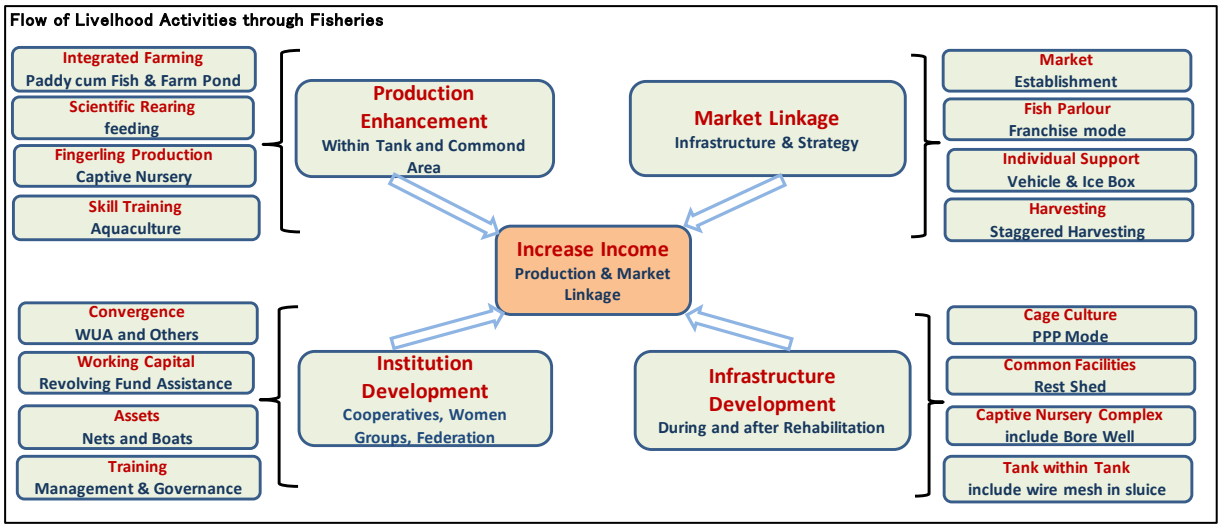
10.4.2 Fishery Development

(1) Objective

Same as Chapter 10.4.1, the main objective of the livelihood support program is to increase the income of unbenefited local groups living in and around the proposed irrigation projects. The objective of the livelihood support for fishery development is to increase the fish production and strengthen market linkage at the medium and minor tank irrigation system that will increase the income of inland fishing and farming families.

(2) Concept

Livelihood support for fishery is a part of an irrigation tank rehabilitation project that will provide an example of holistic rural development that includes agriculture, horticulture, animal husbandry, and fisheries as showin in Attachment 10.4.2. The conceptual image of livelihood improvement through fisheries is shown in Figure 10.4.5.



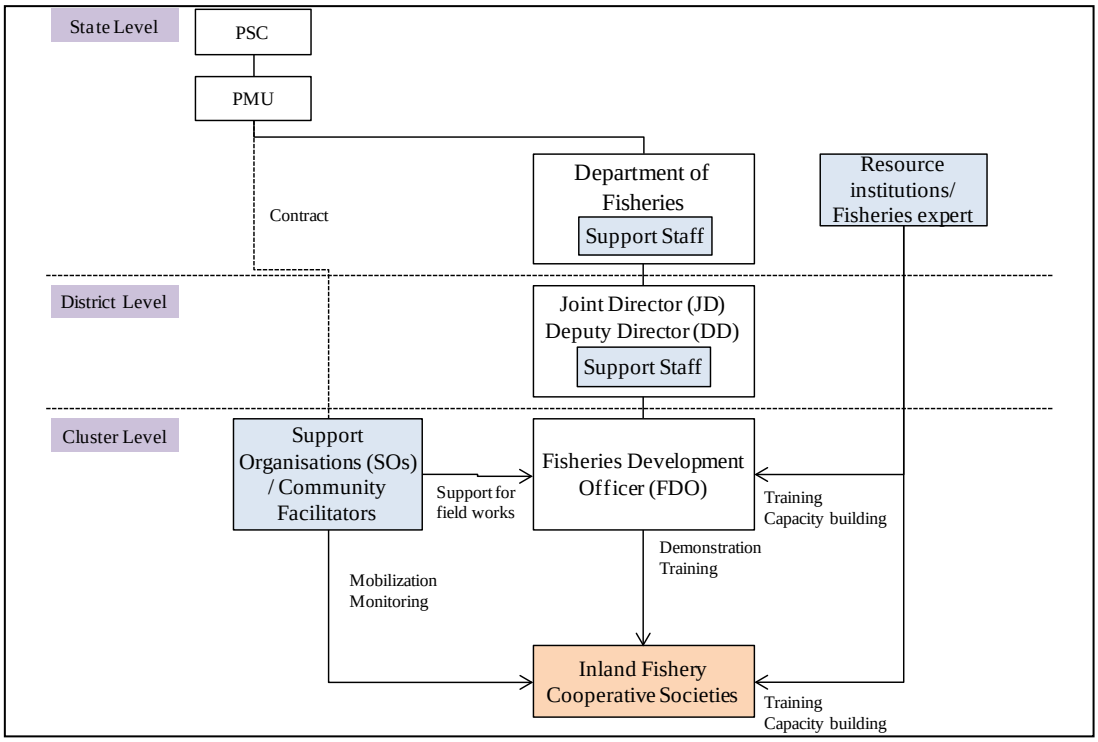
Source: JICA Survey Team

Figure 10.4.5 Livelihood Improvement Through Fisheries

The fisheries livelihood project consists of capacity building, support of fish production activities, support of marketing activities, and support of project management.

(3) Implementation Structure

The program will be implemented by the staff of Department of Fisheries (DoF), Andhra Pradesh state with support of Support Organisations (SOs). The structure and number of staff of the department is shown in Attachment 10.4.3. Implementation structure for livelihood support of animal husbandry is shown in Figure 10.4.6.



Source: JICA Survey Team

Figure 10.4.6 Implementation Structure (Fisheries)

Commissioner of Fisheries will be responsible for the management and evaluation of the project. He may delegate the roles to a Joint Director of Fisheries at the State Fisheries Office. The Joint Director or Deputy Director, who is the head of the District Fisheries Office, will monitor and manage the progress of the project and will be responsible for fund management at cluster level. A Fisheries Development Officer (FDO) will be responsible for day to day activity of the project in the field. FDO will conduct trainings with the help of Support Organisations (SOs) assigned to the project. FDO will also be responsible for procurement and any construction work except for tank related facilities for which the Department of Irrigation is responsible in terms of procurement of contractors and construction management, while Department of Fishery will be responsible for payment. One support staff will be hired for each cluster to support all the necessary tasks at cluster level, while one support staff will be hired at state level to oversee and coordinate all the activities for the nine clusters. The SOs will mobilize fishery cooperative societies for trainings and other activities, facilitate preparation of livelihood plan and conduct market survey in collaboration with the District Fisheries Office and FCSs. Three community facilitators for each cluster will be hired from SOs. Although resource institutes such as agriculture universities or government training institutes will cooperate with the department in terms of training, one fisheries expert will be hired at state level to oversee technical issues and provide technical inputs for capacity building.

(4) Target Group and Site Selection Criteria

Target groups are fishery cooperative societies and women's groups. Target groups and activities will be determined with the following criteria.

- Fishery cooperatives are active and functioning for at least five years.
- Fisheries cooperatives and women's group are able to control fish harvest in accordance with their sales capability and market demand.
- Responsible members will be assigned to manage the ponds.
- Groups have shown capabilities for two years or more to collect fund from the members to purchase fish seed and feed that are partially subsidised by the government.
- Groups have shown capabilities for two years or more to distribute profit from the fish sale among members.

- Groups are capable of deciding rules and burden for the use of marketing facilities and equipment.
- The longer duration of water availability in minor tanks is preferable

The project will be implemented 9 medium irrigation clusters, 3 clusters in the first batch and 6 clusters in the second batch. One cluster will be selected each in North, South and Central districts for the first batch which satisfy the criteria below.

- Existence of at least four active fishery cooperatives which satisfy the criteria above
- Construction work of irrigation rehabilitation is scheduled within the project period.

Two other clusters each for the first three clusters which are located close to the cluster in the first batch and satisfy the above criteria will be selected for the second batch.

Beneficiaries will mainly be FCSs and their family members, depending of the selected medium irrigation tank system and the FCS in the irrigation system. Based on the number of FCSs and their members in Table 8.4.6, the average number of members in a society is 98. As wives of the fishermen are usually engaged in fish marketing activities, about 200 fishermen and fisherwomen are assumed as the beneficiaries of one FCS. As the number of target groups is 4 FCSs in a medium irrigation cluster; one FCS under medium irrigation tank and three FCSs under minor irrigation tanks, 800 will be directly benefited from the project. The scale and length of each cluster is shown in Table 10.4.4.

Table 10.4.4 Scale and Length of Each Cluster (Fisheries)

Item	Survey Team Proposal		Rationale for Proposed Scale
	Period	No. of Beneficiary	
1. Develop livelihood plan	3 years	Inland fishery cooperative societies (FCSs): 4 FCSs in a cluster (200 fishermen/FCS, Total 800 fishermen)	As the average number of members in an inland FCSs is 98 (see Table 8.4.6), about 200 fishermen and their wives are assumed as the beneficiaries from FCS activities. 4 FCSs under a medium irrigation cluster will be targeted in the project, total number of direct beneficiaries is 800.
2.1 Income generating activities using medium irrigation tank	3 years	One FCS in a medium irrigation project (200 fishermen)	Simplest improvement of productivity from a medium irrigation tank. A group will be formed to culture fry to fingerling. Rearing tank as well as landing facilities will also be constructed. A demonstrative cage culture will be constructed in later part of the Project. All of the fishermen and fisherwomen will be benefited from increased fishing.
2.2 Income generating activities using minor irrigation tanks	3 years	Three FCSs under minor irrigation projects (Total of 600 fishermen)	Three rearing tanks (could be a tank within tank) will be constructed for the production of fingerlings, advanced fingerlings, or adult fish. It is estimated that at least 3 FCSs under minor irrigation tanks are formulated in one medium irrigation cluster based on the estimation of Department of fishery.
2.3 Ornamental fish culture by women's group	2 years	One women's group under a FCS (10 members)	Backyard ornamental fish culture and sales activity of aquarium fish. One women group which is most active and motivated will be selected for this activity.
3. Marketing	2 years	Three women groups under FCSs (Total of 30 members)	Marketing surveys will be done by women groups with assistance of fisheries expert and FDO. Location of marketing facilities will be decided based on the results of the survey.

Note: Numbers in the parentheses are the active members involved in the activities.
Source: JICA Survey Team

(5) Activities

Details of activities for livelihood support of fishery are shown in Table 10.4.5.

Table 10.4.5 Details of Activities for Livelihood Support of Fishery

Item	Activities	Responsibility	Target	Contents
0. Project planning	0.1 Selection of target clusters and groups	PMU, DoF	N.A	Selecting medium irrigation clusters for the support with the criteria explained above.
	0.2 Support Organisations (SOs) selection and trainings	PMU, DoF	N.A	<Jointly organised with Component 2&3> A support staff and a fisheries expert at state level and a support staff and three community facilitators in each cluster will be hired.

Item	Activities	Responsibility	Target	Contents
	0.3 Orientation workshop	SO	Villagers in target area	<Jointly organised with Component 2&3> Orientation meeting on project activities Awareness on livelihood support
	0.4 Baseline survey	SO	N.A	<Jointly organised with Component 2&3>
1. Develop livelihood plan	1.1 Staff training	Resource Institutions/ Resource persons	District PMU, Fishery Development Officers (FDO)	1) Understand the importance of Fisheries sector in irrigation project. 2) Baseline survey and detailed marketing survey methodology 3) Project planning methodology
	1.2 Developing livelihood plan	FDO, SO	Leaders of FCSs and women's groups	1) Identify the number of tanks, their sizes, and the period when sufficient water is available for each tank. 2) Make agreement with WUA on the conditions to use irrigation tanks. Keep in mind that activities should start with easier one (stocking and fishing) and progressing to harder ones (rearing fingerling to rearing market size fish), number of ponds gradually increases, and the number of participants increases.
	1.3 Training on Management of Fishery cooperative society	FDO, SO	Leaders of FCSs and women's groups	1) Skills of organization management 2) Skills of organization accounting 3) Basic of economics and marketing 4) Basic of marketing survey
	1.4 Exposure visit for society members	FDO, SO	All the members of FCSs and women's groups	Visit and learn advanced examples of inland fishery in AP or neighboring states
	1.5 Receive exposure visits	FDO	Leaders of FCSs from other districts.	As a model project, receive visitors and trainees from other parts of Andhra Pradesh State.
2. Support for fish production activities	2.1 Income generation activities under medium irrigation projects	FDO, SO	All the members of FCSs	1) Construction of tanks, landing site and captive nurseries in accordance with the development plan. 2) Trainings for fish production activities. · Production of fingerlings and stocking in the tanks for later harvest (Please refer to the definition of fish sizes and names in the table on the next page). · Management of the above tanks and realizing scheduled harvesting. · Production of advanced fingerling from fingerling and their further use. · Production of market size fish from advanced fingerlings.
	2.2 Income generation activities under minor irrigation projects	FDO, SO	All the members of FCSs and women's groups	1) Construction of tank within tank, bore well and community hall in accordance with the development plan. 2) Trainings for fish production activities as same as 2.1.
	2.3 Income generation activities for Women groups	FDO, SO	All the members of FCSs and women's groups	Selected women will be trained for small-scale culturing of ornamental fish in their backyard. FCSs will be responsible on selecting members to conduct activities.
3. Support for marketing activities	3.1 Construction of marketing facilities and provision of marketing equipment	District Fisheries office	FCSs and women's groups	Construction of necessary facilities at strategic spots in available location
	3.2 Trainings	FDO, SO	FCSs and	1) Conducting detailed market survey which includes

Item	Activities	Responsibility	Target	Contents
	for marketing activities.		women's groups	location of current fish markets/parlours, estimate of fish sale (by species and size) and potential fish market/parlours and their sizes. 2) FCS will form a committee for marketing activities that will utilise and manage the facilities and equipment. 3) Harmonizing the harvest with the market demand and the capacity of the member. 4) Marketing of ornamental fish.

Source: JICA Survey Team

In order to ensure that the beneficiary fishermen acquire and sustain the technologies trained, it is recommended to start from easier aquaculture and the training will be conducted accordingly. Therefore, the first year will be for rearing technique from fry to fingerling, the second year will be from fingerling to advanced fingerling, and the third year will be from advanced fingerling to adult fish.

Definition of fish sizes and names used in the activities are shown in Table 10.4.6.

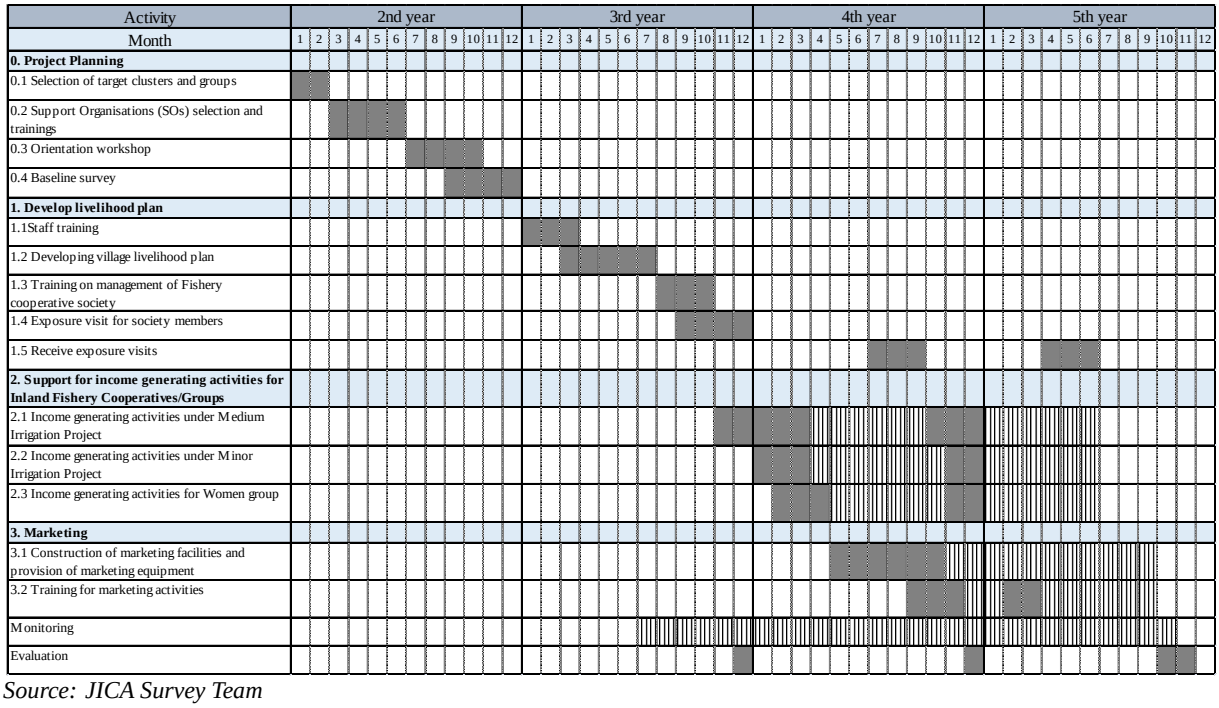
Table10.4.6 Definition of Fish Sizes and Names

Name by Size of Fish	Body Length	Weight	Rearing Days	Farm Gate Price	Consumer Price
Spawn	2 mm	na	2		na
Fry	8 mm	na	15	0.04-0.17/fish	na
Fingerling	80 mm	5 g	45	1/fish	na
Advanced Fingerling	20 cm	100 g	100	80	na
Adult	>40 cm	500 g	200	90	90-100
		1000 g<	300	90-100	100-120

Source: JICA Survey Team

(6) Implementation Schedule

Implementation schedule is shown in the following figure.



Source: JICA Survey Team

Figure 10.4.7 Implementation Schedule of Each Cluster (Fisheries)

2nd year

Selection of target clusters as well as target groups will be held followed by the selection and training of Support Organisations (SOs), orientation workshop and baseline survey as shown in Table 10.1.1.

3rd year

During the 3rd year of the project, the most important activities are formulating a participatory

development plan that will outline the development of aquaculture-based fisheries and construction of facilities. A survey result from irrigation engineers regarding pond numbers and characteristics will be utilised to make a development plan. Consensus will need to be made with the WUA and the Irrigation Department regarding rearing tanks and facilities. Several groups will be formed within FCSs. In the meantime, a baseline survey to understand current socioeconomic situation of the FCSs members will be conducted.

A captive nursery tank or pen will be constructed during the latter part of the year. Fingerlings will be produced. Technical trainings and exposure visit to successful captive nursery will be conducted.

4th year

Landing/marketing facility at the medium irrigation tank will be constructed. Continue producing fingerlings at the first captive nursery tank. Second captive nursery tank will be constructed and advanced fingerling rearing starts. On-the-job trainings of rearing method will continue.

Ornamental fish culture will be introduced. Training for selected women group will be conducted. Backyard tanks will be constructed and ornamental fish culture will start.

Detailed marketing survey including fresh water fish as well as ornamental fish will be conducted in several towns and the location of the fish markets/parlours will be identified. Marketing strategy will be formulated. Marketing equipment will be purchased to expand marketing area as well as improve quality of the fish.

5th year

Third captive nursery tank will be constructed. Adult fish culture will be conducted at this tank. Construction of fish markets and parlours will be executed. During the third year, fresh water fish and ornamental fish marketing will be the focus of the project activity. Receive exposure visits from other FCSs in the Andhra Pradesh State. End line survey will be conducted.

(7) Monitoring and Evaluation

The key approach of the monitoring and evaluation are as follows:

- To use participatory monitoring with the beneficiary,
- To have learning, evaluating, and reviewing the program process, and
- To share the collected data and information among the involved party.

The regular monitoring will be done and reported every month by the appointed department staffs. The evaluation of the project implementation will be held at every end of the year by Joint Director with support of fisheries expert. The state level Department of Animal Husbandry is responsible for the whole process.

The evaluation indicators of each component are listed in Table 10.4.7.

Table 10.4.7 Monitoring and Evaluation Schedule (Fisheries)

Timing	Person in-charge of Monitoring	Monitoring/Evaluation Indicators	Method
End of 3rd year	Monitoring by the Joint Director of the Fisheries	Expected outputs are development plan and construction of captive nursery.	Project documents and observation. Interview with FCS members
End of 4th year	Monitoring by the Joint Director of the District Fisheries Office	Expected outputs are marketing survey report, construction of captive nursery, fingerling and advanced fingerling production amount, increase of fish production, and revenue of fishermen family.	Project documents and observations. Interview with FCS members.
End of 5th year	Evaluation by the Joint Director of the State Fisheries Office	Increase in fingerling, advanced fingerling and adult fish production, increase of fish production and marketing revenue of fishermen family.	Project documents and observations. Interview with FCS members.

Source: JICA Survey Team

The planned activities are considered very effective to improve livelihood of fishery community. The Project will support the implementation of activities in the first nine clusters and Department of Fishery is expected to monitor the first nine clusters and to take over these activities and replicate them to the

rest of clusters after the implementation in the first nice clusters. It is also expected that Department of Fishery will institutionalize those activities which are very effective by including it in their subsidy schemes. For these purpose, monitoring the activities and evaluating the effectiveness is very important to extract good practices and lessons. It is also recommended that Department of Fishery should hire the support staff continuously to ensure the project sustainability. PMU is expected to monitor and guide the Department of Fishery to execute those actions surely.

11. IMPLEMENTATION PLAN OF PILOT PROGRAMMES

11.1 General

Based on the study above, pilot programmes are proposed. The pilot programmes are those programs which Government of Andhra Pradesh State has placed high priority but technologies and mechanisms involved are not necessarily proved effective to date, and thus have difficulties to implement all over the project areas. The objective of the pilot programmes is to disseminate the best practices of the following programmes to all over the Andhra Pradesh State including command area of irrigation projects under APILIP-II. The pilot programmes consist of 3 components; 'food value chain for strategic crops', 'farm mechanisation', and 'conjunctive use of surface water and groundwater', of which the component of conjunctive use of surface water and groundwater was dropped finally from the project.

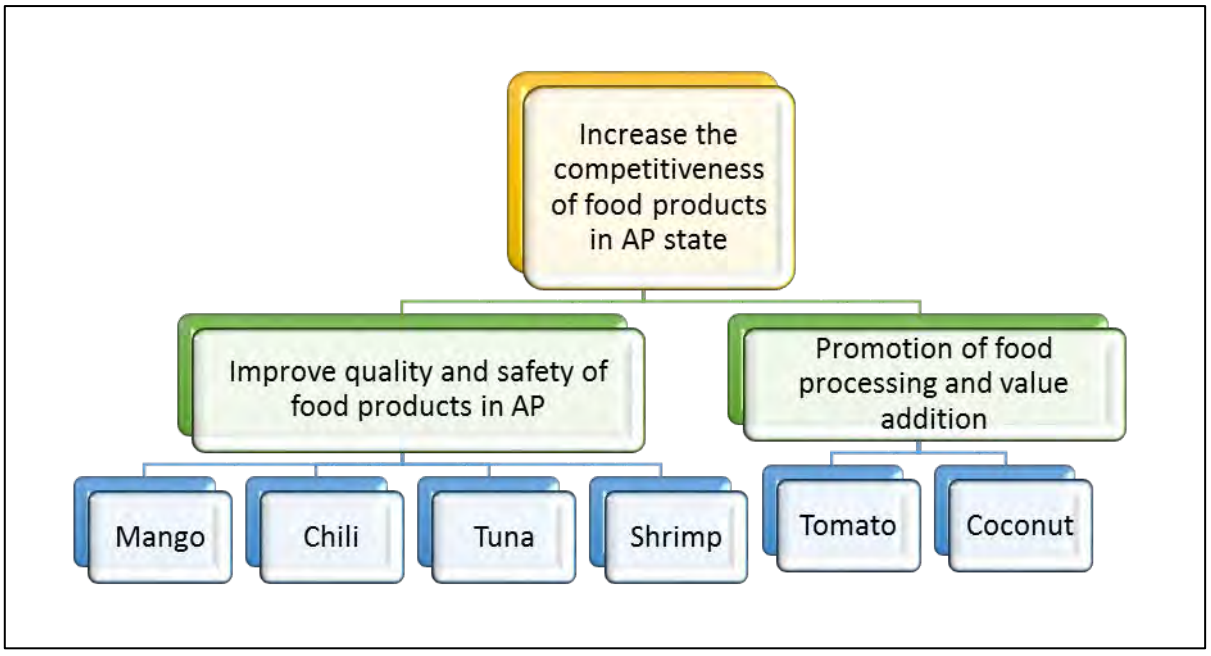
11.2 Food Value Chains for Strategic Crops

(1) Pilot Project Concept

(a) Objectives

The objective of the strategic food value chain assistance is to establish practices and infrastructure for seamless transfer of farm produce to the point of sales as per global standard in order to increase competitiveness of food products in Andhra Pradesh State.

In order to achieve the objective of increasing competitiveness of food products in Andhra Pradesh State, two fundamental weakness of food products in Andhra Pradesh State should be addressed. They are low quality and safety, and low processing and value additions.



Source: JICA Survey Team

Figure 11.2.1 Project Objective

The survey team selected six products which are considered to effectively tackle these issues through the pilot projects. Details are explained below.

(b) Concept

The core concept of the pilot project is two-fold as discussed below.

1) Utilise the Market Force to Enhance Integration of Farmers

As explained in 7.3.2, the core concept of strategic value chain assistance is to utilise the pressure from the high-end market which offers high price but requires high level of quality and safety standard. As explained in 6.6.2, producers do not take extra efforts to improve the quality of their product as the

current market system where small producers participate is not quality sensitive but quantity sensitive. For this purpose, the capable and experienced private companies who have traded with target markets are asked to be partners with a group of small producers in the respective pilot projects. The small producers will be provided technical assistance to improve their skills required to supply products which satisfy the requirements of the target market the partner private company deals with. The producers will make serious efforts to improve their skill to be paid at higher price, while the partner private companies can expand their procurement network that is normally dominated by large scale and progressive producers. Figure 11.2.2 shows a chart of the utilisation of the market force.

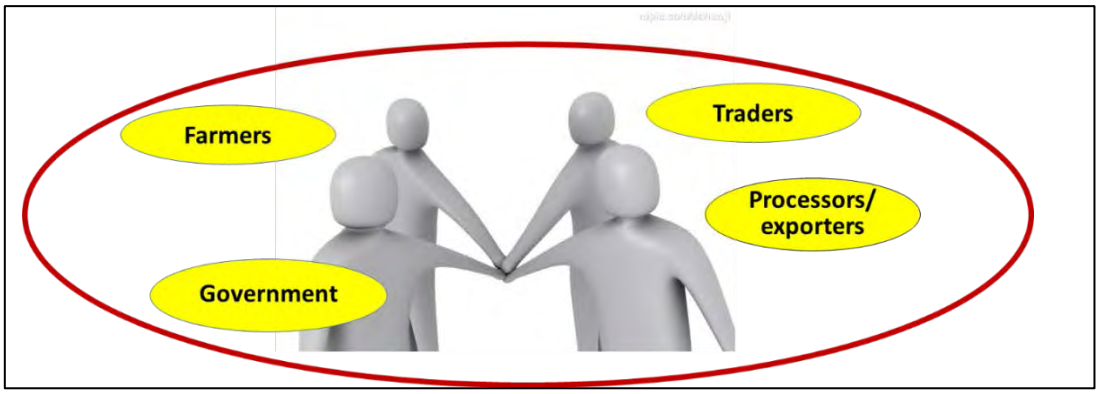
Source: JICA Survey Team

Figure 11.2.2 Utilise the Market Force

In this way, integration of farmers into the food value chain (FVC) will be enhanced. The extensive and efficient supply chain which can supply safe and quality raw materials in a required volume in required timing to food industries will certainly be a big advantage for the Government of Andhra Pradesh (GoAP) to attract foreign investment in food industry in future.

2) Strengthen Public-Private-Partnership (PPP) to Promote Target Products as a State

The survey team during its field survey found that there are mistrust and misunderstanding among concerned stakeholders of value chain. The behaviour of each stakeholder to maximise their benefit erodes the very competence of products at the global level. In order to increase competitiveness of food products, all the stakeholders not only producers and processors but also governments and research institutes should work together. In this regard, the survey team proposes to establish a forum called District Pilot Coordination Committee (DPCC) which consists of the concerned government officials, beneficiaries including producers and private sector partners, and consultant team. The DPCC is to meet regularly, discuss issues related to the project implementation, and coordinate the different interests of stakeholders at respective pilot level. It is also proposed that the marketing and branding strategy of target products should be formulated based on the experience of pilots. As the global competition become intense, the agricultural products cannot be sold at high price without comprehensive strategy. The government should act as a marketing and branding manager of products produced in the state. It is expected that the proposed DPCC will serve as a platform to implement the strategy after the project period. Figure 11.2.3 shows the collaboration of the stakeholders.



Source: JICA Survey Team

Figure 11.2.3 All Stakeholders Should Collaborate

The pilot project will provide government officials of concerned departments with valuable opportunities to learn what are required in the market and how to collaborate with other government organisations. This will also help collect necessary information for formulating strategies for selected products. This learning process is extremely important for the GoAP to think and adjust its administrative structure to the new demand for development.

Although the pilot projects will focus on specific crops, specific markets and limited participants, once the good practices and lessons learned through the pilot projects are reviewed by the government, the improved model will be adapted all over the state and other crops, and be finally reflected to the government policy and system to institutionalise the model.

(2) Selection of Target Products

As explained in 7.2, eight candidate target products for the assistance were selected during the first field survey. The survey team examined their feasibility for the pilot in the second field survey. Based on the outcomes of the detailed survey, the survey team found a difficulty to formulate the project for maize and milk which do not fit into the framework of pilot due to the reasons listed in Table 11.2.1.

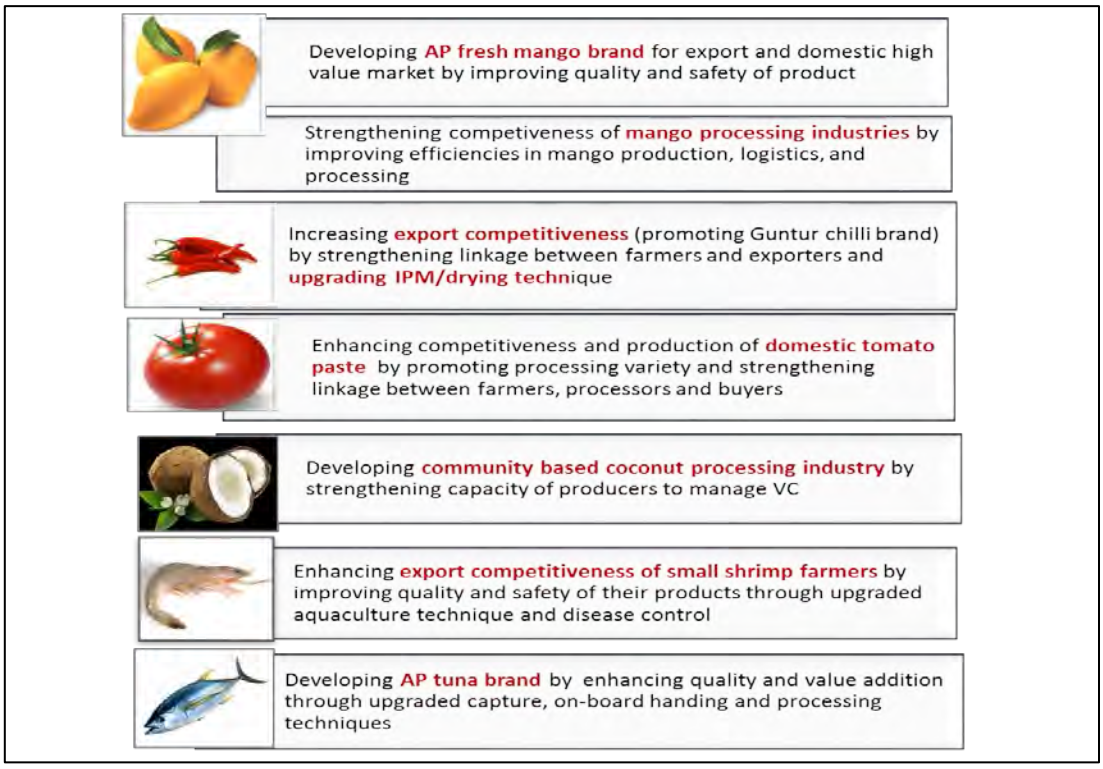
Table 11.2.1 Reasons for Not Including in the Pilot Projects

Product	Reasons for Not Including in the Pilot Project
Maize	- Difficulty in motivating farmers in the existence of minimum support prices (MSP). - There is low scope for quality improvement of maize for processing as the price is not reflective of quality. - Satisfying domestic demand is more important than increasing export.
Milk	- No major issue in value chain at production level. - Major problems are the lack of processing capacity and stagnant market demand. Both of them are in the domain of the private sectors where Japan International Cooperation Agency (JICA's) assistance has limited effect. - No government department is working on processing and marketing of milk at the state level which makes JICA's assistance difficult.

Source: JICA Survey Team

In addition, there is a concern about increasing complexity in management of the pilot projects which involve different departments, namely Agriculture for maize and Animal Husbandry for milk in addition to Horticulture and Fishery. The survey team proposes to include maize in the capacity building component and milk in the livelihood support program.

The survey team proposes to formulate seven pilot projects for the following six products as shown in Figure 11.2.4.



Source: JICA Survey Team

Figure 11.2.4 Products and Concepts of Pilot Project

(3) Pilot Areas

The survey team proposes the pilot areas for each product as shown in Table 11.2.2.

Table 11.2.2 Proposed Pilot Areas

Product	District	Reasons for Selection
Mango (processing)	Chittoor	- Chittoor is the largest mango producing district in Andhra Pradesh State. - There is agglomeration of processing industries at the global level.
Mango (fresh export)	Krishna	- Krishna is the second largest mango producing district in Andhra Pradesh State. - One of the two vapour heat treatment (VHT) and integrated pack house is located in the district. - The new state capital Amaravathi is located in the district.
Chili	Guntur	- Guntur is the largest chili production district. - There is an Asia's largest chili market in the district. - There are several processing industries at global level for dry chili.
Tomato	Chittoor	- Chittoor is the largest tomato producing district in Andhra Pradesh State. - There is agglomeration of processing industries at the global level.
Coconut	East Godavari	- East Godavari is the largest coconut producing district in Andhra Pradesh State. - There are several active coconut producer companies (CPC) operating in the district.
Shrimp	West Godavari	- West Godavari is the top brackish water shrimp production district in Andhra Pradesh State. - West Godavari is the third highest fresh water shrimp production district in Andhra Pradesh State.
Tuna	Vishakhapatnam	- Fishing port is relatively well developed. - There are many mechanised boats based in Vishakhapatnam and some boats are converted to tuna long line. They are eager to catch sashimi quality tuna. - Even traditional boats are catching tuna in Vishakhapatnam. - There are number of national fisheries research institutes and training centre in Vishakhapatnam and capable to conduct trial processing. - Shrimp packers/exporters are interested in tuna export.

Source: JICA Survey Team

The proposed areas are decided based on the discussion with concerned departments for respective crops. The basic selection criteria are the volume and concentration of production, existence of processing, and related facilities.

(4) Scale and Length of the Project

The scale and length of pilot project for respective products are listed in Table 11.2.3. The proposed scale is calculated by taking the capacity of existing processing companies who are expected to participate with the pilot, the capacity of facilities necessary for export, or the expected absorption capacity of producers to new technologies. The survey team also conducted interviews with potential private sector partners for several target products to confirm the feasibility of the pilot.

Table 11.2.3 Scale and Length of Projects

Product	Survey Team Proposal			Rationale for Proposed Scale
	Period	No. of Beneficiary	Target Area	
Mango (processing)	4 years	1,000 farmers	1,000 ha	The estimated production in the target area is 9,000 tons which accounts for 10% of the production capacity for two major processing units in Chittoor.
Mango (fresh export)	4 years	100 farmers	100 ha	The estimated production in the target area is 900 tons which corresponds to the capacity of integrated pack house in Krishna for 90 days of mango season.
Chili	3 years	2,000 farmers	2,000 ha	The estimated production in the target area is 6,000 tons which accounts for 20% of the production capacity for two major processing units in Guntur.
Tomato	3 years	500 farmers	500 ha	The estimated production in the target area is 1,000 tons which accounts for 10% of the production capacity for one major processing unit in Chittoor. The Department of Horticulture (DoH) has its own plan for pilot with processing companies for 260 ha.
Coconut	3 years	1,000 farmers	1,000 ha	The number of small farmer members in the existing CPC in East Godavari.
Shrimp	3 years	1,000 farmers	1,000 ha	One shrimp aquaculture zone which belong to the same water course and consists of small cluster with around 25 farms in one cluster.
Tuna	4 years	225 fishermen	45 boats	Five mechanized boats which are considered appropriate in size to receive technology transfer will be targeted in the first two years. Ten boats will be trained in the third year by five trained boats. Thirty boats will be trained by 15 trained boats in the final year.

Source: JICA Survey Team

Except for Tuna, each project is designed to enable participants to experience two cycles from production to sales in the project period so that the participants can improve their skills and strengthen partnership with their partners in the second cycle based on their experience in the first cycle. The project period is 3 years except mango whose harvest season is only once a year and which required longer time for technical assistance from production to processing, and tuna which requires development of capture techniques before technical transfer and will take a different approach to technical transfer. The beneficiary producers are same between the first cycle and the second cycle except for tuna where the first beneficiary fishermen are expected to teach other beneficiary fishermen in the second cycle.

(5) Target Beneficiaries

(a) Private Sector Partners

The survey team had discussion with various private sector stakeholders about the feasibility of pilot project. The summary of interview with private sector for mango, tomato, and chili is shown in Attachment 11.2.1. Most of them showed their keen interests and willingness to participate in the pilot. The potential partners for each product are shown in Table 11.2.4.

Table 11.2.4 Candidate Private Sector Partners

Product	Candidate Partners
Mango (processing)	Jain Irrigation Systems, Srini Food Park, foods and inn, and other processing companies in Chittoor
Mango (fresh export)	Srini Food Park and other exporters in Andhra Pradesh and other states
Tomato	Jain Irrigation, Srini Food Park and other processing companies in Chittoor
Chili	ITC, Synthite, Byer
Coconut	Noveel and other CPCs in Andhra Pradesh State
Shrimp	Ananda Group, NAGA Hanuman Fish Packers, and other processing companies
Tuna	Ocean Wealth Export (Kochi), Coral Export (Kochi)

Source: JICA Survey Team

There are reputed and capable processing companies in Andhra Pradesh who are competitive at the global level for most of target products. Those companies have assured market for their products and system to ensure quality and safety of their products. The survey team understands that there will be more candidate partners by the time of project implementation as the GoAP has invited proposals from private companies to establish linkage with FPOs, some of which are related to the target products for the pilot[1]. Collaboration with these proposals can also be considered.

However, there are no exporters dealing with tuna in Andhra Pradesh at the moment although some shrimp exporters showed their interests in exporting tuna. In order to include these shrimp exporters in the tuna value chain, the assistance for necessary facilities and their capacity building will also be required. Similar situation is observed for mangoes which are exported mainly by exporters in Chennai or Mumbai. In this context there is a lack of capacity and facilities necessary for export such as quarantine. Some incentives to develop local exporters as well as export infrastructure may be necessary for mango in the long run. In addition, there is no integrated processing unit for coconut in Andhra Pradesh although one of the CPCs has a plan to develop one. Capacity development of CPC for its processing skill and assistance for marketing will be more important for this pilot.

Box 11.2.1 Case study: Technical support for farmers by the private sector and NGO

- There are several processing companies which provide farming technical support for farmers in order to promote contract farming in India. One of the most successful cases in India is gherkin farming conducted by some large companies such as Global Green in Karnataka state. They provide technical support for the contracted farmers to grow good quality products which meet requirements of overseas buyers. India became one of the largest gherkin exporters in the global market.
- In Andhra Pradesh State, similar initiative has been introduced by Srini Food for basil production. The company concluded contract with an European buyer to supply IQF herbs which should be properly controlled chemical residue to meet the strict European standard. Srini contracted with reliable and motivated farmers and provide them cultivation guidance along with GAP through the in-house extension staff. The company procure pesticides approved by European standard and provide it to their contract farmers. The farmers spray pesticides under guidance of the extension staff. The company has been exporting the products successfully and plans to expand the initiative.
- There is also a good practice in technical support for mango production supported by a NGO called Center for Collective Development (CCD) in Andhra Pradesh State. CCD initially supports formation of farmers' group for collective production and marketing in order to maximize their benefit. CCD then provide training for business planning and networking skills for those groups and connects them with the private sector such as exporters and processor. The private sector is supposed to provide guidance to the groups for cultivation skills required for the target markets. CCD has an office in Anantapur district and is currently support 8 mango farmers' groups.

[1] The GoAP held a workshop on 'FPO Policy and Strategy for Andhra Pradesh: Integration of PPPIAD Companies for Better Value Realisation' on March 18, 2016. According to DoH, there are several proposals on chili.

(b) Producers

Priority for beneficiaries is given to small farmers and farmer's organization who are capable and are willing to upgrade their skills but have been deprived of an opportunity to do so. Although they may not be very small farmers, developing successful cases will pave the way for those very small farmers to follow in future.

The mechanized boats for Tuna also belong to fishermen community. They are operated by local fishermen who have earned and invested money for upgraded fishing. They mainly hire local fishermen for the operation of boats. If the pilot project is successful, those in traditional boats operated by small and marginalized fishermen will be motivated to upgrade their boats to mechanized ones. In this way, the upgrade of fishing techniques in the entire community can be achieved.

As for the producers, it is preferable that they are organized in a group such as FPO since promoting FPOs is one of the major policy agendas in agriculture in Andhra Pradesh and it surely gives more power to small farmers. However, it is also possible for private sector stakeholders to identify individual producers as many as they want to work with. It is because some companies have already established their own system of procuring raw materials from a number of small producers and it would be more comfortable for them to utilize their own way of doing business.

(c) Selection Method

As indicated in (1), beneficiaries of the pilot will be a pair of a private sector partner such as processing companies or exporters, and producer organizations such as FPO. The number of pairs depend on how many farmers one companies can take care of. The survey team proposes to select beneficiaries through competition. Project Implementation Team (PIT) to be setup for each pilot with the help of Pilot Project Implement Consultant (PPIC) will select the beneficiary pairs in the following three steps:

- Hold information sessions to explain to farmers, processors, and other stakeholder the objectives, area, period, and activities of the Project;
- Hold a matching session for interested producers and private sector stakeholders to identify their partner; and
- Interested private sector stakeholders or producer organisations will develop a proposal for participating in the Project after identifying the partner to work with.

The selection method should be decided in a balance between the priority of the GoAP and level of interest shown by the private stakeholders towards the pilot. The detailed selection procedures should be decided by PPIC based on the conditions of target crop at the beginning of the pilot project.

The proposal to be submitted should include the information listed in the table below.

Table 11.2.5 Information to be Included in the Proposal

Category	Information
Profile of applicant	- Outlines of business (name, location, audited balance sheets for last 3 years, total turnover of last 3years including export, major trading companies and countries for operation) - Partner farmers (number, total area, the name of group if applicable, and farm conditions)
Project activities	- Rationale for the proposed projects (needs and objectives) - Project area - Conditions of purchasing produce (timing, volume, price, and means of transportation) by a private partner - Required training and required inputs - Implementation schedule - Implementation structure including monitoring, operation, and maintenance of provided facilities and equipment - Names of lead producers in producer groups (At least one producer in 50 producers) - Project cost
Target and future plan	- Output target (volume and quality) - Expansion plan (if applicable)

Source: JICA Survey Team

It should be noted that the beneficiary pair is responsible for monitoring and reporting of the project activities and sustainability of provided equipment and facilities. These plan should be included in the proposal and be evaluated. The proposals will be evaluated by using the following criteria.

Table 11.2.6 Selection Criteria

Category	Criteria
Capacity and experiences of processing units/exporters	- At least five years of experiences - Annual processing capacity of 5,000 ton or more for mango, tomato and chili. - Experience of export to advanced countries such as Europe and USA - Global certificates such as HACCAP, GMP, ISO and Rain Forest Alliance are preferable. - Good financial record with no current account deficit in last five years
Capacity and experience of partner producers	- At least five years of experiences of producing the target products. - There is some mechanism to coordinate members. - (in case of applying common facility fund) The common bank account is required.
Feasibility of proposal	- Capacity and experiences of processing units or exporters are sufficient to carry out proposed project activities. Especially proposed volume and cost of procurement from producer partners are not unrealistic (within 20% of their operation capacity). - Proposed activities are consistent with and effective for the needs and objectives of applicants. - Sufficient number of staffs who will and carry out and monitor the project activities are nominated for the project from both private and producer partners. - Sufficient budget such as salaries for required staffs and budget for procurement of products supported by the pilot for the proposed activities is allocated by the private partners. - Sustainability of proposed activities after the project period.
Sustainability	- Willingness and commitment of applicants to observe conditions for the pilot as explained below in a written form. - Willingness and commitment of applicants to treat partners in a socially responsible and fair manner in a written form.

Source: JICA Survey Team

(d) Conditions to Be Observed by the Beneficiaries

As explained above, the beneficiaries of pilot project will be supported for their capacity building and be provided with necessary inputs and equipment. In order to ensure the sustainability of assistance, the following conditions should be observed by the beneficiaries:

- Each pair should nominate one person each from private sector partner and producer who will be responsible for monitoring and reporting the project activities.
- They will be responsible for the operation and maintenance of equipment and facilities provided.
- A Pilot Project Management Unit (PPMU) explained later has the authority to cancel assistance if it finds breach of agreement.

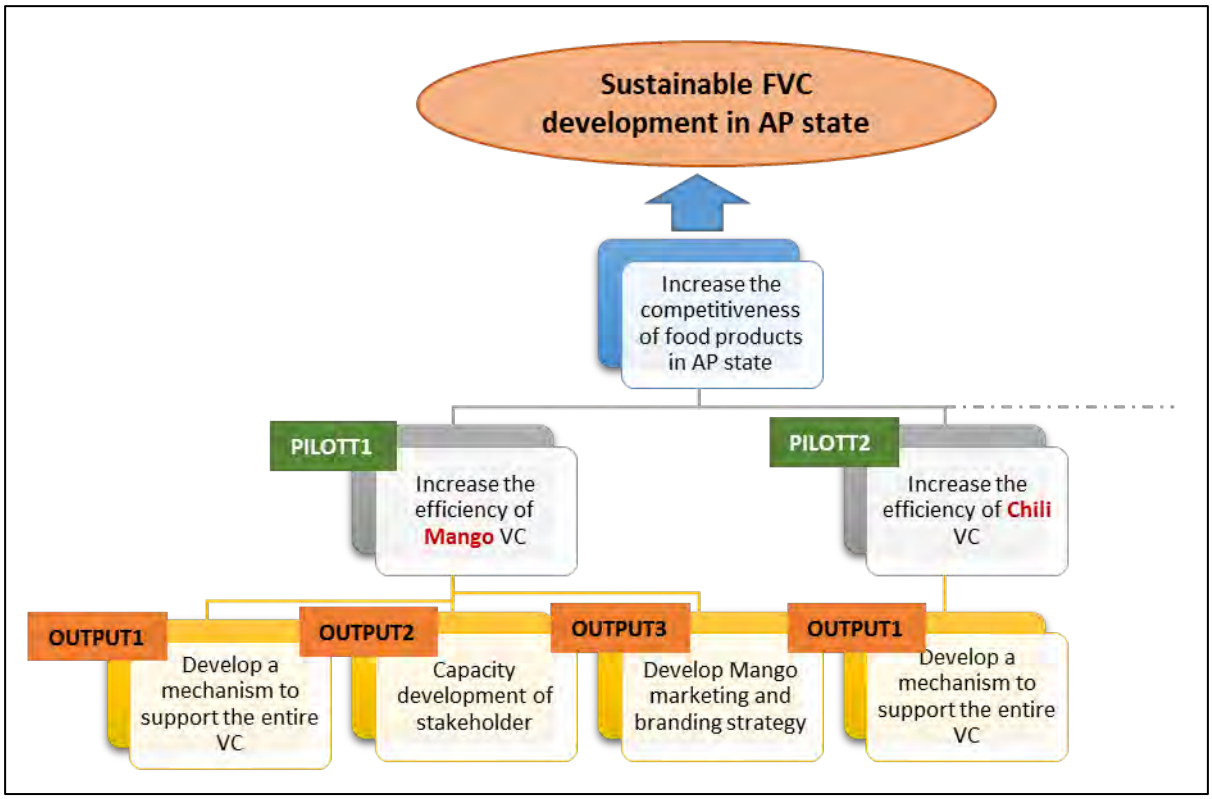
(6) Project Activities

(a) Overview of the Project Activities

In order to increase the competitiveness of food products in Andhra Pradesh State, respective pilot projects aim to increase the efficiencies of value chain for target products. The efficiency of target value chain will increase through the following three activities.

- A mechanism to support the entire value chain of the target product is developed.
- Capacity of government officials, farmers, and private sector partners are developed.
- Marketing strategy for value chain of the target product is developed.

By producing these outputs for the planned seven pilot projects, the efficiency of value chain for target products will improve in the project area and their competitiveness will be increased by reflecting the good practices and lessons through the pilot to the policy and system of GoAP. It is expected that GoAP replicates the pilot projects of the target products to the whole state as a first step and to other products as a second step. Ultimately the government system will be transformed and the platform of stakeholders for respective products will be formed to assist the entire VCs and market the food products of Andhra Pradesh State as a state. Moreover, the small producers develop their capacity to collaborate and improve their skills to produce quality and safe products through the pilot projects. In this way, the benefits of the pilot will spread to the whole Andhra Pradesh State and thus can contribute to a sustainable FVC development in the state. Figure 11.2.5 shows a chart of the products and concepts of the pilot project for a sustainable FVC development in Andhra Pradesh State.



Source: JICA Survey Team

Figure 11.2.5 Products and Concepts of Pilot Project

Each output consists of common activities and activities specific to the target products. As for the executing agency of the pilot project, it is considered difficult for the single department or organisation to carry out the whole project activities as the activities involve every process of the value chain. Besides, it is more preferable for related government departments and organisations to collaborate through the pilot projects, considering that one of the aims is to develop a mechanism to support the entire value chain which involve multiple stakeholders. The survey team proposes that output 1 and 2 which require the network of producers and local resources and technical expertise to be carried out by respective line departments such as horticulture and fishery, while output 3 which involves marketing and branding to be carried out by Andhra Pradesh Food Processing Society (APFPS). Although APFPS does not have much experience of doing these activities, it has a plan to start an activity to support the value chain at district level, and their experiences and skills dealing with investors are certainly its advantage of carrying out the task of output 3. Summary of common activities in each output is listed in Table 11.2.7.

Table 11.2.7 Summary of Project Activities

Output	Activity	By
1. Develop mechanism	Form an implementation unit Identify producers/private sector partners Joint survey and planning Joint review Share experiences with others	Line departments in collaboration with APFPS
2. Capacity building	Production Post-harvest management Processing Good Agricultural Practice (GAP) and Good Aquaculture Practice (GAqP) Traceability How to apply for government subsidy scheme	Line departments (training for private sector by APFPS)
3. Develop marketing/brand strategy	Conduct market survey Collect information and establish linkage with local resources	APFPS in collaboration with central agencies such as APEDA/MPEDA and Agriculture

Output	Activity	By
	Develop guidelines Support market activities Develop a platform for stakeholders Develop brand and marketing strategy	Marketing Department

Source: JICA Survey Team

Project design matrix (PDM) and plan of operation for each pilot project is listed in Attachment 11.2.2.

For the effective information sharing, District Pilot Coordination Committee (DPCC) where all the stakeholders including government, producers and private sector partners meet regularly will be established for each pilot project. The market information will be shared through the activities such as market survey, joint survey and planning, and regular DPCC meetings.

Although the pilot project targets specific crops and specific markets and participants for the pilot project will be very limited, the experiences, good practices and lessons from the pilot projects will be disseminated through the activities such as developing promotional materials and receiving observation tours. In addition, various guidelines including contract farming will be developed to ensure that the good practices learned from the pilot project benefit all the farmers and private sector partners in future.

(b) Focus of Capacity Building

Although most of activities in Output 1 and 3 are standardized, there are some variations in activities of Output 2 depending on the target products. The focus of Output 2, capacity building for respective target products are summarized in Table 11.2.8.

Table 11.2.8 Focus of Capacity Building

Product	Focus of capacity building
Mango (processing)	Pruning, controlling chemical usage, harvesting and post-harvest processing to reduce damage is a focus of training.
Mango (fresh export)	Pruning, controlling chemical usage, harvesting and post-harvest processing including ripening to reduce damage and ensure safety is a focus of training.
Tomato	Cultivation of processing variety, especially achieving high productivity and low cost is the focus of training.
Chili	Controlling chemical residues, traceability and appropriate drying method is a focus of training.
Coconut	Establishment and operation of well-functioning supply network of raw materials and processing is a focus of training.
Shrimp	Culturing quality seed with quality feed in a well maintained pond is a focus of training. For this purpose, the lead farmers who will carry out demonstration activities will be supported for removing mud from their pond and provided with a quality tester along with quality seed and quality feed.
Tuna	Adopting new fishing methods including capture and on-board handling to minimize damage and quality check and grading to ensure the remunerative price of quality captures is a focus of training.

Source: JICA Survey Team

In order to make the capacity building component in line with the market demand, it is recommended that concerned project staffs should take the following points into account when they carry out the capacity building component.

- Teach how to grow and harvest products which suit the market demand. The market requires the specific size, colour and shape of the products. For instance, sufficient red colour is required for processing variety of tomato. Fresh mangoes in the specific size are preferred in the specific market. Study these requirements and design the capacity development program which satisfies these requirements.
- Stable supply in terms of volume and quality is one of the most important conditions private companies request when they think about procurement of raw material from farmers. Small farmers are generally disadvantaged for these issues. In order to supply required amount of products with required quality on time, coordination on timing of planting and harvesting is necessary among farmer’s group. Teach how to coordinate these issues.

- Post-harvest processing such as washing, grading and packing at farm level is an effective value addition when selling directly to private companies. These skills should be taught in the program as a basic skill.

For the purpose of capacity building, inputs such as seeds will be provided all the beneficiaries for the first year only and the required equipment will be provided for selected lead producers whose farms will be utilized as a demonstration farm. The lead producers selected for demonstration will act as master trainers for other members of producer organizations and are obliged to cooperate to line departments for their extension program even after the project completion. The candidate lead farmers have to be proposed in the application.

Among all target products, Tuna requires more technical inputs than other products as the pilot will develop new technologies specifically adjusted to the local contexts of target area. Moreover, developing capacity of quality inspection and grading and marketing support for export is crucial to ensure the remunerative prices for quality captures as there is currently few processing companies dealing with tuna export, involving and training willing processing companies and exporters is particularly important for this pilot. Details of capacity development and marketing activities for tuna pilot are explained below.

Table 11.2.9 Details of Capacity Development and Marketing Assistance for Tuna

Step	Category	Activity
Preparation of training	Survey on fishing grounds location and depth	- Survey on fishing ground and depth for tuna in the whole Andhra Pradesh State fishing zone. - Identify 30 locations for the pilot project. Borrow a research vessel owned by National Research Institute for this purpose.
	Conversion of trawlers to long liners	- Converting existing mechanized boat to tuna long liners cum dropliners. Fish handling deck, fish hold, and other improvement may be done. Conversion of first five boats will be financed by the Project. - The participants of the training in the following year have to convert the boats by themselves with the subsidy from DoF.
	Procurement of materials for Fish Aggregation Device (FAD)	- Materials to construct 30 Fish Aggregation Device (FAD) will be procured. They will be owned and management by mechanized boat owner's associations. - Once constructed, FADs has to be monitored and maintained every season by the associations.
	Procurement of equipment for capture	- Provision of droplines. Each boat in the first year is provided with five droplines. - Provision of electric shocker which is used to numb tuna without damaging. One shocker will be provided for one boat in the first year. - Provision of electric line hauler which is used automatically haul droplines and longline. One hauler will be provided for one boat for the first year. - The participants of the training in the following year have to procure the necessary equipment by themselves with the subsidy from DoF.
	Procurement of equipment for processing	- A quality tester and a vacuum packer will be provided for the first year.
Training for capture	FAD construction	- Training on how to construct FAD and to deploy at the identified locations in the first year will be conducted. Lead fishermen of the mechanized boat as well as selected fishermen who are willing to learn and participate in construction will be trained. Monitoring and maintenance of the FADs will be trained in the second and third year. Only the boat of lead fishermen does this work.
	Fishing and handling method	- Training on fishing methods utilizing dropline, electric shocker and electric hauler. Training will be done on the boat by Tuna expert of PMC. The fishermen belong to the five boats and candidate of master trainer at CIFNET will join the training in the first year.
Training for on-board handling	Killing and cleaning	- Training on killing and cleaning of captured tunas without damage.
	Icing	- Training on icing of captured tunas.
Training for processing	Quality inspection and grading	- Training on quality inspection. Provision of quality tester is necessary. Training will be done at the premises of the government institute such as NIHPHATT. Partner processing companies are beneficiaries of this training. Trainees are expected to act as an expert of grading tuna at the market to ensure that the quality tuna gets remunerative price.
	Cutting	- Training on cutting tuna into fresh round, GG, loins, blocks, and saku (filet

Step	Category	Activity
		for sashimi). Provision of quality tester is necessary. Training will be done at the premises of the government institute such as NIHPHATT. Partner processing companies are beneficiaries of this training. Training targets worker level of processing companies.
	Frozen	- Training on frozen loin and blocks. Other conditions are same as cutting.
	Vacuum packing	- Training on vacuum packing. Other conditions are same as cutting.
Marketing	Sample shipment	- Sample shipment for marketing purpose. Ship samples to prospective customers identified at trade fairs or other means. 20 samples (5 tunas: 100kg) for the first year and 15 each for the second and the third year. Target markets are Europe, Middle East and USA.

Source: JICA Survey Team

(c) Provision of Inputs, Equipment and Facilities

The activities of pilot projects are basically technical assistance where the officials of concerned departments with the help of PPIC conduct training and workshops for technical transfer. Inputs and equipment will be provided based on the following principles.

- Inputs such as seeds or plant materials will be provided to all the beneficiary for the first year only.
- The required equipment and facilities will be provided for selected lead producers whose farms will be utilized as a demonstration farm. The equipment and facilities include water quality tester and renovation of farm pond for shrimp and electric shocker, electric line haulers and fish aggregation devices for tuna.
- In principle, existing processing facilities owned by partner processing companies will be used. Replacement or upgradation of processing facilities is not the scope of the pilot project. However, the cases of tuna and coconut where there are few processing units are exception. For these pilots, necessary processing facilities will be provided for training purpose. The provided facilities will be operated and managed by either government institutions or producer organizations. Modality of providing these facilities should be discussed at the time of appraisal.
- Provision of common facilities for producer groups such as a collection center or pack house will not be considered except for those proposed under the common facility fund explained below.

In addition, an accredited aqua laboratory proposed for shrimp may not be considered unless needs, cost and feasible plan of operation will be proposed by GoAP and agreed by JICA during the phase 1, although it is still included in the cost of the shrimp pilot.

(7) Common Facility Fund

As the aggregation of small producers is one of the most critical issues to achieve sustainable FVC development in Andhra Pradesh State, high priority is placed to strengthening the capacity of producer organizations in the pilot projects. For this purpose, the common facility fund will be developed to provide them an opportunity to manage and operate common facility necessary for their production or processing activities. Participating producer organizations in the pilot are entitled to apply for the fund. Successful cases should be replicated and the good practices and lessons should be reflected in the state policy so that the benefits will be spread to the whole state as explained in (6). Outlines of the fund are explained below.

(a) Size of fund

The amount of budget for this purpose is INR10,000/beneficiary. All the beneficiary producers have to contribute 10% of budget, namely INR1,000 for operation and management (O&M) fund. Each participating producer organization can apply the facility whose cost is below the budget (INR10,000 multiplied by number of members). The amounts of budget and percentage of beneficiary's contribution are proposed on the basis of following considerations:

- INR 1,000 is appropriate for small producers to contribute. If it is too high, the risk of not able to collect agreement from all the members becomes high.
- INR2million-3million which is equivalent to the budget for the average producer organization with 200 - 300 members is enough to cover most of the sample facilities listed in (b).

- 10% of contribution is considered appropriate. It is lower than 25% to 50% of contribution the producers are requested for existing subsidy schemes. As this is pilot, it is more important to show a model and motivate farmers to continue activities.

The allocation of fund for respective pilot projects are as follows:

Table 11.2.10 Allocation of Fund for Respective Pilot Projects

Product	Survey Team Proposal			Fund for collective activity (INR)	OM fund (INR)
	Period	No. of Beneficiary	Target Area		
Mango (processing)	4 years	1,000 farmers	1,000 ha	10,000,000	1,000,000
Mango (fresh export)	4 years	100 farmers	100 ha	1,000,000	100,000
Chili	3 years	2,000 farmers	2,000 ha	20,000,000	2,000,000
Tomato	3 years	500 farmers	500 ha	5,000,000	500,000
Coconut	3 years	1,000 farmers	1,000 ha	10,000,000	1,000,000
Shrimp	3 years	1,000 farmers	1,000 ha	10,000,000	1,000,000
Tuna	4 years	225 fishermen	45 boats	2,250,000	225,000
Total				58,250,000	5,825,000

Source: JICA Survey Team

(b) Eligible Items

Proposed facility or equipment should have impact of improving productivity or increasing incomes of member producers. Based on discussion with concerned government departments as well as field survey, the survey team propose examples of such facilities as follows.

Table 11.2.11 Examples of Eligible Facilities

No	Idea	Approximate cost	Applicable products
1	Farm Mechanisation Centre	INR2,500,000/centre	All horticulture products
2	Mobile Soil Testing Laboratory	INR2,500,000/unit	All horticulture products
3	Model Demonstration Farm	INR250,000/ha	All horticulture products
4	Agricultural Input Centre	INR1,000,000/centre	All horticulture products
5	Mobile Training Facility	INR3,000,000/unit	All horticulture products
6	High-tech Nursery	INR2,500,000/ha	All horticulture products
7	Integrated Chili Pack House	INR20,000,000/house	Chili
8	Value Addition Centre	INR5,000,000	Chili
9	Polyhouse Dryers	INR2,500,000/5 polyhouses	Chili
10	GIS Tagging, Operations and Management	INR8,000,000/pilot	All products especially for chili
11	Youth in Agriculture	INR400,000/program	All products
12	ICT Based Market Information Centre	INR10,000,000/centre	All products
13	Traceability System Development & Management	INR1,000,000/system	All products especially for chili
14	Biological Control Agent Laboratory	INR8,000,000/unit	Coconut
15	Model Ball Copra and Cup Copra Unit	INR2,500,000/ each unit	Coconut
16	Cold storage	INR2,000,000/250MT	Shrimp
17	Collection centre	INR400,000/unit	Mango, tomato, chili
18	Small nursery	INR150,000/ha	Mango, tomato, chili
19	Drying platform	INR150,000/ha	Chili
20	Ripening chamber	INR100,000/MT	Mango

Source: JICA Survey Team

Details of some of these facilities are shown in Attachment 11.2.5.

(c) Application Procedures

All interested producer organizations should submit the proposal to Project Implementation Team (PIT). Timing of application is after the first cycle of project activities, namely the third project year for mango and tuna and the second year for other pilots. The proposal should include the following information:

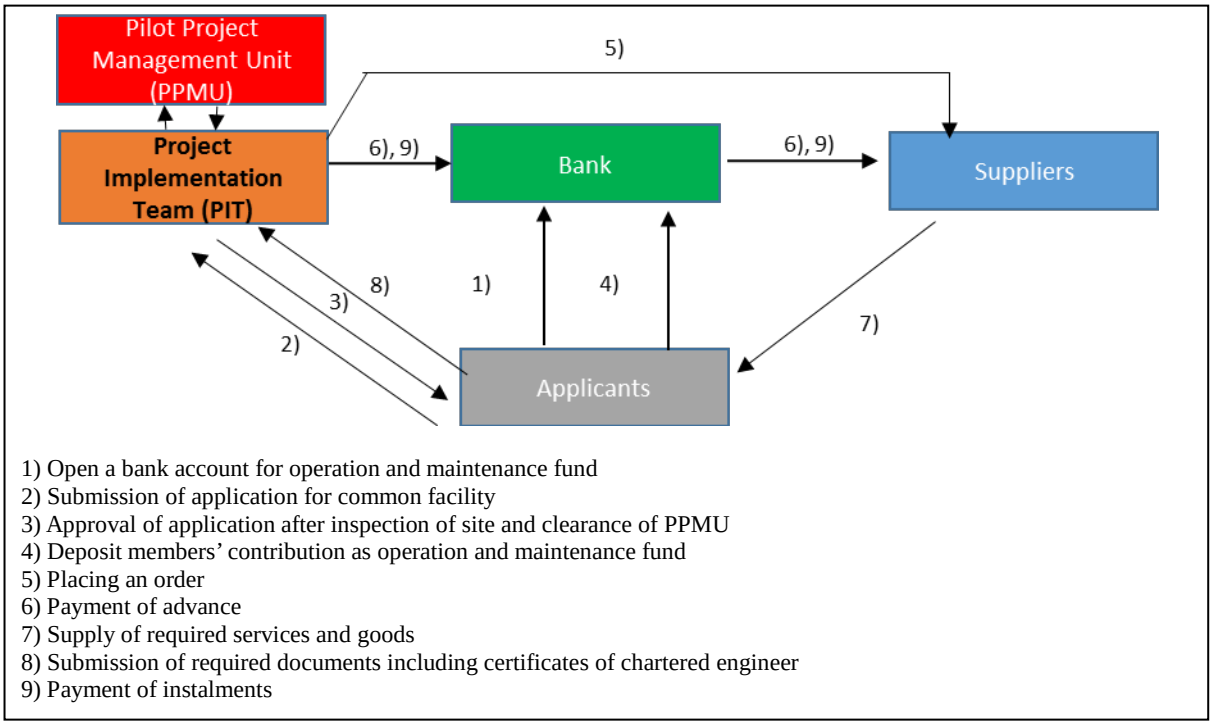
- Details of facilities proposed and their necessity
- Expected impact of having the facilities
- Plan of procurement
- Plan of operation and maintenance
- Proof of commitment by more than 80% of member producers for their contribution

PIT of respective pilot project should include full amount of budget for common facility fund for the annual activity plan of the concerned project year. PIT and DPCC will review the proposals, coordinate any adjustment required and finalized the proposal in consultation with applied producer organizations. The finalized proposals will be submitted to PPMU for approval.

After PPMU reviews and approves the proposals, PIT is authorized to disburse the fund. If there is any amount not utilized in the concerned project year, PIT has authority to call another round of application within the available budget.

(d) Fund Flow

Once PPMU approves the budget of PIT for the concerned project year which include the budget of common facility fund, the fund is available at PIT.



Source: JICA Survey Team

Figure 11.2.6 Fund Flow for Common Facility Fund

The fund will not be disbursed until PIT confirms all the contributions from member producers are deposited to the bank.

(e) Operation and Maintenance

Applied producer organizations will be responsible for operation and maintenance of the provided facilities. The concerned organization have to propose how to operate and maintain the provided facility in the application. For this purpose, operation and management (O&M) fund collected INR1,000 from all the beneficiary producers at INR1,000 should be utilized effectively. For the facilities which can collect service charges such as mobile soil testing laboratory, it is preferable to employ rural unemployed educated youth for its operation. In this way, the project can produce employments in the village. The concrete operation and maintenance plan should be developed through pilot operation in the project period.

In order to ensure the appropriate operation and management, the monitoring officer of each pilot will regularly check the conditions of equipment and facility during the project period. After the project completion, the facility and equipment provided will be subject for ex-post evaluation.

(8) Implementation Schedule

Respective pilot projects have independent implementation schedule which are listed in Attachment 11.2.2. PPIC will be hired by PMU before the pilot project starts. The implementation period is basically

three years starting from 2018 except for those that require longer time to harvest such as mango or for those that require technical transfer such as tuna. The implementation period of these product is four years.

As most of the project activities are standardised, the implementation schedule can be summarised as shown in Table 11.2.12. Each product has two cycles of activities starting from planning and capacity building to endline survey and sharing of experiences. Market survey will be conducted at the beginning of the project period and marketing support will be provided throughout the project period. Marketing strategy will be developed based on the experiences on project activities at the end of project period.

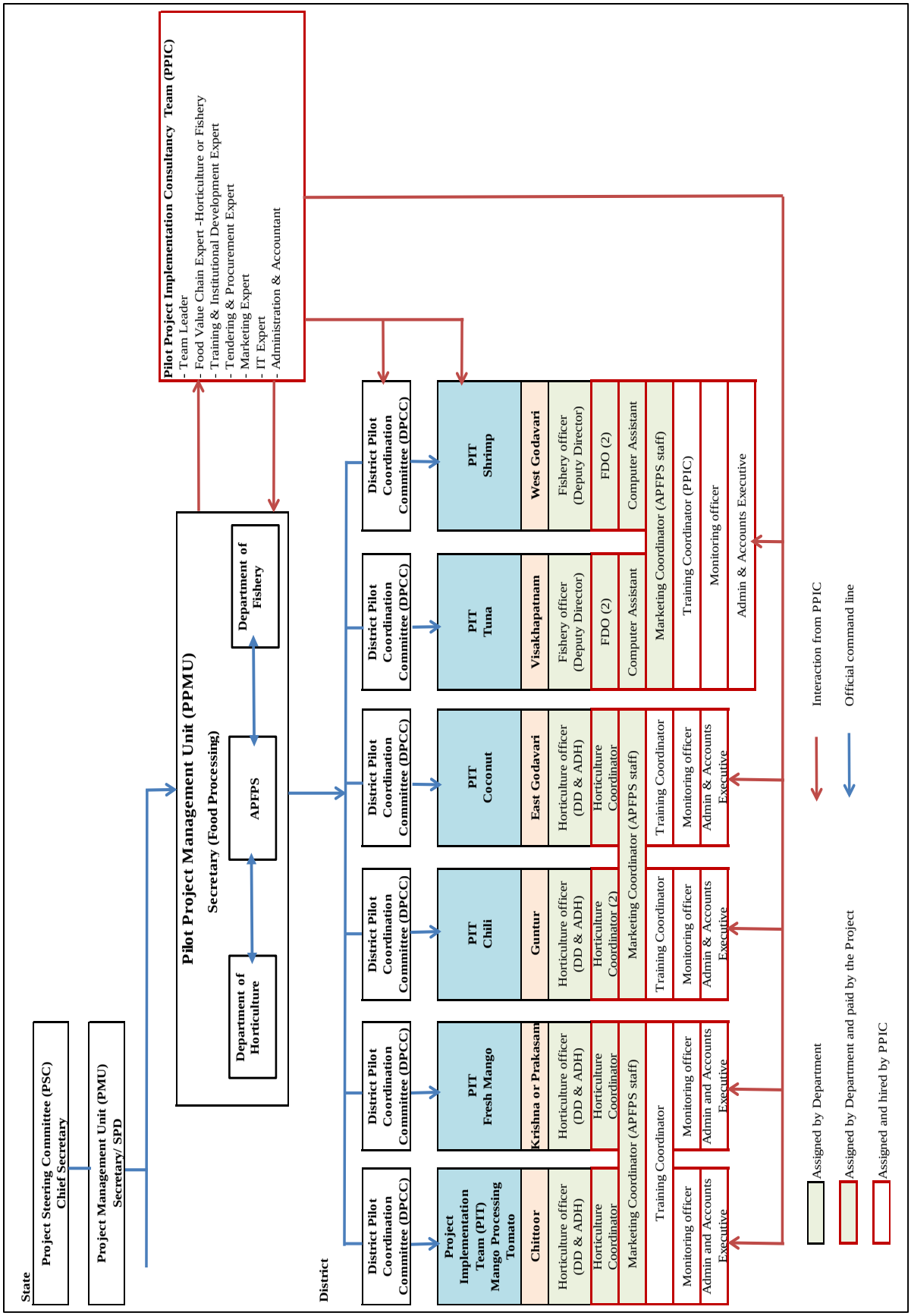
Table 11.2.12 Basic Implementation Schedule

Output	Activities	First Year	Second Year	Third Year
Output1	Preparation of project and selection of beneficiaries			
	Joint planning of project activities			
	Endline survey and sharing experience with other areas			
Output2	Capacity Development and provision of inputs and equipment			
Output3	Market survey			
	Collecting information and establishing networks			
	Marketing support			
	Development of marketing strategy			

Source: JICA Survey Team

(9) Implementation Structure

The proposed implementation structure for the pilot projects is shown in Figure 11.2.7. Four institutional setups are proposed, namely Pilot Project Management Unit (PPMU) at state level, a Project Implementation Team (PIT) and a District Pilot Coordination Committee (DPCC) at district level and Pilot Project Implementation Consultant (PPIC) to support the implementation of the pilot projects. Each organization is explained below.



Source: JICA Survey Team

Figure 11.2.7 Implementation Structure of Pilot Project

(a) Pilot Project Management Unit (PPMU)

As shown in Table 11.2.13, the task of the PPMU is to monitor the progress and coordinate issues related to various organisations at state level. The PPMU will be headed by secretary industries (food processing) and consists of members from related organisations such as horticulture, fishery, and APFPS. They will meet quarterly to monitor the progress and discuss any issues which require coordination at higher level. It is especially important to include Joint Collector (Development) of pilot project districts as he or she has authority to coordinate issues relating to multiple organizations at district level. Involvement of Joint Collectors is considered effective for smooth implementation of the project at district level.

Table 11.2.13 Members and Tasks of PPMU

Member	Task
<Head> Secretary (Food Processing) <Member> APFPS, DoH, DOF, APEDA, MPEDA, Joint Collectors (Development) of project districts <Convener> CEO, APFPS	1. Approve annual activity plans and budget for the pilot 2. Monitor and review the progress of project on a quarterly basis 3. Facilitate convergence of support measures 4. Coordinate issues relating to multiple organizations in order to facilitate smooth implementation of the project

Source: JICA Survey Team

(b) Pilot Project Implementation Consultant (PPIC)

The Pilot Project Implementation Consultant (PPIC) will be a team of consultants which will provide overall support both in terms of technical, and managerial to the PPMU at state level and Project Implementation Team (PTI) at district level. The PPIC will work very closely with the concerned departmental staff at state and district level. The PPIC will work in consultation and coordination with the various stakeholders including government, producers and private sector partners.
It is responsible for the following aspects of the pilot project:

- Responsible for project planning, implementation and monitoring
- Reporting to State and District Level Committee
- Coordinating with PPMU, DPCC as well as with the PIT
- Supervising and instructing PPIC members in PIT
- Preparation and management of documentation of the project

PPIC consists of consultants both at state and district levels as listed below:

Table 11.2.14 Members of PPIC

Position	Number	Month	Note
State level			
1.Team Leader	1	48	
2, Food Value Chain Expert	1	48	
3.Training & Institutional Development Expert	1	48	
4.Tendering & Procurement Expert	1	48	
5.Marketing Expert	1	48	
6.IT Expert	1	48	
7.Administration & Accountant	1	48	
Sub-total	7	336	
District level			
1.Marketing Coordinator*1	3	132	48 x 2, 36 x 1
2.Training Coordinator	4	168	48 x 2, 36 x 2
3.Monitoring Officer	5	216	48 x 3, 36 x 2
4.Administrative & Accounts Executive	5	216	48 x 3, 36 x 2
Sub-total	14	600	
Total	21	936	

**1: To be hired by APFPS with the funds of project*
Source: JICA Survey Team

PPIC consultants at state level consists of experts who has knowledge and experiences of the designated areas and are supposed to assist PPMU and PIT in their project implementation with their technical expertize. On the other hand, PPIC consultants at district level will more focus on implementation. As explained below, they will belong to PIT and carry out the project activities as their own task while following instruction and advice from PPIC at state level. In this way, the concept and direction of the

pilot projects as a whole will be ensured.

TOR of PPIC is shown in Attachment 11.2.4.

(c) Project Implementation Team (PIT)

At the district level, a project implementation team (PIT) will be established for each pilot project. The team consists of officials of line departments as well as consultants hired by the PPIC. An office will be set up in the premises of a district line department. They will sit together in the office.

Table 11.2.15 Members and Tasks of PIT

Member	Task
<Head> District Head of Line Department <Member> -Horticulture coordinator (DoH)/Fishery development officer (DoF) -Marketing Coordinator (APFPS/PPIC) -Training coordinator (PPIC) -Monitoring officer (PPIC) -Computer Assistant (DoF)[2] -Admin & Accounts executive (PPIC)	1. Implementation of the project at field level with the support of PPIC 2. Report to PPMU 3. Providing field level inputs to PPIC for planning, implementation and monitoring

Source: JICA Survey Team

The deputy director (DD) of the line department will be a project director for each pilot project. Assistant Director of Horticulture (ADH) and DD of Fishery is responsible for fund management at each pilot[3].

Horticulture coordinators, fishery development officers (FDO), marketing coordinators and training coordinators, and monitoring officers along with above officers will carry out the activities at the field level. Horticulture coordinators will support farmers to develop their farm management plan if necessary. While horticulture coordinators and FDOs will be hired by respective line departments, training coordinators, monitoring officers and administration and accounts executives will be hired by PPIC.

Marketing coordinator for output 3 (marketing support), training coordinator for output 2 (capacity development), and monitoring officers will be instructed by PPIC at the state level to ensure consistency and concept of the pilot among different pilot projects. Marketing coordinators are hired by APFPS under the condition that they will be retained by APFPS as staffs at the district level after the project completion.

The role of PIT is to work at the field level and the prime responsibility is implementation of the project activities at the field level. However, the PIT will interact and provide inputs and feedbacks as desired on a regular basis with the PPIC in regard to planning and monitoring of the project. PIT is expected to cooperate with PPIC in the following respects:

- Provide inputs and feedback to PPIC regarding all the activities of the project on a regular basis to help PPIC in effective planning, execution and monitoring of the project.
- Identification of various stakeholders to be involved in the project (farmers, FPOs, processing industry, exporters and others) as per the requirement and following the guidelines.
- Undertake a baseline survey of the area and stakeholders identified for the pilot projects as per the guidelines issued by PPIC.
- Preparation of a Detailed Project Report and Implementation Plan including the components of the project, budget requirement and detailed project implementation schedule and Plan.
- Preparation of tender documents along with detailed specifications for procurement of all infrastructure facilities/ components identified in the project
- Inspection of the infrastructure facilities/ components and recommend for payment to the lead agency.

[2] This post is added to the pilot projects for tuna and shrimp upon request from DoF.

[3] The Department of Fishery (DoF) requested the survey team to finance the cost of the DD throughout the project. There is a severe shortage of staff at the DoF. The DoF propose to assign one capable senior officer as the DD for the pilot but asked finance to hire another staff to replace him/her. The DoF indicated that the DD will be responsible for replicating pilot model to other areas after the pilot project completion. This issue should be discussed between the GoAP and JICA.

- Coordination of all the meetings pertaining to the project along with background papers – state level as well as district level. Also provide material and inputs for the other meetings organized by PPIC.

(d) District Pilot Coordination Committee (DPCC)

The deputy director (DD) of the line department will be a project director who chairs monthly 'District Pilot Coordination Committee (DPCC)' in which all stakeholders in the Project regularly meet and discuss issues related to the Project. As indicated in (1), the DPCC is expected to serve as a platform to promote the target and implement marketing strategy as state.

Table 11.2.16 Members and Functions of DPCC

Member	Function
<Head> District Head of Line Department <Member> APFPS, DoH, DOF, APEDA, MPEDA, Marketing Department, Department of Industries, Stakeholders representatives including FPO, Processing Industry, and Exporter, etc. <Convener> Line Department	1. Review of progress of project on monthly basis 2. Share the latest market information and adjust marketing strategy accordingly 3. Facilitate coordination between various agencies and departments 4. Facilitate smooth implementation of project at district level

Source: JICA Survey Team

(10) Project Cost

The estimated cost for FVC pilot projects is shown in Table 11.2.17. The detailed cost is shown in Attachment 13.3.18. The project cost consists of activity cost for respective pilot projects and implementation cost which includes cost for PPIC and that for additional human resources for government.

Table 11.2.17 Project Cost for FVC Pilot Projects

	Component	Budget (INR)	Line Department	APFPS
1	Mango (processing)	41,012,000	30,590,000	10,422,000
2	Mango (fresh export)	23,112,000	8,000,000	15,112,000
3	Tomato	40,177,000	32,575,000	7,602,000
4	Chili	79,252,000	62,918,000	16,334,000
5	Coconut	48,199,000	37,609,000	10,590,000
6	Shrimp	83,815,000	70,025,000	13,790,000
7	Tuna	65,717,000	48,417,000	17,300,000
8	Project implementation cost (PPIC)	185,472,000	-	-
9	Additional human resource for government	21,840,000	16,560,000	5,280,000
Total		588,596,000	306,694,000	96,430,000
			76%	24%

Source: JICA Survey Team

Activity costs are divided into two, for output 1 and 2 which line departments are responsible and that for output 3 which APFPS is responsible for implementation.

Annual budget and activity plans for the next fiscal year will be prepared by each department, discussed at PPMU at the end of every fiscal year, and submitted to the PSC. After the approval from PSC, the budget will be transmitted directly to line department and APFPS. However, there is an opinion at the GoAP that the entire budget for respective pilot projects should go to line departments first and that for APFPS will be transferred to it by the line departments. This issue should be discussed and agreed between the GoAP and JICA.

(11) Monitoring and Evaluation

(a) Monitoring

The survey team proposes four tier monitoring system for the pilot as explained in Table 11.2.18.

Table 11.2.18 Four-tier Monitoring System

Level	Person in Charge of Monitoring	Method of Monitoring
Pilot project	Two persons, one from producers and the other from private sector partner in each pilot are in charge of monitoring.	Submit monthly progress report to PIT
PIT	A monitoring officer at each PIT	Regular monitoring of the project activities Monthly monitoring meeting with the beneficiaries Submit monthly progress report to PPIC Attend quarterly monitoring meeting at PPIC
PPIC	Team leader and FVC experts	Regular monitoring of all pilot projects Organise a quarterly monitoring meeting at PPIC Submit monthly progress report to PMC
PMC	FVC experts (international and local consultants)	Attend quarterly PPMU meeting Supervise and monitor the overall progress of FVC pilot projects

Source: JICA Survey Team

The basic principle of monitoring for FVC pilots is that beneficiary pairs themselves are responsible for monitoring and reporting the progress of their project activities. This system is considered feasible and effective with the following two reasons. Firstly, the beneficiary pairs have logical reasons to carry out the project activities as they are in a business relationship where the failures of the other party to carry out project activities will directly affect the incomes of another party. Therefore, they have an incentive to carry out the project activities as planned and monitor the activities each other. Secondly there have been several examples in AP state system where the government department supports private companies directly procuring raw materials from farmers and farmer's groups. In Chittoor, DoH supports private companies finding farmers from whom they procure processing varieties of tomato and provide subsidy and technical assistance to those farmers. In these cases, private companies and lead farmers are responsible for monitoring the activities. This system is also effective for the pilot project.

In order to make the self-monitoring of the beneficiary pairs effective, each pilot project beneficiaries assign two persons who are responsible for internal monitoring. Each PIT has one monitoring officer who has regular contact with beneficiaries. They are responsible for the monitoring of each pilot. In this way, activities of 1,000 farmers can be monitored effectively.

At the state level, PPIC and FVC experts of PMC will supervise the overall progress of FVC pilot projects. They will report progress to PPMU and PMU respectively.

(b) Evaluation

PMU will evaluate the progress and achievements of the FVC pilot projects along with other pilot programs at its regular quarterly meeting based on the report from respective PPMU.

In addition to regular evaluation activities by PMC, respective pilot projects have baseline survey and endline survey as their activities. Based on the baseline survey, the exact targets will be fixed as evaluation indicators. The level of achievement will be evaluated at the time of the endline survey. Evaluation indicators for respective pilot projects are listed in PDM of Attachment 11.2.2.

Further details are available in Attachment 11.2.1 through 11.2.5 and 13.3.18. Their outlines are explained below.

Table 11.2.19 Outlines of Attachment

Attachment	Outlines
Attachment 11.2.1	Summary of interview with processing companies for mango, tomato and chili.
Attachment 11.2.2	PDM, PO of each pilot projects.
Attachment 11.2.3	Government Subsidy Schemes in Horticulture and Food Processing in Andhra Pradesh State. It consists of assessment of existing subsidy schemes in Andhra Pradesh State and overview of Mission for Integrated Development of Horticulture (MIDH).
Attachment 11.2.4	TOR for PPIC which includes role, qualification, tasks to be carried out, key deliverables, team composition with detailed job descriptions of each staff.

Attachment	Outlines
Attachment 11.2.5	Brief descriptions of the examples for common facility fund
Attachment 13.3.18	Detailed Cost for each pilot projects, PPIC and additional human resource for government.

Source: JICA Survey Team

11.3 Farm Mechanisation

11.3.1 Background

Modernization for increasing productivity of the major crops, i.e. rice, maize, pulses and sugarcane, is a crucial issue for improvement of livelihood of farmers. As the initiation of agricultural modernization, agricultural mechanization for major crop productions are selected as the first priority measure based on the shortage of labours, especially for planting and harvesting works. The overall improvement for production of those crops is the priority policy measures including farm mechanization in the State.

11.3.2 Current Status and Issues for Farm Mechanisation

The causes of stagnant and fluctuated productivity of major crops in Andhra Pradesh state are:

- Increasing labour cost and shortage of labours in the peak seasons, i.e. planting and harvesting seasons;
- Shortage of knowledge and skills of machinery operators, especially for specific advanced machines, i.e. transplanter, harvester;
- Shortage of management skills for farm machinery hiring service for major crops;
- Shortage of mechanics and their adequate maintenance services for advanced farm machines such as paddy transplanter, especially at the remote locations from the respective district capitals;
- Shortage of comprehensive plan on mechanization of farm production applicable to small and marginal farmers; and
- Shortage of supporting, monitoring and evaluation activities for promoting mechanization of farm production

11.3.3 Essential Points for Promotion of Farm Mechanisation

The concept note for promotion of farm mechanization in Andhra Pradesh state was prepared by Department of Agriculture (DoA), GoAP, and reviewed by the JICA survey team. The results of the review are shown as follows:

(1) Target Crops

Rice is fundamental staple crop in Andhra Pradesh state and no question to include it in the plan. Maize, pulses and sugarcane are also essential in agricultural production in Andhra Pradesh state and targeted.

(2) Strengthening of Functions for Training for Farm Mechanization

DoA has proposed that Agricultural Mechanisation & Technology Centre (AMTC) be established at strategic location(s) for promoting agricultural mechanization and dissemination of other agricultural technologies through provision of technical training on machinery's operation and maintenance for users of farm machinery and timely monitoring on farming activities including operational performance and constraints of machineries.

(3) Formulation of Custom Service Units (CSUs)

For expansion of custom services to marginal and small farmers and tenants, it is proposed that users, who are interested in farm machinery business, should organize Custom Service Unit (CSU) with around 5 to 10 members. Members of cooperatives as well as farmers' societies are also allowed to formulate CSU. Further they will be able to have any training on operation and maintenance of farm machinery, proposed farming practices, and also management of CSU at the AMTC. After training, CSU will purchase farm machinery, which they request, through the existing subsidy system.

(4) No. of CSUs and farm machinery to be required

To expect maximum effect from the investment, target areas shall be selected carefully by priority of

cultivated area especially for rice-based machine since its know-how for operation is distinct from other machines. East Godavari, West Godavari and Krishna districts are the biggest granary area in Andhra Pradesh state where 46% of paddy was cultivated in the state, those 3 districts shall be the target area for rice-based mechanization. Meanwhile for other 3 crops, northern 6 districts shall be covered in this plan.

Cultivated area of major crops (2013/14) is shown as follows:

Table 11.3.1 Cultivated Area of Major Crops (2013/14)

District	Rice (,000 ha)			Maize (,000 ha)			Total Pulse (,000 ha)			Sugarcane (,000 ha)		
	Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total
Srikakulam	200	3	203	6	5	11	3	79	82	6	0	6
Vizianagaram	109	8	117	13	15	28	4	36	40	17	0	17
Vishakhapatnam	99	7	106	6	1	7	6	23	29	38	0	38
East Godavari	235	170	405	1	11	12	3	41	44	14	0	14
West Godavari	240	180	420	3	51	54	2	13	15	24	0	24
Krishna	264	99	363	7	26	33	5	102	107	16	0	16
Others (7 dist.)	559	411	970	74	133	207	208	584	792	38	0	38
Total	1706	878	2584	110	242	352	231	878	1109	153	0	153

Source: DoA, 2016

One Service Unit for custom service, i.e. Custom Service Unit (CSU) shall cover 200 ha depending on the scale of irrigation command area in the plan. Accordingly required number of CSUs for each crop is shown as follows:

Table 11.3.2 Target Area for Rice-Based Mechanization, East and West Godavari, Krishna

District	Area Harvested ('000 ha)			Double Cropping Area ('000 ha)	Target for Mechanization ('000 ha)	Target CSUs (No.)
	Kharif	Rabi	Total		2%	
East Godavari	235	170	405	170	3.4	17
West Godavari	240	180	420	180	3.6	18
Krishna	264	99	363	99	2.0	10
Total	476	449	1,188	1,188	9.0	45

Source: DoA, 2016

Table 11.3.3 Target Area for Maize-Based Mechanization, Six Districts

District	Area Harvested ('000 ha)			Rabi Cropping Area ('000 ha)	Target for Mechanization ('000 ha)	Target CSUs (No.)
	Kharif	Rabi	Total		2%	
Srikakulam	6	5	11	5	0.1	1
Vizinagaram	13	15	28	15	0.3	1
Vishakhapatnam	6	1	7	1	0	1
East Godavari	1	11	12	11	0.2	2
West Godavari	3	51	54	51	1.0	4
Krishna	7	26	33	26	0.5	6
Other 7 dist.	74	133	207	133	-	-
Total	110	242	352	242	5.5	15

Source: DoA, 2016

Table 11.3.4 Target Area for Pulse-Based Mechanization, Six Districts

District	Area Harvested ('000 ha)			Rabi Cropping Area ('000 ha)	Target for Mechanization ('000 ha)	Target CSUs (No.)
	Kharif	Rabi	Total		2%	
Srikakulam	3	79	82	79	1.58	8
Vizinagaram	4	36	40	36	0.72	4
Vishakhapatnam	6	23	29	23	0.46	3
East Godavari	3	41	44	41	0.82	5
West Godavari	2	13	15	13	0.26	2

District	Area Harvested ('000 ha)			Rabi Cropping Area ('000 ha)	Target for Mechanization ('000 ha)	Target CSUs (No.)
	Kharif	Rabi	Total		2%	
Krishna	5	102	107	102	2.04	11
Other 7 dist.	208	584	792	584	-	-
Total	231	878	1109	878	14.7	33

Source: DoA, 2016

Table 11.3.5 Target Area for Sugarcane-Based Mechanization, Six Districts

District	Area Harvested ('000 ha)			Kharif Cropping Area ('000 ha)	Target for Mechanization ('000 ha)	Target CSUs (No.)
	Kharif	Rabi	Total		2%	
Srikakulam	6	0	6	6	0.12	1
Vizinagaram	17	0	17	17	0.34	2
Vishakhapatnam	38	0	38	38	0.76	4
East Godavari	14	0	14	14	0.28	2
West Godavari	24	0	24	24	0.48	3
Krishna	16	0	16	16	0.32	2
Other 7 dist.	38	0	38	38	-	-
Total	153	0	153	153	5.8	14

Source: DoA, 2016

As shown in the above tables, total number of CSUs are estimated at 107 units. Further it is expected that one workshop be established for ten (10) CSUs covering 2,000 ha, considering accessibility from the other neighbouring CSUs.

Hence, 10 workshops are required for covering 107 CSUs, in order to repair farm machinery at cost. Construction of 10 workshops are conducted, depending on work progress of selection of CSUs.

(5) Target Area (District)

Considering the current agricultural situation in the Andhra Pradesh state, DoA selected the following Districts for target crops:

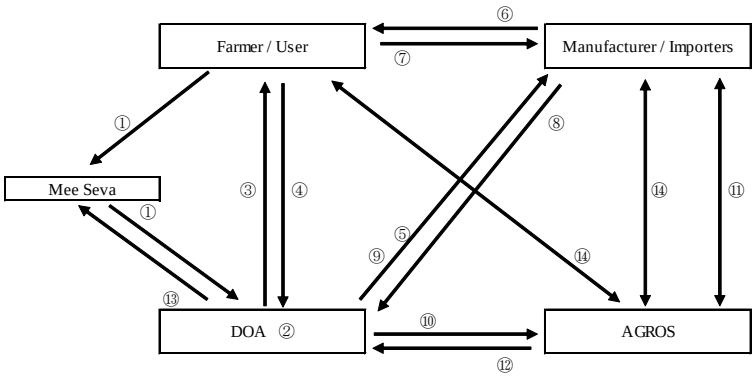
- Rice: 3 Districts (East Godavari, West Godavari, Krishna)
- ID Crops: 6 Districts (Srikakulam, Vizianagaram, Vishakapatnum East Godavari, West Godavari, Krishna)

(6) Awareness Activities for Promotion of farm Mechanisation

Promotion of farm mechanisation as well as activities of AMTC could be disseminated to farmers through the baseline survey and ordinary extension activities as well. The baseline survey shall be conducted in the target area mentioned above, in order to clarify the current agriculture situation as well as prevalence of farm machinery in those areas. The baseline survey should be conducted by the consultants in cooperation with DoA.

(7) Selection of CSUs

In the current situation, farmers should apply subsidy for procurement of farm machinery through the online system for procurement of farm machinery as shown in the following procedure.



① Forwarding of request from applicant to DOA through Mee Seva
Period: from June to March (anytime)
Selection of farm machinery
Selection of model
Selection of dealer
If Mee Seva is not available, the applicants can contact to Gram Panchayat or Mandal office of DOA.
② Checking / Approval / Reject of Applications
ADA: Application for less than Rs. 100,000 worth of farm machinery
JDA: Application for more than Rs. 100,000 worth of farm machinery
③ Notice on approval or reject from DOA (Mandal Office) to Applicants
④ Payment of non-subsidy portion to DOA
⑤ Order on supply of farm machinery with non-subsidy portion
⑥ Supply of farm machinery to applicants within 3 weeks after receiving of ⑤
⑦ Receipt of farm machinery
⑧ Forwarding of the receipt
⑨ Remittance of subsidy portion
⑩ Forwarding of list of manufacturers to be requested by applicants by the end of March
⑪ Tender in April (once a year)
From tenderer
FMTTI reports
List of authorized dealers and manufacturers
Prices of authorized models
Documents to be prepared by AGROS
List of authorized dealers
Price list of authorized models
⑫ Forwarding of information on manufacturers and dealers to DOA
⑬ Forwarding of information on manufacturers and dealers to Mee Seva
⑭ Handiling some claims / request from users

Source: JICA Survey Team based on the information from Department of Agriculture, GoAP

Figure 11.3.1 Procedure on Procurement of Farm Machinery

As shown in the above procedure, applicants are checked ad selected by Joint Director of Agriculture (JDA) or Assistant Director of Agriculture (ADA). In the APILIP II, it is proposed that the same online system be utilized and applicants that is future CSUs be selected by JDA or ADA. Further selected applicants that is the future CSUs are definitely instructed to participate the training course at the AMTC before procurement of farm machinery, which are selected by applicants. Selection of CSUs are conducted every two seasons as shown in Figure 11.3.3.

(8) Construction of AMTC As Well As Workshop

In the concept note, followings are proposed.

- AMTC: 2 units for rice and ID Crops

  -AMTC for rice: to be constructed in West Godavari District (the site is not yet decided.)
  -AMTC for ID Crops: to be constructed in Vishakapatnum District (the site is not yet decided.)

- Workshop: 10 units (the sites are decided, depending on the location of CSUs)
  Workshop is constructed for around 10 CSUs

Outline of these facilities are shown in Attachment 11.3.1. However, no detailed plan for construction and management of facilities is not yet available. It is planned that the detailed plan be prepared by the consultant in cooperation with DoA at the initial stage of the implementation period. Construction of facilities shall be supervised by DoA along with other institutes.

(9) Training of Trainers of AMTC

Training of applicants (CSUs) should be carried out by trainers of the AMTC. The trainers of the AMTC are trained by Japanese experts, because they could have limited skills as well as experience such as preparation of rice seedlings with seedling trays, and operation and maintenance of rice transplanter as well. DoA has strong expectation on assignment of Japanese experts on operation and maintenance of farm machinery as well as preparation of rice seedlings.

Two types of trainers such as farm machinery and agronomist are deployed in AMTC. They have certain

experience on operation and maintenance of farm machinery or crop cultivation. However, it is sure that they have limited skills as well as experience on preparation of rice seedlings with seedling tray and also operation and maintenance of rice transplanters. Therefore, Japanese experts are requested for implementation of training of trainers. Meanwhile, local experts to be recruited as counterparts of Japanese experts have mandate to conduct training of applicants on cultivation of ID Crops.

This training of trainers could be carried out before commencement of training of users (CSUs). Especially, it is strongly expected that trainers be required to do preparatory work of rice seedlings for training of users in cooperation with Japanese experts. Further, trainers would have practical suggestion from Japanese expert as well as their counterparts through implementation of training of farmers. Outline of training of trainers are shown as follows:

Table 11.3.6 Subjects for Training of Trainers

Trainers	Subjects
Farm machinery (operation)	- Operation and maintenance of tractor - Operation and maintenance of rice transplanter - Operation and maintenance of rice combine harvesters - Operation and maintenance of other machinery for ID Crops - Operation and maintenance of seedling trays and automatic seeder - Proposed farming practices for rice and ID Crops - Monitoring and evaluation
Farm machinery (maintenance)	- Operation and maintenance of tractor - Operation and maintenance of rice transplanter - Operation and maintenance of rice combine harvesters - Operation and maintenance of other machinery for ID Crops - Operation and maintenance of automatic seeder
Agronomist	- Preparation of rice seedlings with seedling trays and automatic seeder - Proposed farming practices for rice and ID Crops - Monitoring and evaluation

Source: JICA Survey Team

Meanwhile training guidelines for trainers as well as applicants (CSUs) should be prepared by Japanese expert in cooperation with trainers of the AMTC.

(10) Training of Applicants

Training of applicants (CSUs) should be carried out by trainers of the AMTC. As shown in Figure 11.3.3, one training programme for users is arranged in each Kharif and Rabi. Furthermore, training programme for users has two sessions as field training that is (i) land preparation and transplanting/sowing, and (ii) harvesting. Additionally class room training on proposed farming practices, preparation of business plan, and management of CSUs. Outline of training of users are summarized as follows

Table 11.3.7 Subjects for Training of Users (CSUs)

Session	Stage	Subjects in Field Training	Subjects in Class Room Training
1	Land preparation and transplanting/sowing	- Operation of tractor with attachments - Operation of rice transplanter / planters for ID Crops / other equipment - Maintenance of tractors and other machinery - Preparation of rice seedlings with auto seeders	- Preparation of business plan -Management of CSU
2	Harvesting	- Operation of harvesters - Maintenance of harvesters	

Source: JICA Survey Team

(11) Package and Subsidy for Procurement of Farm Machinery

In the concept note, it is proposed that ordinary conditions for subsidy on farm machinery should be applied for procurement of package of farm machinery. Packages in the note are arranged for rice, maize, pulses, and sugarcane as shown in Attachment 11.3.2. However total cost of each package might be expensive that is users can't afford to procure a packaged farm machinery nor to get financial support

from commercial bank. Therefore it is required that users be able to select package or single unit of farm machinery, depending on the financial capacity of users.

(12) Particulars to Be Covered by JICA Loan and Local Budget

It is expected that the following particulars be covered by JICA loan and own budget of DoA:

Table 11.3.8 Particulars to be Covered by JICA Loan and Own Budget of DoA

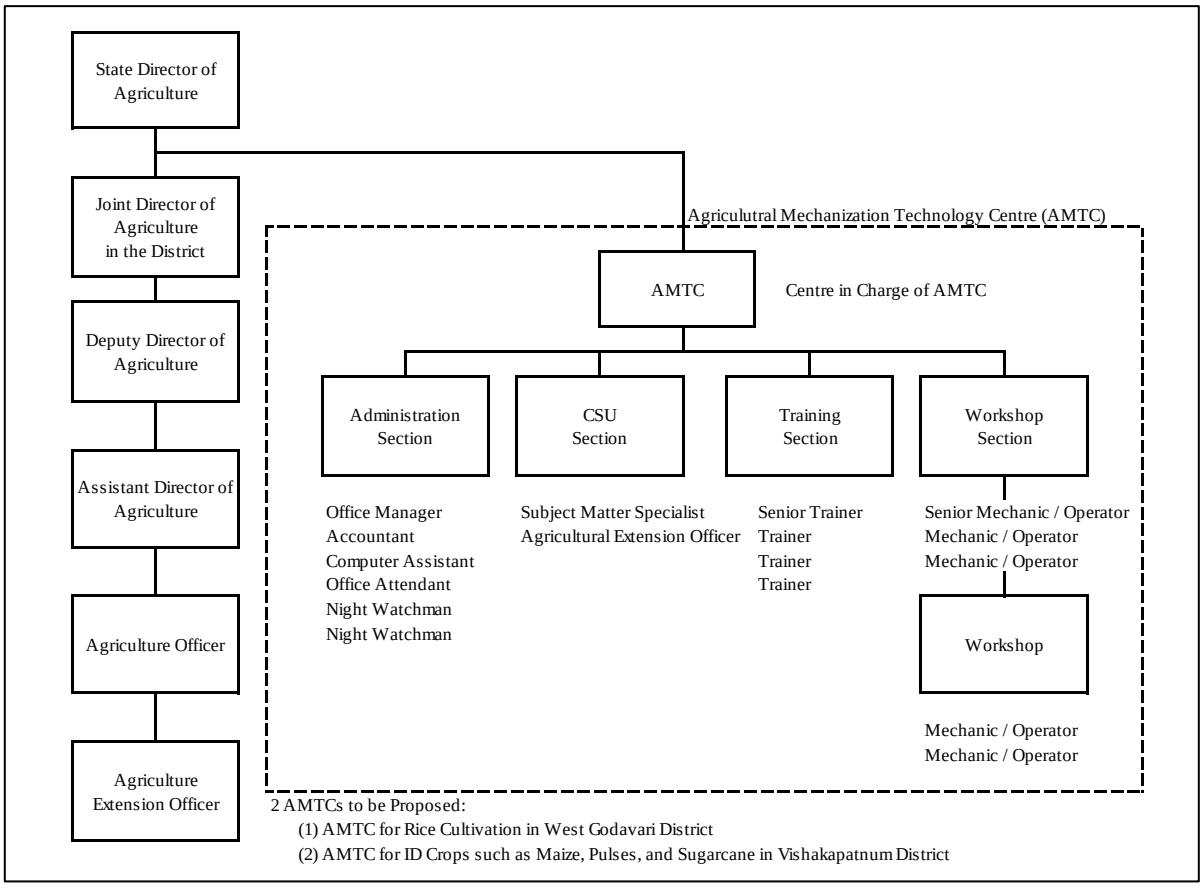
Particulars	JICA Loan	Own Budget of DoA
2 units of AMTC	- Construction cost	-Administrative cost -Maintenance cost of farm machinery, tools and equipment
10 units of workshop	- Construction cost	-Administrative cost -Maintenance cost of tools and equipment
Training activities	- Transportation cost - Lodging and Boarding - Fuel for farm machinery	- Indirect cost for stationary and office equipment
Farm machinery	- Machinery for training purpose	- Subsidy for procurement by users - Maintenance cost for farm machinery

Source: JICA Survey Team, 2016

(13) Organization and staffing for operation and Maintenance of AMTC and Workshop

There are no details on organization and staffing for operation and maintenance of Agriculture Mechanization and Technology Centre (AMTC) and workshop in the concept note. Therefore JICA survey team propose the tentative outline.

AMTC and workshop are required to be managed by DOA. It is expected that executing institutes would be Agriculture Collage, Andhra Pradesh State Agro Industries Corporation Limited (AGROS) or State Agricultural Management and Extension Training Institute (SAMETI). It seems that DOA will prepare the detailed plan for operation and management of AMTC and workshops after getting approval of JICA loan. Further taff shall be permanent staff of DOA and/or other relevant institutes, but not outsourced persons. Organization and staffing are proposed in Figure 11.3.2 and Table 11.3.9, respectively.



Source: JICA Survey Team

Figure 11.3.2 Organization Chart for Agriculture Mechanisation and Technology Centre

Table 11.3.9 Staffing of AMTC and Workshop

Facility	Section	Position	No.
AMTC for Rice	Officer in Charge of AMTC Rice		1
	Administration Section	Office Manager	1
		Accountant	1
		Computer Assistant	1
		Office Attendant	2
		Night Watchman	2
	CSU Section	Subject Matter Specialist	1
		Agricultural Extension Officer	1
	Training Section	Senior Trainer	1
		Trainer	3
	Workshop Section	Senior Mechanic / Operator	1
		Mechanic / Operator	2
	Total		17
AMTC for ID Crops	Officer in Charge of AMTC ID Crops		1
	Administration Section	Office Manager	1
		Accountant	1
		Computer Assistant	1
		Office Attendant	2
		Night Watchman	2
	CSU Section	Subject Matter Specialist	1
		Agricultural Extension Officer	1
	Training Section	Senior Trainer	1
		Trainer	3
	Workshop Section	Senior Mechanic / Operator	1

Facility	Section	Position	No.
		Mechanic / Operator	2
	Total		17
Workshop	10 locations	Mechanic / Operator (2)	20
Total			54

Source: JICA Survey Team

(14) Mandates of AMTC and Workshop

There are no descriptions on duties and mandates of AMTC and workshop in the original concept note. Tentative duties and mandates of AMTC and workshop are shown as follows:

Table 11.3.10 Mandates of AMTC and Workshop

AMTC	Workshop
- Management of AMTC and Workshop - Preparation of annual management plan of AMTC - Preparation of training schedule for CSUs - Preparation of training materials - Training of CSUs, using farm machinery*1 - Monitoring of activities of CSUs as well as workshop	- Repair work of farm machinery, tools and equipment

*Note: *1: refer Attachment 13.3.21*
Source: JICA Survey Team, 2016

(15) Consulting Services

For promotion of farm mechanisation as well as management of AMTC, it is necessary to prepare detailed plan and undertake baseline survey, while local experts are deployed for training and O&M of farm machinery. Breakdown of each activity is shown as follow:

Table 11.3.11 Breakdown of Preparation of Detailed Plan

Particular	Contents
(1) Period	- 3 months
(2) Outputs	- Preparation of detailed design for construction of AMTC and workshop - Preparation of management plan for AMTC and workshop - Preparation of training plan of CSUs with training materials - Preparation of TOR of local experts for AMTC and Workshop operation support - Preparation of plan for monitoring and evaluation on activities of AMTC as well as CSUs
(3) Experts to be deployed	-Engineer: 2 persons - Agronomist: 2 persons - Farm machinery: 2 persons

Note: refer Attachment 13.3.21 for details
Source: JICA Survey Team, 2016

Table 11.3.12 Breakdown of Baseline Survey

Category	Contents
(1) Period	- 3 months
(2) Objectives	Identification of current situation and prevalence of farm machinery in the target regions
(3) Outputs	-Prevalence of farm machinery -Needs and requirement of farmers regarding farm machinery - Constraints on agricultural activities
(4) Experts	-Sociologist: 2 persons -Agronomist: 4 persons

Note: refer Attachment 13.3.21 for details
Source: JICA Survey Team, 2016

Table 11.3.13 Breakdown of Local Experts for AMTC and Workshop Operation Support

Category	Contents
(1) Position of Experts and Deployment Period	- Farm machinery: 2 persons from 2018 to 2022 - Mechanic: 2 persons from 2018 to 2022 - Agronomist: 1 person from 2018 to 2021
(2) Mandate for Farm Machinery Expert	1) Prepare training curriculum and materials on operation and maintenance of major farm machinery in cooperation with Japanese expert 2) Train trainers of AMTC, regarding operation of farm machinery 3) Provide advice and guidance trainers of AMTC on training of members of CSU 4) Assist monitoring and evaluation to be conducted by the AMTC, regarding activities of CSUs
(3) Mandate for Mechanic Expert	1) Prepare training curriculum and materials on operation and maintenance of major farm machinery in cooperation with Japanese expert 2) Train trainers of AMTC, regarding maintenance of farm machinery 3) Provide advice and guidance trainers of AMTC on training of members of CSU 4) Assist monitoring and evaluation to be conducted by the AMTC, regarding activities of CSUs
(3) Mandate for Agronomist	1) Prepare training curriculum and materials on seedling preparation with seedling tray in cooperation with Japanese expert 2) Train trainers of AMTC, who conduct training of members of CSUs, regarding the following subjects: - Preparation of rice seedling with seedling tray - General guidance on rice cultivation - General guidance on crops cultivation plan - General guidance on business plan to be prepared by CSU 3) Provide advice and guidance trainers of AMTC on training of members of CSU 4) Assist monitoring and evaluation to be conducted by the AMTC, regarding activities of CSUs

Note: refer Attachment 13.3.21 for details
Source: JICA Survey Team, 2016

Tentative cost on consulting services is shown in Attachment 11.3.3.

(16) Preliminary Financial Estimate on Management of AMTC

In the concept paper on promotion of farm mechanisation, there are no descriptions for financial status of AMTC. Therefore, annual financial status is preliminarily estimated as follows:

Table 11.3.14 Tentative Annual Expenditure for Management of AMTCs

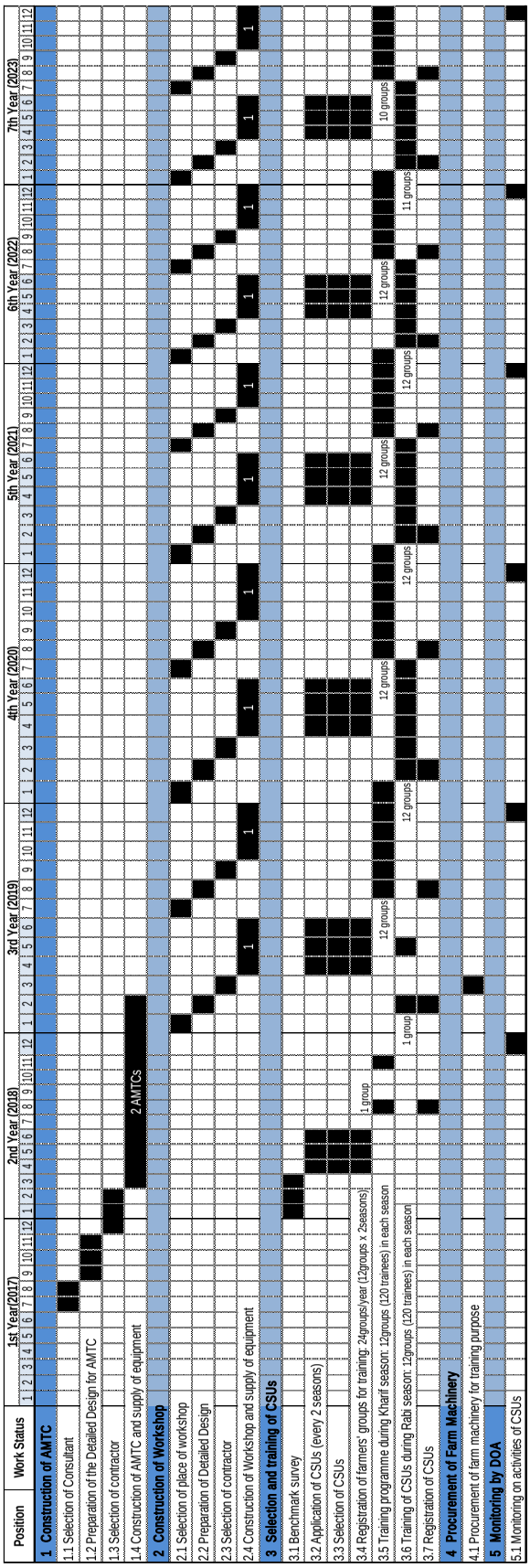
(Unit: INR'000)

Items	AMTC		Workshops (10nos)	Total	Remarks
	Rice	ID Crops			
(1) Manpower	4,440	4,440	4,800	13,680	Refer Attachment 11.3.4
(2) Maintenance for AMTC	360	570	-	930	3% of total cost of machinery
(2) Maintenance for workshop			30	30	3% of total cost of tool/equipment
(3) Training cost	11,000	16,000		27,000	
(4) Miscellaneous	474	630	145	1,249	3% of (1) to (3)
Total	16,274	21,640	4,975	42,889	

Note: refer Attachment 13.3.19 for details
Source: JICA Survey Team, 2016

(17) Implementation Schedule

It is proposed that the construction of facilities as well as training activities in AMTC should be commenced from 2018, as shown in Figure 11.3.3. Further it is expected that the preparatory work for AMTC such as selection of Consultant, preparation of detailed plans, deployment of local experts for promotion of farm machinery, etc. be carried out from 2017.



Source: JICA Survey Team, based on the information of DoA

Figure 11.3.3 Implementation Plan for Promotion of Farm Mechanisation

(18) Monitoring

The purpose of monitoring is to follow up on what AMTC has planned to accomplish and promote farm mechanisation in Andhra Pradesh State. The survey team proposes three-tier monitoring system for the pilot as explained in table below.

Table 11.3.15 Three-tier Monitoring System

Level	Person in Charge of Monitoring	Method of Monitoring
PMC	Farm machinery expert (operation and maintenance) and Agronomist	Attend seasonal monitoring meeting at Department of Agriculture, GoAP Supervise and monitor the overall progress of AMTC activities
Department of Agriculture	A monitoring officer at state level	Organise seasonal monitoring meeting with Office managers of 2 AMTCs and PMC experts Prepare annual progress report and submit to PMU
AMTC	Two persons, one CSU section staff of AMTC for rice and one CSU section staff of AMTC for ID crops are in charge of monitoring.	Organise monthly meeting Submit monthly progress report to State Director of Agriculture Attend seasonal monitoring meeting at Department of Agriculture, GoAP

Source: JICA Survey Team

Farm machinery expert and agronomist assigned for PMC will supervise and monitor overall progress of AMTC activities. They are also expected to attend seasonal monitoring meeting to be held per season (Kharif and Rabi) at Department of Agriculture, GoAP in order to review the progress and outcomes of AMTC activities.

Department of Agriculture will nominate a monitoring officer for AMTC activities and organise seasonal monitoring meeting with Office managers of 2 AMTCs and PMC experts. Department of Agriculture also prepares quarterly progress report and reports to PMU.

At AMTC level, it is expected that CSU Section of AMTC be an executing section of monitoring. Monitoring subjects and indicators required to be done periodically by AMTC are as shown in the table below.

Table 11.3.16 Subjects and Indicators for Monitoring

Subject	Indicators	Remarks	Executed by
(1) Construction of AMTCs and Workshops	- AMTC for rice: 1 location - AMTC for ID Crops: 1 location -Construction schedule	- Detailed plan including construction schedule should be prepared by consultant.	DOA AMTC
(2) Training of CSUs	- CSUs have to take training programmes and get certificate before procurement of farm machinery. - Total target no. of CSUs: 107 CSUs for rice : 45 CSUs for maize: 15 CSUs for pulses: 33 CSUs for sugarcane: 14 CSUs - Training schedule for CSUs should be prepared annually. - Training materials for CSUs should be prepared.	- Training activities are carried out, according to the implementation schedule shown in Figure 11.3.3.	Training Section CSU Section Workshop Section
(3) No. of farm machinery to be distributed to CSUs	- Target requirement of farm machinery is shown in Attachment 13.3.20.	- Requirement of farm machinery is different depending on the situation of each CSU. - Therefore, it is not practical to arrange the target requirement of farm machinery for monitoring.	CSU Section
(4) Business Plan	- Business plan for operation and maintenance of farm machinery should be prepared by each CSU.	- Business plan should be modified every year, depending on work progress of CSU.	Training Section CSU Section

Subject	Indicators	Remarks	Executed by
(5)Management of AMTC	- Financial analysis - Payment to dealers - Annual management plan of AMTC - Annual Work Progress Report	- It is said that some dealers are facing to delay of payment by DOA. This situation should be improved.	Administration Section Training Section CSU Section Workshop Section

Source: JICA Survey Team

(19) Evaluation

PMU will evaluate the progress and achievements of pilot projects of farm mechanisation along with other pilot programs at its regular seasonal meeting based on the report from Department of Agriculture, GoAP.

In addition to regular evaluation activities at PMC, respective pilot projects have baseline survey and endline survey as their activities. Based on the baseline survey, the exact targets will be fixed as evaluation indicators. The level of achievement will be evaluated at the time of the endline survey.

Furthermore, it is expected to arrange some opportunity for information exchange among DOA, AMTC, research organizations, manufacturers, dealers, and CSUs, in order to timely provide trouble-shooting actions and strengthen promotion of farm mechanisation, according to the data obtained from monitoring. The following plans as well as materials might be required to be modified after monitoring, if necessary.

- Annual management plan of AMTC
- Training schedule for CSUs
- Training materials for CSUs

11.4 Conjunctive Use of Surface Water and Groundwater

Conjunctive use of surface water and groundwater is universally defined as “harmonious combined uses of two sources in order to maximise the economic and environmental effects of each and also to optimise the water demand and supply balance”. The total water requirements both in terms of quantity and its timely availability are usually not met fully from surface water or groundwater individually. However, it is possible to meet the water requirements both in quantity and time by conjunctive use of surface water and groundwater. Moreover, the conjunctive use would increase the water use efficiency of the irrigation system. Adopting conjunctive use of surface water and groundwater, it is also possible to control and mitigate the potential problem of water logging and salinity in the command area. The pilot programme is to demonstrate the conjunctive use of surface water and groundwater in a participatory manner as a part of overall approach to water conservation and development indicated below.

11.4.1 Objective

The objective of the pilot programme for conjunctive use of surface water and groundwater is to optimise the utilisation of total water resources available in the command area of irrigation projects, reduce gap ayacut through improving water use efficiency, and improve agriculture production and productivity especially in tail-end command area through timely supplementing insufficient delivery of canal water with groundwater. To develop an institutional model and the process and procedures for the conjunctive use and its acceptability by the WUAs are also objectives of the pilot programme.

11.4.2 Pilot Projects

The pilot projects will be selected form the midst of the medium irrigation projects proposed for APILIP-2, by adopting the following criteria:

- Two pilots from the Rayalaseema Region (Kurnool, Kadapa, Anantapur, and Chittoor districts)
- Tail-end farmers of the designed command area do not receive adequate canal water for irrigation and when it is required as per irrigation schedule
- Insufficient use of water causing water losses
- Availability of adequate groundwater to sustain its use when canal water is not available, and
- WUA has been constituted in the command area for implementing the pilot programme.

Accordingly two pilot projects were tentatively selected, namely (i) Upper Pennar Irrigation Project in Anantapur District and (ii) Araniar Irrigation Project in Chittoor District, with consent of the Department of Water Resource (DoWR), Department of Groundwater (DoGW), and Andhra Pradesh Micro Irrigation Project (APMIP) of Department of Horticulture (DoH). The basic information on these pilots is shown in Table 11.4.1 below.

Table 11.4.1 Basic Information on Pilot Projects

Name of Pilot Project	District	Mandal (Damsite)	Village (Damsite)	Command Area (ha)	Number of Farmers in WUA	Numbers of WUA	Gap Ayacut (%)	Water Use Efficiency (%)
1. Upper Pennar	Anantapur	Ramagiri	Peruru	4,066	3,250	5	53	21
2. Araniar	Chittoor	Pichatur	Pichatur	2,226	4,085*	5	28	73

*Note: *) Number of Land owner*
Source: JICA Survey Team

11.4.3 Activities Under the Pilot Programme

The following activities shown in Table 11.4.2 are envisaged for effective implementation of the conjunctive use of surface water and groundwater in two pilot projects.

Table 11.4.2 Major Activities Under the Pilot Programme

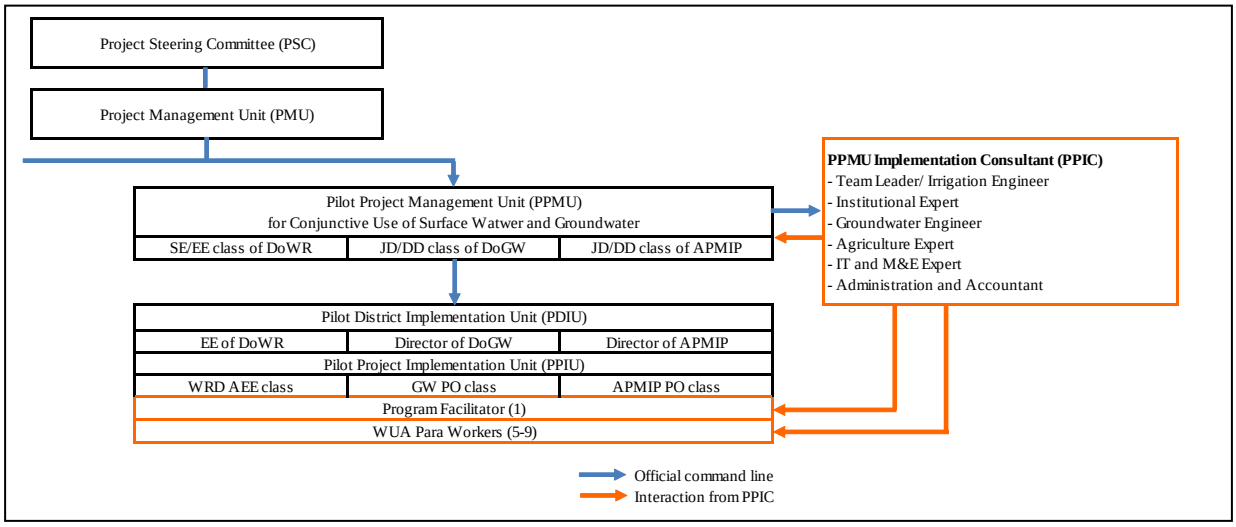
Stage	Activities
First Year	(1) Base line surveys to collect information on surface water and ground water, area irrigated under canal and ground water during different seasons, cropping pattern as also other demographic details. Collection of information on hydrology, groundwater, irrigation, and agricultural practices followed in the pilot area. (2) Conduct social assessment surveys for socioeconomic conditions in the pilot area. (3) Mobilization of the community and building their capabilities to manage available surface and ground water, educating the community about the need for self-regulations for effective use of canal water and changes in agricultural practices, including extensive Informatin, Education and Communication (IEC) campaign to create awareness amongst all water users. (4) Assisting WUAs in preparation of community based action plans for conjunctive use of surface water available from the irrigation system and groundwater available in the aquifer covering the pilot area based on the findings of the baseline surveys and proposals received from and WUAs. (5) Construction and installation of 3 nos. of piezometers and 1 no. of automatic weather station (AWS) in suitable locations in each pilot area and subsequently monitoring groundwater level and metrological data. (6) Promotion of micro irrigation using available dug-wells and bore-wells especially in the tail-end command area. (7) Development of GIS database and updating.
Second Year	(1) Repeating the first year's activities (2) to (4). (2) Continuation of monitoring groundwater level and metrological data. (3) Promotion of micro irrigation using available dug-wells and bore-wells especially in the tail-end command area. (4) Updating GIS database
Third Year	(1) Repeating the second year activities (1) to (4). (2) Terminal evaluation surveys of the pilot programme.

Source: JICA Survey Team

11.4.4 Organisation for Coordination of Pilot Programme

(1) Organisation for Coordination of Pilot Programme

The PPMU will be set up under the PMU as shown in Figure 11.4.1. The PPMU for conjunctive use of surface water and groundwater is one of three sub-units of PPMU. The DoGW will be responsible for implementation of this pilot programme with the support of DoWR and APMIP. These departments will appoint at least one official for PPMU, PDIU, and PPIU.



Source JICA Survey Team

Figure 11.4.1 Proposed Organisations for Pilot Programme

(2) Institutional and Implementation Arrangements

The institutional arrangement at state and district level and implementation arrangement at pilot level are summarised in Table 11.4.3. The PPMU and PDIU are the coordination and regulatory bodies at respective administration levels among the departments concerned. At pilot project level, respective departments shall supervise the activities of PPIC and give technical advice to PPIC in their specific fields under management of the PDIU.

Table 11.4.3 Institutional and Implementation Arrangements of Pilot Programme

(a) Institutional arrangement				
Institutional arrangement	Level	Frequency	Member	Function
Pilot Project Management Unit (PPMU)	State	Monthly	<Head> SPD (DoWR) <Member> JD/DD class of DoWR, DoGW, APMIP	1. Approve annual activity plans and budget for the pilot 2. Review the progress of project on a quarterly basis 3. Facilitate convergence of support measures 4. Facilitate smooth implementation of the project
Pilot District Implementation Unit (PDIU)	District	Monthly	<Head> Director of DoGW at district level <Member> JD/DD class of DoWR, DoGW, APMIP, Team Leader of PPIC	1. Review of progress of project on monthly basis 2. Facilitate coordination between various agencies & departments 3. Facilitate smooth implementation of project at district level
(b) Implementation arrangement				
Organization	Level		Member	Task
DoWR	Pilot Project		<Head> EE/DE class <Member> AEE	1. Supervise PPIC in paticipatory water management 2. Technical advice to PPIC for participatory water management 3. Report to PPMU
DoGW	Pilot Project		<Head> JD/DD class <Member> GW PO	1. Supervise PPIC in groundwater management 2. Technical advice to PPIC for groundwater management 3. Support farmers in construction of farm ponds and bore-wells 4. Report to PPMU
APMIP	Pilot Project		<Head> JD/DD class <Member> APMIP PO	1. Supervise PPIC in horticulture development with micro irrigation 2. Technical advice to PPIC for micro irrigation and horticulture 3. Support farmers for application of micro irrigation facilities 4. Report to PPMU
PPIC	Pilot Project		<Head> Team Leader <Member> - Institutional Expert - Groundwater Engineer - Agriculture Expert - IT and M&E Expert - Administration & Accountant	1. Responsible for project planning, implementation and monitoring 2. Reporting to PDIU 3. Coordinating between DoWR, DoGW and APMIP 4. Supervising and instructing to program facilitator and WUA para workers 5. Preparation and management of documentation of the pilot

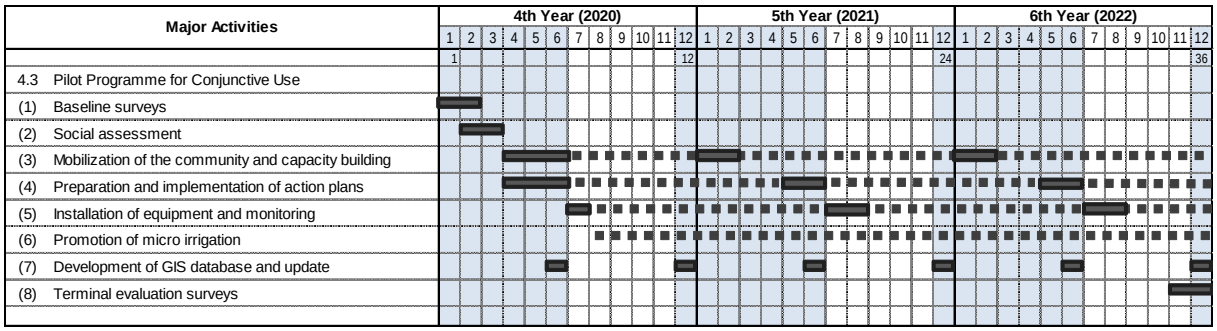
Source: JICA Survey Team

(3) Procurement of PPIC

The PPMU Implementation Consultant (PPIC) will be selected by the PMU in compliance with JICA/GoPA procurement guidelines to execute pilot activities under the guidance of PPIU and PDIU. The PPIC will comprise of six experts as shown in Figure 11.4.1 to provide wide range of services, of which team leader/irrigation and administration/accountant would be on full-time basis and the rest on part-time basis. In addition to the above, a programme facilitator (full-time base) and WUA para workers (part-time base) will be employed out of educated local youths or progressive farmers in the community for each pilot project and they will be trained by PPIC.

11.4.5 Implementation Plan

The implementation schedule is proposed as shown in Figure 11.4.2 below.



Source: JICA Survey Team

Figure 11.4.2 Proposed Implementation Schedule of Pilot Programme

The implementation plan of each activity is described below.

(1) Baseline Survey

First of all, the baseline survey will be carried out by the PPIC with support from the multidisciplinary team called the PPIU headed by the project officer of DoGW under the overall supervision of the PDIU. Detailed hydrogeological survey of the pilot area will include 100% inventory of the existing wells for collecting information pertaining to hydrogeology of the aquifers, depth of wells, water level, seasonal fluctuation of water levels, average yield from irrigation wells, water quality, and present and projected demand of surface water and groundwater for domestic and industrial use in the entire pilot area. Similarly, detailed information pertaining to canal water supplies, rotation of irrigation water supply from the canal, status and condition of canal system, types of crops, cropping pattern, irrigation practices, water requirement of crops during different seasons, and crop economics will also be collected for the pilot areas. The baseline information collected will be used to project the pre-project scenario analysis of which will form the initial part of the project implementation. Results from the baseline survey will provide basic inputs for designing capacity building programme.

(2) Social Assessment

As a second step towards developing an approach and plan for a community based conjunctive use of surface water and ground water, it is proposed to carry out social assessment in pilot areas. The main objective of the social assessment is to identify the social issues associated with the proposed approach of conjunctive use of surface water and ground water and understand its ramifications. The results of social assessment will form the basis to develop a strategy to involve local communities in the overall planning, implementing (including operation and maintenance of structures and systems developed), and monitoring the pilot activities in the pilot project command areas.

(3) Mobilisation of Community and Capacity Building

The PPIC will appoint one programme facilitator (full time base) and WUA para worker, one each for WUA (part time base) for person-to-person communication in the community for each pilot project. The programme facilitator would be trained by the PPIC about the project concept and for effective communication of the project concepts and objectives amongst local community. In addition, the PPIC will also attend to following works:

- Encourage farmers to use groundwater when canal water is in short supply or not available.
- Advise farmers to adjust irrigation schedule depending upon the availability of canal water and switch over to groundwater when canal water is not available.
- Suggest changes in cropping pattern and agricultural practices.
- Canvas training modules and implement vigorous capacity building programme.
- PPIC will work as a liaison between the PPIU and Project Committee (PC)/WUAs.
- Prepare action plan for various activities required for implementation of the conjunctive use of surface water and groundwater in the pilot areas.
- Facilitate execution of physical activities involving PC/WUAs.
- Arrange for supervision and monitoring of works executed by the WUAs including recording of measurement books and quality control.

(4) Preparation and Implementation of Action Plans

The PPIC will support WUAs/farmers in preparation of the following three action plans (shown in Table 11.4.4) for a long terms and the year based on findings of baseline survey and social assessment. Each action plan shall be reviewed by the PDIU and approved by the PPMU of the conjunctive use of surface water and groundwater at the end of the year during implementation of the pilot programme.

Table 11.4.4 Action Plans under Pilot Programme

Action Plan	Major Activities (Tentative)
1) Surface water management action plan	a. Proper use of water at proper time b. Irrigation water requirement c. Irrigation schedule and rotation cycle d. Measurement and recording of canal discharge at diversion points
2) Agriculture action plan	a. Preparation of cropping pattern based on available water and weather forecast b. Promotion of micro irrigation with solar power (APILIP-II funds)

Action Plan	Major Activities (Tentative)
	c. Switching over to low water demanding crops d. Market research for high value crops
3) Groundwater conservation and management action plan	a. Rain water harvesting ponds and farm ponds (GoI/GoAP programme) b. Trenches/diversion work/check dam for surface water storage and recharge to groundwater (GoI/GoAP programme) c. Innovative activities (GoI/GoAP programme) d. Irrigation wells in the command area (GoI/GoAP programme) e. Installation of GW piezometers, AWLR and AWS (APILIP-II funds)

Source: JICA Survey Team

Each WUA para worker will organise a WUA level workshop for preparation of action plans in his/her WUA and thereafter a Project Committee (PC) level workshop with support of the programme facilitator under guidance of the PPIC experts. It is proposed to invite local administrative officers and other stakeholders for the PC level workshops.

Once the action plans are approved by the PPMU, the plan shall be implemented in accordance with the time schedule. The PPIC will prepare a progress report and report it to the PDIU on a monthly basis.

Figure 11.4.3 shows the water harvesting structures that will be promoted by the programme.

- (a) Check Dam (Anantapur)

- (b) Farm Pond (Anantapur) (=10x10x2.5m)

- (c) Dug-Well (Guntur)

Source: JICA Survey Team

Figure 11.4.3 Water Harvesting Structures to be Promoted by the Programme

(5) Installation of Equipment and Monitoring

Piezometers will be installed with automatic water level recorders (Andhra Pradesh standard model of Automatic Water Level Recorder (AWLR)) for continuous monitoring of groundwater levels. The data will be used to estimate seasonal availability of groundwater in the pilot area and would help in planning of conjunctive use of surface water and groundwater during different agriculture seasons. In addition, an automated weather station (Andhra Pradesh standard model of Automatic Weather Station (AWS)) for monitoring meteorological data and an AWLR for measuring reservoir water level will be procured and installed (if not available) at each dam site. Figure 11.4.4 shows images of the major equipment to be procured under the programme.

- (a) AWS for Meteorological Data

- (b) Piezometer with AWLR

(c) Solar Panels for 5 HP Pump

Source: JICA Survey Team (Guntur District)

Figure 11.4.4 Major Equipment to be Procured Under the Programme

In addition to the above, it is proposed to procure scientific equipments such as ground penetrating radar (which uses electromagnetic waves for locating aquifer), seismic refraction unit, tensiometer for measuring soil moisture to plan irrigation schedule, rain-gauges, and water quality testing kits. Satellite data for the pilot area and other critical areas in the state will be procured from Andhra Pradesh Space Applications Centre (APSAC). The indicative list of equipments and satellite data is shown in Table 11.4.5.

Table 11.4.5 List of Equipment and Satellite Data to be Procured

Items	Upper Pennar	Araniar	Total
1. Piezometer with AWLR	3	3	6
2. Automated Weather Station (AWS) including Rain gauge	1	1	2
3. Automatic Water Level Recorder (AWLR) at reservoir	1	1	2
4. Tensiometer	1	1	2
5. Flow Meter	1	1	2
6. Water Quality Testing Kits	1	1	2
7. Satellite Data*	6	6	12

*Note: *) It may be provided by DoGW.*
Source: JICA Survey Team

(6) Promotion of Micro Irrigation

The PPIC in collaboration with DoGW and APMIP will promote micro irrigation for water saving agriculture in the pilot projects especially in tail-end command area. The GoAP initiates the micro irrigation mission in a big way. Micro irrigation has various models out of which farmers would carefully select the best one taking into account his/her cultivation plan. A comparative table of micro irrigation models is given in Attachment 11.4.1. Figure 11.4.5 shows images of micro irrigation models to be promoted under the programme.

- (a) Drip Irrigation (Pomegranate)

- (b) Sprinkler Irrigation (-)

- (c) Raingun Irrigation (Groundnut)

Source: JICA Survey Team (Anantapur District)

Figure 11.4.5 Micro Irrigation Models to be Promoted Under the Programme

(7) Development of GIS Database and Updating

The PPIC will develop a GIS database for both pilot projects. The outputs of baseline survey and social assessment shall be visually depicted by using GIS technologies. The GIS database shall be updated on a six-month interval.

(8) Terminal Evaluation Survey

At the end of the pilot programme, the PPIC will carry out the terminal evaluation survey with technical support from the PPIU and prepare the terminal evaluation report covering inputs and outputs and impacts of the pilot programme along with way-forward.

11.4.6 Inputs, Outcomes, and Key Performance Indicators

The performance matrix of pilot programme as an evaluation tool is proposed as shown in Table 11.4.6.

Table 11.4.6 Performance Matrix of Pilot Programme

Inputs	Outcomes	Indicators
• <Farmer's initiatives> 1. Farm ponds 2. Dug-wells/Bore-wells 3. Crop diversification 4. Active participation in pilot progamme <JICA's Interventions> 5. Baseline surveys including inventory of dug-wells, bore-wells, farm ponds, check dams, etc. 6. Social assessment including. 7. Capacity building to WUA/farmers in terms of better water management 8. Monitoring and evaluation of the work performance and feed-back to lessons learnt to the next year action plan 9. Piezometers, AWLRs and AWS 10.Micro irrigation facilities with solar power	a) Groundwater recharge b) Reduction of Gap Ayacut. c) Improvement of water use efficiency d) Enhancement of agriculture produces and incomes of farmers, especially in the tail-end command area. e) Empowerment of WUAs/farmers for conjunctive use of surface water and groundwater f) Preparation of water bench-marking and water audit reports g) Real time monitoring of groundwater level and meteorological data for groundwater management as well as early warning system of GoAP	a) Seasonal groundwater fluctuation (GW level) b) Seasonal cultivation area (ha) c) Seasonal water use efficiency (%) d) Seasonal average of yield (ton/ha), production (ton) of crops, and farm incomes (INR) e) Combination of items 1 to 4 f) Publication of water bench-marking and water audit reports (Nos.) g) GoAP websites; - CORE Dash- board (http://www.core.ap.gov.in/CMDashBoard/Index.aspx) - Early Warning Centre (http://apsdps.gov.in/pages/early_warning_center.html)

Source: JICA Survey Team

Box 11.4.1 Feedback from APWSIP (WB)

Andhra Pradesh Water Sector Improvement Project (APWSIP) has been implementing with financial assistance by World Bank (WB) since 2010. The conjunctive use of surface water and groundwater pilot in Nagarjuna Sagar Scheme is sub-component C6. From the past three-year operation, some lessons learnt are as follows:

1) Electricity supply is the main constraint for development of irrigation wells especially for areas over 210 m (over rate contract distance) away from the national grid.
2) Awareness programme on crop diversification from high water consuming crops to low water consuming crops is essential.
3) Construction of water harvesting structures such as farm ponds, check dams, and percolation ponds in and around the command area shall be promoted for groundwater recharge in participatory manner.

12. ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

12.1 General

As discussed in the previous chapters, serious negative impact on the natural environment and vulnerable people would not be envisaged under the proposed Andhra Pradesh Irrigation and Livelihood Improvement Project (APILIP-II). However, the proposed project should be implemented in line with the Japan International Cooperation Agency (JICA) Guideline for Environmental and Social Considerations (2010). In this chapter, the environmental and social related information were confirmed based on the relevant guidelines and field observations during the data collection survey period.

12.2 Legislation Related to Environmental and Social Considerations

The Environmental (Protection) Act 1986 is the principal law on protecting and improving the environmental conditions in the country. The act confirms the role of the central government in environmental conservation and other relevant legislations regarding environmental assessment organised in the country. The important legislation, laws, and policies that are related to environmental and social considerations are presented in Table 12.2.1.

Table 12.2.1 Legislations of Andhra Pradesh State Applicable to the Project

No.	Name	Issued	Description
1	Environmental (Protection) Act Amended 1991	1986	This is an umbrella act providing for the protection and improvement of environment and for matters connected therewith. This act authorizes the central government to intervene directly in order to protect the environment and also allows public interest litigation for the same purpose.
2	Environmental (Protection) Rules 1986	1886	This notification provides environmental standard for the industrial development.
3	Environment Impact Assessment Notification	2006	This imposes restrictions & prohibitions on the expansion & modernization of any activity or new projects listed in the Schedule I of the notification unless Environmental Clearance has been accorded by the MoEF.
4	Forest Conservation Act Amended 1988 & 2012	1927 1980	This Act provides the conservation of forests and regulating diversion of forestlands for non-forestry purposes.
5	National Forest Policy	1952 1988	To preserve and restore biological diversity, this notification provides overall management policy in India.
6	Wild Life (Protection) Act Amended 2012	1972	This act provides protection of wildlife and procedure for the notification of National Park and Wildlife Sanctuary.
7	Air (Prevention and Control of Pollution) Act	1981	This act provides the scheme of air pollution control in India. Following this act, the standards related to Air pollution are set by the State Government and the actual control is made by each State Pollution Control Board.
8	Ancient Monuments and Archaeological Sites and Remains Act	1958	The act provides Conservation of Cultural and Historical remains found in India, especially which has existed more than 100 years. The monuments are protected by the act under Ministry of Culture, Archaeological Survey of India (http://asi.nic.in/asi_monu_alphalist.asp) This act is not applicable to the project as project road alignment is not close to Monument declared protected under the act.
9	Environment (Siting for Industrial Projects) Rules	1999	The rule was notified by the Indian government in 1999 providing draft rule for the project siting. This regulates Siting of projects to comply and avoid sites which are environmentally sensitive. The siting of developmental projects in India is managed by Siting Guidelines for activities and projects delineated by the MoEF and the CPCB. The overall purpose of the guideline is to aid proponents in judiciously selecting project sites, keeping in mind various environmental sensitivities. (http://ces.iisc.ernet.in/biodiversity/legis/envrule4.htm) The rules are not applicable, as the project activities will not involve the industrial project.
10	Hazardous Waste (Management and Handling) Rules	1989 2003	For safe handling and disposal of Hazardous waste without affecting the environment, this rule (notification) regulates handling of hazardous substances and identifies persons responsible for discharges and pollution prevention.

No.	Name	Issued	Description
11	Municipal Solid Waste (Management and Handling) Rules	2000	This notification establishes consistent regulations governing collection, segregation, transportation, and disposal of all types of municipal solid wastes.
12	The Noise Pollution (Regulation and Control) Rules, 2000	2000	This is a notification to provide a standard for ambient noise level for 4 categorized area, A) Industrial area, B) Commercial area, C) Residential Area and D) Silence Zone. The silence zone defined as less than 100 meters around hospitals, educational institutions and courts.
13	Water (Prevention and Control of Pollution) Act	1974	This act provides a scheme for preventing water pollution. Under this, State Pollution Control Bard takes a role for actual prevention setting standard in states.
14	Notification on use of Fly Ash	Sept, 1999	This notification provides the use of fly ash for construction material if the project located within a radius of fifty kilometres from coal or lignite based thermal power plants.
15	The Explosives Act (&Rules)	1884	This Act regulates regarding the use of explosives and precautionary measures while blasting and quarrying.
16	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	2013	This Act provides for the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement in the country incorporating previous Act and notifications. The provisions of this Act relating to land acquisition, compensation, rehabilitation and resettlement, shall apply, when the appropriate Government acquires land for its own use, hold and control, including for Public Sector Undertakings and for public purpose.
17	THE Special Economic Zones Act, 2005(No.28, 2005)	2005	The act provides for the establishment, development and management of the Special Economic Zones for the promotion of exports and for matters connected. This includes Procedure for making proposal,
18	Special Economic Zones Rules, 2006	2006	Procedure for establishment of special economic zone, and procedure for establishment of a unit.
19	ACT No. 1 OF 2013 An Act Andhra Pradesh Scheduled Castes Sub-Plan and Tribal Sub-Plan (Planning, Allocation and Utilisation of Financial Resources) ACT, 2013	2013	The act provides framework for the SC and ST development in terms of Planning, budgetary Allocation and institutional arrangement aiming to ensure, accelerated development of Scheduled Castes and Scheduled Tribes with emphasis on achieving equality in the next ten years focusing on economic, educational and human development along with ensuring the security and social dignity and promoting equity among Scheduled Castes and the Scheduled Tribes.
20	Notification dated 28 April 2015. Andhra Pradesh Scheduled Castes Sub-Plan (SCSP) and Tribal Sub-Plan (TSP) (Planning, Allocation and Utilization of Financial Resources) Rules of 2013	2015	The rule ensures the enactment of the Act No.1 in 2013 and provides detail framework of the plan and practical institutional arrangement for the implementation.
21	The scheduled tribes and other traditional forest Dwellers (Recognition of Forest Rights) Act, 2006.	2007	The purpose of this Act is to recognize forest rights to tribal communities who have been occupying the land before the forest laws. The Act grants forest rights to Scheduled Tribes and other traditional forest dwellers. Those are: right to live in the forest land for habitation or for self-cultivation for livelihood; right of ownership, access to collect, use, and dispose of minor forest produce; right to use grazing areas, pastoralist routes, etc.; and right to protect, regenerate or conserve forests and wildlife. Activities such as hunting and trapping shall be prohibited. The Gram Sabha shall be the authority empowered to initiate the process of determining the nature and extent of forest rights and the Act further contains penal provisions and provisions of miscellaneous nature.
22	Panchayats (Extension to the Scheduled Areas) Act, 1996	1996	The Act extends the provisions of Panchayats contained in Part IX of the Constitution to the Schedule Areas. The Act redefines a village based on its people and their customs and traditions. It empowers the Gram Sabha to ensure people centric governance and govern the common property resources.

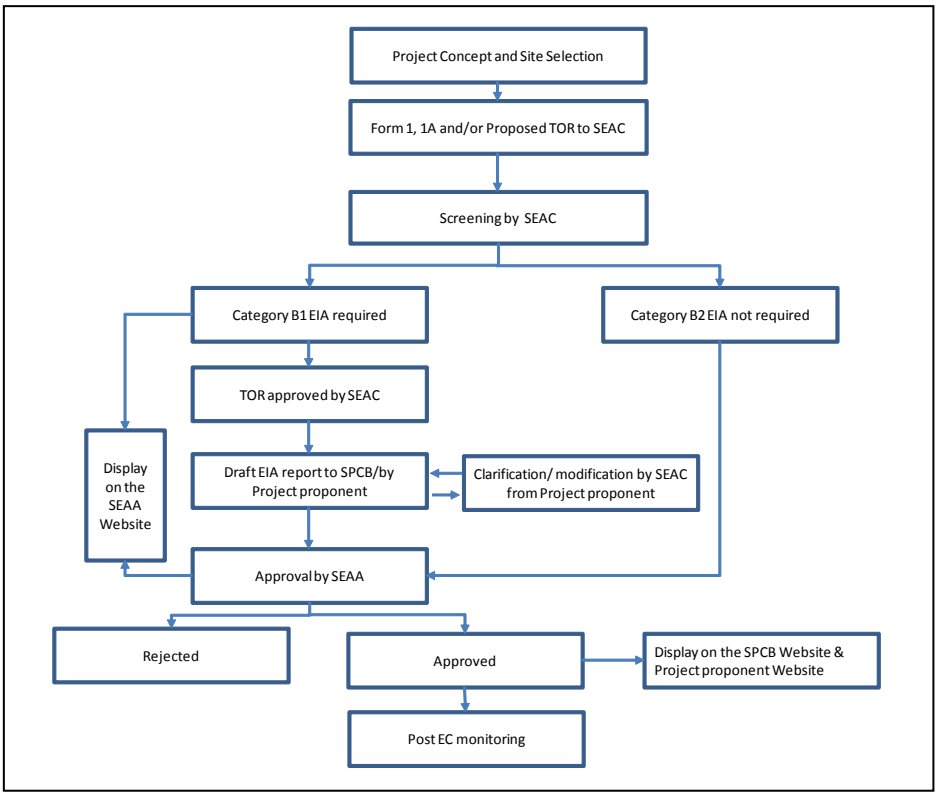
No.	Name	Issued	Description
23	Andhra Pradesh Scheduled Area Laws(Extension and Amendment) Regulation, 1963	1963	The regulation provides some amendment on the legislation related to the Scheduled Area. Those are; 1)The Andhra Agency Rules, 2)the Andhra Pradesh Scheduled Area Land Transfer Regulation, 1959, 3) The Andhra Pradesh(Andhra Pradesh Regulation Areas Money-Lenders Regulation, 1960(Andhra Pradesh Regulation I of 1060) and 4) The Andhra Pradesh(Andhra Pradesh Scheduled Tribes) Debt Relief Regulation, 1960(Andhra Pradesh Regulation II of 1960).
24	Andhra Pradesh Scheduled Areas Land Transfer Regulation,1959 (as amended in 1970, 1971 and 1978)	1959	The regulation limits the land and immovable asset transfer in the Scheduled Areas in AP. Principally the transfer should be within the tribal members.
25	Panchayats Extension to Scheduled Areas Act ,1998	1998	The Act extends the provisions of Panchayats contained in Part IX of the Constitution to the Schedule Areas. The Act redefines a village based on its people and their customs and traditions. It empowers the Gram Sabha to ensure people centric governance and govern the common property resources.

Source: JICA Survey Team based on the legislation analysis (Gazette of India, Faolex, UNDP and Andhra Pradesh State government)

12.2.1 Legislation Related to Environmental Assessment

Implementation of environmental assessment is provided by the Environmental (Protection) Act 1986, and the detailed types of projects and activities are provided by the EIA Notification 2006 and its amendment. Each project is categorised under categories A and B depending on the scale of impact. Category A project should be processed in the central government by the Ministry of Environment and Forest, and Category B project should be processed in the state government by the State Environment Impact Assessment Authority (SEIAA).

In the assessment, there are four steps, namely: screening, scoping, public consultation, and appraisal. After the application to the relevant state/central authority, the screening of the categorisation will be conducted. Based on the category, the scoping of the environmental study will be made and actual environmental study will be conducted by the project proponent. The draft result of the study will be disclosed to the general public through public consultation. Then, the report will be finalised reflecting the public comments during the consultation. The finalised EIA report will be submitted to the ministry and the appraisal process for the environmental clearance will be finally made. The typical flow for the EIA process in Category B is shown in Figure 12.2.1 below.



Source: JICA Survey Team

Figure12.2.1 EIA Process for Category B

The gap analysis between JICA guideline and legislation in India is given in Attachment 12.2.1.

12.2.2 Required Environmental Process for the Components Proposed for the New JICA Project

(1) Overview of the Project Component

There are five major components in the project. The detailed project contents will be determined in the early stage of project implementation. The environmental screening format is given in Attachment 12.2.2. The brief descriptions are shown in Table 12.2.2 below.

Table 12.2.2 Major Project Components

Component	Description
Component 1: Modernisation of Medium and Minor Irrigation Projects	All 13 districts of Andhra Pradesh State -Modernisation works for medium and minor irrigation facilities. The major works include the rehabilitation of tank such as replacement of sluice shutter, installation/amplification/repair of surplus weir, bund strengthening by widening and raising, de-silting and rehabilitation of canal such as strengthening of feeder canals, canal re-sectioning, and repair of structures.
Component 2: Participatory Irrigation Management (PIM)	-Target area will be in and around the proposed medium irrigation clusters. -Target number of WUA is 604 (approximately 253,000 farmers) in the irrigation areas.
Component 3: Promotion of Farmer Producers Organisation (FPO)	-Target area will be in and around the proposed medium irrigation clusters. -Target number of FPOs is 20 (approximately 20,000 farmers).
Component 4: Livelihood Support Programme 4.1 Animal Husbandry 4.2 Fishery	-Target area will be in and around the proposed medium irrigation clusters. 4.1 Animal husbandry improvement activities in the whole state 4.2 Inland fishery improvement activities in West Godavari
Component 4: Pilot Programmes 5.1 Food Value Chains for Strategic Crops 5.2 Farm Mechanisation for Paddy Cultivation	-Pilot programmes targeted for the state and develop mechanisms to increase the competitiveness of the food industry and water management. The programmes contain the following: 5.1 Food value chains development activities mainly targeting the Chittoor District area.

Component	Description
	5.2 Farm mechanisation targeting the Northern Region (Srikakulam, Vizianagaram, and Visakhapatnam districts), East Godavari and West Godavari districts.

Source: JICA Study Team

A sample environmental screening format and JICA environmental checklist are given in Attachment 12.2.2.

(2) Modernisation of Medium and Minor Irrigation

Irrigation project was classified as one of the river valley projects under EIA Notification 2006 and it has been changed slightly to clearly express this in a recent amendment. Modernisation of medium irrigation project may be related to the following:

- EIA Notification 2006 (S.O. 1533, 2006), Article 7(ii): Prior Environmental Clearance Process for Expansion or Modernisation or Change of Product Mix in Existing Projects;
- EIA Notification 2006 (S.O. 1533, 2006), Item 1(c) in Schedule: List of Projects or Activities Requiring Prior Environmental Clearance; and
- Amendment of EIA Notification 2006 (S.O. 1599, 2014), Article 1. For item 1(c) and the entries relating thereto, the following item and entries shall be substituted:

"1(c)	(i) River Valley projects (ii) Irrigation projects	(i) ≥ 50 MW hydroelectric power generation; (ii) ≥ 10,000 ha. of culturable command area.	(i) < 50 MW ≥ 25 hydroelectric power generation; (ii) < 10,000 ha. > 2000 ha. of culturable command area.	General condition shall apply. Note:- Category 'B' river valley projects falling in more than one state shall be appraised at the central Government Level...";

Source: Gazette of India (S.O. 195, 2009)

- d) Amendment of EIA Notification 2006 (S.O. 195, 2009), (I): In para 2, after sub-para (3), the following shall be inserted:

"However, modernisation or expansion proposals without any increase in pollution load and, or without any additional water and or land requirement, are exempted from the provisions of this notification.

Provided that, a self certification, stating that the proposal shall not involve any additional pollution load, waste generation, or water requirement, be submitted to the regulatory authority by the project proponent."

The actual requirement should be officially confirmed based on the discussion between the Department of Water Resources and SEIAA, e.g., pollution control board or EIAA and central pollution board in each project depending on the scale.

(3) Agriculture

There is no particular regulation in agriculture development in terms of environmental clearance. However, if the work involves some industrial works relevant to agriculture, such as factories of fertiliser and pesticides requiring chemical fertilisers, the pesticide industries are required to conduct EIA study under Category A of the EIA notification. Also, it is required for sugar industry if the scale is equal or more than 5,000 tcd cane crushing capacity. Also, if the project involves some construction work and it may require clearance as mentioned in "8(a) Building and construction projects equal or more than 50,000 sqm and equal or more than 150,000 sqm if it is in the built-up area", it shall be under Category B.

Currently, any large-scale construction work has not been planned within the agriculture development scheme in Component 2 and Component 3. However, the project scheme has not been fixed yet at the time of this environmental study.

(4) Food Park

In terms of food park development, the relevant activities are described in " item 7(c) industrial estates/parks/complexes/areas, export processing zones (EPZs), biotech parks, leather complexes in physical infrastructure including environmental services" in the Schedule I under the EIA Notification 2006. The category is shown in Table 12.2.3 below.

Table 12.2.3 Environmental Category for Activities Related to the Food Park Development

Project Activity	Category with Threshold Limit		Conditions if Any
	A	B	
7	Physical Infrastructure including Environmental Services		
7(c) Industrial estates/parks/complexes/ areas EPZs, biotech parks, and leather complexes	If at least one industry in the proposed industrial estate falls under Category A, the entire industrial area shall be treated as Category A, irrespective of the area. Industrial estates with area greater than 500 ha and housing at least one Category B industry.	Industrial estates housing at least one Category B industry and area < 500 ha. Industrial estates with area > 500 ha and not housing any industry belonging to Category A or B.	Special condition shall apply. Note: Industrial estate with area below 500 ha and not housing any Category A or B industry does not require clearance.

Source: EIA Notification 2006, India

12.2.3 Related Organisation for the Environmental Process in Andhra Pradesh State

(1) The Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India

The MoEFCC is the nodal agency under the administrative structure of the central government for the planning, promotion, coordination, and overseeing of the implementation of India's environment and forest policies and programmes including climate change issues. The primary concerns of the ministry are the implementation of policies and programmes relating to conservation of the country's natural resources including its lakes and rivers, its biodiversity, forests and wildlife, ensuring the welfare of animals, and the prevention and abatement of pollution. Whilst implementing these policies and programmes, the ministry is guided by the principle of sustainable development and enhancement of human well-being.

(2) SEIAA and State Expert Appraisal Committee (SEAC) in Andhra Pradesh State

The EIA Notification 2006 provides for the constitution of an SEIAA which is empowered to grant environmental clearance to Category B projects to mitigate pollution and protect the environment, which is an essential prerequisite to start the project. To assist this authority, SEAC is constituted. SEAC will scrutinise the project proposals and forward its recommendations to the SEIAA for making the decision on environmental clearance.

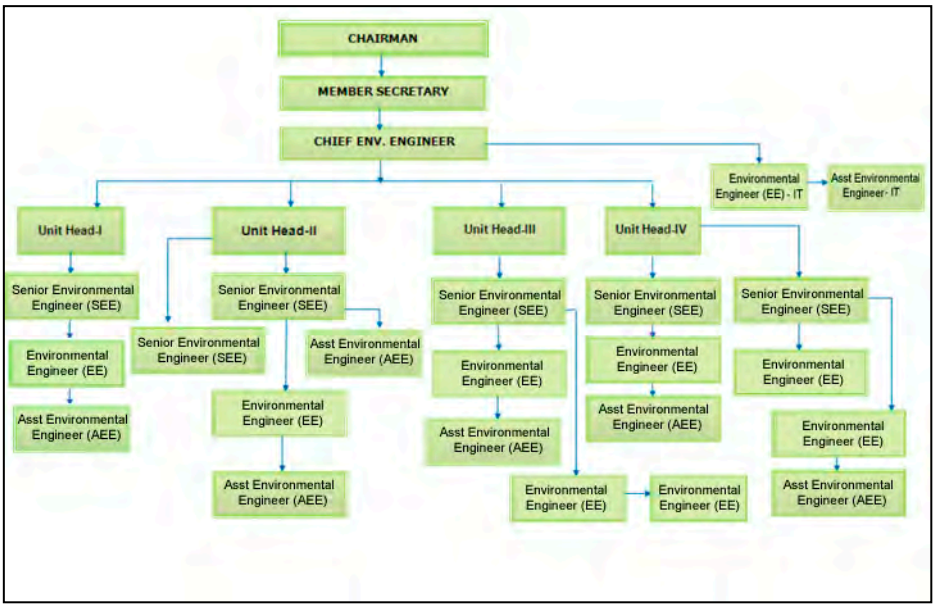
Upon the recommendations of the Government of Andhra Pradesh State, the Government of India notified, vide S.O 2618 (E) on 13 October 2014, the constitution of three members of SEIAA and 15 members of SEAC for Andhra Pradesh for a term of three years.

(3) Andhra Pradesh State Pollution Control Board

The Andhra Pradesh State Pollution Control Board (PCB) is the nodal agency for pollution control in the state and for processing environmental clearance. The Andhra Pradesh State PCB has a coordinating role for the SEIAA as the secretariat.

Currently, the environmental clearance can be applied through the "Online Submission and Monitoring of Environmental Clearances" webpage (http://environmentclearance.nic.in/). All applications (Category A and Category B) can be through the internet.

The organisation chart of the Andhra Pradesh PCB is shown in Figure 12.2.2 below. The unit head-1 is in charge for the consent for establishment (CFE); unit head-2 is for the water assessment, education, assembly and municipal solid waste; unit head-3 is for the environmental clearance, legal and training including EIA; and unit head-4 is for the consent for operation (CFO), hazard waste and planning.



Source: Andhra Pradesh State Pollution Control Board

Figure 12.2.2 Organisational Structure of Andhra Pradesh State Pollution Control Board

12.3 Check Items and Their Description

12.3.1 Screening during Categorisation

In line with the JICA Environmental and Social Guidelines (2010), the information relevant to the project screening during categorisation were organised as shown in Table 12.3.1 below.

Table 12.3.1 Environmental Items to be Considered at the Project Screening

Environmental Items	Sub-items	Situation
Environmentally sensitive items	Involuntary resettlement; Large-scale groundwater pumping; Large-scale land reclamation, land development, and/or land clearing; and Large-scale logging	-In principle, the irrigation project is planned to avoid any new land acquisition because all the sub-projects consist of the rehabilitation of already existing irrigation facilities. Hence, no involuntary resettlement is anticipated. However, resettlement should be avoided during the detailed design stage. -Agriculture component may involve some pilot activities to use groundwater for cultivation. Groundwater use should be considered to avoid/minimise impact. -Value chain component may involve some small-scale facility construction on the available land where any involuntary resettlement is not involved.
Environmentally sensitive area	Natural Environment 1) Protected area (e.g., National Parks) 2) Primeval forests and tropical natural forests 3) Ecologically important habitats 4) Habitats of endangered species protected under local laws or international treaties 5) Areas that run the risk of a large-scale increase in soil salinity or soil erosion 6) Remarkable desertification areas	-A medium project, the Siva-Basham medium irrigation scheme, partly fell into the area of the Nagarjunasagar-Srisailam Sanctuary, (Nagarjunasagar-Srisailam Tiger Reserve), in Kurnool District. The proposed project may contain some maintenance works for the facilities. These are road improvement (part of the current 4 km maintenance road), additional field office (approx. 5 m x 5 m with 2F) on the top of the dam body serving as store shed the ground floor, solar system illumination, and 0.7 km of canal lining and standby generator installation. The impact of the work is very limited however adequate permission should be taken. - For selection of the target area in fishery activity in West Godavari should coordinate with the Wildlife Authority to avoid impact to protected area, Kolleru Lake Wild Life Sanctuary (WLS). The majority of the area of Kolleru Lake WLS, the biggest freshwater natural lake in India in West Godavari, a Ramsar Site in the United Nations Educational, Scientific and Cultural Organization (UNESCO), has been converted to fishpond even in the area of WLS. Since 2006, the sanctuary authority is trying to remove/rehabilitate these ponds but has not succeeded yet. The area is not easily identified on the ground.
	Social Environment 1)Areas with unique archaeological, historical, or cultural	-Project area has not been fixed yet. However, there are some scheduled areas where there are scheduled tribes (defined in the fifth schedule in the constitution) in the Andhra Pradesh State in Northern Region (Srikakulam, Vizianagaram, and Visakhapatnam districts), East Godavari and West

Environmental Items	Sub-items	Situation
	value 2) Areas inhabited by ethnic minorities, indigenous peoples, or nomadic peoples with traditional ways of life, and other areas with special social value.	Godavari districts. Some minor tank irrigation projects are within Madugula mandal in Vishakhapatnam, Addateegala and Gangavaram mandals in East Godavari, which are declared as a mandal fully covered by scheduled area. Because of the project scale, large-scale impact may not be associated for the rehabilitation of minor tanks. However, adequate countermeasure should be taken based on the sufficient understanding of the people when some impacts/issue will be identified.
Permits and Explanation		Regarding the Environmental Clearance; In case of modernisation of medium irrigation project, which has 2,000 ha or more command area, environmental clearance will be required based on EIA Notification 2006. However, in case the project is "without any increase in pollution load and/or without any additional water and/or land requirement", the process can be simplified when the proponent provides a self certification, stating that the proposal shall not involve any additional pollution load, waste generation or water requirement, to the regulatory authority. (Amendment of EIA Notification 2006 (S.O. 195, 2009))

Source: JICA Study Team

12.3.2 Present Situation of the Project Site

The project area extends over the Andhra Pradesh State including the irrigation facilities in all the 13 districts. The environmental situations of the project area are summarised in Table 12.3.2 below.

Table 12.3.2 Summary of Social and Natural Environmental Conditions

Items		Summary
Social Conditions	Economic Activity	Agriculture is the main activity in Andhra Pradesh State and it accounts for 15% of the gross state domestic product (GSDP). Some other major sectors are trade and hotel (13%), real estate (10%), construction (9%), and livestock (7%). Agriculture-related workers are more than 60% of total workers in the state consisting of agriculture labour (48%) and cultivator (14%).
	Settlement Social Structure	Total population of 49 million people are living in the area of 162,000 km^2 and population density is 304 persons per km^2. Approximately 70% of the total population are living in rural area and 30% are living in urban area. Literacy rate of the state is 67.4 % (male: 74.8% and female: 60% in 2011 census)
		The state has comparatively high rate of scheduled tribes. The scheduled caste population is 17.1% and the scheduled tribe population is 5.3%. There are scheduled areas (fifth schedule in constitution) in Northern Region (Srikakulam, Vizianagaram, and Visakhapatnam districts), East Godavari and West Godavari districts.
	Land Use	Predominant land use in Andhra Pradesh State is agriculture and it accounts 48.2% of the state land. For other land use, the forest area is 20.5%, fallow area is 10.9%, waste land is 9.8%, water bodies is 5.6%, built-up area is 2.5%, aquaculture is 1.1%, wetland is 1%, and industrial and mining built up area is 0.5%. At the district level, the rates of agriculture area range from 34.2% in Visakhapatnam to 66.2% in West Godavari while Krishna, Guntur, and Srikakulam have nearly similar rates of 65.6%, 64.6%, and 63.4%, respectively. Forest areas range from 7.0% in Krishna to 38.8% in Visakhapatnam.
	Poor Population Data	In Andhra Pradesh State, the poverty rates are 10.96% in the rural area, 5.81% in the urban area, and 9.20% for both rural and urban areas (Planning Commission 2011). Srikakulam has the highest poverty rate of 15.3%, while West Godavari has the lowest rate of 4.6%.
	Infrastructure and Public Facilities	In the 13 districts, there are many existing public facilities and infrastructures. There are eight operational airports/airstrips and six operational seaports. There are nine hydropower plants and three operational thermal power stations.

Items		Summary
	Heritage	There are also several structures in terms of religious architecture in Andhra Pradesh State. The archaeological survey of India provides the list of protected monuments in Andhra Pradesh State (http://asi.nic.in/asi_protected_monu_andhra.asp). Based on the Archaeological Sites and Remains Act, 1958, the number of monuments are the following: 7 in Srikakulam; 3 in Vizianagaram; 8 in Visakhapatnam; 14 in East Godavari; 6 in West Godavari; 4 in Krishna; 32 in Guntur; 20 in Prakasam; 8 in Nellore, 12 in Kadapa; 23 in Kurnool; 34 in Anantapur; and 14 in Chittoor districts with a total of 185 protected monuments in Andhra Pradesh State. Currently, Amaravathi in Andhra Pradesh State is in the tentative list as UNESCO world heritage.
	Hygienic Condition	Andhra Pradesh has the sixth highest prevalence of acquired immune deficiency syndrome (AIDS) in the country. Provisional estimates put the number of people living with human immunodeficiency virus (HIV) at 2,500,000 in India and 300,000 in Andhra Pradesh State. 94% of the infection is through sexual transmission, 4% through transmission from parent to child, 0.6% through injection of drugs, and 0.4% through blood and blood products (Andhra Pradesh Socio Economic Survey 2014-2015).
	Hazard	Andhra Pradesh State is located in the eastern coast of southern India having the longest coastline (972 km) among all the states in India. The state is one of the disaster-prone states in terms of flood, drought, and cyclone. A moderate to severe intensity cyclone can be expected to make landfall every two to three years. The cyclones mainly develop in the pre-monsoon (April to May) and post-monsoon seasons (October to December) but most of them tend to form during the month of November. For approximately 110 years (1891-2010), 71 cyclones hit the Andhra Pradesh State. For drought disaster, out of 13 districts, Anantapur, Chittoor, Kadapa, Kurnool, and Prakasam are recognised as disaster-prone districts. The record in recent years shows that drought was declared by the Andhra Pradesh government in 15 out of 19 years (from 1995-1996 to 2014-2015).
Natural Environment	Topography	Andhra Pradesh State is located in the eastern coast of southern India and is bordered by Maharashtra, Chhattisgarh and Orissa in the north, the Bay of Bengal in the east, Tamil Nadu in the south, and Karnataka in the west. In the state, three distinct physical zones can be distinguished, namely: i) coastal plains, ii) Eastern Ghats, and iii) western pen plains. The coastal plains stretch along the state's coast from the northernmost point in Srikakulam District to the southernmost point in Nellore District. The shallow freshwater lake of Kolleru is located in the middle of this region covering an area of about 260 km2 during the rainy season.
	Geology	The state area extends from the undulating hills of the eastern Ghats to the tropical plateau in the coastal plain connecting to the Bay of Bengal. Topographically, undulating hills are predominant feature and the pre-Cambrian granite gneiss is a major rock in the area. -Andhra Pradesh State area – hard rock – granites, gneiss, shales, laterites, conglomerate with absence of major faults In terms of seismic zone in Andhra Pradesh State, the Godavari River and south coast area from Godavari Estuary fall into Zone III Moderate Damage Risk Zone (MSK VII) and other areas fall into Zone II Low Damage Risk Zone (MSK VI or less)
	Climate	The state has a tropical climate with moderate to subtropical weather. The southwest monsoon accounts for about 70% of the annual rainfall in the state. The state generally receives reasonably widespread rainfall across various districts. The rainfall is received from both the southwest and northeast monsoons, predominantly the former, but precipitation varies across the state. There are six agri-climatic zones, namely: I) high altitude and tribal areas zone; II) north coastal zone; III) Godavari Zone; IV) Krishna Zone; V) southern zone; and VI) scarce rainfall zone.
	Hydrology	There are three main river basins covering the state, namely: Godavari, Krishna, and Pennar River basins. These are the major rivers and there are tributaries and 17 other rivers like Sarada, Nagavali, Musi, and other streams. The Godavari, with a length of 1,464 km, about 772 km of which lies within the state, is the longest and the broadest river in South India.

Items		Summary
	Flora and Fauna	The state has wide and varied vegetation types enriched by a variety of flora and fauna. Its varied topography ranging from the hills of Eastern Ghats and Nallamallais to the shores of Bay of Bengal supports varied ecotypes, which in turn support a rich diversity of flora and fauna. The vegetation found in the state is largely of dry deciduous type with a mixture of Teak, Terminalias, Dalbergias, Pterocarpus, and Anogeissus. As per Champion and Seth's classification, the forests of the state fall under southern moist mixed deciduous forest, littoral swamp forest, dry teak forest, dry red sanders bearing forest, southern dry mixed deciduous forest, dry deciduous scrub, dry savannah forest, hardwickia forest, dry bamboo brakes, southern thorn forest, dry scrub forest, tropical and dry evergreen forest types. The faunal species in the state are varied which includes tiger, panther, wolf, wild dog, hyena, sloth bear, gaur, black buck, chinkara, chowsingha, nilgai, cheetal, sambar, and a number of birds and reptiles. The long sea coast provides the nesting ground for sea turtles, and the back waters of Pulicat Lake are the feeding grounds for flamingos and grey pelicans. The estuaries of Godavari and Krishna rivers support rich mangrove forests with fishing cat and otters as keystone species. There are some rare and endemic plants species in the state and those are cycas beddomei, pterocarpus santalinus, terminalia pallida, syzygium alternifolium, shorea talura, and shorea tumbuggisilotum nudam. Similarly, the double banded or the Jerdon's courser, golden gecko and slender loris are the rare, endangered, and endemic fauna in the state.
	Protected Area	There are 16 legally protected areas in Andhra Pradesh State consisting of 13 wildlife sanctuaries and three national parks. Besides these areas, there are some other conservation areas in India including 17 important coastal and marine biodiversity areas (ICMBAs), 14 important bird areas, one biosphere reserve and one Ramsar site, although these are not currently legally protected.
Pollution	Air Pollution	The Andhra Pradesh PCB monitors ambient air qualities at major city area in each district (25 monitoring points in 2014-15) in terms of respirable suspended particulate matter (RSPM) (PM10), total suspended particulate matter (TSPM), SO2, NOx, NH3, and CO. The results show that RSPM values tend to be high although the other values of SO2, NOx, NH3 and CO are still within the standard values (annual average).
	Water Pollution	The Andhra Pradesh PCB monitors the water qualities in the major rivers and their tributaries (monthly), canals and drains (monthly), and wells (half yearly). The water quality of the Godavari River is monitored in terms of pH, total dissolved solid (TDS, mg/L), dissolved oxygen (DO, mg/L), hardness (mg/L), total.coliform (T.coli, MPN/100 mL), and fluoride (F, mg/L) in the middle of the river at Polaravaram in West Godavari to Dawaleswaram in East Godavari. The results in 2014-2015 show that pH ranged between 7.33 and 7.84, TDS ranged from 174 to 213, DO ranged from 5.3 to 5.6, BOD ranged from 1 to 1.1, hardness ranged from 84 to 109, T.coli ranged from 143 to 260, and F ranged from 0.40 to 0.5. Except the value of T Coli, these values meet the class A category of the central pollution control board (CPCB). The water qualities of the Krishna River are monitored for the same parameters as for Godavari in between Srisailam in Kurunool and Hamsaladeevi in Krishna. The results in 2014-2015 show that pH ranged between 7.2 and 7.9, TDS ranged from 382 to 436, DO ranged from 5.11 to 7.2, BOD ranged from 0.6 to 2.4, hardness ranged from 125 to 3,469, T.coli ranged from 523 to 1529, and F ranged from 0.30 to 0.70. Although the value of DO and BOD are comparatively well maintained, TDS and T Coli values are very high especially in Hamsaladeevi, near the estuary.

Source: Planning Department Andhra Pradesh (May 2014), Andhra Pradesh State Statistical Abstract , Webpage in Districts and Andhra Pradesh Pollution Control Board (2015), Annual Report 2014-2015 and others.

12.3.3 Preliminary Environmental Evaluation

Further study for environmental and social consideration is required based on the information finalised as project plan. As tentative confirmation using open source satellite image, primary environmental evaluation is conducted as shown in Attachment 12.3.1 and briefly presented in Table 12.3.3 below.

Table 12.3.3 Preliminary Environmental Evaluation for Andhra Pradesh Irrigation and Livelihood Improvement Project (APILIP) II

Classification	No.	Items	Rating
Social Environment	1	Involuntary resettlement	C
	2	Local economy such as employment and livelihood	B+
	3	Land use and utilisation of local resources	B+
	4	Social institutions	B+
	5	Existing social infrastructures and services	B+
	6	Poor, indigenous, and ethnic people	C/B+
	7	Misdistribution of benefit and damage	C
	8	Historical and cultural heritage	D
	9	Local conflict of interests	B+
	10	Water usage or water rights and rights of common	B-/B+
	11	Sanitation	D
	12	Hazardous (risk) infectious diseases such as HIV/AIDS	B-
Natural Environment	13	Topographic and geographic features	-
	14	Groundwater	C
	15	Soil erosion	B-
	16	Hydrological situation	B-
	17	Coastal zone	D
	18	Fauna and flora and biodiversity	B-/ B+
	19	Protected Area	C
	20	Meteorology	D
	21	Landscape	D
	22	Global warming	D
Pollution	23	Air pollution	B-
	24	Water contamination	B-
	25	Soil contamination	B-
	26	Waste	B-
	27	Noise and vibration	B-
	28	Ground subsidence	D
	29	Offensive odour	D
	30	Bottom sediment	D
	31	Accidents	B-

Rating: A-: Serious impact is expected, if any measure is not implemented against the impact; B-: Some impact is expected, if any measure is not implemented against the impact; C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses.); D: No impact is expected; A+: Remarkable effect is expected due to the project implementation itself and environmental improvement caused by the project; and B+: Some effect is expected due to the project implementation itself and environmental improvement caused by the project.

Source: JICA Study Team

12.3.4 Possible Mitigation Measure

The environmental management plan (EMP) should be finalised during the detailed design stage in accordance with the further detailed project report (DPR) preparation. Here, the expected mitigation measures in the EMP are tentatively presented as shown in Attachment 12.3.2 and briefly provided in Table 12.3.4 below.

Table 12.3.4 Tentative Mitigation Measure for the Potential Impact in APILIP-II

Classification	No.	Items	Rating
Social Environment	1	Involuntary resettlement	C
	2	Poor, indigenous, and ethnic people	C
	3	Misdistribution of benefit and damage	C
	4	Local conflict of interests	B-
	5	Water usage or water rights and rights of common	B-
	6	Hazardous (risk) infectious diseases such as HIV/AIDS	-
Natural	7	Groundwater	C

Classification	No.	Items	Rating
Environment	8	Soil erosion	B-
	9	Hydrological situation	B-
	10	Fauna and flora and biodiversity	B-
Pollution	11	Air pollution	B-
	12	Water contamination	B-
	13	Soil contamination	B-
	14	Waste	B-
	15	Noise and vibration	B-
	19	Accidents	B-

Source: JICA Study Team

12.3.5 Action to be Taken by the Implementing Agency

The project details will be determined in the early stage of project implementation. Detailed environmental situation should be confirmed after the scheme is fixed. Some recommendable actions are presented in Table 12.3.5 in order to implement the project on schedule.

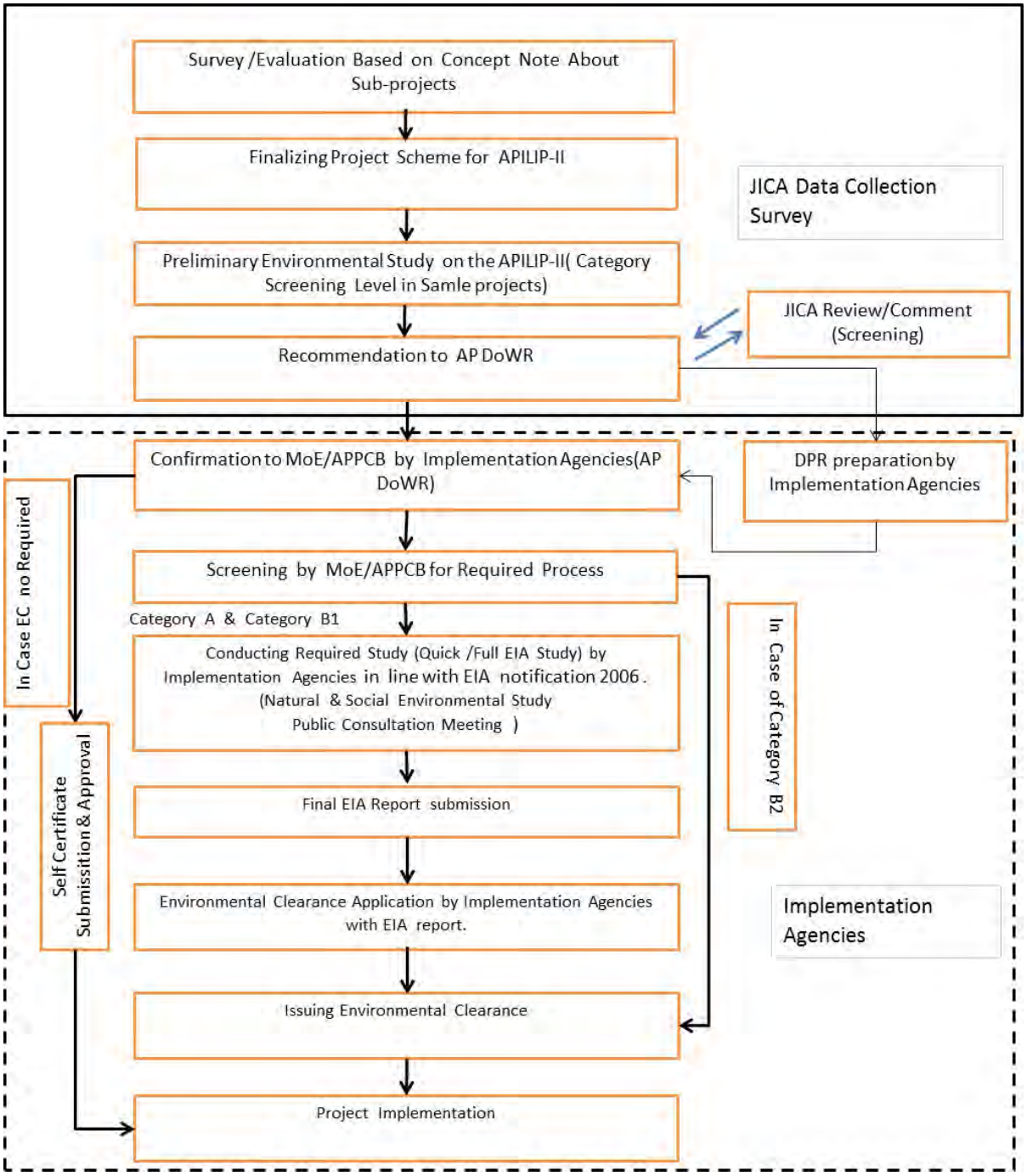
Table 12.3.5 Draft Monitoring Plan for APILIP-II

Monitoring items	Mitigation measures to be taken in the Project	Method of confirmation	Implemented By	Frequency and expected time
Design and Pre-construction phase				
Avoidance of Involuntary resettlement	1.Confirmation of the DPR whether it does not involve resettlement	Detail Project Scheme	DoWR/ PMU	Once after completion of DPR.
Confirmation of Impact to Forest Dwellers	1.Confirmation of Forest Dweller's involvement 2.Preparation of Frame Work for Forest Dweller Plan 3.Preparation of Forest Dweller Plan if the project impacts them 4.Implementation of the Plan 5.Information disclosure	Detail Project Scheme	DoWR/ PMU	Once after completion of each process (All individual projects should be confirmed)
Environmental Clearance(EC)	1. Confirmation of required process for each sub-projects 2. Implementation of Required process 3. Obtaining Approval from SEIAA(If applicable) 4. Developing a necessary management plan and monitoring plan for construction	Submission relevant documents (photocopy of Approval letter, application documents)	DoWR/ PMU	Once after completion of each process (All individual projects should be confirmed)
Construction Phase				
Implementation of Forest Dwellers Plan (If the project impacts them)	Based on the Approved plan, adequate monitoring should be taken	-Relevant documents -Monitoring Sheet in the Plan	DoWR/ PMU	Once every 6 months during project implementation / construction
Pollution generated by the projects such as soil erosion, water quality and dust preventions.	To be determined depending on the scale of works based on the Instruction on the EC/ National Building Code of India 2005 /Standards in AP pollution Control Board	-Relevant documents -Monitoring Sheet	Consultant/ Contractors	To be determined depending on the scale of the project
Grievance from the local residents	Grievance	Record of grievance	DoWR/ PMU	Once every 6 months during project implementation / construction
Operation Phase				
Grievance from the local residents	Grievance	Record of grievance	DoWR/ PMU	Once after completion of bridge

Source: JICA Study Team

(1) Regarding the Environmental Clearance

The implementation agency, i.e., the Department of Water Resources (DoWR), should officially confirm the requirement of environmental clearance after finalising the project scheme. The proposed project involves the modernisation of irrigation facilities. As mentioned in earlier section, even in the case of modernisation project, the project is also subject to environmental clearance in line with the EIA Notification 2006. If the scale of the command area is equal or more than 10,000 ha, the project may be handled by the central government, through the Ministry of Environment, Forest and Climate Change (MEFCC). If the scale is equal or more than 2,000 ha to less than 10,000 ha, the project will be handled by the State Environmental Impact Assessment Authority (SEIA), e.g., Andhra Pradesh State PCB can be consulted regarding the situation. Appropriate process should be implemented prior to the project implementation.



Source: JICA Study Team based on EIA Notification 2006

Figure 12.3.1 Expected Environmental Process Taken by Implementing Agencies

(2) Regarding the Impact to the Forest Dweller

Andhra Pradesh State, as one of the 11 major states, is one of the tribally rich states in the country. More than 50% of scheduled areas of the country are located in these 11 major states. The 34 scheduled tribes are living in Andhra Pradesh State. Out of the total 34 tribes in Andhra Pradesh State (list shown in Attachment 12.3.3), seven tribes are classified as particularly vulnerable tribal groups (PVTGs) who have unique lifestyle such as traditional agricultural system through the practice of hunting and gathering, zero or negative population growth, and extremely low level of literacy in comparison with other tribal groups.

The detailed project design for the construction projects in the irrigation tanks is not yet available. During the preparation of the detailed project document such as DPR, the situation should be confirmed.

(a) Scheduled area in Andhra Pradesh State related to the Integrated Tribal Development Projects (ITDPs) and Integrated Tribal Development Agency (ITDA).

Based on the fifth schedule in the constitution, the areas shown in Table 12.3.6 are declared as scheduled areas in Andhra Pradesh State. The ITDPs are generally contiguous areas with size of a *tehsil* or block or more in which the scheduled tribe population is 50% or more of the total. Andhra Pradesh and Orissa states had adopted an agency model under the Registration of Societies Act and the ITDPs there are known as ITDAs. So far, 194 ITDPs/ITDAs had been delineated in the country in the 23 states including Andhra Pradesh State.

Table 12.3.6 Notified Agency Area in Andhra Pradesh State

- Visakhapatnam Agency area 1[excluding the areas comprised in the villages of Agency Lakshmipuram, Chidikada, Konkasingi, Kumarapuram, Krishnadevipeta, Pichigantikothagudem, Golugondapeta, Gunupudi, Gummudukonda, Sarabhupalapatnam, Vadurupalli, Pedajaggampeta], 2[Sarabhupathi Agraharam, Ramachandrarajupeta Agraharam, and Kondavatipudi Agraharam in Visakhapatnam district.
- East Godwari Agency area 2[excluding the area comprised in the village of Ramachandrapuram including its hamlet Purushothapatnam in the East Godavari district].
- West Godawari Agency area in West Godavari district.

1. Inserted by the Madras Scheduled Areas (Cesser) Order, 1951
2. Inserted by the Andhra Scheduled Areas (Cesser) Order, 1955

Source: Extracted from Ministry of Tribal Affair Webpage (2016), Scheduled Areas in Andhra Pradesh State (Including Telangana), http://tribal.nic.in/Content/ScheduledAreasinAndhraPradeshSSAreas.aspx

The scheduled areas in Andhra Pradesh State have been confirmed referring to the Tribal Welfare Department (2008), *The Basic Statistics on Scheduled Tribes of Andhra Pradesh State*. The actual situations are shown in Table 12.3.7 below.

Table 12.3.7 Mandal List in Scheduled Areas in Andhra Pradesh State

SI.No.	Name of the ITDA/ District	Mandals Full Inclusion of Scheduled Areas		Mandals Partial Inclusion of Scheduled Areas	
		No.	Name	No.	Name
1	Seethampeta /Srikakulam	1	1) Seethampeta	12	1) Kothuru, 2) Hiramandalam, 3) PathAP Stateatnam, 4) Bhamini, 5) Veeragattam, 6) Palakonda, 7) Sarubujjili, 8) Saravakota, 9) Burja, 10) Meliaputti, 11) Tekkali, 12) Nandigam
2	Parvathipuram /Vizianagaram	1	1) Gummalakshmipuram	13	1) Kurupam, 2) Komarada, 3) Pachipenta, 4) Saluru, 5) Makkuva, 6) Parvathipuram, 7) Jiyyammavalasa, 8) Mentada, 9) Srungavarapukota, 10) Bondapalli, 11) Ramabhadrapuram, 12) Vepada, 13) Gantyada
3	Paderu /Visakhapatnam	11	1) Aaku Valley, 2) Dumbriguda, 3) Paderu, 4) Hukumpeta, 5) G. Madugula, 6) Pedabayalu, 7) Munchingput, 8)	7	1) Golugonda, 2) Devarapalli, 3) Madugula, 4) Cheedikada, 5) Rolugunta, 6) Nathavaram, 7) Ravikamatan

SI.No.	Name of the ITDA/ District	Mandals Full Inclusion of Scheduled Areas		Mandals Partial Inclusion of Scheduled Areas	
			Chintapalle 9) G.K. Veedhi, 10) Ananthagiri,11) Koyyuru		
4	Rampachodavaram /East Godavari	7	1) Rampachodavaram, 2) Y. Ramavaram, 3) Rajavommanji, 4) Maredumilli, 5) Devipatnam, 6) Addatheegala, 7) Gangavaram	3	1) Sankavaram, 2) Kotanandur, 3) Prathipadu
5	Kota Ramachandrapuram/ West Godavari	2	1) Buttayagudem, 2) Jeelugumilly	2	1) Polavaram, 2) Koyyalagundem
	Total	22	-	37	-

Source: Andhra Pradesh State Tribal Welfare Department Webpage(2016), ITDA/ District wise No. of Scheduled and Non-Scheduled Villages and Total Population and ST Population in TSP Covered Scheduled Area and Non Scheduled Area, ((http://publishing.cdlib.org/ucpressebooks/view?docId=ft8r29p2r8&chunk.id=d0e195&toc.depth=100&brand=ucpress)
Andhra Pradesh State Tribal Welfare Department (2008), The Basic Statistics on Scheduled Tribes of Andhra Pradesh State

(b) Forest Dwellers Development Framework (FDDF)

FDDF is an instrument for the project executing agency to ensure protection of interests of the forest dwellers in the design and implementation of the project. A sample FDDF has been provided in Attachment 12.3.3. The FDDF has been prepared referring to the past project preparation survey in India based on the JICA's Guidelines for Environmental and Social Considerations and with reference to the World Bank's (WB) Operational Manual – OP 4.10 for the Indigenous Peoples (the World Bank Safeguards Policy). The framework shall guide the project staff to prepare FDDP, whenever the forest dwellers are going to be significantly affected by the project. Efforts must be made to obtain the consent of indigenous peoples in Andhra Pradesh State through the process of free, prior, and informed consultation. The list of particularly vulnerable tribal groups (PVTGs) is shown in Table 12.3.8 below.

Table 12.3.8 List of Particularly Vulnerable Tribal Groups (PVTGs)

No.	Tribal Groups	Districts
1	Chenchu	Guntur District
2	Gadabas, Bodo Gadaba, Gutob Gadaba, Kallayi Gadabarangi Gadaba, Kathera Gadaba, KAP Stateu Gadaba	Vishakapatnam
3	Kondareddis	East Godavari
4	Kondhs, Kodi, Kodhu, Desaya Kondhs, Dongria Kondhs, Kuttiya Kondhs, Tikiria Kondhs, Yenity Kondhs, Kuvinga	Visakhapatnam
5	Porja	Visakhapatnam
6	Savara	Srikakulam, Vizianagaram

Source: Andhra Pradesh State Tribal Welfare Department (2016) List of Scheduled Tribes of Andhra Pradesh State, Scheduled Castes and Scheduled Tribes Orders (Amendment) Act, 2002 (data from 2011 Census) (http://publishing.cdlib.org/ucpressebooks/view?docId=ft8r29p2r8&chunk.id=d0e195&toc.depth=100&brand=ucpress)

(3) Impact on Protected Area

(a) Legally Protected Area (National Parks and Wildlife Sanctuaries)

In Andhra Pradesh State, there are 13 wildlife sanctuaries (shown in Table 12.3.9) and three national parks (shown in Table 12.3.10) that are notified as protected areas. Aside from these, the Biosphere Reserve of Seshachalam Hills was designated under UNESCO's Man and Biosphere (MAB) Programme.

Table 12.3.9 Wildlife Sanctuaries (WLS) in Andhra Pradesh State

Sl. No.	Protected Area	Year Established	Area (km^2)	District(s)	S.N. in Fig. 12.2.2 Provided by Wildlife Institute of India
1	Coringa WLS	1978	235.7	East Godavari	7
2	Gundla Brahmeswaram WLS	1990	1,194.00	Kurnool, Prakasam	9
3	Kambalakonda WLS	2002	71.39	Visakhapatnam	10
4	Koundinya WLS	1990	357.6	Chittoor	11
5	Kolleru WLS	1953	308.55	West Godavari, Krishna	14

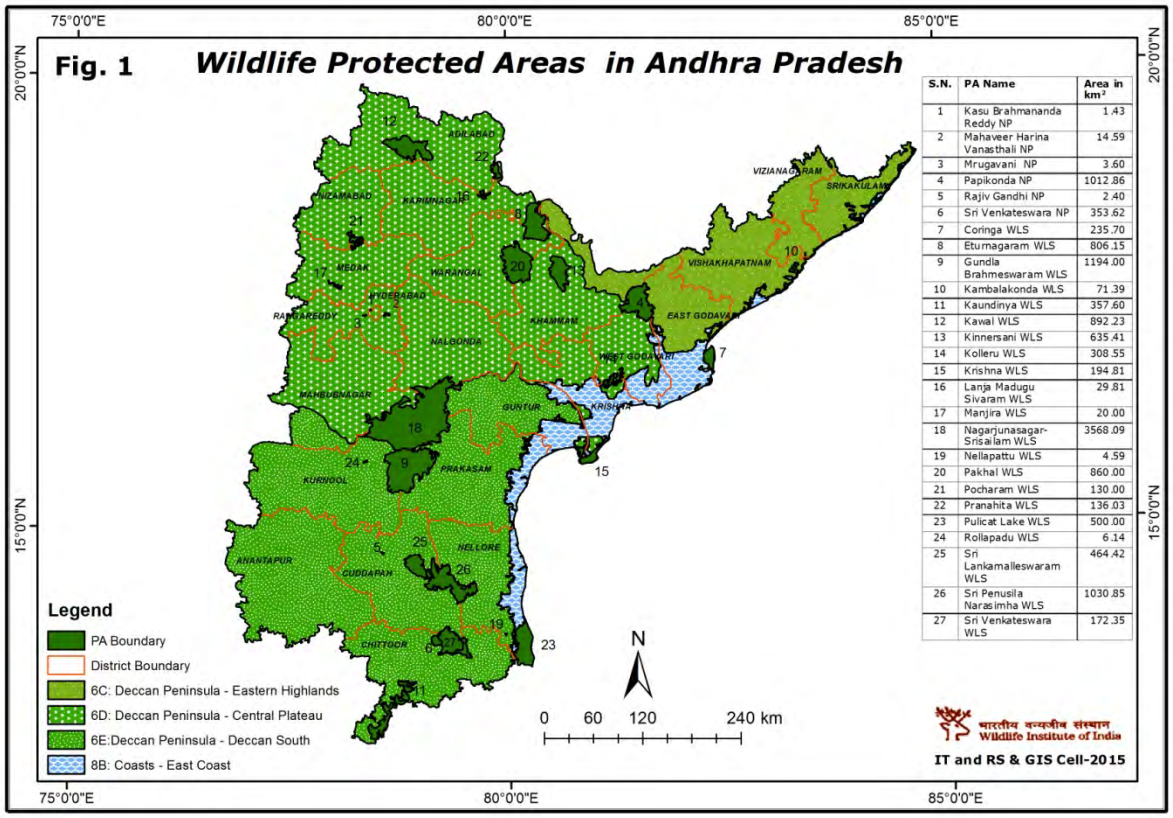
Sl. No.	Protected Area	Year Established	Area (km^2)	District(s)	S.N. in Fig. 12.2.2 Provided by Wildlife Institute of India
6	Krishna WLS	1989	194.81	Krishna,Guntur	15
7	Nagarjuna Sagar-Srisailam WLS	1978	3568.09*	Guntur, Prakasam, Kurnool, Nalgonda, and Mahaboobnagar	18
8	Nellattu WLS	1976	4.59	Nellore	19
9	Pulicat Lake WLS	1976	500	Nellore	23
10	Rollapadu WLS	1988	6.14	Kurnool	24
11	Sri Lankamalleswara WLS	1988	464.42	Kadapa	25
12	Sri Penusila Narasimha WLS	1997	1,030.85	Kadapa, Nellore	26
13	Sri Venkateswara WLS	1998	172.35	Kadapa, Chittoor	27

Source: Environmental Information System (ENVIS) Centre on Wildlife and Protected Areas (2016), State-wise break up of Wildlife Sanctuaries (As of February, 2016), (http://wiienvis.nic.in/Database/wls_8230.aspx)
**Combined area with Telangana*

Table 12.3.10 National Parks in Andhra Pradesh State

No.	Name of National Park	Year of Notification	Total Area (km^2)	District	S.N. in Fig. 12.2.3 Provided by Wildlife Institute of India
1	Sri Venkateswara National Park	1989	353.62	Chittoor, Kadapa	6
2	Rajiv Gandhi National Park	2005	2.40	Kadapa	5
3	Ikonda National Park	2008	1012.86	East and West Godavari, Khammam	4

Source: ENVIS Centre on Wildlife and Protected Areas (2016), State-wise break up of National Parks (July, 2015): http://wiienvis.nic.in/Database/npa_8231.aspx



Source: ENVIS Centre on Wildlife and Protected Areas (2016), (http://wiienvis.nic.in/WriteReadData/UserFiles/image/PAs_MAP State_Database/images/andhra_pradesh.jpg)

Figure 12.3.2 Protected Areas in Andhra Pradesh State

(b) Important Coastal and Marine Biodiversity Areas (ICMBAs) in India

India has taken several steps to achieve the National Biodiversity Target No. 6 and Aichi Biodiversity

Target No. 11 which aim to conserve a substantial portion of the coastal and marine areas in the country and world, respectively. Towards achieving these two targets, 106 coastal and marine sites have been identified and prioritized as ICMBAs by the Wildlife Institute of India. The areas identified in Andhra Pradesh are shown in Table 12.3.11 below.

Table 12.3.11 Important Coastal and Marine Biodiversity Areas (ICMBAs) in India

State	District	Identified Site	North	East	Area (km^2)	Suggested Category
Andhra Pradesh State (17)	Srikakulam	77. Sunur/ Nilarevu/ Ichch	19 º 05.342	84 º 44.235	34.54	Cons. / Comm. Reserve
	Srikakulam	78. Nuvularevu	18 º 40.754	84 º 26.460	10.32	Com. / Cons. Reserve
	Srikakulam	79. Naupada	18 º 33.740	84 º 20.875	28.98	Com. / Cons. Reserve
	Srikakulam	80. Kalingapatnam	18 º 20.535	84 º 07.449	10.00	Com. / Cons. Reserve
	Vishakapatnam	81. Gangavaram	17 º 38.770	83 º 11.945	3.00	Com. / Cons. Reserve
	Vishakapatnam	82. Pudimadka	17 º 28.531	82 º 59.599	2.00	Com. / Cons. Reserve
	Vishakapatnam	83. Bangarampalem	17 º 25.186	82 º 51.718	4.20	Com. / Cons. Reserve
	Puducherry	84. Yenam	16 º 43.513	82 º 12.565	8.40	Conservation Reserve
	East Godavari	85. Vashisti/Kothapalem	16 º 35.605	82 º 17.885	148.00	Com. / Cons. Reserve
	Krishna	86. Bantumeli	16 º 20.628	81 º 20.410	28.44	Conservation Reserve
	Krishna	87. Machilipatnam	16 º 07.919	81 º 10.827	26.38	Conservation Reserve
	Krishna	88. Hamasaladevi	15 º 58.627	81 º 06.035	42.00	Com. / Cons. Reserve
	Guntur	89. Nizampatnam	15 º 53.711	80 º 38.584	45.64	Com. / Cons. Reserve
	Guntur	90. Chinna Ganjam	15 º 40.120	80 º 15.331	14.85	Community Reserve
	Prakasam	91. Pennar	14 º 34.881	80 º 10.155	23.50	Com. / Cons. Reserve
	Nellore	92. Krishnapatnam	14 º 15.341	80 º 75.182	48.60	Com. / Cons. Reserve
	Nellore	93. Pulicat	13 º 34.080	80 º 08.454	383.00	Wildlife Sanctuary

Source: (http://wiienvis.nic.in/Database/ICMBAs_8247.aspx) Citation: K. R. Saravanan, K. Sivakumar and B.C. Choudhury (2013). Important Coastal and Marine Biodiversity Areas of India. In Sivakumar, K. (Ed.) Coastal and Marine Protected Areas in India: Challenges and Way Forward, ENVIS Bulletin: Wildlife and Protected Areas. Vol. 15 Wildlife Institute of India, Dehradun-248001, India. Pages 134-188.

(c) Important Bird Area (IBA) in Andhra Pradesh State

The IBAP programme of Birdlife International aims to identify, monitor, and protect a global network of IBAs for conservation of the world's birds and associated biodiversity. The Bombay Natural History Society (BNHS; www.bnhs.org) and Birdlife International have identified 467 IBAs in India (Islam and Rahmani, 2004). Out of 467, 14 areas are located in Andhra Pradesh State.

Table 12.3.12 Important Bird Area in Andhra Pradesh State

No.	S.N in India	Site Name	PA Status	IBA Criteria	Final Code	IBA Code	District
1	77	Coringa Wildlife Sanctuary and Godavari Estuary	WLS	A1, A4iii	IN215	IN-AP STATE-01	Shown in above table
2	194	Kolleru Lake Wildlife Sanctuary	WLS	A1, A4i, A4iii	IN218	IN-AP STATE-04	-ditto-
3	290	Nelapattu Bird Sanctuary	WLS	A1, A4i	IN221	IN-AP STATE-07	-ditto-
4	331	Pulicat Lake	WLS	A1, A4iii	IN224	IN-AP STATE-10	-ditto-
5	337	Nagarjunasagar – Srisailam Wildlife Sanctuary (Nagarjunasagar – Srisailam Tiger Reserve)	WLS	A1	IN220		-ditto-
6	352	Rolladu Wildlife Sanctuary	WLS	A1, A4ii	IN225	IN-AP STATE-11	-ditto-
7	399	Sri Lankamalleswara Wildlife Sanctuary	WLS	A1, A2	IN226	IN-AP STATE-12	-ditto-

No.	S.N in India	Site Name	PA Status	IBA Criteria	Final Code	IBA Code	District
8	400	Sri Penusila Narasimha Wildlife Sanctuary	WLS	A1, A2	IN227	IN-AP STATE-13	-ditto-
9	401	Sri Venkateswara Wildlife Sanctuary and National Park	WLS/NP	A1, A2	IN228	IN-AP STATE-14	-ditto-
10	419	Telineelapuram	None	A1	IN229	IN-AP STATE-15	-ditto-
11	NA	Horsely Hills	None	-		IN-AP STATE-02	Chittoor
12	NA	Kaundinya	WLS			IN-AP STATE-03	Chittoor
13	NA	Nagarjuna Sagar - Srisailam Rajeev	WLS/ Tigar Reserve			IN-AP STATE-06	Showing above table
14	NA	Uppalapaddu	None			IN-AP STATE-16	Guntur

S.N. in India shows the No. used in the list of Important Bird Areas (IBAs) from the ENVIS database in India in Feb. 2016
Source: ENVIS Centre on Wildlife and Protected Areas (2016), (http://wiienvis.nic.in/Database/IBA_8463.aspx)

(d) Biosphere Reserve:

There is no comprehensive legislation in India dealing with all aspects of the biosphere reserves. The area is designated by the Indian government to be listed in the schedule in UNESCO. The wildlife protection act is complementary to the set-up of biosphere reserves to the extent that it has considerable flexibility and latitude to establish such reserves. The concept of biosphere reserves, especially its zonation, into core area(s) (dedicated to conservation), buffer area(s) (sustainable use) and transition area(s) (equitable sharing of benefits) were later broadly adopted under the Convention on Biological Diversity (CBD) process which entered into force on 29 December 1993. Presently, there are 18 notified biosphere reserves in India (2016). Out of the 18, one area was notified in Andhra Pradesh State as shown in Table 12.3.13.

Table 12.3.13 Biosphere Reserve in Andhra Pradesh State

No.	S.N.	Name	Date of Notification	Area (km^2)	Location (State)
1	17	Seshachalam Hills	20.09.2010	4,755.997	Seshachalam Hill Ranges covering parts of Chittoor and Kadapa districts of Andhra Pradesh

Source: ENVIS Centre on Wildlife and Protected Areas, http://wiienvis.nic.in/Database/br_8225.aspx

(e) Ramsar Site in Andhra Pradesh

The Ramsar Convention is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. One such site was designated in Andhra Pradesh State as shown in Table 12.3.14 below.

Table 12.3.14 Ramsar Wetlands Sites

No	S.N.	Name	Date of Notification	Area (km^2)	Location (State)
1	12	Kolleru Lake	19.8.2002	673	West Godavari, Krishna

Source: ENVIS Centre on Wildlife and Protected Areas, (http://wiienvis.nic.in/Database/ramsar_wetland_sites_8224.aspx)

12.4 Gender Issues

Gender issue has been an important key factor within the development of the country. The agriculture sector is one of the most crucial industries in the country. With this, gender issues should be considered in implementing the current JICA study.

Women play an important although a somewhat less recognised role in the agriculture sector in India. They constitute 46% of total labourers employed in the agriculture sector and 32% of total cultivators (2011 Census of India). 73% of livestock-related work is carried out by women as against 37% in crop agriculture. However, despite the high dependence of agriculture activity on female labour and involvement, women face a number of important challenges in the agriculture sector. JICA conducted a comprehensive study of gender issues in India, which is the Revision of Country Gender Profile (2015).

It analysed the gender issues in each sector in India. The key factors to assess the gender situation in the agriculture sector in India are the following: 1) Growing trend on agriculture in India; 2) Women's position as primarily marginal and small farmers and their landholdings are predominantly individually held; 3) Limited work participation of women; and 4) Increasing mechanisation of agricultural activities and chemical processes in agriculture as challenges facing women. Based on the analysis, some recommendations made in the report are shown in Box 12.4.1.

Box 12.4.1 Recommendation for Agriculture Sector Made by JICA (2015) India Revision of Country Gender Profile

- **Improving resources, strengthening skills, and opportunities for agricultural women:** Women own smaller farms and have lower productivity of their farming operations primarily because they lack access to inputs such as quality seeds, farm implements and fertilisers. Access to these inputs can dramatically increase farm productivity. Providing effective and timely credit lines is one important way in which these inputs can be provided to women so that they can purchase agriculture-related machines and implements. Women also require tailor-made extension services to provide them with latest information about technologies to improve farm productivity, agricultural produce storing, and marketing. Women working in the farms also need appropriate support services like crèches, child care centres, nutrition, health and training.
- **Building on the extensive knowledge base of rural women:** Women have in-depth knowledge about forest resources, agriculture, forest, livestock, and food crops. This information needs to be drawn out and used in building programmes and schemes for sustainable development. For example, women need to be involved in organised efforts to improve seed quality and their timely availability.
- **Extension services in non-farm activities:** Women are predominantly employed in agriculture-related farm activities and lack the skills and training in non-farm activities. Extension services which can impart such skills are urgently needed in rural areas.
- **Gender-friendly implements:** Women farmers are tasked with the responsibilities of running their households in addition to the demands of their farms. However, implements and technological innovations that would reduce time and effort in fulfilling their responsibilities effectively are not available to women. Research and development (R&D) towards developing such implements and technology, and assisting companies working to develop such product would have a long standing impact on the position of women in rural areas and their role in agriculture.

Source: JICA (2015) India Revision of Country Gender Profile Final Report

In 2001, the Government of India developed National Policy for Empowerment Women aiming to initiate advancement, and empowerment of women. Regarding right of women, the Constitution of India mandated gender equality and women have the legal right to inherit, purchase, and own land just as men have such rights. Hindu Succession Amendment Act, 2005 which overriding any inconsistent State laws considers all agricultural land with other property makes land inheritance rights of Hindu women legally equal to that of men across states. However, religious and customary laws often prevail over the command of non-discrimination of the constitution. For example, traditionally male family members became co-parcenars and received an undivided share of the joint family property at birth while female family members were excluded from the share. Moreover, A study conducted by United Nations Women and Landesa in 2011 in Andhra Pradesh and Bihar presented that only 12 per cent of female respondents have inherited or believe that they will inherit land from their parents.[1] Group discussions in the target are of this study also revealed that most of land is registered under men's name. Regarding gender issue in irrigation, discrimination of women in water management is in most cases closely related with the land rights, as eligibility of membership of WUAs is land ownership. Further discrimination of women who even have land was observed in AP as mentioned in the following paragraph of situation of AP state. Regarding economic opportunities, in many place of India, women have limited access to microfinance and similar services because of lack of land ownership. Even though access to formal financial service for individual women is same as the situation in other states, women in Andhra Pradesh, with a series of external support, have been developing SHG system, from which women can avail loan even without landholdings.

Women's participation in rural cooperatives and producer associations has been very limited in India so

[1] Source: Prabhakar Reddy Tada (2016) 'Land rights from a gender perspective: a study of Andhra Pradesh and Telangana state, India' , Governance Unit. UN Women, New Delhi, India

as to other countries in the world. Some state-level laws on cooperatives have been amended to reserve for women seats in managing committees (Kerala in 1985; Andhra Pradesh in 1991). Even though this change was challenged for court case, the Supreme Court dismissed such a challenge with regard to the legislation of Andhra Pradesh[2]. However, as stated below, actual participation of women to cooperatives highly depends on the nature of the cooperatives. While PACS, as mentioned in the previous chapters, mostly consists of or managed by men, female membership prevails over male membership in some MACS. This is mainly because the MACS were developed with empowered SHG.

In general, women are legally entitled with the same right as men, actual situation are highly controlled by the customary gender discrimination. It is also noted that, even though there is no discrimination by sex in legislation, rules to counteract against the prevailing disadvantaged situation of women, such as positive discrimination, provision of women are not regularly mentioned.

Some gender related activities in AP state observed by the JICA survey team are discussed as follows.

(1) Women Participation in Social Organisation

Andhra Pradesh State has strong women self-help group (SHG) structure that has been established through more than 30 years of practice. More than 80% of rural women are members of SHGs and availing loans through their SHGs. Even though SHG is a primary mutually helping group of 10 to 15 members, the federation of the groups, as mentioned in Chapter 5, Chapter 5.3.4, has proliferated power to have a certain extent of influence in the society. The Village Organisations (VOs), the village level federations of SHGs, can influence in Panchayat governing, through SHG women being Panchayat members. In this context, it can be said that women in Andhra Pradesh State have been well empowered in a certain aspect, having their financial resources, platform for their social activities, and access to information and supports. The Andhra Pradesh State, recognising good financial management and social activities of SHG federations, delegated the work of paddy procurement to well performing VOs. Moreover, there are some newly established Farmers Producer Organisatins (FPOs) that have aggregated active SHGs with particular productive activities such as millet, fishery, and dairy. Majority of the members of these FPOs are women who take charge of management.

On the other hand, women are hardly participating in decision-making especially in water resource management as mentioned in Chapter 8.5. Most women are excluded from voting due to absence of legal entitlement of landholdings. Even women with land under their name are not fully aware of their right in the Water Users Association (WUA), thus not participating in decision making. Although both men and women are entitled to participate in the discussion and activities, many of the women take water management as male work. Likewise, there are few male-dominated social organisations. The Primary Agricultural Credit Society (PACS) is one of them that is mostly managed by men. Rythu Mitra Groups (RMGs) have been formed for agriculture activities that ended up as male groups, most of which fell defunct.

From the experiences of SHGs and their federations in Andhra Pradesh State, it should be noted that women's involvement in social organisation is crucial in the sustainable and accountable operation of the organisations. Judging from the abovementioned empowerment of women through SHG activities, it can be said that there are good number of women who can take leadership in the community even in a male-dominated society. Therefore, it is strongly recommended to make specific provision for women in terms of membership and management positions in the organisations to be supported through the project. As mentioned in Chapter 10.8, the legal authorization as well as actual encouragement of women participation are included in the PIM activity support programmes.

(2) Division of Works in Agriculture-related Activities

Regarding agriculture activities, gender perspectives are judged based on the interview survey with community-based organisations and farmers by the JICA Survey Team in February 2016. The household survey sought for division of works by gender in agriculture activities starting from land preparation to marketing and sales and further to participation in social gatherings. Even though there are some

[2] FAO (2002) 'Law and Sustainable development since Rio- Legal rends in agriculture and natural resource management'

limitations in the household survey, such as unequal gender balance in the respondents, the following findings were drawn.

It is observed that, in general, agricultural activities continue to be male dominated. In the study area, most of the activities are done jointly whilst some are by male members alone. The activities such as transportation, marketing and sales, as well as participation in social gatherings, are handled by male members of the family. Female work domains are mainly transplanting, weeding, watering, harvesting, and processing; among which where women contribute maximum labour are watering (75%) and harvesting (70%). In the fishermen community, works are clearly divided between men and women. Fishing activities are the responsibility of men while women are more engaged in processing and selling. Women mainly take care of dairy activities. However, many of the women who are SHG members taking up these activities feel they lack knowledge and skills to develop their activities.

Women's participation in value chain after production, mostly related to marketing, highly depends on the level of marketing, such as marketing at household level or as organisation. In some FPOs, majority of those who are in charge of marketing is women, while marketing of produce at household level are rather done by men. Even though many women feel lack of skills in marketing, those who are capacitated through organisations like FPO, with support of supporting organisations (SOs), have enough confidence of marketing. This indicates high possibility of women to take part of major decision making in value chain through organisations.

Even though the project programmes do not specifically target the women SHGs, SHG structures shall be well accommodated or co-opted to maximise the involvement of women and dissemination of the project. Intervention in the project with regard to agriculture activities shall target either equally or with positive discrimination to fill the Andhra Pradesh State of gender needs depending on the gender-related situation of each activity. Throughout the programme, gender perspective and consideration should be integrated in the detailed planning of each programme, which includes target groups, arrangement of training programmes that enable equal participation of both men and women, and input and capacity building in consideration of positive impact on gender status. Wherever advantage is observed, positive discrimination such as targeting only women, special provision for women, environmental setting that is favourable for women and male-targeted intervention to divert gender mindset shall be considered. This could be achieved through incorporation with other schemes that tackle issues of household works and responsibility and capacity building of women, such as those implemented by the Society for Elimination of Rural Poverty (SERP), which the project cannot directly handle by itself. Convergence meetings with different departments and stakeholders included in the project components can be also utilised as one of the opportunities to collaborate with gender-specific programme to make the project intervention more gender sensitive.

12.5 Climate Change Resilience

12.5.1 Vulnerability to Natural Disasters

Andhra Pradesh State is exposed to cyclones, storm surges, floods, and droughts. A moderate to severe intensity cyclone can be expected to make landslides every two to three years. According to the Government of Andhra Pradesh, about 44% of the state is vulnerable to tropical storms and related hazards.

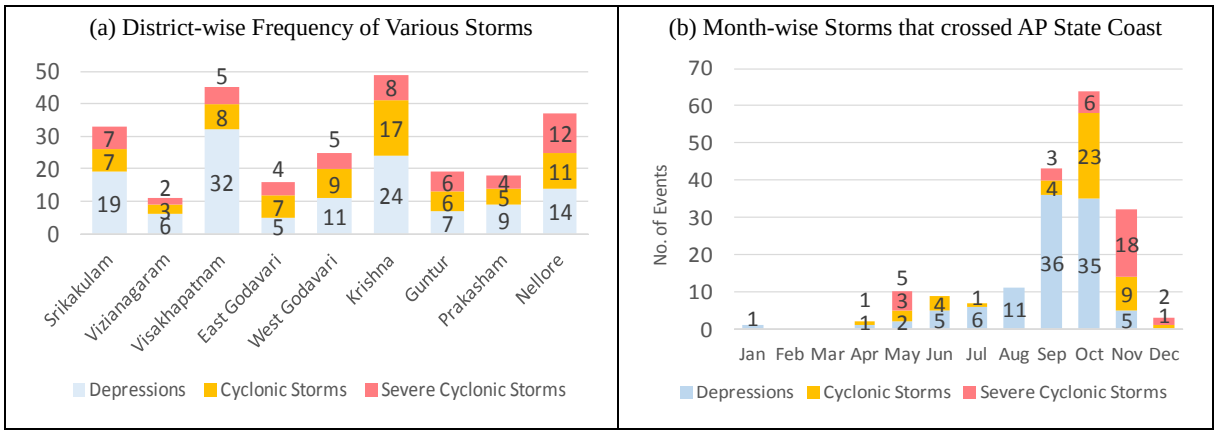
Two of the deadliest cyclones with fatalities of about 10,000 people in each case took place in Andhra Pradesh and Odisha in October 1971 and November 1977, respectively. Cyclones in the east coast originate in the Bay of Bengal, the Andaman Sea or the South China Sea, and usually reach the coastal line of Tamil Nadu, Andhra Pradesh, Odisha, and West Bengal. With a frequency of four cyclones per year, one of which usually becomes severe. Once the cyclones enter the mainland of India, they give way to heavy rains which often translate into floods. There were cases of damaging cyclone-induced floods in the Godavari Delta in August 1986, September 2005, August 2006, July 2013, and similarly in the Krishna Delta in July 1989, September-October 1998, and September-October 2009. Historical data of the past cyclones and floods in Andhra Pradesh State from 1977 to 2014 is shown in Attachment 12.5.1a, and recent major disasters are briefly shown in Table 12.5.1 below.

Table 12.5.1 Recent Major Cyclones and Floods in Andhra Pradesh (2004-2014)

Year	Month	Kind of Disaster
2004	December	Tsunami
2006	August	Godavari Floods
2009	September to October	Krishna Floods
2010	May	Laila Cyclone
	November	Jal Cyclone
	December	Depression
2011	October	Thane Cyclone
	November	Neelam Cyclone
2013	July	Godavari Floods
	October to November	Phailin Cyclone
	-	Helen Cyclone
	-	Lehar Cyclone
2014	October to November	HudHud-Cyclone

Source: Andhra Pradesh State Development Planning Society (APSDPS)

As seen in Figure 12.5.1 below, storms intensively hit Krishna, Visakhapatnam, and Nellore in terms of district and in October, September, and November in terms of month in Andhra Pradesh State.



Note: Data from 1891 to April 2014
Source: Andhra Pradesh State Development Planning Society (DPS)

Figure 12.5.1 Frequency of Various Storms Across Andhra Pradesh State Coast by District and Month

Drought-prone districts are the following: i) Kadapa, ii) Chittoor, iii) Prakasam and Anantapur, vi) Nellore, and v) Kurnool in order of descending frequency of occurrence as shown in Attachment 12.5.1b, and briefly presented in Table 12.5.2 below.

Table 12.5.2 Frequency of Occurrence of Droughts in Andhra Pradesh State (1984-2014)

District	1984-88	1989-93	1994-98	1999-2003	2004-08	2009-14	Total
Kadapa	4	1	3	5	2	5	20
Chittoor	3	1	3	5	2	5	19
Prakasam	4	1	2	4	2	5	18
Anantapur	3	2	2	4	2	5	18
Nellore	4	0	2	5	1	5	17
Kurnool	4	0	2	4	2	4	16
Vizianagaram	2	1	3	5	1	3	15
Srikakulam	1	1	2	5	1	2	12
East Godavari	2	1	1	5	1	2	12
Guntur	1	1	1	4	1	4	12
Visakhapaatnam	2	1	1	4	1	2	11
West Godavari	3	1	1	3	1	2	11
Krishna	2	1	1	3	1	2	10

Note: Number of drought years recorded in Andhra Pradesh State of respective district in each five year period.
Source: Andhra Pradesh State Development Planning Society (APSDPS)

Box 12.5.1 Andhra Pradesh Early Warning Centre

The Andhra Pradesh government established an early warning centre (EWC) to forewarn people about cyclones and floods based on mathematical models. The EWC framework involves running of weather forecasting models supported by real time acquisition of data on a number of weather-related parameters. To facilitate data collection, Andhra Pradesh DPS has installed 1,602 automated weather stations (AWS), 93 river gauges, five coastal stations, and 76 reservoir level recorders across the state to acquire data on real time basis. The AWS measures six weather parameters, namely: rainfall, wind speed, wind direction, atmospheric pressure, humidity, and temperature at every one hour interval and transmits it in the form of short message service (SMS) using global system for mobile communication (GSM) technology. Presently, at least one AWS for each Mandal is installed. River gauge measures the water level in the river at that particular location and transmits data at hourly interval using satellite technology. This data is being used by various government agencies like the agriculture department, disaster management, irrigation department, and energy department for proper planning and implementation of varied government programmes and schemes. AWS data is also being used by the Agriculture Insurance Company of India for implementation of the Weather Based Crop Insurance Scheme (WBCIS) for various crops in the districts.

12.5.2 Climate Change Impacts in Andhra Pradesh State

According to the information from the state's Department of Ground Water (DoGW), the climate change in Andhra Pradesh State from year 2046 to 2065 is interpreted using a web-based tool called climate wizard (http://ClimateWizard.org). The temperature would rise more in the southern region and less in the rest within a range of 1.50°C to 2.77°C at the maximum and 1.64°C to 2.13°C at the minimum. Similarly, rainfalls would increase more in the southern region and less in the rest but its range is uncertain.

Apart from natural disasters discussed in Chapter 12.5.1, agriculture sector is most vulnerable against climate change. As an impact of the global climate change in the future, the Intergovernmental Panel on Climate Change (IPCC) predicts that the productivity of some cereals might decrease in low latitudes but increase in high latitudes, and the International Rice Research Institute (IRRI) forecasts that rice yield would be reduced by 20% per one degree Celsius of temperature rise over the region.

12.5.3 Action Plans for Climate Change

With the formulation of a national policy on climate change (refer to Attachment 12.5.2), it has become imperative to achieve coherence between strategies and actions at the national and state levels. Most of the additional challenges such as coastal zone disasters, droughts, adverse effect on human health, and depleting water resources are experienced at the state level and programmes aimed at improving the adaptive ability are also undertaken and implemented at the state level. A draft state action plan was prepared in 2012 before the separation of Andhra Pradesh State and Telangana in 2014, which was submitted to but not approved by the central government yet and some modification is ongoing. The key issues and interventions in the agriculture sector in Andhra Pradesh State for climate change are summarised in Table 12.5.3 below.

Table 12.5.3 Key Issues and Interventions for Agriculture Sector by Andhra Pradesh State

Key Issues	Interventions
· Decrease in winter rainfall has a negative impact on winter crops (Rabi crops), especially in the rainfed areas. · Temperature fluctuations affect Rabi crops severely. · Heat waves result in dehydration of plants. · There is decrease in area under crops on account of insufficient rainfall, particularly during the southwest monsoon period. · Rainfed agriculture has become risky due to unpredictable rains.	· Development and dissemination of new crop varieties resilient to heat, light, and water stress. · Insurance against crop failures (not just for the bank loan component). · Increase the efficiency of water use. · Extension work for change of cropping timings and patterns, efficiency of water use, weather advisories to farmers, and information on market prices. · Intensive research work on stable agriculture in the context of climate change, and in all its aspects. · Establishment of field centres, data banks, and germplasm banks · Use of energy-efficient pump sets and other agricultural equipment. · Retrofitting of existing pump sets for higher energy efficiency.

Key Issues	Interventions
· Due to loss in vegetation, heavy runoff takes place resulting in wastage of water and soil erosion. · Dryland areas (parts of Anantapur, Kurnool, Kadapa, West Guntur, East Mahabubnagar, Prakasam, and Nalgonda) exist in the state where annual rainfall is less than 550 mm and rainfed farming is not viable. · Loss in fertility of soil in many areas due to excessive use of fertilisers and pesticides.	· Reuse of domestic wastewater for horticulture crops and crops with minimum risk of contamination. · Soil health improvement and Integrated Nutrient Management (INM). · Increase the efficiency of water use by micro-watershed development, catchment area systems, and water management practices. · Strict regulation of groundwater abstraction. · Minor irrigation works and other engineering solutions to recharge groundwater aquifers.

Source: State Action Plan on Climate Change for Andhra Pradesh State, May 2012 by Environment Protection Training and Research Institute.

The Government of Andhra Pradesh State has initiated various projects and programmes for water conservation and management in the state as adaptation measures for climate change as stated in Table 12.5.4 below.

Table 12.5.4 Projects/Programmes for Water Conservation and Management in Andhra Pradesh State

Projects/Programmes	Objectives
· Intrastate River Linking Projects: Godavari and Krishna Penna rivers	· Mitigate the floods and droughts, from water-rich region to water-scarce region
· Reforestation Programme	· Increase green coverage in vacant lands in addition to forest area
· Rain Water Harvesting and Tree Plantation under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and Integrated Watershed Management Programme	· Construct check dams, check walls, percolation tanks, and staggered trenches · Plant trees in a big way
· Panta Sanjeevini Programme under Neeru – Chettu (water and trees)	· Construct farm ponds
· Groundwater Management	· Monitor groundwater levels at real time · Guide and regulate proper exploitation of groundwater
· Accelerated Irrigation Benefit Programme	· Accelerate the completion of ongoing irrigation project · Create new irrigation potential area
· Modernisation of Irrigation Projects	· Increase the tank storage capacity through de-silting in tank beds · Increase in irrigation system efficiency
· Micro Irrigation Projects	· Promote drip and sprinkler irrigation for water saving agriculture · Rain guns for life saving irrigation in rainfed crops
· Conjunctive Use of Surface Water and Groundwater	· Reduce gap ayacut by making maximum use of available water resources such as surface water and groundwater
· Neeru – Pragathi (water and development)	· Create awareness among all the stakeholders on rainfall, groundwater, and surface water and the methods and practices for best utilisation of water resources.

Source: Initiatives in Irrigation Sector, Water Resources Department, Government of Andhra Pradesh, February 2016.

12.5.4 Adaptation Measures for Climate Change by APILIP-II

According to JICA Climate Finance Impact Tool for Adaptation (June 2011), the basic concept of adaptation for the irrigation and drainage sub-sector is set as "securing and improving agricultural productivity through enhancement of water supply and drainage capacity against drought, flood, and change of rainfall and temperature pattern". The vulnerability and adaptation measures for irrigation and drainage sub-sector by APILIP-II can be expected briefly as shown in Table 12.5.5.

Table 12.5.5 Vulnerability and Adaptation Measures for the Irrigation and Drainage Sub-sector Against Climate Change by APILIP-II

Vulnerability	Adaptation Measure by APILIP-II
- Decrease in precipitation and shift of rain pattern - Increase in air temperature,	- Modernisation of medium and minor irrigation projects for restoring of storage capacity and improvement of irrigation system efficiency *(Component-1)* - Capacity building for participatory irrigation management and agriculture for

Vulnerability	Adaptation Measure by APILIP-II
precipitation, rain intensity, and frequency, intensity, and duration of natural disaster (e.g., cyclone and drought) - Rise in sea level	water saving agriculture *(Component-2)* - Conservation and management of forests for water resources *(by the Government of India/Government of Andhra Pradesh State)* - Construction of rainwater harvesting structures - check dams, and farm ponds for groundwater recharge *(by the Government of India/Government of Andhra Pradesh State)* - Construction of dug-wells and bore-wells *(by farmers)*

Source: Prepared by the JICA Survey Team based on JICA Climate Finance Impact Tool for Adaptation (June 2011)

As for the agriculture sector, the threats of climate change in the state and potential adaptation measures against climate change under APILIP-II are assumed as shown in Table 12.5.6 below.

Table 12.5.6 Threats of Climate Change for Agriculture Sector and Adaptation Measures by APILIP-II

Threat	Adaptation Measures
Decrease in crop yield and production	- Arrangement of farming calendar - Application of hybrid seeds/improved varieties - Improvement of agricultural productivity through proper irrigation water management
Escalation of crops due to decrease of production	- Contribution to food self-sufficiency by enhancing capacity of food production through proper irrigation water management and agricultural extension service
Degradation of crop quality by fluctuation of precipitation and temperature	- Designing proper cropping pattern suitable to climate and geography of Andhra Pradesh State - Improvement of crop quality by agricultural extension service
Irruption of pest insect by change of temperature and humidity	- Adoption of pest tolerant variety - Integrated pest control
- Destabilisation of agriculture by frequent natural disaster - Impoverishment by decline of agricultural income	- Adoption of early warning system for natural disasters - Enhancement of storage capacity of tanks by de-silting of tank bed

Source: Prepared by the JICA Survey Team based on Natural Resource Management for Horticulture Development, Satish Serial Publishing House, India

The proposed APILIP-II is aiming at the livelihood improvement of farmers in cultivable command area by enhancing productivity and production of crops through the modernisation of irrigation facilities, proper irrigation water management, and agriculture extension service. It is expected to carry out adaptation measures against climate change in an integrated manner as abovementioned.

13. PROJECT COST

13.1 General

The cost estimate is prepared in foreign currency and local currency. The former is for the procurement of international consultants. The latter includes the procurement of the rest of the goods and services to be procured locally with local tax and duties.

13.2 Basic Conditions of Cost Estimate

The basic conditions and assumptions employed for the project cost estimate are the following:

- Prices are referred to as of April 2016.
- The following exchange rate is applied for the cost estimate:
  USD 1.0 = INR 67.0 = JPY 113.1, INR 1.0 = JPY 1.69
- Unit prices of labour, construction materials, and engineering works are collected from the standard schedule of rates (SSR).
- Project costs are divided into foreign currency (F/C) portion and local currency (L/C) portion. The ratios of F/C and L/C are estimated based on each unit price analysis and by referring to similar types of projects in India.
- Price escalation rates are assumed to be 1.6% per annum for F/C and 3.7% per annum for L/C.
- Physical contingency is assumed to be 5.0% for the sum of base costs and their price escalation.
- Taxes are 5.0% for value added tax (VAT) and 14.5% for services tax according to the government regulation.
- Project administration cost is 5.0% of the eligible portion cost.
- Interest during construction is 1.4% for works of the accumulated loan portion and similarly 0.01% for the consulting services (PMC).
- Front-end fee is 0.2% of the accumulated loan portion.
- The project costs are categorised into F/C portion and L/C portion as shown below.

  F/C portion:

  - Foreign currency portion of the consulting services (PMC)
  - Taxes and duties of foreign currency portion
  - Interest during construction
  - Front end fee

  L/C portion:

  - Modernisation of Medium and Minor Irrigation Projects
  - Participatory Irrigation Management (PIM)
  - Promotion of Farmers Producer Organisations (FPOs)
  - Livelihood Support Programme for Animal Husbandry and Fishery Sectors
  - Pilot Programmes
  - Project Management
  - Local currency portion of the consulting services (PMC)
  - Project administration
  - Taxes and duties of local currency portion

13.3 Summary of Project Cost

The total project cost is estimated to be INR 22,949 million (equivalent to JPY 38,784 million) consisting of INR 20,991 million for the L/C portion and JPY 3,443 million (equivalent to INR 2,037 million) for the F/C portion. The breakdown of total project cost is shown in Attachment 13.3.1 and summarised in Table 13.3.1.

Table 13.3.1 Summary of Total Project Cost

Item	F/C (Yen mil.)	L/C (INR mil.)	Total Cost (Yen mil.)	Total Cost (INR mil.)	Share
JICA Share					
1. Modernisation of Medium and Minor Irrigation Projects	0	12,077	20,410	12,077	**52.6%**
2. Participatory Irrigation Management (PIM)	0	615	1,040	615	**2.7%**
3. Promotion of Farmers Producer Organisations (FPOs)	0	833	1,408	833	**3.6%**
4. Livelihood Support Programme for Animal Husbandry and Fishery Sectors	0	460	778	460	**2.0%**
5. Pilot Programmes	0	895	1,513	895	**3.9%**
6. Project Management	0	853	1,442	853	**3.7%**
Sub-total of Items 1 to 6	0	15,734	26,591	15,734	**68.6%**
Price Escalation (Items 1 to 6)	0	2,052	3,468	2,052	
Physical Contingency (Items 1 to 6)	0	889	1,503	889	
7. Consulting Services	1,119	270	1,575	932	**4.1%**
Sub-total of Items 1 to 7 (Eligible Portion)	**1,119**	**18,945**	**33,136**	**19,607**	**85.4%**
State Share					
8. Administration and Other Costs	2,324	1,967	5,648	3,342	**14.6%**
Grand Total	**3,443**	**20,991**	**38,784**	**22,949**	100.0%

Source: JICA Survey Team

The eligible portion of the yen loan is estimated at JPY 33,136 million (equivalent to INR 19,607 million), which accounts for 85.4% of the total project cost. The balance, JPY 5,648 million (equivalent to INR 3,342 million), is the non-eligible portion of the yen loan.

13.3.1 Modernisation of Irrigation Projects

The construction cost of the modernisation of medium and minor irrigation projects is divided into (i) the medium irrigation projects and (ii) the minor irrigation projects. The modernisation of medium and minor irrigation projects cost is estimated as shown in Attachment 13.3.2 and summarised in Table 13.3.2 below.

Table 13.3.2 Summary of Cost Estimate for Modernisation of Medium and Minor Irrigation Projects

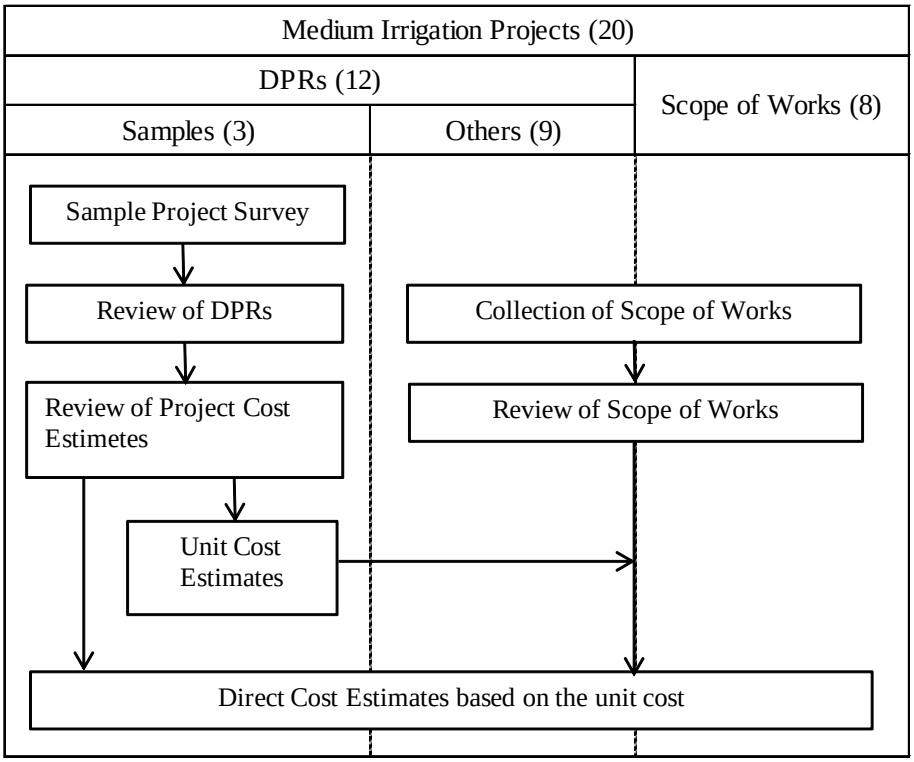
Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Medium Irrigation Projects	0	8,611	14,553	8,611
2	Minor Irrigation Projects	0	3,466	5,857	3,466
	Total	**0**	**12,077**	**20,410**	**12,077**

Source: JICA Survey Team

(1) Construction cost Estimates of Medium Irrigation Projects

(a) Procedure of Construction Cost Estimates of Medium Irrigation Projects

Of the 20 targeted medium irrigation projects, detailed project reports (DPRs) are available for 12 projects and not available for the remaining eight projects. Unit cost estimates are based on the results of the survey of the three sample projects selected among projects with DPRs. Estimates of construction cost of projects with DPRs (except three sample projects) are based on unit cost and scope of works provided in the DPRs. Construction cost of sample projects is based on DPRs. The construction cost of projects without DPRs are estimated based on the data on unit cost and scope of works collected from the Department of Water Resources (DoWR) as shown in Figure 13.3.1 below.



Source: JICA Survey Team

Figure 13.3.1 Procedure of Direct Cost Estimates of Medium Irrigation Projects

(b) Unit Cost of Medium Irrigation Projects

Of the 20 proposed medium irrigation projects, DPRs have been prepared for 12 projects so far, and Project Note (salient features of the project) is available for each of the other eight projects.

In order to estimate the project costs within the limited time available for the survey and given that sufficient information is not forthcoming immediately, the following steps have been adopted:

Step-1 The DPRs of three sample medium irrigation projects are analysed and the scopes of works are confirmed through site visits to the respective project sites. The costs are sorted into work items by structure and scope such as dam, canal lining, system-fed tanks, etc. The results are shown in Attachment 13.3.3.

Step-2 The DPRs of the three sample projects are prepared applying the standard schedule of rates[1] (SSR) of 2014-15. Therefore, the DPRS are updated to the current value by multiplying with 11.8%[2].

Step-3 The unit cost is obtained by averaging the costs of three sample medium irrigation projects. The results are summarised in Attachment 13.3.4.

This unit cost will be the basis for the cost estimates of the other 17 medium irrigation projects.

(c) Construction Costs of Medium Irrigation Projects

The construction cost of medium irrigation project is estimated by multiplying the unit cost with the work quantity, which is presented in Attachment 13.3.5. For the three sample irrigation projects, the costs estimated in their DPRs are maintained as they are upgraded to 2015-16 price level.

The total construction cost of the proposed 20 medium irrigation projects is estimated at INR 8,611 million at 2015-16 price level as listed in Table 13.3.3.

[1] SSR is prepared and published every year effective from 1st June by AP State government presenting the unit prices to be employed for cost estimate. It is available at http://irrigationap.cgg.gov.in/wrd/downloads?mode=SSR#.

[2] The unit costs of common excavation, concrete lining and sidewall in SSR 2014-15 and 2015-16 are compared and the average of the cost increases have been assumed as the overall cost escalation rate.

Table 13.3.3 Construction Costs of Medium Irrigation Projects

No.	Project Name	District	Command Area*1 (ha)	Construction Cost by DoWR*2 (INR Million)	Cost by Survey Team (INR Million)
1	Peddankalam Anicut	Vizianagaram	3,113	179.0	395.3
2	Vottigedda Reservoir	Vizianagaram	6,746	442.3	441.8
3	Vengalaraya Sagaram	Vizianagaram	9,996	647.2	500.4
4	Peddagedda Reservoir	Vizianagaram	4,858	242.8	703.7
5	Andra Reservoir	Vizianagaram	3,603	250.0	344.7
6	Torrigedda Pumping Scheme	East Godavari	5,998	182.1	311.8
7	Thammileru ReservoiRScheme	West Godavari	3,711	225.6	225.0
8	Mopadu ReservoiRSystem	Prakasam	5,147	324.1	424.9
9	Veeraraghavani Kota Anicut System	Prakasam	2,248	22.0	56.2
10	Krishnapuram Reservoir	Chittoor	2,479	426.0	273.9
11	Araniar Reservoir	Chittoor	2,226	349.7	367.1
12	Buggavanka	Kadapa	3,926	332.8	666.8
13	Upper Pennar	Ananthapur	4,066	175.1	316.0
14	Pennar Kumudvathi	Ananthapur	2,479	163.9	155.3
15	Mallimadugu	Chittoor	1,710	70.0	(withdrawn)
16	Maddigedda Reservoir	East Godavari	14,995	850.0	167.9
17	Kanupur Canal System	Nellore	6,111	850.0	(withdrawn)
18	Narayanapuram Anicut	Srikakulam	4,894	412.1	1,138.2
19	Guntur Channel Scheme	Guntur	6,648	747.1	(withdrawn)
20	Raiwada Reservoir	Visakhapatnam	10,117	770.0	709.4
21	Siva Bhashyam Sagar	Kurnool	4,894	342.5	317.9
22	Muniyeru	Krishna	6,648	(newly added)	666.4
23	DR & DM Channels	Nellore	10,117	(newly added)	428.5
Total				7,661.8	8,611.2

*Note: *1 The area in hectare given by DoWR varies depending on theiRSources. The priority is given to DPRSecondly to Project Note, and lastly to Abstract Project Note.*

*Note: *2 The cost estimated by DoWR varies depending on the source. The priority is given to DPRSecondly to Project Note, next to Abstract Project Note, and lastly to Concept Note issued in March 2015.*

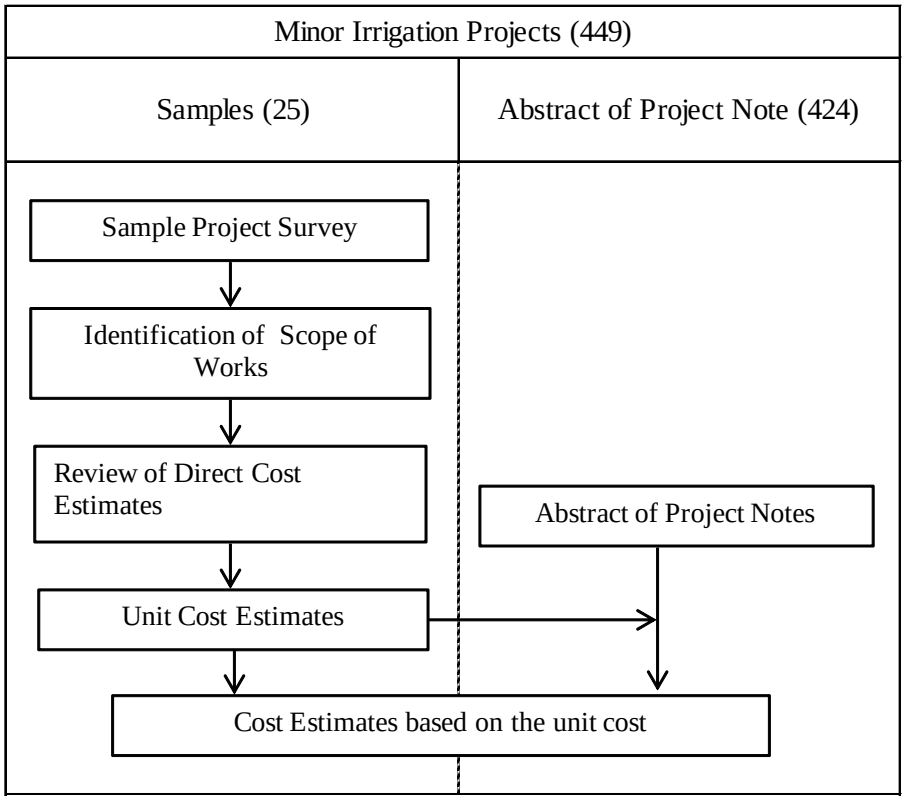
The cost estimated by DoWR is based on the price level 2014/15

Source: JICA Survey Team

(2) Construction Cost of Minor Irrigation Projects

(a) Procedure of Construction Cost of Minor Irrigation Projects

Of the targeted 449 minor irrigation projects, 25 projects have DPRs and the DPRs of the remaining 424 projects are required to be prepared yet. Unit cost estimates are based on the analysis of these 25 DPRs. Construction cost of all projects shall be estimated using the unit cost and command area based on the data collected from DoWR as shown in Figure 13.3.2 below.

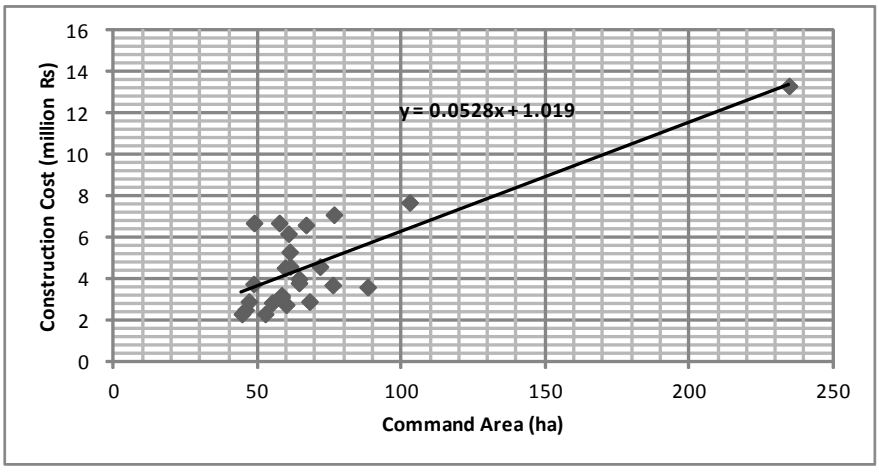


Source: JICA Survey Team

Figure 13.3.2 Procedure of Direct Cost Estimates of Minor Irrigation Projects

(b) Unit Cost of Minor Irrigation Projects

Of the targeted 449 minor irrigation projects, 25 projects have DPRs and the DPRs of the remaining 424 projects are required to be prepared yet. Unit cost estimates are based on the analysis of these 25 DPRs. Construction cost of all projects shall be estimated using the unit cost and command area based on the data collected from DoWR as shown in Figure 13.3.3 below.



Construction cost equation	
Y = a X + b	
a =	0.0528
b =	1.019

r = 0.80
(Correlation coefficient)

Source: JICA Survey Team

Figure 13.3.3 Equation of Command Area and Direct Cost

Table 13.3.4 Summary of Minor Irrigation Projects

No.	SN.	Distrrict	Name of project	Command area (ha) (a.)	Cost (million INR) (b.)	Unit cost (INR/ha) (c.=b./a.*10^6)
1	A-1	East Godavari	Thammadu	67.99	2.900	42,653
2	A-2	East Godavari	Nalla	88.22	3.600	40,807
3	A-3	West Godavari	Chinna	64.35	4.000	62,160
4	A-4	West Godavari	Ura	66.77	6.600	98,847
5	A-5	Krishna	Rama	71.63	4.590	64,079
6	A-6	Krishna	Pedda	59.49	4.530	76,147
7	A-7	Guntur	Vipperla West	45.73	2.500	54,669
8	A-8	Guntur	Inavolu	44.52	2.300	51,662
9	A-9	Prakasam	Medarametlapalem	46.94	2.900	61,781
10	A-10	Prakasam	Z.Uppalapadu	48.56	3.750	77,224
11	A-11	Nellore	Durgavaram	76.08	3.700	48,633
12	A-12	Nellore	Pullayapalli	52.61	2.300	43,718
13	A-13	Kurnool	Mettupalle	55.04	2.850	51,781
14	A-14	Kurnool	Thurupucheruvu	59.89	2.750	45,918
15	A-15	Ananthapuram	D.Chennam Palli	58.28	3.200	54,907
16	A-16	Ananthapuram	Guddampalli	58.28	3.100	53,191
17	A-17	Kadapa	Maddireddypalli	102.79	7.690	74,813
18	A-18	Kadapa	Nandyalampet	234.68	13.320	56,758
19	A-19	Chittoor	Gundraju Kuppam	61.28	4.600	75,065
20	A-21	Srilkakulam	Pothuru	60.70	6.180	101,812
21	A-22	Srilkakulam	Pedda	76.49	7.100	92,823
22	A-23	Vizianagaram	Raju	61.11	5.300	86,729
23	A-24	Vizianagaram	Buradalapati	48.73	6.700	137,492
24	A-25	Visakhapatnam	Reddivani-Peddavani	57.47	6.700	116,583
25	A-26	Visakhapatnam	Lova	64.35	3.800	59,052
Average/total				1,731.98	116.960	67,530

Remarks: JICA Survey Team received Chokkamadugu Tank DPR from DoWR (26 DPRs in total). However, the tank is excluded due to the system-fed tank of Krishnapuram medium irrigation project. JICA Survey Team analyses the unit cost based on 25 DPRs.
Source: JICA Survey Team

(c) Construction Cost of Minor Irrigation Projects

Construction cost of all minor irrigation projects is shown in Table 13.3.5 below. The total number of projects is 449, total command area is 56,966 ha, total construction cost is INR 3,466 million, and unit cost is INR 60,843/ha based on the SSR of 2015-16. Among the districts, Srikakulam has the maximum number of 80 minor irrigation (MI) projects and Guntur has the minimum number of 10 MI projects.

Table 13.3.5 Summary of Construction Cost of Minor Irrigation Projects

District		Number (nos.)	Command Area (ha)	Construction Cost (million INR)
01	Srikakulam	80	8,557	533
02	Vizianagaram	63	6,250	394
03	Visakhapatnam	50	3,422	232
04	East Godavari	25	3,079	188
05	West Godavari	18	1,919	120
06	Krishna	19	2,955	175
07	Guntur	10	1,842	107
08	Prakasam	20	4,638	265

District	Number (nos.)	Command Area (ha)	Construction Cost (million INR)
09 Nellore	30	7,882	447
10 Kadapa	30	3,118	195
11 Kurnool	25	2,091	136
12 Anantapur	19	3,883	224
13 Chittoor	60	7,330	448
Total	449	56,966	3,466
	Unit cost	60,843	(INR/ha)

Source: JICA Survey Team

(3) Combined Construction Cost of Medium and Minor Irrigation Projects

As explained in Chapter 7.2, the development of irrigation projects is planned in a cluster manner.

- Minor irrigation projects form a cluster with their parent medium irrigation project.
- The clusters are ranked in accordance with the scores evaluated in Chapter 7.2.
- The minor irrigation projects that are isolated from any proposed medium irrigation project are ranked as the lowest priority.

The construction costs considering the cluster method are summarised in Table 13.3.6 and detailed in Attachment 13.3.6.

Table 13.3.6 Construction Costs of Irrigation Projects by Medium Irrigation Cluster

Medium Irrigation Project				Minor Irrigation Project		Total
Rank	No.	Project Name	Construction Cost (INR million)	Nos.	Construction Cost (INR million)	Construction Cost (INR million)
1	13	Upper Pennar	316	5	26	342
2	08	Mopadu Reservoir System	425	1	11	436
3	06	Torrigedda Pumping Scheme	312	16	149	461
4	07	Thammileru Reservoir	225	19	125	350
5	14	Pennar Kumudvathi	429	0	0	429
5	23	DR-DM Channel	155	11	185	340
7	22	Muniyeru Irrigation	666	12	100	766
8	11	Araniar Reservoir	367	26	192	559
9	10	Krishnapuram Reservoir	274	9	53	327
10	02	Vottigedda Reservoir	442	10	65	507
11	03	Vengalaraya Sagaram	500	2	29	529
12	20	Raiwada Reservoir	709	31	143	852
13	18	Narayanapuram Anicut	1,138	18	120	1,258
14	01	Peddankalam Anicut	395	8	44	439
15	09	Veeraraghavani Kota Anicut System	56	7	39	95
16	16	Maddigedda Reservoir	168	9	39	207
17	05	Andhra Reservoir	345	22	113	458
18	12	Buggavanka	667	8	58	725
19	21	Shiva Bhasham Sagar	318	0	0	318
20	04	Peddagedda Reservoir	704	4	20	724
-	-	Isolated Minor Irrigation Project		231	1,956	1,956
Total			8,611	449	3,467	12,078-

Source: JICA Survey Team

13.3.2 Participatory Irrigation Management (PIM)

The cost of the Participatory Irrigation Management (PIM) includes: (i) cost for the capacity building of department officers, (ii) cost for the capacity development and monitoring of NGOs in charge, (iii) cost for the capacity development of WUA for Minor irrigation (to be implemented by NGOs) and (iv) cost for the capacity development of WUA for Medium irrigation (to be implemented by NGOs). The PIM cost is estimated as shown in Attachment 13.3.7 and summarised in Table 13.3.7 below.

Table 13.3.7 Summary of Cost for Participatory Irrigation Management

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Capacity Building of Department officers	0	9.3	15.7	9.3
2	Capacity development and monitoring of NGOs in charge	0	14.8	25.0	14.8
3	Capacity development of WUA for Minor irrigation (to be implemented by NGOs)	0	426.5	720.8	426.5
4	Capacity development of WUA for Medium irrigation (to be implemented by NGOs)	0	164.8	278.5	164.8
	Total	**0**	**615**	**1.040**	**615**

Source: JICA Survey Team

13.3.3 Promotion of Farmers Producer Organisations (FPOs)

The cost of the Promotion of Farmers Producer Organisations (FPOs) is divided into (i) Strengthening of Extension Service Function and (ii) Farmer Support Programme Component. The FPOs cost is estimated as shown in Attachment 13.3.8 to Attachment 13.3.16 and summarised in Table 13.3.8 below

Table 13.3.8 Summary of Cost for Promotion of Farmers Producer Organisations

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Strengthening of Extension Service Function				
1-1	Strengthening of Extension Service Function of DOA	0	173.6	293.4	173.6
1-2	Strengthening of Extension Service Function of DOH	0	159.5	269.6	159.5
Sub-total		0	333.1	562.9	333.1
2	Farmer Support Programme Component				
2-1	Promotion of FPO	0	26.7	45.1	26.7
2-2	Initial awareness/preparation (Preparatory work)	0	10.9	18.4	10.9
2-3	Farm Management (class room training)	0	2.9	4.9	2.9
2-4	Fundamental Techniques (class room training)	0	34.4	58.1	34.4
2-5	Demonstration and field school (hands-on training)	0	221.0	373.5	221.0
2-6	Exposure and learning experiences (hands-on training)	0	136.6	230.9	136.6
2-7	Demonstration and exposure visit on farm mechanization (hands-on training)	0	67.8	114.6	67.8
Sub-total		0	500.3	845.5	500.3
	Total	**0**	**833**	**1,408**	**833**

Source: JICA Survey Team

13.3.4 Livelihood Support Programme

The cost of the livelihood support programme includes: (i) cost for animal husbandry and (ii) cost for fishery. The livelihood support programme for animal husbandry and fishery sectors cost is estimated as shown in Attachment 13.3.17 and summarised in Table 13.3.9 below.

Table 13.3.9 Summary of Cost for Livelihood Support Programme

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Animal Husbandry				
1-1	Develop livelihood plan	0	41.9	70.7	41.9
1-2	Enhancing Productivity of Animals	0	144.2	243.7	144.2
1-3	Promotion of Livestock based income generation activities	0	26.2	44.3	26.2
1-4	Project Management	0	30.2	51.1	30.2
Sub-total		0	242	410	242
2	Fishery				
2-1	Develop livelihood plan	0	20.3	34.4	20.3
2-2	Support of income generating activities for Inland Fisheries Cooperatives/Groups	0	122.9	207.6	122.9

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
2-3	Marketing	0	25.2	42.6	25.2
2-4	Project Management	0	49.7	83.9	49.7
Sub-total		0	218	368	218
Total		**0**	**460**	**778**	**460**

Source: JICA Survey Team

13.3.5 Pilot Programmes

Considering the scope described in Chapter 11, the cost and activities of the pilot programmes includes: (i) cost for the food value chain for strategic crops, and (ii) farm mechanisation. The pilot programmes cost is estimated as shown in Attachment 13.3.18 to Attachment 13.3.21 and summarised in Table 13.3.10 below.

Table 13.3.10 Summary of Cost Estimate for Pilot Programmes

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Food Value Chain for Strategic Crops	0	589	995	589
2	Farm Mechanization	0	306	518	306
	Total	**0**	**895**	**1,513**	**895**

Source: JICA Survey Team

(1) Food Value Chain

The cost for food value chain for strategic crops is estimated as shown in Attachment 13.3.18 and summarised in Table 13.3.11 below. The project cost consists of activity cost for respective pilot projects and implementation cost which include cost for PPIC and that for additional human resources for government.

Table 13.3.11 Summary of Cost Estimate for Food Value Chain for Strategic Crops

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Mango (processing)	0	41	69	41
2	Mango (fresh export)	0	23	39	23
3	Tomato	0	40	68	40
4	Chili	0	79	134	79
5	Coconut	0	48	81	48
6	Shrimp	0	84	142	84
7	Tuna	0	66	111	66
8	Project implementation cost (PPIC)	0	185	313	185
9	Additional human resource for government	0	22	37	22
	Total	**0**	**589**	**995**	**589**

Source: JICA Survey Team

As the exact project activities will be decided based on the proposal of the beneficiary pairs, the budget should have some flexibility for new ideas and proposals. With this background, the survey team includes INR 10 million for the funds for new ideas in the horticulture pilot projects which have more variety of activities. Some of the examples of new ideas are listed in Attachment 13.3.18. These examples are basically common facilities for farmer's group to own, operate and maintain such as a mobile testing unit, a farm mechanization centre or a drying platform. The beneficiary pairs can decide how to use this fund based on their needs.

(2) Farm Mechanisation

The cost for farm mechanisation is estimated as shown in Attachment 13.3.19 to Attachment 13.3.21 and summarised in Table 13.3.12 below.

Table 13.3.12 Summary of Cost Estimate for Farm Mechanisation

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Construction of AMTC (2 locations)	0	138	233	138
2	Construction of Workshop (10 locations)	0	40	68	40
3	Farm Machinery for Training at AMTC*	0	31	53	31
4	Training for Users	0	27	46	27
5	Activities by Local Consultants	0	70	118	70
	Total	**0**	**306**	**518**	**306**

*Note: *) Only 2 packages each for rice, maize, pulse and sugarcane.*
Source: JICA Survey Team

Farm machinery other than those for training purpose will be procured under the government programme (50% subsidy).

13.3.6 Project Management

The cost of project management includes: (i) cost for support to the project management unit (PMU), (ii) cost for capacity building, (iii) cost for monitoring and evaluation, and (iv) cost for thematic study and action research. The project management cost is estimated as shown in Attachment 13.3.22 and summarised in Table 13.3.13 below.

Table 13.3.13 Summary of Cost for Project Management

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Support to PMU	0	434	733	434
2	Capacity Building	0	342	577	342
3	Monitoring and Evaluation	0	58	97	58
4	Thematic Study and Action Research	0	20	34	20
	Total	**0**	**853**	**1,442**	**853**

Source: JICA Survey Team

13.3.7 Consulting Services

The project management unit (PMU) will employ an international project management consultant (PMC) for overall management of the project activities. The cost for the consulting services by PMC is estimated based on the tentative assignment schedule of PMC in Attachment 9.8.1 and the draft terms of reference shown in Attachment 9.8.2. The cost estimate is shown in detail in Attachment 13.3.23, which consists of remuneration for international and national experts and direct costs such as transportation, communication, office operational cost, office furniture and equipment, and report preparation, and briefly in Table 13.3.14 below.

Table 13.3.14 Summary of Cost Estimate for Consulting Services (PMC)

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Base Cost	1,009	223	1,386	820
2	Price Escalation	57	34	114	68
3	Physical Contingency	53	13	75	44
	Total	**1,119**	**270**	**1,575**	**932**

Source: JICA Survey Team

13.3.8 Administration and Other Costs

The administration cost includes the expenditures of the staff members of PMU who are deputised from the government, some contractual project staff members, fuel and maintenance of vehicles, travel expenses and accommodations of project staff, office maintenance and running cost, and costs for organizing internal meetings and workshops. The non-eligible portion of the yen loan shall be funded by the Government of India. This portion includes the administration cost, taxes and duties, and interest during construction. The non-eligible cost is summarised in Table 13.3.15.

Table 13.3.15 Summary of Administration and Other Costs

Sub-Component		F/C (JPY mil.)	L/C (INR mil.)	Total Cost (JPY mil.)	Total Cost (INR mil.)
1	Administration Cost	0	980	1,657	980
2	Tax and Duty	162	986	1,829	1,082
3	Interest during Construction	2,091	0	2,091	1,238
4	Front End Fee	70	0	70	42
	Total	**2,324**	**1,967**	**5,648**	**3,342**

Source: JICA Survey Team

13.4 Annual Disbursement Schedule

Based on the Japan International Cooperation Agency (JICA) funding policy, the administration cost, taxes and duties, interest during construction and front end fee relating to the project activities will not be covered by the JICA loan. As a result, the total cost to be shouldered by the Government of Andhra Pradesh is estimated at INR 3,342 million (JPY 5,648 million equivalent), while the total cost to be covered by the loan is estimated at INR 19,607 million (JPY 33,136 million equivalent). The annual disbursement schedule of APILIP-II is shown in Attachment 13.4.1 and briefly in Table 13.4.1.

Table 13.4.1 Summary of Annual Disbursement Schedule

Fiscal Year	Total (JPY million)	JICA Portion (JPY million)	Others (JPY million)
2017/18	663	587	76
2018/19	5,889	5,186	703
2019/20	14,972	13,344	1,628
2020/21	11,242	9,831	1,410
2021/22	3,722	2,960	762
2022/23	1,497	929	568
2023/24	795	295	500
Total	**38,784**	**33,136**	**5,648**

Source: JICA Survey Team

14. PROJECT EVALUATION

14.1 General

Aiming to justify the validity of Data Collection Survey on Agriculture, Food Processing and Distribution in Andhra Pradesh State, the economic, financial, and socio-economic evaluations are to be carried out by referring to the proposed development plan as well as relevant information collected from the Department of Water Resources (DoWR) and other relevant departments. The economic evaluation is to be conducted through the calculation of the economic internal rate of return (EIRR). The financial evaluation is to be performed by analyzing the net on-farm income per hectare.

14.2 Economic Evaluation

14.2.1 Basic Assumption

The following basic assumptions are adopted for the economic evaluation:

- The economic project life is 30 years.
- The exchange rate is USD 1 = INR 67.0 = JPY 113.1 as of April 2016.
- All local prices are expressed in price level at the end of April 2016.
- Only use the direct cost of components 1, 2, 3, 6, 7 and 8, which are associated with irrigation in the project evaluation.
- Transfer payments such as land acquisition cost, tax, duty, subsidy, front end fee and interest are excluded from the economic analysis.
- Only the direct benefit from the project is considered as project benefit.
- The standard conversion factor is estimated at 0.97 (refer to Table 14.2.1).
- The shadow wage rate for agricultural labour works is estimated at 0.69 (refer to Table 14.2.2).

14.2.2 Economic Cost

(1) Evaluation of Economic Factors

The economic project cost comprises initial investment cost including direct construction cost, on-farm development cost, operations and maintenance (O&M) equipment procurement cost, and consulting services cost as well as annual O&M cost, and large scale repair and replacement cost. Financial cost of these items is to be converted into economic cost by applying economic conversion factors (ECF). In this evaluation, the applied ECF are as follows:

(a) Standard Conversion Factor (SCF)

In order to evaluate the costs and benefits with respect to world market prices, an SCF of 0.97 is applied. This figure is calculated on the basis of export and import statistics for the years 2010/11 to 2014/15, as shown in Table 14.2.1.

Table 14.2.1 Calculation of SCF from Foreign Trade Figures of India

Unit: INR million

Item / Year	2010/2011	2011/2012	2012/13	2013/14	2014/15
Export (E)	11,370	14,660	16,343	19,050	18,963
Import (I)	16,835	23,455	26,692	27,154	27,371
Export Subsidy (Es)	0	0	0	0	0
Export Tax (Et)	0	0	0	0	0
Import Subsidy (Is)	0	0	0	0	0
Import Tax (It)	1,056	1,155	1,320	1,358	1,380
(Customs/Duties)					
SCF*1	0.96	0.97	0.97	0.97	0.97

*Note: *1) Calculated from trade statistics applying the following formula:*
SCF=(E+I)/{(E+Es-Et)+(I-Is+It)}
Source: JICA Survey Team based on data of Reserve Bank of India

(b) Shadow Wage Rate

The existence of unemployment and underemployment of unskilled workers in Andhra Pradesh State's economy means that the opportunity cost of unskilled labour can be considered to be lower than its wage rate. Shadow wage rate for agricultural labour is estimated as shown in Table 14.2.2 below. As shown in the table, the average wage for unskilled agricultural labour in the study area was estimated at INR 213 per day. The minimum wage rate for other industrial labour in Andhra Pradesh State was INR 307 per day. Based on this figure, the shadow wage conversion factor was estimated at 0.69 as shown in Table 14.2.2.

Table 14.2.2 Shadow Wage Rate

Casual agricultural labour wage (L)	INR/day	213
Wage of unskilled labour in other industries (M)	INR/day	307
Shadow wage rate factor (Y)		**0.69**

Source: JICA Survey Team based on State Level, Government of India, Ministry of Labour and Employment Office of the Chief Labour Commission, No. 1/13 (1, 2)/2016-LS II, March 2016 and for the Study Area Hearing Survey, March 2016

(2) Project Cost for Evaluation

The project cost for evaluation broadly comprises irrigation projects and capacity building, project management and maintenance (O&M), engineering services, administration, and physical contingencies. The financial costs are converted into the economic costs by applying the SCF for each of components. As shown in Table 14.2.3, the project cost is estimated at INR. 16,324 million at economic prices.

Table 14.2.3 Project Cost in Financial and Economic Prices

No.	No. and Name of Project Component	Foregin Currency Portion (INR Millions)		Local Currency Portion (INR Millions)		Total Amount (INR Millions)	
		Financial Prices	Economic Prices	Financial Prices	Economic Prices	Financial Prices	Economic Prices
1	Modernisation of Medium and Minor Irrigation Projects	0	0	12,077	11,714	12,077	11,714
2	Participatory Irrigation Management (PIM)	0	0	615	597	615	597
3	Promotion of Farmers Producer Organisation (FPO)	0	0	832	807	832	807
6	Project Management	0	0	853	827	853	827
	Price Escalation (1,2,3,6)	0	0	1,847	0	1,847	0
	Physical Contingency (1,2,3,6)	0	0	811	697	811	697
7	Consulting Services (PMC)	597	597	223	216	820	813
	Price Escalation (7)	34	0	34	0	68	0
	Physical Contingency (7)	32	30	13	11	44	41
8	Administration Cost	0	0	852	826	852	826
	Tax & Duty	96	0	937	0	1,034	0
	Interest during Construction	1,141	0	0	0	1,141	0
	Front End Fee	40	0	0	0	40	0
	Total	**1,939**	**627**	**19,094**	**15,697**	**21,034**	**16,324**

Source: JICA Survey Team

(3) Economic Annual Operation and Maintenance Cost

Annual O&M cost is set up to be 1.25% of development cost for direct construction costs. The economic annual O&M cost in the full operation stage is estimated at INR 146 million.

(4) Economic Repairing and Replacement Cost

In order to secure proper functions of the newly developed irrigation system, it is indispensable to allocate periodical investment for undertaking major repairing and repairing works of irrigation canals

and related structures with a certain interval. The required repairing and replacement cost for every ten years is assumed at INR 1,171 million on the economic price base.

14.2.3 Economic Benefit

The economic benefit is estimated as shown in Attachment 14.2.1 and summarized in Table 14.2.4.

Table 14.2.4 Economic Benefit

	Cropping Pattern			Unit Price (INR/ton)	Unit Yield (ton / ha)	Production Cost (INR)			Unit Return (INR/ha)	Net Return (INR)
	Kharif (ha)	Rabi (ha)	Total (ha)			Material	Labour	Total		
Without Project Condition										
Paddy (Rabi)		4,622	4,622	13,679	5.8	8,676	20,281	28,957	50,138	231,727,134
Paddy (Kharif)	25,692		25,692	13,679	4.8	8,402	21,304	29,706	36,202	930,075,163
Maize	16,826		16,826	11,640	7.4	13,695	19,429	33,124	53,012	891,954,729
Ground Nut		8,428	8,428	48,500	1.5	15,322	17,895	33,217	38,660	325,825,133
Pulses	38,209		38,209	72,750	0.5	4,229	6,135	10,364	25,574	977,156,793
Sugarcane		14,137	14,137	2,134	74.1	38,320	42,778	81,098	77,031	1,089,008,950
TOTAL	80,726	27,187	107,913			88,644	127,823	216,466	280,617	**4,445,747,901**
With Project Condition										
Paddy (Rabi)		4,275	4,275	13,679	6.7	10,757	22,326	33,084	59,198	253,098,092
Paddy (Kharif)	59,477		59,477	13,679	5.8	9,955	22,838	32,792	46,275	2,752,294,794
Maize	22,256		22,256	11,640	8.6	14,100	20,963	35,063	65,565	1,459,235,166
Ground Nut		21,377	21,377	48,500	2.0	17,489	17,895	35,384	60,452	1,292,294,023
Pulses	26,384	20,295	46,679	72,750	0.9	7,014	7,840	14,854	48,075	2,244,100,787
Sugarcane		27,790	27,790	2,134	86.5	40,208	44,482	84,690	99,794	2,773,313,303
TOTAL	108,117	73,738	181,855			99,523	136,344	235,867	379,359	**10,774,336,166**
Incremental Benefit										**6,328,588,265**

Source: JICA Survey Team

14.2.4 Economic Internal Rate of Return and Sensitivity Analysis

The economic analysis has been carried out based on economic cost and benefit flows as shown in Tables 14.2.3 and 14.2.4. The following indicators are to be applied:

- Benefit cost (B/C) ratio is used to compare the benefit with the cost, on present value basis, under the “With Project” scenario;
- Net production value (NPV) is used to convert the amount of incremental benefit into the present value using 10% discount rate. The NPV figures indicate the project investment advantage;
- EIRR is used to examine the economic viability of the project; and
- Sensitivity analysis is used to examine the economic sensitivity against future adverse changes in cost and benefit such as: 1) increase in cost by 10% and 20% due to price escalation of construction materials and/or rise in work quantity caused by unforeseen conditions; 2) decrease in benefit by 10% and 20% due to decline in prices of agricultural products and a reduction in anticipated crop yields; and 3) combination of both factors.

The calculated results are shown in Table 14.2.5 and Attachments 14.2.2.

Table 14.2.5 Results of Economic Evaluation

Indicator	Economic Analysis	Sensitivity Analysis			
		Benefit Decrease	Cost Increase		
			Base	+ 10%	+ 20%
NPV (i = 10%)	INR 20,824million	Base	23.5%	21.8%	20.4%
B/C (i = 10%)	2.57	-10%	21.7%	20.1%	18.7%
EIRR	23.5%	-20%	19.8%	18.3%	17.0%

Source: JICA Survey Team

14.3 Financial Evaluation (Farm Economy)

14.3.1 Financial Analysis

The financial evaluation of the proposed project was undertaken in terms of financial status of average farmer's farm income in the irrigation scheme. According to the Questionnaire Survey to DoWR (JICA Survey Team, January to March 2016), the average cultivated area per household in the medium irrigation culster by region was estimated. The region-wise incremental net return of beneficiary farmers is shown in Table 14.3.1.

Table 14.3.1 Region-wise Incremental Net Return of Beneficiaries in the Irrigation Scheme

(1) North Region (Average cultivated area in the scheme: 0.43 ha) (Unit: Rs.)

Crop	Present / Without Project Condition		With Project Condition		Incremental Net Return
	Kharif	Rabi	Kharif	Rabi	
Rice	3,100	-	9,900	-	6,800
Pulses / Maize	5,200	-	13,900	-	8,700
Total	8,300		23,800		15,500

Note: GAP Ayacat for Vottigedda Reservoir Scheme is applied: 25%
Source: JICA Survey Team

(2) Central Region (Average cultivated area in the scheme: 1.22 ha) (Unit: Rs.)

Crop	Present / Without Project Condition		With Project Condition		Incremental Net Return
	Kharif	Rabi	Kharif	Rabi	
Rice	6,800	-	21,000	-	14,200
Pulses / Maize	14,000	-	31,000	-	17,000
Total	20,800		52,000		31,200

Note: GAP Ayacat for Thammileru Reservoir Scheme is applied: 32%
Source: JICA Survey Team

(3) South Region (Average cultivated area in the scheme: 0.87 ha) (Unit: Rs.)

Crop	Present / Without Project Condition		With Project Condition		Incremental Net Return
	Kharif	Rabi	Kharif	Rabi	
Rice	-	900	-	3,600	2,700
Groundnut	-	1,300	-	19,200	17,900
Sugarcane	3,700		37,900		34,200
Total	5,900		60,700		54,800

Note: GAP Ayacat for Krishnapuram Reservoir Scheme is applied: 86%
Source: JICA Survey Team

14.3.2 Indirect Benefits

There are various indirect benefits and impacts expected from the introduction and expansion of the modernisation of medium and minor irrigation projects in the site. Major indirect benefits and impacts expected after the implementation of the project are described below.

(1) Poverty Alleviation and Productivity and Economic Growth

- Increased household incomes from primary sector and employment generation contribute to poverty alleviation.
- Increased irrigated area and introduction of improved cultural practices contribute to productivity and overall situation.

(2) Employment

- More irrigated agriculture and allied services increase labour opportunities for landless and small and marginal farmers.
- Farm mechanisation provides employment opportunity for local youth.

(3) Women Support

- Woman commodity interest groups are supported for taking up livelihood activities. Woman fisher folk is supplied with iceboxes and mobile units to obtain income from fish vending.

- Improved household income provides benefits to women and children.
- Restored irrigation systems improve drinking water supply which would reduce woman's drudgery in fetching drinking water.

(4) Environment Including Land, Water, and Biodiversity

- Greater water spread area and longer duration of water retention increase fish production and productivity
- Improvement of water environment makes natural biodiversity in certain extent.

14.4 Operational and Effect Indicators

14.4.1 Operational Indicators

Selected operational indicators with target values for irrigation component and other components are shown in Table 14.4.1 and Table 14.4.2 respectively.

Table 14.4.1 Operational Indicators for Irrigation Component

Indicator	Unit	Baseline (2016)			Target (2025)		
		Medium	Minor	Total	Medium	Minor	Total
Beneficiary farmers	('000) Nos	160	93	253	160	93	253
Irrigation potential utilised*1	('000) ha	69	39	108	104	57	161
Gap ayacut*1	%	33	29	-	0	0	-
Water conveyance efficiency*1	%	35	35	-	60	60	-
Water tax collection*2	%	44	8	-	50	50	-

*Note: *1= Target is set on normal rainfall (not draught and floods) condition.*
**2= Target is set in % of water tax collected against water tax assessed by the Tax Revenue Office.*
Source: JICA Survey Team

Table 14.4.2 Operational Indicators for Other Components

Indicator	Unit	Baseline (2016)	Target (2025)	Remarks
WUAs trained	Number	-	604	= Total number of WUA
FPOs established	Number	-	20	= 1 FPO x 20 medium irrigation clusters
Animal husbandry communities trained	Number	-	36	= 4 groups x 9 clusters
Fishery communities trained	Number	-	36	= 4 groups x 9 clusters
Farmers trained for mango (process)	Number	-	1,000	Refer to FVC
Farmers trained for mango (fresh export)	Number	-	100	- ditto -
Farmers trained for tomato	Number	-	500	- ditto -
Farmers trained for chilli	Number	-	2,000	- ditto -
Farmers trained for coconut	Number	-	1,000	- ditto -
Farmers trained for tuna	Number	-	225	- ditto -
Farmers trained for shrimp	Number	-	1,000	- ditto -
Farmers trained for farm mechanisation	Number		1,070	= 10 x 107 CSU

Source: JICA Survey Team

14.4.2 Effective Indicators

Selected effective indicators for the projects are: i) total cropped area of major crops; ii) yield of major crops per unit area per season; iii) gross annual average farm income in irrigation command area and iv) gross annual average farm income of strategic crops under FVC pilot programme, which is expressed by such formula as production volume by crop multiplied by unit price, as shown in Table 14.4.3.

Table 14.4.3 Effective Indicators

Indicator	Unit	Present Condition (2016)	Target (2025)
1. Total Cropped Area of Major Crops			
Paddy *(Kharif)*	ha	25,692	59,477
Paddy *(Rabi)*		4,622	4,275
ID Crops		77,600	118,102
2. Yield of Major Crops*1			
Paddy *(Kharif)*	ton/ha	4.8	5.8
Paddy *(Rabi)*		5.8	6.7
Maize *(Kharif)*		7.4	8.6
Ground Nut *(Rabi)*		1.5	2.0
Pulses *(Kharif and Rabi)*		0.5	0.9
Sugarcane *(Kharif to Rabi)*		74.1	86.5
3. Gross Annual Average Farm Income			
North Region	INR. / household	8,300	23,800
Central Region		20,800	52,000
South Region		5,900	60,700

*Note:*1:Yields under present condition were estimated, based on the results obtained from field visits to the sample irrigation schemes and information from DoA offices in three districts (Vizianagaram, West Govdavari, and Chittoor Districts). Meanwhile, target yields in 2025 were estimated, based on data and information obtained from Rice Research Centre in West Godava, DoA offices in three Districts mentioned above, and district-wise statistical data of DoA.*

Source: JICA Survey Team

The present and target values for 'strategic crops of food value chain' and 'livelihood support' will be set based on the baseline survey to be conducted at the beginning of the project.

14.5 Monitoring and Evaluation System

Operation and effect indicators of the project will firstly confirm the present values at the time of project planning and secondly to monitor actual values through the proposed management information system (MIS). When necessary, it will be reinforced by follow-up survey. The outputs will be organized in the baseline survey report and/or follow-up survey report. The reports shall evaluate successful cases and difficulties encountered during the implementation and these will be feed back for the next phase of operation. At the end of the project, terminal impact assessment will be carried out in order to confirm the project impact including operation and effect indicators.

The key approaches of the monitoring and evaluation are the following:

- To have an internal and external monitoring and evaluation agency;
- To use participatory monitoring with the beneficiary;
- To learn, evaluate, and review the program process; and
- To share the collected data and information among the involved party.

Regular monitoring will be done and reported every month by the appointed department's staffs. The evaluation of the project implementation will be held every end of year by local consultants with support of the department.

The joint director is in charge of carrying out the monitoring and evaluation. The state level DoWR is responsible for the whole process.

The evaluation indicators of each component are listed in Table 14.5.1 below.

Table 14.5.1 Monitoring and Evaluation Schedule

No.	Indicator	Unit	Method	Implementation	Frequency
1	Command area	ha	Field survey	DoWR	Baseline and annually
2	Gap ayacut	%			
3	Irrigation potential utilised	ha	Bench		3 times

No.	Indicator	Unit	Method	Implementation	Frequency
4	Yield of major crops	ton/ha	mark survey		(Baseline, Mid-term and Endline survey)
5	Gross annual average farm income	INR. / household			
6	Beneficiary farmers	Nos.	Field survey		Baseline and annually
7	Water conveyance efficiency	%			
8	Water tax collection	%			

Source: JICA Survey Team

In addition to the alone, project states report (PSR); a sample form is given in Attachment 14.5.1, shall be prepared on a quarterly basis.

15. PROSPECT FOR JICA'S INTERVENTIONS ON FOOD PARKS AND JAPANESE TECHNOLOGIES IN ANDHRA PRADESH STATE

15.1 General

(1) Global Food Value Chain Strategy

The Ministry of Agriculture, Forestry and Fishery (MAFF) in Japan has formulated the Global Food Value Chain Strategy in 2014. The objective of the strategy is to establish food value chain (FVC) from production to consumption through public-private partnership by utilising the unique strengths of the Japanese food industry. Through the establishment of FVC, MAFF targets to double the overseas sales of the Japanese food industry from JPY 2.5 trillion to JPY 5 trillion in 2020. According to MAFF, the Global Food Value Chain will be established through the following three strategies:

(a) Strategy 1: Overseas business development and investment in Japanese food industry

As Japanese food industry has already developed with advanced technologies like high quality cold chain, cutting-edge technologies such as Information and Communication Technologies (ICT), energy-saving technologies, and convenient food distribution system such as Point-of-sale (POS) system.

(b) Strategy 2: Strategic utilisation of economic assistance to accelerate economic growth in developing countries.

The Japanese government has contributed in terms of economic assistance to developing countries for the development of infrastructure, human resources, institutions, and technologies. These experiences can be applied for FVC development too.

(c) Strategy 3: Promotion of Japanese food export through the enhancement of a favourable business environment.

As Japanese traditional food, "washoku" is registered as a United Nations Educational, Scientific and Cultural Organization (UNESCO) intangible cultural heritage. Japanese food has emerging demands in overseas markets. In line with the export of Japanese food, FVC for export market such as cold chain and logistic system will be promoted.

(2) Basic Concept of FVC Development in Andhra Pradesh State

The Global Food Value Chain Strategy can be adopted for the development of FVC in Andhra Pradesh State as shown in Figure 15.2.1 below.

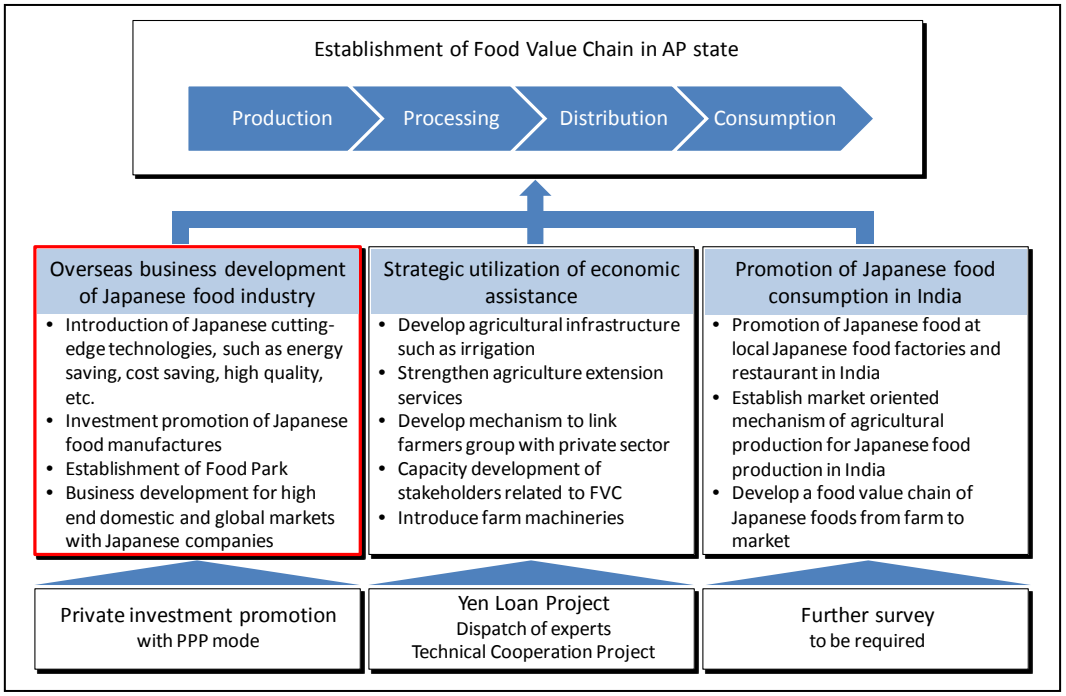


Figure 15.2.1 Concept of FVC Development in Andhra Pradesh State

(a) Strategy 1: Overseas business development of Japanese food industry in Andhra Pradesh State

Andhra Pradesh State has one of the biggest agriculture productions in India. With variety of products such as rice, mango, chilli, tomato, and shrimp, Andhra Pradesh State government is quite active to promote private investment especially in the food processing sector, which is one of most important industries in the state. The Andhra Pradesh State government is also expecting foreign investment from Japan, therefore, the Japanese International Cooperation Agency (JICA) Survey Team had a preliminary survey with the following components to identify the business opportunities of Japanese food industry in Andhra Pradesh State:

- Introduction of Japanese technologies, such as energy and cost saving, and high quality technologies
- Investment promotion of Japanese food manufacturers
- Establishment of food park
- Business development for high-end domestic and global markets

As a result, it was identified that there were high demands for Japanese technologies from food processing companies in Andhra Pradesh State, even though the actual sales were quite low. Regarding the investment promotion, Japanese food manufacturers show low interest to invest in Andhra Pradesh State, despite of the high expectation from Andhra Pradesh State government and private companies. It is recommended that further detailed surveys and investment promotions should be implemented to attract investment from Japanese companies in the future. The details of the components are described in Chapter 15.2 to 15.4.

(b) Strategy 2: Strategic utilisation of economic assistance in Andhra Pradesh State

Strategic utilisation of economic assistance will be basically implemented by the Andhra Pradesh Irrigation and Livelihood Improvement Project (APILIP-II), which includes the following components:

- Develop agricultural infrastructure such as irrigation
- Strengthen agriculture extension services
- Develop mechanism to link farmers group with private sector
- Capacity development of stakeholders related to FVC
- Introduction of farm machineries

In APILIP-II, there will be some opportunities for private companies to introduce advanced technologies such as farm machineries, cold storage, and fishing equipment.

(c) Strategy 3: Promotion of Japanese food consumption in India

According to the Global Food Value Chain Strategy prepared by the Ministry of Agriculture, Forestry, and Fisheries (MAFF), the following three components are considered for the promotion of Japanese food consumption in India:

- Promotion of Japanese food consumption at Japanese food factories and restaurant in India
- Establish market-oriented mechanism of agricultural production for Japanese food production in India
- Develop a food value chain of Japanese foods from farm to market; including introduction of quality seeds, GAP application, food safety, cold chain infrastructure and logistics, etc.

Since the study for Japanese food export was out of the terms of reference in this survey, it is recommended to implement further survey in the future.

15.2 Introduction of Japanese Technologies

(1) Current Business Conditions and Issues of Food Processing Companies in Andhra Pradesh State

In order to introduce Japanese technologies and machines to India, it is important to assess the current business conditions and issues on food industry in India and identify business opportunities of Japanese companies to solve these issues. Therefore, the JICA Survey Team conducted an interview survey to food processing companies in Andhra Pradesh State. The objectives of the survey are as follows:

- To assess current business conditions and issues of food processing companies, and
- To identify business opportunities of Japanese companies in terms of trade of produces and processed foods and sales of machineries and technologies.

The target companies are food processing companies located in Andhra Pradesh State and procuring raw materials such as grain, fruits and vegetables, and spices. The survey was conducted through interview with the management or executive person of the company in order to identify the real interests and requirements of the business.

The result of the interview survey is underway.

(a) Grain (rice and maize)

Most of the rice mill companies are present in East Godavari and West Godavari districts. Capacities of rice millers range from 1 ton/day to 2500 tons/day of paddy handling. The very small village level rice mills which had been used for self-consumption are becoming unviable and closing down. On the other hand, large and modern rice mills are increasing. The small and medium sized rice mills are either undergoing modernisation or new modern ones. There are few rice bran oil extraction and refining companies and two large maize processing plants (starch and starch derivatives) with capacity of about 150 tons/day.

Issues on Procurement

- There is a very limited long-term association between the farmers and processors. The price of both paddy and maize depends on the supply-demand situation and the minimum support price (MSP) fixed by the government.

Issues on Processing

- Most of the old rice mills have outdated equipment and technology whose head rice yields are low and also consume high power for processing leading to high processing cost. They look forward to better equipment for higher yield and power saving equipment in processing of rice.
- There is a demand to improve the quality management systems and food safety systems in most of the small and medium sized processing units. Most of the larger units meet international standards and requirements.
- Most of the companies use steam boiler for generation of steam for processing, but many have

not adopted any heat recovery systems from exhaust gases. There is potential in this area.
- Power generation using rice husk as fuel in large rice mills is a good initiative. There is potential in this area for Japanese companies.
- There are limited secondary and tertiary value added rice products in Andhra Pradesh or India, although Japan has many rice-based products. It can have potential in India.
- Processing industry lacks scientific storage of paddy and rice. Support is required in this area.

Issues on Distribution and Sales

- Working capital requirement for this industry is high as the raw material is available at reasonable prices only during or immediately after harvest. But the interest rates for the working capital are very high (up to 12%). The millers are looking for higher requirement of working capital at reduced interest rates.
- Marketing activities including market development, branding, promotion, test marketing, and such other activities are to be taken up in major export markets by the major companies or as a consortium of companies.

(b) Fruits and Vegetables

The fruit and vegetable processing sector in Andhra Pradesh State is dominated by the processing of mango fruit into mango pulp and concentrate. The processing capacity of the units ranges from 10 to 100 tons/hour of fresh fruit handling. Since mango processing is seasonal (60 to 75 days in a year), most of the processing units also process other fruits such as papaya, guava, banana, and tomato in smaller quantities based on orders.

Issues on Procurement

- Generally, long-term association between farmers and processors is very limited; hence, there is no consistency in quality, price, availability, and stability. Mango and tomato, which are the major processed commodities in Andhra Pradesh State, undergo wide price fluctuation. Close link between farmers and processing industry by contract farming can contribute to reduce fluctuation.
- Quality to certain extent is monitored by processing companies in procurement of produces. They buy fruits which meet their minimum specifications. There are some companies, such as Jain Irrigation, Srini Foods, and Capricorn Food Products, which are working with the farmers to improve quality through education and awareness of farmers. But these activities are limited in Andhra Pradesh State only. Post harvest losses are also high owing to inappropriate harvesting and handling practices. Farmers and fruit handlers are required to be trained in harvesting and post harvest handling practices.

Issues on Processing

- There are few companies looking at alternate processing methods such as high pressure processing/sterilization. Since Japan is strong in this area, there is a potential for introducing this technology.
- Currently, aseptic bag is mostly supplied by an Italian company, Goglio. There is a scope for introducing aseptic bags from Japan if technology and suppliers are available from there.
- There is a need to improve the quality management systems and food safety systems in most of the small and medium sized processing units. Most of the larger units have already met international standards and requirements.
- The companies look at energy efficient refrigeration/cold store solutions.
- All the companies use steam boiler for generation of steam for processing, but many have not adopted any heat recovery systems from exhaust gases.
- These processing companies generate huge amount of wastewater (up to 2000 tons per company per day). The companies look for cost efficient water treatment and recycling plants.
- Disposal or use of solid waste consisting of seeds and skin (e.g., about 50% of the raw material handled is estimated as disposal in mango) up to 50,000 tons per company per season is a major issue.

Issues on Distribution and Sales

- Marketing activities including market development, branding, promotion, test marketing and such

other activities are to be taken up in major export markets by the major companies or as a consortium of companies.

(c) Spices

Most of the raw material is procured locally from Andhra Pradesh State. However, since the chilli market in Guntur District is an established and large market in the country, the material comes from other states like Karnataka, Tamil Nadu, and Maharashtra.

Issues on Procurement

- With regard to exports, quality is a major concern in view of high pesticide residue and aflatoxin content. Many exporters buy chillies that meet their minimum specification. There are some reputable and big companies, such as ITC Food Synthite Industries, which are working with the farmers (to a limited extent) to improve quality through education and awareness to farmers. They are working in the areas of integrated pest management and integrated crop and nutrition management to get better quality raw materials and to also ensure better returns to farmers.

Issues on Processing

- Raw material quality is one of the biggest concerns of the processing industry. Hence, the availability of good quality chillies adopting good agricultural practices and harvest and post harvest handling facilities needs focus and support.
- As quality requirements/conditions for export are more stringent, linkage between farmers/ farmers' producer organizations (FPOs) and processing industry is much required and should be supported.
- Dry chilli in whole form is an important export commodity. Better packing systems including vacuum packing needs to be promoted.

Issues on Distribution and Sales

- Marketing activities including market development, branding, promotion, test marketing, and such other activities are to be taken up in major export markets by the major companies or as a consortium of companies.

(2) Identified Needs on Technologies and Machineries

As a result of field survey and interview with food processing companies in Andhra Pradesh State, the needs on technologies and machineries were identified per step on food value chain, production, post-harvest/processing, and distribution/sales.

Table 15.3.1 Identified Needs on Technologies and Machineries

Target Crop	Production	Post-harvest/ Processing	Distribution/ Sales
Rice/ Maize	・ Farm machines (Rice trans-planter, combine harvester, etc.) ・ Fertilizers and agro-chemicals ・ Nursery Seeding Machine	・ Rice milling machine ・ Processing machines (Rice bran oil, starch, glucose) ・ Quality check system ・ Hygiene management ・ Corn sheller ・ Storage, Silo management ・ Power generation by rice husk	・ Products development, ・ sales promotion
Mango/ Tomato/ Chili/ Coconut	・ Traceability (e.g., Good Agriculture Practice (GAP), etc.) ・ Farm management ・ Quality Seeds (for processing purpose) ・ Drip irrigation ・ Contract farming ・ Harvesting technology ・ Harvesting machine	・ Post-harvesting technology (crate, ripening) ・ Sorting and Grading ・ Processing machine (concentrated, dehydrated) ・ Aseptic packaging ・ Packaging/ boxing technology ・ Vapor Heat Treatment facility ・ IQF/ freezing facility ・ Quality check system ・ Hygiene management	・ Cold chain (cooling/ freezing) ・ Logistics management ・ Products development, ・ Sales promotion
Fishery (Shrimp/ Tuna)	・ Traceability for shrimp farming ・ Environmental-friendly aquaculture	・ IQF/ freezing facility ・ Weighing machine ・ Quality Tester	・ Cold chain (cooling/ freezing)

Target Crop	Production	Post-harvest/ Processing	Distribution/ Sales
	・ Disease prevention ・ Fishing technology (electric shocker, electric line howler) ・ Processing on board	・ Quality check system ・ Hygiene management	・ Logistics management ・ Products development, ・ Sales promotion
Livestock (Cow milk)	・ Fodder grass improvement ・ Farm machinery (round baler, fodder grass cutter) ・ Cattle rearing ・ Mastitis inspection ・ Method for detecting estrus of cattle	・ Hygiene management	・ Cold chain (cooling/ freezing) ・ Logistics management ・ Milk processing facility
Livestock (Poultry)	・ Farm management ・ Quality Formula Feed ・ Poultry house facilities (automatic temperature control, radiation control, feeding, egg collection)	・ Meat processing machine ・ Quality check system ・ Hygiene management	・ Efficient egg package and transportation ・ Cold storage

Source: JICA Survey Team

(3) Proposed Activities toward the Introduction of Japanese Technologies

Japanese technologies are generally recognized as advanced and cutting-edge technologies which are high quality, accurate, energy saving, and durable. However, many food processing companies answered that they do not use any Japanese machines and equipment even though they expect to install them. The major reasons for not using Japanese technologies are the lack of information regarding machines, high price compared with other products, and mismatch of specifications with the requirement. In order to promote the introduction of Japanese technologies and machineries in Andhra Pradesh State, the JICA Survey Team proposes the following three steps:

- Establishment of an information center (Japan Desk) in Andhra Pradesh State in order to collect information about the demands of local companies and to distribute the information of Japanese technologies
- Promotion of export of Japanese technologies and machineries from Japan to Andhra Pradesh State
- Invitation for Japanese technology and machinery company to set up its plant in Andhra Pradesh State

The proposed activities for the above steps are shown in Table 15.3.2 below.

Table 15.3.2 Proposed Activities Toward the Introduction of Japanese Technologies

Item	Description
Project Goal	Number of installation of Japanese technologies and machineries is increased.
Expected Output	1. Information centre (Japan Desk) is established for information collection and distribution for Japanese companies. 2. Export and sales of Japanese technologies and machineries from Japan to AP state are increased 3. Manufacturing plants for machines and equipments are set up by Japanese companies in AP state.
Activity	1-1 Establish a Japanese Desk to provide facilitation services and liaison with AP state government. 1-2 Undertake market research on demands and competiveness of Japanese technology and machinery in AP/ India 1-3 Provide information and advice to Japanese companies on technical, legal and statutory matters. 1-4 Conduct BtoB meetings between Japanese technology and machinery companies and identified food processing companies in AP. 2-1 Support Japanese companies to participate international exhibition of food technology and equipment held in AP/ India and/or to demonstrate their own technologies and machines. 2-2 Support Japanese companies for business mission to India. 2-3 Support Japanese companies (suppliers) and AP companies (buyers/ recipients) for negotiation until contract signing 2-4 Offer incentive plans for the export of advanced technologies, such as energy saving, high quality and accuracy, etc. 2-5 Establishment of a demonstration centre for technology dissemination and skill training for Japanese technology and machinery.

Item	Description
	3-1 Identify potential companies based on the previous market research. 3-2 Support to identify potential industrial area to set up a factory in AP state. 3-3 Consultation of F/S for factory construction and necessary clearance and legal matters. 3-4 Development of infrastructure of surrounding area of factory/ industrial area

Source: JICA survey team

15.3 Investment Promotion of Japanese Food Manufacturers

(1) Current Status and Issues of Investment of Japanese Food Manufacturers in Andhra Pradesh State

As per the results of questionnaire survey to Japanese companies about business operation in India shown in Chapter 8.7.2, Japanese food processing companies have interests of business operation in India due to the reasons of expectation to market expansion, high economic growth and high potential of agricultural productions. On the other hand, it is also identified there are several constraints to start up a business in India. Major constraints mentioned by Japanese companies were complicated laws and regulations, lack of infrastructures and unstable procurement. For example, import and sales of foods from overseas are restricted due to regulation on food labelling, finding of local partner having own distribution network is a challenge, and etc. Those are the possible entry barriers for Japanese food processing companies.

About business operation in Andhra Pradesh state, there is no Japanese food processing company operating in Andhra Pradesh state up to date. The interests on Andhra Pradesh state of Japanese companies are also relatively lower than the interests on other states. Even though some of Japanese companies shows high interests on agricultural products as raw material, they are still negative to set up a factory in Andhra Pradesh state due to not only the above entry barriers but also distance from major market and under-development of cold chain network. Many of companies request on the questionnaire survey to provide information regarding such investment environment, legal issues and local food companies and distributers, Andhra Pradesh state is expected to provide broad information to attract Japanese companies. In addition to provision of business information, it is also expected to provide funding support for a feasibility study and a pilot project to exercise a business operation in India and financial support of investment and lending for overseas business.

(2) Proposed activities toward the introduction of Japanese technologies

In order to promote investment of Japanese food manufacturers in Andhra Pradesh State, the JICA Survey Team proposes the following three steps:

- Establishment of investment promotion mechanism including set-up of Japan Desk in Andhra Pradesh State
- Funding support for F/S and pilot project to conduct business operation in India
- Financial support for investment and lending for business operation in India

Proposed activities for the above steps are shown in Table 15.4.1 below.

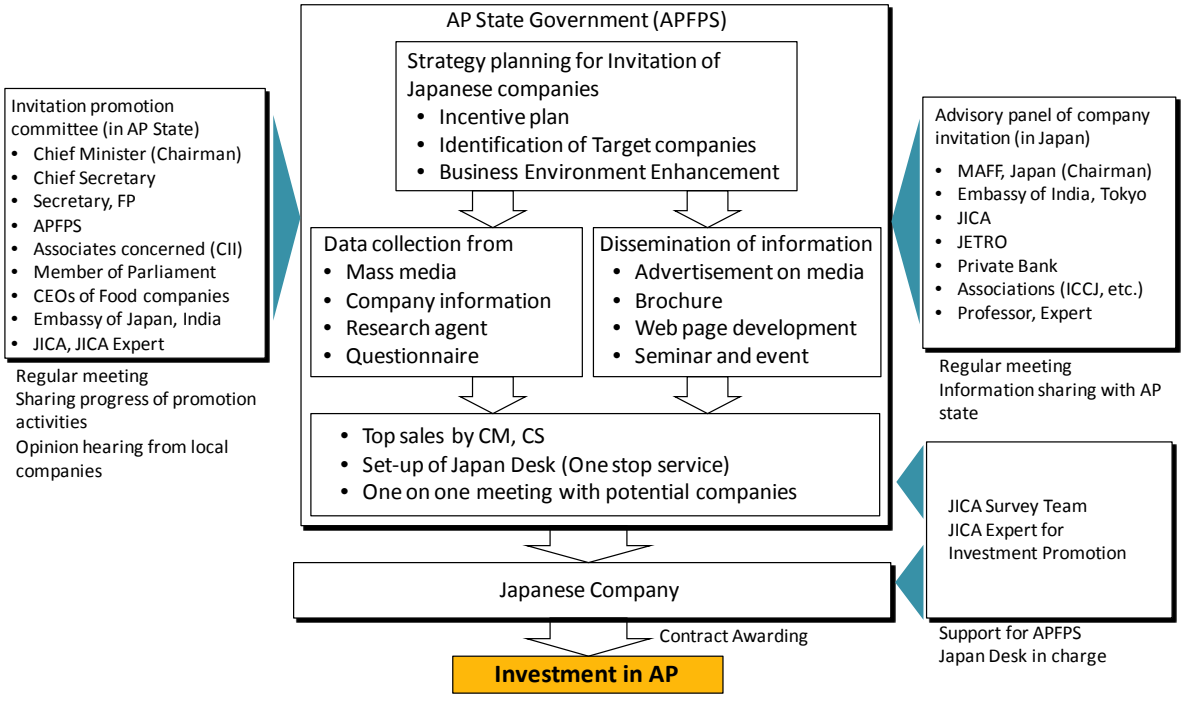
Table 15.4.1 Proposed Activities Toward Investment Promotion of Japanese Food Manufacturers

Item	Description
Project Goal	Number of Japanese food manufacturers operating in AP state is increased
Expected Output	1. Investment promotion mechanism is established. 2. Investments of Japanese food manufacturers (Major) are promoted. 3. Investments of Japanese food manufacturers (Small and Medium) are promoted.
Activity	1-1 Establish “invitation promotion committee” in AP state. 1-2 Establish “advisory panel of company invitation to AP state” in Japan. 1-3 Prepare the strategy for invitation of Japanese companies including incentive plan, identification of target companies/industry, business environment enhancement etc. 1-4 Establish a Japan Desk in AP state as one stop service for Japanese companies. 1-5 Support services in technical, legal and statutory matters for investment in India 2-1 Data collection and information dissemination though media, website, seminar, meeting, etc. 2-2 Top sales by Chief Minister and/or Secretaries of AP state, targeting for the potential companies. 2-3 Arrange Japanese delegation involving major companies to visit AP state to conduct a field visit and a

Item	Description
	BtoB meeting. 2-4 Funding support for customized market research for major food manufacturers based on their requirement. 2-5 Organise "Japanese Food Trade Fair" in AP/ India to promote awareness of Japanese food products. 3-1 Data collection and information dissemination are executed though media, website, seminar, meeting, etc. 3-2 Top sales by Chief Minister and/or Secretaries of AP state are executed targeting for the potential small and medium companies. 3-3 Japanese delegation involving small and medium companies is arranged to visit AP state to conduct a field visit and a BtoB meeting. 3-4 Funding support for customized market research for small and medium food manufacturers based on their requirement. 3-5 Organising "Japanese Food Trade Fair" in AP/ India to promote awareness of Japanese food products. 3-6 Financing support for construction of food factory and its operation in AP/ India

Source: JICA survey team

Especially for the establishment of investment promotion mechanism, it is important that wide range of stakeholders of both public and private sectors should be involved in this mechanism to share information and knowledge about investment promotion. The JICA Survey Team proposes to set up the institutional structure of investment promotion of Japanese food manufacturers shown in Figure 15.4.1 below.



Source: JICA Survey Team

Figure 15.4.1 Institutional Structure for Investment Promotion of Japanese Companies

Andhra Pradesh State government is expected to lead the overall investment promotion for Japanese companies. The Andhra Pradesh State Food Processing Society (APFPS) as the secretariat of Andhra Pradesh State government drafts the strategy for invitation of Japanese companies with support of JICA expert for investment promotion. The JICA expert also assists to operate Japan Desk to be placed at APFPS office. The Andhra Pradesh State government collects data about investment of Japanese and local companies from mass media and research agent and also disseminate information of incentive plan and business environment through media and seminar. The chief minister as well as the chief secretary of Andhra Pradesh State are expected to convince potential investors to conduct business operation in Andhra Pradesh State.

There are two coordination bodies to support the Andhra Pradesh State government. One is the invitation

promotion committee to be set up in Andhra Pradesh State and another one is the advisory panel for company invitation to be set up in Japan. The roles and responsibilities of these stakeholders are described in Table 15.4.2 below.

Table 15.4.2 Roles and Responsibilities of Stakeholders on Investment Promotion

Name	Member	Role and Responsibility
AP state government (APFPS)	・ Chief Minister ・ Chief Secretary ・ Secretary, Food Processing ・ APFPS (secretariat) ・ JICA survey team/ JICA expert for investment promotion (Japan desk in charge)	・ Strategy planning for Invitation of Japanese companies including incentive plan, identification of target companies, and business environment enhancement ・ Data collection from mass media, research agent, questionnaire ・ Dissemination of information through advertisement on media, brochure, web page, seminar and event ・ Top sales by Chief Minister and Chief Secretary ・ Set-up of Japan Desk (provision of one stop service) ・ One on one meeting with potential companies
Invitation promotion committee (in AP State)	・ Chief Minister (Chairman) ・ Chief Secretary ・ Secretary, Food Processing ・ CEO, APFPS ・ Associates concerned (e.g., Confederation of Indian Industry (CII), etc.) ・ Member of Parliament ・ CEOs of food companies in AP ・ Embassy of Japan, India ・ JICA, JICA Expert	・ Regular meeting ・ Sharing progress of promotion activities ・ Opinion hearing from local companies
Advisory panel of company invitation (in Japan)	・ MAFF, Japan (Chairman) ・ Embassy of India, Tokyo ・ JICA ・ JETRO ・ Private Bank ・ Associations(e.g., Indian Chamber of Commerce Japan (ICCJ), etc.) ・ Professor, Expert	・ Regular meeting ・ Information sharing with AP state

Source: JICA Survey Team

Due to recent dietary change in India, the interest in Japanese food among the people in India is expected to increase; however, information about Japanese food is quite limited presently. Generally, it takes time to penetrate food culture; therefore, Japanese food companies expect long lasting assistance to build up business in India. It is also expected for the Japanese government to provide opportunities to talk and taste Japanese food in India, and these activities can be considered as investment promotion.

15.4 Establishment of Food Park in Andhra Pradesh State

(1) Selection Criteria for Potential Food Park Development

Since there is a challenge to identify a potential Japanese food manufacturer to set up a factory in Andhra Pradesh state, it is said that establishment of a food park dedicated for Japanese food manufacturers in Andhra Pradesh is too early to invest so far. Therefore, JICA survey team in this section identified the potential location of food park for future development, The following criteria were adopted for the selection of potential food park development:

i) Andhra Pradesh state shall be geographically divided into three areas, namely: north area, central area, and south area, for the formulation of conceptual plan.

ii) Evaluation criteria of candidate sites for food park are the following:
- Accessibility: to have easy access to existing transportation systems such as national highway, seaport, and airport;
- Securing of Land: whether land/plot corresponding to the investor's request (minimum of 50 acres) is available or not;
- Site Condition: topographic condition to affect the land reclamation work;
- Construction Cost: factors to influence cost such as topographic condition (e.g., flat, hilly, and

hill) and external/internal infrastructure development condition (e.g., access road and locations of water source);
- Development of Infrastructure: development condition of infrastructure around site, especially road, power, and water;
- Suitability of Food Park: whether heavy industries, power plants, and chemical industries are situated on the periphery of the site or not;
- Environmental Issues: whether resettlement and/or acquisition of farm land are required or not; and
- Relation Among Producers and Consumers: physical relationship between site, production area, and major market.

iii) Candidate sites for food park are not limited only in new development site but existing food park like Srini Food Park in order to use the existing and planned food parks and special economic zones (SEZs).

iv) Operational range of each food park is assumed to be about 100 km to 200 km from food park according to the practices of existing food parks.

(2) Promising Locations of Food Parks

As a result of the survey, the conceptual plan of food park development in Andhra Pradesh State is illustrated in Figure 15.5.1.

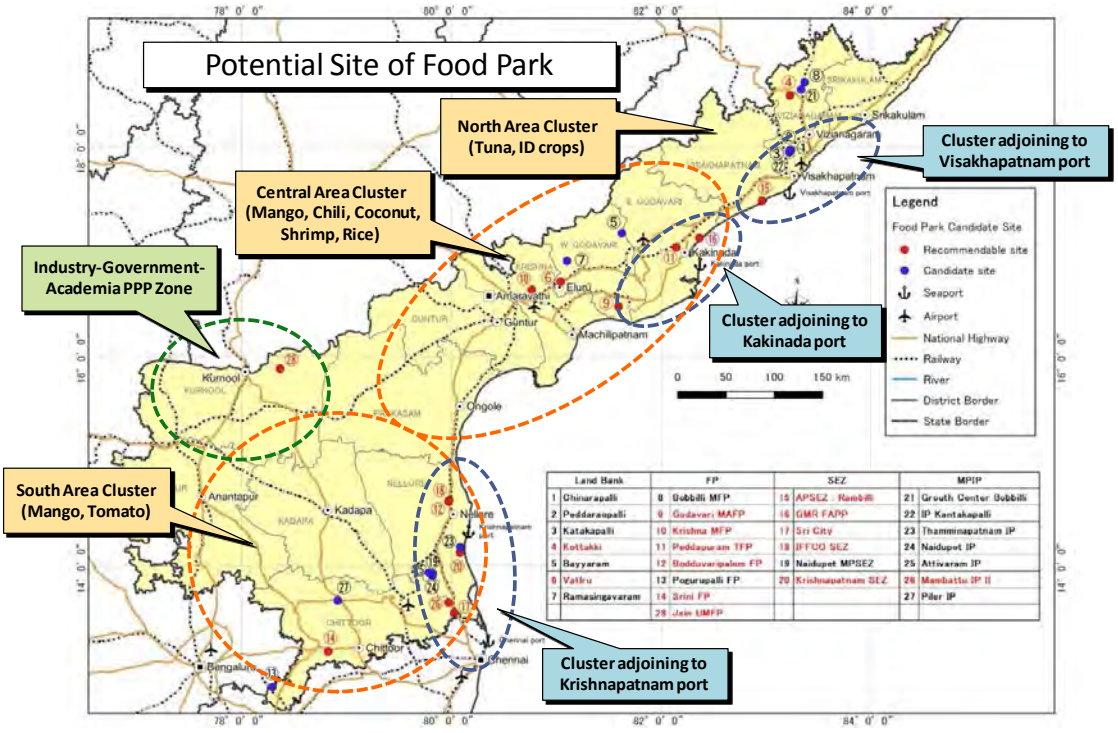


Figure 15.5.1 Conceptual Plan of Food Park Development in Andhra Pradesh State

The conceptual plans for food park development are summarised below.

(a) North Area

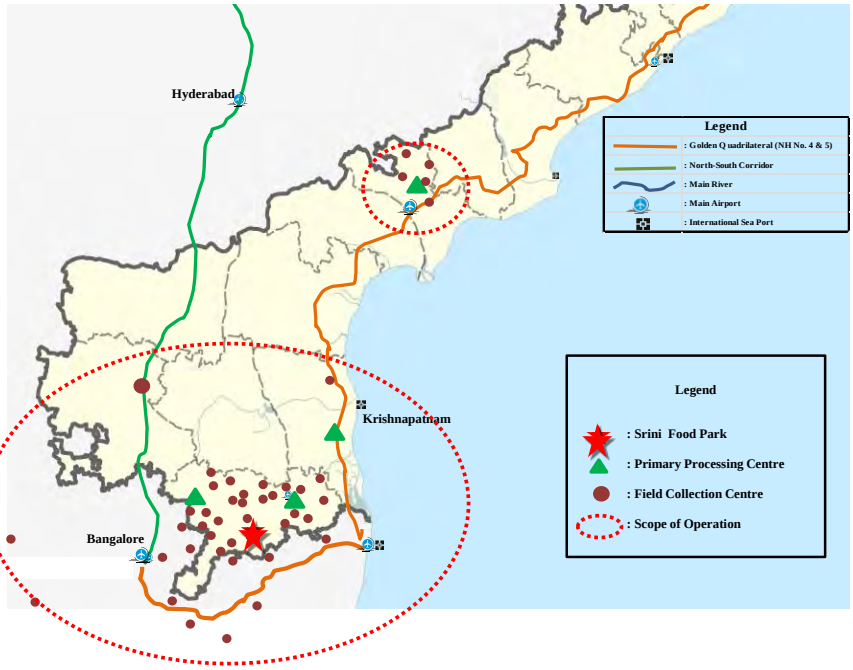
There is no existing food park in the north area. Although the Bobbilli Mega Food Park (MFP) is proposed, it is not approved yet by the Ministry of Food Processing Industry (MoFPI) since its flow of ripple effect is uncertain given that Bobbilli MFP is dedicated only to sugarcane industry and operational range is limited within a radius of 30 km. Among the four candidate sites introduced by APIIC, Kottakki Site is selected as one of the suitable sites for food park from viewpoints of unit construction cost and geographic condition. The Andhra Pradesh Special Economic Zone (APSEZ) in Rambilli is also recommended as potential site for food park development. The evaluation summary of the north area is shown in Attachment 15.5.1.

(b) Central Area

The Godavari Mega Aqua Food Park (MAFP) is supposed to be completed by July 2016 and will commence its operation afterwards. Godavari MAFP has one Central Processing Center (CPC) and two Primary Processing Centers (PPCs) in Amalapuram and Karlapalem with nine Collection Centers (CCs). The operational range is envisioned to be 200 km along the coastline of the Bay of Bengal. Krishna Mega Food Park (MFP) is planned to set up one CPC and two Field Collection Centers (FCCs) in Agiripalli, four PPCs and two FCCs in Tadepalligudem, two FCCs in Rangampeta, and three FCCs in Sattenapalli. The range of operation is within a radius of more than 200 km. Among the three candidate sites introduced by APIIC, Vatlru Site is selected as the suitable site of food park. GMR Kakinada SEZ has been developing as an agri-product base. The evaluation summary of the central area is shown in Attachment 15.5.2.

(c) South Area

The Srini Food Park has developed a wide range of operational area, which has a radius of more than 200 km. Srini Food Park has 44 FCCs, where 27 are in Chittoor, 5 in Krishna, 5 in Karnataka State, and 7 in Tamilnadu State, as shown in Figure 15.5.2.



Source: JICA Survey Team

Figure 15.5.2 Operational Range of Srini Food Park, Chittoor

Sri City, Chittoor, Indian Farmers Fertiliser Cooperative Limited (IFFCO) Kisan SEZ, and Nelloor have been developing actively. Although Krishnapatnam SEZ is planned to be set up as a multi-purpose SEZ including food processing industry, an F/S is necessary to establish it as an SEZ. In Nelloor District, Bodduvaripalem Food Park, Naidupet Muti-Purpose SEZ, and Mambattu Industrial Park II are recommended as candidate sites for food park development. The evaluation summary of the south area is shown in Attachment 15.5.3

(3) Proposed Activities toward the Introduction of Japanese Technologies

As a conclusion of data collection and field observation, the potential sites of food park development are identified as follows:

i) North Area
- High potential area for development of food park with strategic crops (e.g., tuna and coconut)
- APSEZ (Rambilli) is a potential site as a combinat adjoining to Visakhapatnam Port

ii) Central Area
- High potential area for food park with strategic crops (e.g., mango, chilli, coconut, and shrimp)
- GMR Food & Agri Processing Park (FAPP) is a potential site for combinat as Kakinada SEZ and/or with improvement of existing Kakinada Port
- Collaboration with Krishna MFP proposed by APIIC
- Possible for new food park development under APIIC's land bank

iii) South Area
- High potential area for food park with strategic crops (e.g., mango and tomato)
- Collaboration with existing food park (Srini Food Park)
- Development of new food park in Krishnapatnam SEZ adjoining to Krishnapatnam Port
- Possible to formulate an industry-government-academe PPP development in Kurnool District

However, the above selection is based on geographical location and site condition, which is just one of the survey items of F/S for industrial park development. The existing food parks are not fully operated and occupied and no Japanese company shows interest to put up a factory in these parks. It is still premature to propose a plan of food park as a result of this survey.

In order to assess the feasibility of food park, further detailed information should be collected. Basic scopes of the study are described as follows:

i) Pre-feasibility study
- Review of socio-economic conditions;
- Review of policy and regulations (Andhra Pradesh Infrastructure Development Enabling Act 2001, etc.), foreign investment, and human resources for promotion activities;
- Review of existing industrial parks around the site;
- Study of present conditions of the site, including topographic survey, land use survey, and soil survey;
- Study of present conditions of infrastructure in and around the site; and
- Formulation of the development strategies for promotion of food park.

ii) Feasibility study on food park project (Detailed Project Report (DPR))
- land use plan, layout plan, basic design, project cost estimation, planning for operation and management, project evaluation, social and environmental considerations, and investment promotion plan, etc.

iii) Application for approval of food park development
- Review of F/S and detailed design (D/D) for implementation of the project
- Supervision and marketing, and operations and maintenance (O&M) of food parks.

16. CONCLUSION AND RECOMMENDATIONS

16.1 Conclusion

The proposed Andhra Pradesh Irrigation Livelihoods Improvement Project-II (APILIP-II) will widely cover agriculture and allied sectors which require an integrated development approach, i.e., (i) horizontal integration with centre on PMU forming cross-departmental platform and (ii) vertical integration from production to processing and marketing in a unit of medium irrigation cluster. The project can be judged relevant for implementation by the following:

(1) Selection of Target Medium and Minor Irrigation Projects

Twenty out of 21 medium irrigation projects have been selected in consideration of (i) maturity of project, (ii) water availability, (iii) status of irrigation system, and (iv) farmer's organisation, benefit-cost (BC) ratio, with cut-off items of land acquisition, and BC ratio below 1.0.

Four hundred forty-nine out of 485 minor irrigation projects have been selected in consideration of (i) maturity of project, (ii) water availability, (iii) status of irrigation system, and (iv) farmer's organisation, benefit-cost (BC) ratio, with cut-off items of command area less than 40 ha, system tank, land acquisition, and BC ratio below 1.0.

Therefore, 20 medium irrigation projects and their nearby minor irrigation projects will form clusters for the integrated agriculture development under the project.

(2) Selection of Target Crops for Food Value Chain Development

Six agricultural produces, namely: mango, chilli, tomato, coconuts, shrimp, and tuna, have been selected taking into account the (i) production capacity, (ii) possibility of value addition, (iii) market trend, (iv) access to processing industries and export market, and (v) possible linkage with irrigation project. Quality, food security, and traceability of these strategic produces will be improved targeting high value domestic and export market to advanced countries first on a pilot basis.

(3) Project Scope

Modernisation of irrigation projects consisting of (i) 20 medium irrigation projects and (ii) 449 minor irrigation projects, which will be executed in phases: Batch-1: 12 medium and 119 minor and Batch-2: 8 medium and 330 minor. Moreover, 155 units of multi-purpose community centres and other agriculture infrastructure will be procured and constructed under the project. Livelihood support to local poor in animal husbandry and inland fishery communities will be implemented by phase: Batch-1: 3 medium irrigation clusters and Batch-2: 6 medium irrigation clusters. Furthermore, technical advice for participatory irrigation management and promotion of farmers producers organisations (FPOs) will be provided by the project.

In addition, the food value chain development for strategic crops through public-private partnership (PPP) and farm mechanisation on a pilot basis will be implemented under the project.

(4) Project Period

The project period will be for nine years from 2017 and will be divided into three phases, namely: (i) Preparatory phase: first year mainly for establishment of project management unit (PMU), detailed project report (DPR), preparation and its sanction, procurement of contractors for modernisation of irrigation projects, and procurement of Project Management Consultant (PMC); (ii) Implementation phase: second to seventh year mainly for all project activities; and (iii) Closing phase: eighth to ninth year mainly for contingency and follow-up activities.

(5) Project Organisation

The project executing agency is the Department of Water Resources (DoWR), Government of Andhra Pradesh (GoAP).

DoWR/GoAP will set up (i) one state Project Steering Committee (PSC), (ii) one state PMU, and (iii) 13 District Implementation Units (DIUs) with PMU individual consultants, consulting firms, and non-governmental organisations (NGOs). In addition, two Pilot Project Management Units (PPMUs)

will be set-up for pilot programmes under PMU.

Each department concerned is responsible for the proposed activities within its scope of services under control and management by PMU. PSC will function as a decision making body for the overall project implementation.

(6) Project Management Consultant

PMC will be employed for the period of six years from second year to assist PMU in the overall project management and technical advice for modernisation of irrigation projects, institutional development and capacity building programme, livelihood support programme, and pilot programmes.

(7) Environmental and Social Considerations

There would be no land acquisition and resettlement taken place in the Project. It is however environmental and forest clearance shall be obtained from the relevant department and/or authority in compliance with the Central Water Commission's (CWC) guideline if necessary. Moreover, environmental checklist, monitoring plan and forest dwellers development framework if required shall be prepared and monitored in accordance with the JICA environmental guideline.

(8) Project Sustainability

The project itself builds in a mechanism to ensure project sustainability. In concrete terms, institutional development and capacity building of water user associations (WUAs) and farmers producer organisations (FPOs) coincide with the national and state policies and plans. This programme will be continuously supported by GoAP even after the project is over.

(9) Project Evaluation and Impact

The economic internal rate of return (EIRR) of the project is estimated at 23.5%, which is economically good enough to justify the project. Aside from that the annual incremental net return of the project will reach to INR 6,329 million from the ninth year of the project and similarly, the annual net farm income will increase to INR 379,359/ha (with project condition) from INR 280,617/ha (without project condition). Moreover, this project is social and environment friendly due to the following reasons: (i) land acquisition and resettlement are not required, (ii) canal lining itself has adaptation measures for climate change, and (iii) groundwater recharge by rainwater harvesting tank and farm ponds.

Taking the abovementioned reasons into account, it can be said that the proposed APILIP-II is technically viable, economically feasible, institutionally sustainable, and environmentally friendly.

16.2 Recommendations

The following recommendations shall be considered on a condition that the proposed APILIP-II will be implemented with financial and technical support from the Japan International Cooperation Agency (JICA).

<u>DoWR/GoAP</u>

(1) Actions to be taken before Loan Agreement

The status of detailed project reports (DPRs) of irrigation projects selected for APILIP-II by the end of March 2016 is as follows: *(Refer to Chapter 10.2)*

- DPRs for eight (8) medium irrigation projects have been prepared and submitted to the Central Water Commission (CWC) for checking and approval. These DPRs are to be updated with Standard Schedule of Rates (SSR) 2015-16 and resubmitted to CWC in accordance with the CWC's clearance letters already issued.
- DPRs for four (4) medium irrigation projects have been prepared and awaiting CWC's checking and approval. These DPRs shall be followed up depending on the CWC's clearance letter to be issued.
- DPRs for the remaining eight (8) medium irrigation projects shall be prepared and submitted to

CWC for checking and approval.

- DPRs for 25 minor irrigation projects have been prepared but not approved by the state technical advisory committee yet.
- DPRs for the remaining 424 minor irrigation projects shall be prepared and approved by the state technical advisory committee.
- Environmental and forest clearance including work permission for Siva Bhashyam Sagar medium irrigation partially located in the Nagarjunasagar-Srisailam Tiger Reserve shall be obtained if required.

All DPRs of irrigation projects selected for the proposed APILIP-II shall be prepared before the project appraisal that would be made by JICA.

(2) Actions to be taken right after Loan Agreement

For quick implementation of APILIP-II, DoWR/GoAP shall facilitate the following actions immediately after the loan agreement is made effective:

- Setting up of PSC/PMU/DIU by GoAP;
- Selection of PMC by DoWR;
- Administrative and technical sanctions by GoAP for modernisation of irrigation projects;
- Formation of farmer groups/FPOs in the target medium irrigation clusters by DoA; and
- Preparation of annual work plan and budget proposal of all project components for the 1st year's operation by all the departments concerned.

To JICA

(1) Adjustment of the Project Cost

The total project cost estimated by the JICA Survey Team exceeds the amount set in the Project Concept Note for APILIP-II (2016-17 to 2020-21) prepared by DoWR/GoAP. Beside, the eligible portion of the JICA loan slightly exceeds the ceiling of 85% of the total project cost. It is required therefore to adjust the total project cost as well as the JICA loan portion with DoWR/GoAP at the time of upcoming fact finding.

(2) Follow-up Action for Promoting Agri-business in Andhra Pradesh State

Action plan to be realistic and efficient for promoting agri-business in Andhra Pradesh State in collaboration with Indian local and Japanese food industries shall be designed and implemented on public-private partnership (PPP) mode with public intervention by the Government of Andhra Pradesh (GoAP) and the Government of Japan (GoJ), to promote the following:

- Establishment of an agri-business promotion committee both in Andhra Pradesh State and Japan;
- Preparation of a joint action plan for promoting food industry in Andhra Pradesh State with Japanese technologies and investments; and
- Implementation of the action plan on PPP mode with technical and financial assistance by GoAP and GoJ.