
CHAPTER 8. AGRICULTURE AND AGRIBUSINESS DEVELOPMENT PROGRAM

In Chapter 6, basic strategies and direction in formulating an integrated regional development plan for the Jordan Rift Valley area were discussed from various viewpoints. Agricultural and agribusiness development is oriented to economic development through the efficient use of natural resources in the Jordan Rift Valley, as agriculture plays a primary role in economic development of this area. This chapter identifies sectoral issues, and formulates strategies and programs for sustainable agriculture-based economic development to be implemented for the attainment of overall targets set for the region.

It is clear that the limitation of water resources is a major constraint to agriculture-based economic development. The focal point to cope with this is how to raise the water use efficiency in order to maximize productivity in the agricultural sector including animal husbandry. Likewise, for a market-oriented economy, it is necessary to enhance competitiveness of the regional agricultural sector and its ability to adapt to market needs. Major issues to be addressed for these purposes are: (i) improvement of productivity and quality in agricultural production; (ii) enhancement of agricultural marketing and trade capability and quality control; (iii) increase in high value added processed products; and (iv) promotion of investment for agro-based industrialization through rural and agricultural finance as well as agricultural institutions. To attain a high rate of economic growth in line with their medium and long-term development plans, Palestinians should aim at exporting their agricultural products to external markets, such as neighboring countries and the EU. Palestinians should also aim at recycle-oriented or zero-emission-oriented farming systems in view of ecological natural resources.

8.1 Issues to be Addressed in Agriculture and Agribusiness

The current situation of agriculture and agribusiness is compiled in the Annexes; i.e., water resources in Annex 2, irrigated and rain-fed agriculture and animal husbandry in Annex 3, and trade and agro-industry in Annex 5, incorporating the results of surveys and analysis conducted in the course of this Study. In general, agriculture and agribusiness development in the region has deteriorated due to poor allocation of natural resources, restricted market options of farmers, lack of institutional decision-making information, and limited guidance on and assistance in applying appropriate technology as a result of the Israeli imposed closure after the Second Intifada.

As the MTDP states, the status of agriculture and agribusiness is likely to suffer from long-term damage if the current situation persists. Issues in the agriculture and agribusiness sector are multi-fold. These issues are discussed herein by sub-sector and by institutional setting, taking lessons from the previous and on-going improvement activities.

The current situation of land resources presents issues in the availability of agricultural lands, and legal and institutional frameworks for land management, while issues with water resources consist of inter-sector allocation of water, water use efficiency, and legal and institutional frameworks for water management.

With respect to the current situation in irrigated agriculture, issues consist of lands under irrigated cultivation, production of crops such as field crops and forage, vegetables and fruits, farming systems and cropping seasons as well as water and labor inefficiencies. Regarding rain-fed agriculture, issues are concentrated on productivity of field crops and self-sufficiency in basic staples of wheat/cereals. The animal husbandry sub-sector is composed of dairy cattle, sheep/goats, poultry, honeybees, and work animals. Analyses have been made to examine adjusting livestock production to keep in step with increasing demand, together with forage requirements. Such analyses indicate that there are some issues to be addressed for self-sufficiency in forage due to restricted free grazing unless the present feeding method is drastically improved.

Study results on horticulture and field crop marketing and trade indicate that export issues are: Israeli imposed border closures, time-consuming security, transport and trade restrictions, high cost of inputs from Israeli suppliers and restricted access to the world market, etc. Livestock marketing faces: high cost of imported feed, inadequate quality control, restrictions on transportation, etc. The survey on the agro-processing industry in the Jordan Rift Valley area has revealed that there are some issues in agro-processing such as making bread, cheese, pickles and cakes for neighbors. There are few processing factories having a large market. Due to a shortage of financial resources for introduction of such modern technology as cooling and automation systems, agro-processing business has remained at a primitive level. Issues in agribusiness, including fresh and processed foods, are analyzed by the possible actors in both the public and private sectors. Improvement in infrastructure for distribution should be the responsibility of the public sector, while individual investments in agribusiness should be promoted under the self-reliant efforts of the private sector even though public support is necessary.

8.1.1 Overview

Social and economic backgrounds, as well as physical characteristics, of the West Bank and the Jordan Rift Valley area have been discussed in the previous Chapters. Under such backgrounds, the issues to be addressed in the agricultural sector are summarized in the following:

(1) Economic and Social Viewpoints

As discussed in Chapter 5, in 2003 the agricultural sector contributed 10.1% of the total GDP of US\$ 4.17 billion, accounting for the third largest share following the service sector, and the mining, manufacturing, electricity and water sector. Agricultural exports represented 11.2% of the Palestine's total export earnings. Although its contribution is not as large as other developing countries, due mainly to various

physical limitations, the agricultural sector is expected to grow steadily and lead the economy in the West Bank and the Jordan Rift Valley area.

On the other hand, the agricultural sector employed about 16% of the total working population in the West Bank and Gaza and 17% in the West Bank alone (2004). It is reported that the unemployment rate is as high as 26.8% in the West Bank and Gaza and 23.8% in the West Bank (2003), and the unemployment and underemployment rates would increase if and when the working opportunities on the Israeli farmlands and enterprises are closed to Palestinian workers. In the short and medium term, the agricultural sector is expected to create and steadily provide job opportunities for the Palestinian workers even under the physically limited conditions.

Another important issue is poverty reduction. Approximately 47% of Palestinians live below the official poverty line (US\$ 2.1/day/person) and 16% of the population live below the subsistence poverty line (cannot afford the basics for survival). The incidence of severe malnutrition is currently high in part of the West Bank (13%). In addition to the expectations to create job opportunities, the agricultural sector should address the issues of malnutrition, food security and poverty alleviation in the West Bank and the Jordan Rift Valley area.

(2) Land and Water Limitations

Of the total land in the West Bank (about 5,800 km²), 27% or 1,662 km² (1,662,000 dunums or 166,200 ha) is categorized as agricultural or cultivable land in 2003-04. The remaining land (73% or 4,138 km²) is rangeland, desert and non-cultivable land. According to the 1993-94 agricultural statistics, the agricultural land in the West Bank was estimated to be 1,653 km², which leads to the implication that the farmlands have not been expanded during the past decade. The limitation in the farmlands is mainly attributable to the undulating topography of the highlands, limited rainfall and water resources over the West Bank.

Of the agricultural land in the West Bank, irrigated fields totaled about 132 km² (132,000 dunums) or 9% of the farmland, while rain-fed farmland was 1,530 km² (1,530,000 dunums) or 91% in 2003-04. As discussed in the foregoing Section, available water resources are quite limited in the West Bank and the Jordan Rift Valley area. Characteristics of the agricultural patterns in the West Bank and the Study area in the cropping year 2003-04 are summarized in the following table.

Table 8.1.1 Characteristics of Agricultural Pattern in the Study Area (2003/04)

District/ Governorate	Field Crops		Vegetables		Fruit Trees		Total	
	Irrigated	Rain-fed	Irrigated	Rain-fed	Irrigated	Rain-fed	Irrigated	Rain-fed
Tubas	-	50,703	14,471	5,210	820	13,993	15,291	69,906
Jericho	6,570	-	36,238	-	7,211	-	50,089	-
Study Area	6,570	50,703	50,709	5,210	8,031	13,993	65,310	69,906
West Bank	10,557	427,262	94,320	33,934	26,555	1,069,506	131,432	1,530,702

(Unit: Dunum)

Source: Agricultural Statistics, PCBS (October 2005)

As can be observed from the above table, agricultural patterns in the Study area are different in the north and the south. In the northern area (represented by Tubas district), no irrigation is practiced for field crops such as wheat and barley, and the same is true with fruit trees for which irrigation is not practiced for 94% of the total cultivated land in fruit trees. This general trend is more or less the same as the highland area in the West Bank, where irrigation is not practiced for most field crops and fruit trees. In contrast with the above agricultural pattern, in the southern part of the Study area (represented by Jericho governorate), irrigation is practiced for all crops, including field crops, vegetables and fruit trees. In this area, no cultivation of crops is possible without irrigation due to lack of rainfall.

As pointed out in Chapter 2.4, over half of the irrigated agricultural lands in the West Bank and Gaza are in the Jordan Rift Valley. In view of the fact that the water resources are quite limited throughout the West Bank and Gaza, the foremost technical issue to be addressed in the agricultural sector is how to make utmost use of the limited water in the Jordan Rift Valley.

(3) Issues Defined under the National Strategy

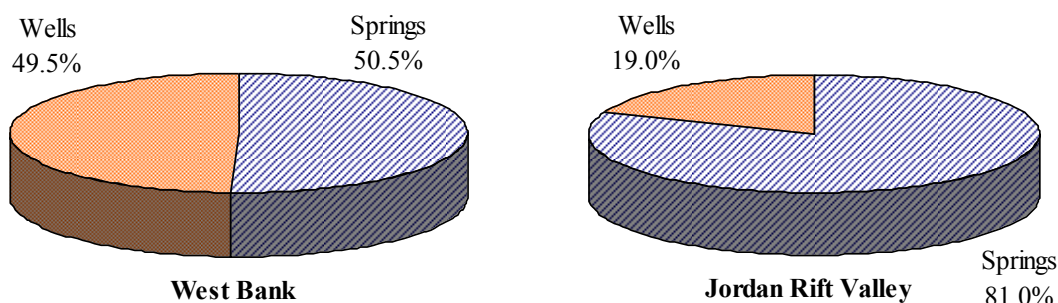
As introduced in Chapter 3.1, several strategies have been set up under the national development plans. The Strategy for Sustainable Agriculture in Palestine for the Period 2001-2005 was formulated in the context of the political and economic issues, rapidly changing socioeconomic parameters and policies, as well as the programs towards the independent Palestinian State in the future. This stipulated the principal direction for agriculture and food supply to develop a system for food security as part of the effort to ensure availability of food and nutrients in adequate quantity and quality at affordable prices. The Medium Term Agricultural Development Plan, 2001-2005 has attached importance to (i) sustaining natural resources, (ii) enhancing agricultural productivity and food security, (iii) developing sustainable rural financing, (iv) enhancing marketing and exports, and (v) building agricultural institution and service capability.

As noted in Chapter 3.2, the Ministry of Agriculture (MoA) is now preparing the Agricultural Medium-term Development Plan, 2005-2007. A preliminary draft prepared in March 2005 proposes six programs, i.e., (i) improving rural livelihoods by raising food security and reducing poverty, (ii) undertaking institutional reform and capacity building, (iii) developing natural resources, (iv) providing technical assistance to farmers, (v) providing support in marketing and trade, and (vi) preserving green areas and wildlife.

The national strategies imply that, in addition to the enhancement of agricultural production, productivity and exports, food security is one of the issues to be addressed in agricultural development. This unique issue should also be duly taken into account in formulating the agricultural development programs in the Jordan Rift Valley area.

8.1.2 Issues by Sub-Sector**(1) Water Resources and Irrigated Lands**

It is clear from the discussion in Chapter 5.4 that the shortage and deteriorating quality of water is a prime constraint on both agricultural and urban development in the West Bank. It is well recognized that the alleviation of this constraint is highly dependent on the outcome of the peace negotiations between the Palestinians and the Israelis, including negotiations for sharing of water resources.



Source: Water Supply for Domestic and Industrial Use (PWA, 2003), PWA Database

Figure 8.1.1 Existing Water Resources

Meanwhile, the following issues associated with water availability and usage are to be addressed: (Refer also to **Annex 2**)

- (i) Declining static water level due to over extraction of aquifer water in the Jordan Rift Valley,
- (ii) Increasing chloride concentration due to excessive exploitation and contamination of spring water
- (iii) Contamination of existing water resources by untreated wastewater,
- (iv) Weak enforcement of existing laws that restrict well drilling and water usage,
- (v) Deterioration of existing water infrastructure such as wells, springs, ponds, and conveyance channels,
- (vi) Inefficient use of irrigation water given the continued use of open channels and other traditional methods,
- (vii) Weak awareness of water saving methodology among users and owners,
- (viii) Unclear property rights over certain wells and springs leading to uncontrolled use and possible conflicts among uses,
- (ix) Lack of water users' associations to serve as a way to educate efficient water uses and to cooperate in rational use of scarce water,
- (x) Substantial difference in water supply service level by regions and water resources,

- (xi) No clear policy with respect to local water markets and no framework for regulating these markets, and
- (xii) Limited knowledge on applied research on salt tolerant crops to allow use of brackish water for profitable production.

(2) Land Resources: Rain-fed Agricultural Lands and Rangelands

Faced with fewer land resources and an increased cost of living, many Palestinian farmers had no choice but to seek work in Israel and other counties to provide a more stable source of income, and this in turn led to further marginalization of the rain-fed farming sector. Consequently, there has been a continuous decline in the area cultivated by Palestinians. In the West Bank, the area actually cultivated in 1965 was estimated to be 243,500 ha, compared to 166,200 ha in 2003, or a net loss of approximately one third of total cultivated land. Consequently, there has been a decline in rain-fed agricultural land and grazing land. The following are specific issues to be addressed in efficient use of land in the Jordan Rift Valley area:

Agricultural Lands

- (i) Loss of sustainability,
- (ii) Desertification of some areas,
- (iii) Land degradation,
- (iv) Soil erosion,
- (v) Creeping soil salinization,
- (vi) Tragic decline in biodiversity,
- (vii) Increased encroachment on limited available land in urban areas,
- (viii) Weak land registry,
- (ix) Poor enforcement of laws regarding land management, and
- (x) Lack of expertise in integrated land resource management.

Rangelands

- (i) Lack of physical and biological data about rangelands,
- (ii) Absence of laws to permit control of grazing in common areas,
- (iii) Land tenure in rangelands, based on Ottoman and Jordanian legislation, is fragmented with uncertain tenureship, leading to overgrazing and abuse,
- (iv) Lack of knowledge and understanding on the dynamics of social and economic interactions in rangelands, and

- (v) Lack of management.

(3) Production of Agriculture and Livestock

Palestinian agriculture has been suffering from deterioration during the past 30 years; nonetheless, it has clear comparative advantages in production of many high value crops and some livestock products. The political and economic constraints have combined, putting heavy burdens on farmers. Resources are not always allocated to their optimum economic use, and hence productivity has declined. The marketing options of farmers have been severely restricted. Furthermore, producers have not had access to institutional decision-making information and guidance on and assistance in identifying and applying appropriate technology. Following are the major issues to be addressed in the agricultural and livestock sub-sectors: (Refer also to **Annex 3**, Chapters 2 and 3)

Agricultural Production

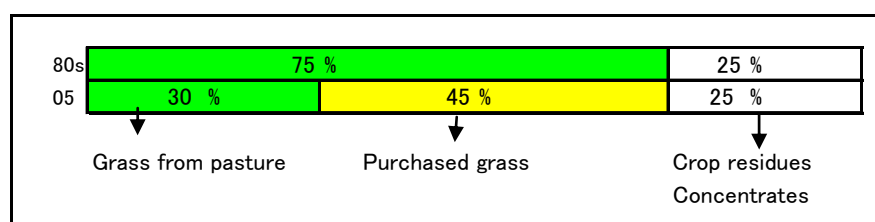
- (i) Yields are low due to inappropriate varieties, poor cultural practices and insufficient input,
- (ii) Lack of supporting information on decision-making in selecting more profitable products and technologies,
- (iii) Insufficient access for farmers to credit for production and marketing,
- (iv) High cost of inputs,
- (v) Limited access to alternative markets and high export transaction costs,
- (vi) Limited availability of food processing market outlets,
- (vii) Lack of effective farmers' associations to improve management of water resources, reduce input costs and improve marketing,
- (viii) Weak agricultural extension services,
- (ix) Inadequate applied research linked closely to extension programs, and
- (x) Small farm sizes resulting in high production costs, marketing problems, and a complicated process of knowledge dissemination and technology transfer.

Livestock Production

- (i) Inefficient production due to:
 - Water: limited wells, poor rainfall, and lack of small scale water harvesting facilities,
 - Fodder: imported at high prices, poor pasture grass in dry season,

- Crop residues: lack of techniques to transform into fodder for livestock,
 - Grazing pasture: strict limitation of grazing under the occupational situation, and
 - Extension service: lack of experience, lack of facilities.
- (ii) Low performance of livestock industry, due to
- Genetic factors: lack of breeding, poor artificial insemination,
 - Raising and breeding management factors: scarce opportunity to study, and
 - Nutritive factors: poor grass nutrition, lack of grass storage (hay and silage).
- (iii) Inadequate animal health care, due to
- Inadequate disease prevention,
 - Increasing neonatal diseases causing a high mortality rate, and
 - Inadequate breeding through inbreeding.

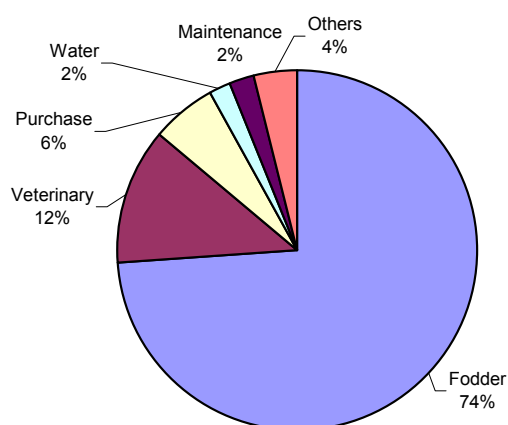
One of the most notable issues in animal husbandry is the supply of fodder. Since raising and feeding livestock have been shifted from an extensive system to the semi-intensive and intensive system, livestock owners have to feed concentrates and hay to animals. Due to restriction of free grazing, most concentrates and fodders are now imported from Israel at high prices. According to an interview at the veterinary service office, it was revealed that the fodder supply from pastures dropped from about 75% in the 1980s to the level of around 30% in 2005 making farmers purchase the difference (45%), as illustrated in the following figure.



Source: Veterinary Service Office, Ramallah

Figure 8.1.2 Fodder Supply for Livestock

Such a situation has made farmers spend more for food for animals. The expenditures for concentrates and fodder account for 74% of the average livestock expenditures, as shown in the following figure.



Source: Veterinary Service Office, Ramallah

Figure 8.1.3 Average Livestock Expenditures

The second largest expenditure for livestock farmers is veterinary service cost (12% of livestock expenditures) for animal health care. Most livestock owners are Bedouins and they do not seem to be interested in disease prevention or vaccination. They need to be enlightened in order to understand the importance of disease prevention. Neonatal diseases also bring huge economical loss to owners. Neonatal diseases are caused by insufficient nutrition, low levels of immunity due to low intake of colostrums, poor hygiene, lack of equipment for disease surveys, outbreaks of Salmonellosis and Pasteurellosis, and seasonal diseases such as diarrhea and pneumonia that cause a mortality rate ranging from 25% to 30%, etc. Breeding and improvement of animal breeds is also important to increase production. Body size and productivity are getting worse through inbreeding, and this results in undersized bodies and low production of milk, meat and hides.

(4) Marketing and Trade Support Services

Development of the Palestinian private sector is dependent on the capacity of Small and Medium Enterprises (SMEs) that represent a vast majority of its enterprises. SME development is in turn highly reliant on the availability and accessibility of business and trade support services. Under the current situation, most business and trade support services are under-developed (refer to Annex 3, Chapter 4). PALTRADE summarizes in its trade development plan the current issues for such services:

(i) Marketing advisory and market research services

Very few Palestinian enterprises have in-house capacity for marketing or market research functions. Knowledge of potential export markets is almost nil and there are few suppliers of such services to SMEs.

(ii) Advertising and promotion services

A number of firms provide such services, but in most cases their services are limited to

campaigns and materials for use in the local market.

(iii) Merchandizing, distribution, and export marketing services

Merchandizing and distribution are the weakest areas in the value chain of most Palestinian sectors. Some Palestinian exporters have managed to develop business relationships with distributors in export markets or with Israeli distributors and agents, but only a few SMEs export their products through Palestinian agents.

(iv) Packaging and labeling services

Most Palestinian manufacturers purchase packaging materials from Israeli manufactures. A few packaging material manufactures operate in the West Bank and Gaza with limited design capacity. Mandatory requirements related to packaging and labeling in export markets have become increasingly complex and practically no local service is available to address these export requirements.

(v) Testing and certification services

A number of Palestinian establishments provide services for certification of operations to ISO9000 and other management standards. However, product testing and certification services are more limited due to the relatively heavy investment required in equipment and skill development. There is a lack of services available to assist firms in compliance with international standards and specifications. Laboratories operated by Palestinian Standards Institute (PSI) and at academic institutions provide some testing capacity, but none of these laboratories are accredited internationally and the range of product testing services is still limited. Firms often rely on laboratories in Israel and Jordan to provide evidence of compliance.

(vi) Maintenance and calibration service

Engineering and technical services such as equipment selection, installation, and maintenance are lacking. While local capacity exists for basic equipment repair and even manufacturing some spare parts, Palestinian industries are heavily reliant on Israel for technical services. Calibration services for measurement equipment are unavailable.

(vii) Shipping and clearance services

A number of shipping and clearance agents operate in the West Bank and Gaza. Most of them depend on Israeli agents for facilitating clearance through the Israeli ports. Despite the impediments to crossing borders and port access, adequate shipping services are available to Palestine exporters.

(viii) Transportation and warehousing service

Transportation services are impeded by the closures within and between the West Bank and Gaza. Delays and restrictions on movement have increased transaction costs and

have a serious impact on the competitiveness of Palestinian products, even in the local market. Nonetheless, access to transportation services is available, including access to both Palestinian and Israeli vehicles, but at a high price. Warehousing services are to some extent limited, particularly for specialized needs such as cold storage. The lack of infrastructure at border terminals with Jordan and Egypt, such as warehousing and loading/unloading facilities, creates further impediments to trade.

(ix) General and technical consulting services

Several management consulting firms operate in the West Bank and Gaza, particularly in the Ramallah and Nablus areas. However, demand for such services is limited, particularly from SMEs. Technical services such as product design, facility design, equipment selection and installation are quite limited.

(x) Information technology services

Palestine has a growing IT industry that provides a range of services including software development, network installation and support, and Internet service provision as well as hardware retailing and some maintenance. Software development is well developed and capable of meeting the growing need of business.

(5) Agribusiness

Constraints on agribusiness, including fresh and processed foods, are analyzed by the responsible actors in both public and private sectors. (Refer also to Annex 3, Chapter 4) Improvement in infrastructure for distribution should be the responsibility of the public sector, while individual investment in agribusiness should be done under the self-reliant efforts of the private sector even though public support is necessary.

Public Sector Issues

Institutional Strengthening

Standards, grading and inspection are necessary for fairness and efficiency in trading, and they should be well institutionalized. Without these basic functions, agribusiness will not be modernized to attain international standards.

(i) Food standards

In terms of the “food **standards**”, the MoA states that Palestine will follow the EU food standards and has no intention to introduce an original Palestinian standard.

(ii) Grading

Similarly, **grading** of horticultural products should be clarified. At the wholesale market, the evaluation of quality such as individual size and weight is not clarified at the auctions so that some farmers and traders are unsatisfied with the resulting transaction

prices. The unit of their trading is not the weight of crops but designated boxes, and the unit prices are decided by physical appearance since the grades of vegetables and fruits are not fixed.

(iii) Inspection

Inspection is necessary to assess residual agricultural chemicals and residual pesticide. Food safety should be strongly emphasized by the responsible public agencies. It is reported that some products grown in the Jordan Rift Valley area have been rejected by Israeli inspectors due to the quality being degraded by polluted irrigation water. Inspection by a third party is crucial when trade is expanded to the international markets. In the case of olive oil for export, a laboratory at Birzeit University has been analyzing the contents and degree of acidity to differentiate between the virgin and extra virgin varieties following the international standard of classification. It is necessary to introduce legislation to ensure that international standards are met.

Dissemination, Information and Education

Three systems (i.e., standards, grading and inspection) should be clarified and open to the public. Dissemination should be the responsibility of the public sector as well. Unless information regarding the developed legal systems is disseminated to the public, the system will not function. The government has to keep everyone informed about the inspection institution, particularly in food safety. In terms of the standard and grading, the government has to exercise its leadership in their introduction. The international system should be taught to the people, and auctions should be improved to comply with the modern system.

(i) Coordination of trade fairs and festivals

Coordination of trade fairs and festivals would be another significant role that the public sector should play. The purposes of trade fairs and festivals are information sharing and matching of business partners. Stimulating the business activities of the private sector would foster dynamism in the economy. Making opportunities in the expanding business network is one of the important public contributions to the private sector.

(ii) Technology transfer

Technology transfer is an important role of the public sector as well. Through dissemination of new information by using public relations and events, growers and traders might learn modern technology and tendencies of the consumer market. If the required technology would be specific and the government could not handle it, the public sector should introduce an appropriate resource person. The private sector expects that the public sector will take responsibility for organizing an information network and support system.

Private Sector Issues

Processing Technology

Palestine remains confined as a supplier of raw materials, and not a manufacturer of value-added processed food. If they are able to install modern machinery, they might process their products by themselves though the balance of profitability and initial cost should first be taken into account. Quality control is a critical issue if they are to compete with international food processing enterprises. The investment in modern machinery could be promoted by ensuring a regular market.

Marketing and Sales Promotion

Enhancement of the quality of raw material and processing skill might be feasible for the well-educated Palestinian people, but it would not be sustainable to run the business without market development. Producers have to learn the consumer's desires and improve marketing skill, including expertise in product development, sales promotion, logistics and so on. Local brand development would also ensure a marketing strategy for the Palestinian products. There are two opposing strategies according to targeting markets, for example, some companies want to keep their product lines small and manageable, while others think the bigger the better. In the case of Palestine, they would better focus first on the idea of the marketing strategy.

(6) Food Industry

Under the current situation, there are many issues to be addressed in the development of food industries. (Refer to Annex 5) PALTRADE identifies, in its trade development strategy for the processed food sector, the following main issues.

(i) Raw material procurement

Generally, it is estimated that 80-90% of raw materials used in the food industry are imported from abroad or from Israel. The bulk of Palestinian foodstuff inputs, are imported from Israel, Turkey, Europe, America, and East Asia, through Israel. Nevertheless, in the last few years, manufacturers have begun to import raw material directly. Even though there have been several initiatives to use domestic raw materials, the cost and complexity of imported raw materials has become an increasing challenge for the Palestinian food industries. The raw materials represented 72% of total production costs in food industries as opposed to 67% in manufacturing industries in 2002. Food industries are vulnerable to price fluctuation of raw materials, their availability, and quality.

(ii) Low performance of food processing plants

As indicated above, the food processing production capacity is underutilized due to inability to secure a steady supply of inputs, poor maintenance of equipment and reduced

market demand resulting from market share loss against imported products since the imposition of closures in the West Bank and Gaza.

(iii) Packaging and packing

Some packaging machinery is manufactured locally, but by and large, packaging machinery and equipment are imported. Packaging materials are mainly provided by Israeli suppliers. This is still a nascent and weak complementary industry lacking experience and know-how, particularly in terms of packaging design appropriate for export markets.

(iv) Marketing and distribution

Marketing and distribution activities in the local market vary depending on the size of the firms. While some large firms have established local distribution networks through local wholesalers and retailers, the majority of food processors distribute directly to retailers or even to consumers. Export marketing and distribution is particularly underdeveloped, with only a small number of firms having successfully entered export markets.

(v) Standards and regulations

Food industries suffer from lack of a conducive legal and regulatory environment in spite of the many standards and legislations that have been prepared since 1995. The absence of a food law and well-defined responsibilities of public sector institutions involved in supervision and regulation has negatively affected their supervisory performance and resulted in failure of preventing the uncontrolled influx of imported products into the market. Restriction has been limited to the enforcement of standards and regulations on national products. No measures have been proposed to counter competitive products imported from other countries. Despite the PSI's efforts to play its role, there is still a clear shortage in a number of aspects, particularly regulations and their enforcement.

(vi) Environmental issues

The food processing sector's primary environmental concern is potential contamination of raw materials used in their manufacturing processes. This issue is made less immediate by the fact that most raw materials used are imported and not produced locally. To the extent that usage of local raw materials continues to grow, it will become increasingly critical to ensure that these materials are not contaminated with unallowable residues of pesticides, herbicides or other chemicals.

The food processing industry also has a direct effect on the surrounding environment. Effluents and waste from food processing plants are currently not controlled. The possibility of regulation being introduced to control industrial waste may necessitate future investments by this industry.

(7) Transportation

Based on the review of the current transport situation, the following issues are identified in the promoting of agriculture and agribusiness.

(i) Mobility of Palestinian vehicles

Major cities in the West Bank are covered by main and regional roads, but the mobility of Palestinian vehicles is constrained by the Israeli physical barriers and checkpoints. In addition, Area C is limited for construction of any new road and it is not allowed to modify the alignment of the existing roads.

(ii) Passenger transport service

The passenger transport services connecting between cities are insufficient. Since there is no reliable passenger transport service except for taxis, the mobility and accessibility of the people are limited for marketing and other agriculture activities.

(iii) Freight transport in the West Bank

The freight transport in the West Bank has to pass the checkpoints and to detour around the blockades, and is suffering from the resulting higher transport costs, longer travel time and damage to goods being transported.

(iv) Freight transport across the Jordan River

The freight transport across the Jordan River is affected by serious delays at the border due to security and customs clearance procedures by the back-to-back system. Consequently, extensive transport costs would be incurred and opportunities to transport perishable commodities for export/import are lost.

(v) Inner and outer ring road

The main and regional roads in the Jericho city are connected to the city center. Since there is no inner or outer ring road, heavy traffic congestion is caused at the city center.

(vi) Pavement marking

Since there are no pavement markings such as lane lines or zebra marking at the roundabout intersection in the city center of Jericho, carriageways and parking spaces are not divided. As a result, many vehicles are parked and taxis use the roundabout intersection as a taxi pool.

(8) Credit for Agriculturally Related Activities

(i) Agricultural and rural finance

Several studies have been conducted to assess the agricultural and rural finance situation in the West Bank and Gaza and to examine alternative institutional arrangements to

enhance farmers' access to credit and to mobilize rural savings. Based on these studies, the MoA concluded that the establishment of a public agricultural credit bank is neither a viable nor desirable option. It also became clear that commercial banks would continue to be reluctant to provide agricultural/rural credit, particularly to small farmers, because of high risk and administrative costs as well as a lack of guarantees. Although several NGOs currently implement rural micro-credit programs, these programs do not seem financially sustainable, given their heavy dependence on donor funding. In light of the above, the MoA has opted to promote Rural Finance Cooperatives as a model to enhance farmers' access to credit and mobilize rural savings.

(ii) Financial services for SMEs

According to the UNCTAD document entitled "Palestinian small and medium-size enterprises: Dynamics and contribution to development", trade finance, including export credit and guarantee facilities, are considered by Palestinian firms to be one of their most immediate needs for export development. Other financial services, such as financial management and general lending facilities are available to some extent but are still identified as areas needing service development. The Palestinian financial sector has yet to develop a range of financial products to meet the financial needs of Palestinian firms, particularly SMEs. Lending/deposit ratios in Palestine are estimated to be about 30%, about half the typical levels in developing countries in the region.

8.1.3 Institutional Issues

Within the legal and administrative framework, the government institutions are expected to provide needed services to the agricultural sector. These services include policy formulation, research, extension services, field services, education, training, grading and standardization, information on marketing, and organization and management of cooperatives. Research provides technology needed for increasing agricultural productivity, improved product quality, and solving problems faced by farmers in the production process. Extension services help farmers to know and adopt appropriate production technologies and marketing techniques. Field services help increase agricultural production and prevent the outbreak of plant and animal diseases. Grading and standardization, along with market information, help farmers to get better prices and increase their incomes. Farmers' organizations help to improve agribusiness activities such as purchase of farm inputs, marketing and trade, including marketing information, and processing and distribution of products. These services could be provided through public and/or private institutions as well as participatory and non-participatory NGOs.

(1) Agricultural Policy Analysis and Planning

As noted in Chapter 3.2, the Palestinian Agricultural Policy provides an overall policy framework for agricultural development in the West Bank and Gaza, while the Strategy for Sustainable Development of

Agriculture in Palestine (2001-2005) identifies constraints and strategic options for sustainable natural resource management, agricultural production, agricultural marketing and trade, rural agricultural finance and institution building. The General Directorate for Policy and Planning (GDPP) has been set up in the MoA. The MoA is still in need of support and capacity building in policy analysis and planning, assessment of assistance projects, and detailed investment plans. There is also a need for capacity building in formulation of implementation plans (including policy monitoring) and in international cooperation activities. Advisory services to the top management of the Ministry are needed in various specialized areas of policy formulation and planning, as well as institutional support and human resources development. Major issues to be further addressed in agricultural policy analysis and planning are summarized as follows:

- (i) Limited technical capabilities in the GDPP in policy planning and project formulation, especially in such key areas as natural resource management (water policies and planning in particular), animal production, agricultural inputs, and agricultural export promotion,
- (ii) Limited technical capabilities of the GDPP Monitoring and Evaluation Department in project monitoring, evaluation and appraisal, investment program appraisal, and development of policy monitoring and impact assessment programs,
- (iii) Limited GDPP capabilities in project preparation and evaluation, preparation of investment plans and preparation of economic studies,
- (iv) Lack of basic policy analysis and planning, sub-sector analysis, and project/policy monitoring skills at the Directorate and District office levels,
- (v) Inadequate formulation of sub-sector policies in selected areas, for example natural resource planning, production sub-sectors, agricultural input sub-sectors, and
- (vi) Insufficient advisory assistance available to the Ministry's top management on a wide range of technical and management issues.

(2) Support for the Higher Agricultural Council

The Higher Agricultural Council, originally proposed at the Hebron Strategic Planning Conference, is expected to have a three-fold role: (i) providing the MoA with a broad spectrum of advice and support on rural and agricultural development issues, (ii) promoting institutional linkage between the MoA and other organizations involved in rural and agricultural development, and (iii) promoting relationships between Palestinian and international agro-industry organizations. The MoA strategy includes creation of this Council, consisting of representatives from the agricultural academics, NGOs, private business and other appropriate sub-sectors. In the process of developing the MTDP, it became apparent that there was a lack of coordination among government agencies as well as with the non-government sectors regarding rural and agricultural development. The plan for the Council calls for the Council to address this problem by organizing appropriate meetings to exchange information and promote coordination.

The PNA recognizes its financial limitations, especially the narrow tax base from which vital government services must be provided. Accordingly, the PNA's development policy recognizes that economic development must be led by the private sector with the government's role restricted to creating and enabling the business environment as well as providing basic infrastructure services and facilities.

In addition, issues to be addressed by the Council will include the following.

- (i) Lack of ability of the private sector to provide sound service and counsel to MoA,
- (ii) Lack of awareness of parties involved in rural and agricultural development of each other's activities and inappropriate coordination.
- (iii) Lack of adequate financial and administrative support for the Council to insure its continued effectiveness and sustainability,
- (iv) Insufficient international contacts for Palestinian agriculture,
- (v) Limited awareness of Palestinian agriculture abroad, and
- (vi) Lack of contacts that would lead to opportunities for trade, technical licensing, joint ventures, and investment that would bring new technology to Palestinian agriculture and increase their agricultural exports.

(3) Agricultural Research, Extension Services and Education

Institutional development has been one of the priority subjects of the PNA. Actions include immediate hiring of additional staff; training of personnel; rehabilitation of agricultural stations; transportation and communication facilities; provision of tools, investment and equipment for the sector; and expansion of agricultural extension centers in rural areas. The MoA now has a total of 1,144 employees, including regulatory staff, researchers and extension personnel.

Formal agricultural research is presently implemented through the National Agricultural Research Center (NARC) with eleven research stations in different regions of the West Bank and Gaza. Cooperation with private companies dealing in agricultural inputs is on going. Research activities are concentrated on crop varieties and rotation and use of inputs, with some limited activities in the fields of integrated pest control and livestock production. The College of Agriculture also undertakes formal applied research. Problems facing agricultural research include lack of research infrastructure such as laboratories and equipment, under-staffing, lack of training activities, low remuneration and insufficient funding, as well as a weak relation with the extension services.

Agricultural extension services are provided, free of charge, through the Department of Extension, Information and Applied Research of the MoA and its fifteen branches distributed within the Palestinian territories. A total of approximately 160 extension workers provide services through direct contract with individual farmers or through farmers' groups. Other formal institutions provide some extension activities related to agriculture. These include the Ministry of Environmental Affairs (MEnA),

Palestinian Water Authority (PWA), Ministry of Health (MoH), Ministry of Labor (MoL), and Ministry of Social Affairs (MoSA).

Issues to be addressed in the field of agricultural research, extension and education are summarized as follows:

- (i) Shortage of well trained agricultural researchers, extension workers and entrepreneurs,
- (ii) Weakness of the link between research and extension, which if rectified could provide that research becomes the foundation for agricultural extension services,
- (iii) Inadequate involvement of stakeholders in policy formulation, applied research and extension programs,
- (iv) Lack of research infrastructure, such as laboratories and equipment, lack of training activities, low remuneration, and insufficient funding,
- (v) Limited informal research activities carried out by NGOs and universities,
- (vi) Lack of extension workers who have reliable information on demand, supply and prices in domestic and international markets,
- (vii) Absence of extension workers who have sufficient knowledge of quality demands, quality and food safety assurance and required post-harvest practices,
- (viii) Unclear strategy for agricultural education and insufficiently allocated resources, and
- (ix) Non-existence of proactive education personnel who can access global research results and work with local researchers to help disseminate knowledge to farmers and agricultural businesspersons.

(4) Agricultural Finance

The recovery of the Palestinian agricultural sector will require a large amount of investment capital and bank lending. Loans should be available to encourage farmers to install more efficient irrigation systems and to rehabilitate old systems to improve water use efficiency. The program should be linked to a special new extension education and technical assistance program to help farmers improve the design, rehabilitation, maintenance, and water application decision process.

The eventual development of a Palestinian export industry for high value horticulture and olive products will require investment and credit for upgrading farm and post-harvest facilities, such as greenhouses, irrigation equipment, packing, cold storage and processing facilities. Investment and credit will also be needed for domestic marketing, such as wholesale market improvements, transportation and cold storage facilities. (Refer to **Annex 3**)

As the peace process proceeds, there is every reason to believe that the level of foreign investment will increase. Wealthy Palestinians living abroad are one expected source of capital investment. However,

agriculture does not typically attract foreign investment. It will therefore be necessary for the PNA to explore ways of encouraging rural and agricultural investment credit facilities. Consequently, the issues to be addressed in agricultural finance will include the following.

- (i) Absence of special state banks or quasi-governmental lending institutions for agriculture,
- (ii) Absence of rural financial co-operatives that could be established utilizing a revolving fund established with donor support, and
- (iii) Lack of donor funding to support central bank credit re-discount lines for agriculture and agribusiness through private banks (on-lending scheme).

(5) Farmers' Organizations

The impacts of the major constraints facing marketing and trade of agricultural products and farm inputs are considered to make agricultural commodity prices and input costs unstable, and as a result, make profitability of agricultural production unsteady due to high cost inputs, price variation of fruits and fresh horticulture produce, and lack of reliable information on demand, supply and prices. In order to solve and/or alleviate such constraints and risks, it is necessary to encourage establishment of adequate organization and management of cooperatives as well as their business activities such as joint marketing, joint purchasing, etc. In the West Bank and Gaza, new cooperatives are still in the early period of establishment, and some of them have no facilities or staff members on the payroll for a management base.

Under such situation, it is preferable to assist farmers in establishing water users' associations as a core of the farmers' organizations. It is proposed to establish multi-purpose farmers' organizations by adding functions of farmers' cooperatives to the water users' associations, and promote understanding of the necessity and merits of collaboration through cooperatives as well as their fundamental rules, for encouraging the formation of democratic cooperatives, strengthening farmers' organizations, and enlightening members for participation. It is also needed to strive to conduct agribusiness activities (purchase of farm inputs, marketing and trade, including marketing information, processing and distribution of products) through cooperatives in view of the regional characteristics and the positive participation of cooperative members.

Major issues to be addressed in forming water users' associations and farmers' cooperatives are summarized as follows:

- (i) Lack of methods for promotion of autonomous corporations and cooperation between businesses to take advantage of the economy of scale and competitiveness in business activities,
- (ii) Lack of policy framework and necessary measures required for the formation and strengthening of farmers' organizations,
- (iii) Insufficient experience in establishing farmers' organizations, including water users'

associations as well as agricultural cooperatives,

- (iv) Absence of guidelines for establishment of adequate organizational management of cooperatives as well as their business activities, such as joint marketing, and joint purchasing, and
- (v) Absence of guidelines for appropriate financial management in the cooperatives, including introduction of an exterior auditing system.

8.1.4 Pilot Program Operations and Lessons Learned

In the course of this Study, three pilot quick impact projects have been planned and executed with a view to enhance agriculture and agribusiness; i.e.,

- (i) Well rehabilitation and water saving irrigation pilot program,
- (ii) Olive oil marketing pilot program, and
- (iii) Agricultural production with brackish groundwater.

The tube-well rehabilitation and water saving irrigation pilot project is outlined herein, together with the lessons learned. The outline of the olive oil marketing program has been introduced in Section 7.1.4 as it might be designed as a community-based income generation program. The lessons learned through this olive oil pilot program, however, are discussed again from the viewpoint of marketing and agribusiness. The third pilot program for brackish groundwater irrigated agriculture is still being executed, and the research and monitoring activities will be conducted by MoA.

(1) Program Outline of Well Rehabilitation and Water Saving Irrigation Pilot Project

This program has been formulated in view of the greater significance of agricultural activities with efficient management of irrigation water for sustainable use of natural resources with cooperative ownership and management. This program has four objectives: (i) to resume cultivation of crops by means of rehabilitation of the well which has long been abandoned, (ii) to raise the water efficiency for maximizing the productivity in the agricultural sector including animal husbandry with the limited water resources, (iii) to formulate a water and agricultural management association, and (iv) to implement demonstration farming as an extension/dissemination program.

The pilot quick impact project is located at Furush Beit Dajan, Nablus governorate. Program components and work items are as follows:

Program Components

- (i) Rehabilitation of the well (Well No: 19-17/50, Ownership: Ahmad Mohammad, Abdel Jabbar)
- (ii) Development of demonstration farm (1.6 ha)

- (iii) Demonstration of water saving cultivation to farmers

Work Items

- (i) Rehabilitation of the Well

- Dismantling of the existing pump facilities
- Additional drilling of the well (20 m)
- Pumping test
- Installation of new pump facilities

- (ii) Development of Drip Irrigation System

- Installation of transmission pipelines
- Rehabilitation of existing reservoir
- Installation of drip irrigation facilities
- Development of a demonstration-farm of 1.5ha (vegetables: 0.6ha, organic vegetables: 0.2ha, citrus: 0.3ha, grapes: 0.2ha, dates: 0.2ha)
- Installation of a meteorological station (evaporation pan and tension meter)

- (iii) Demonstration of Water Saving Cultivation to the Farmers (Suspended)

- Selection of crops and commencement of cultivation
- Measurement of meteorological conditions and water requirements for each crop
- Monitoring of water consumption
- Workshops for dissemination



Rehabilitation of an Old Pump



Setting of an Inspection Camera

- (2) Lessons Learned from Well Rehabilitation

The well rehabilitation pilot project is really a challenging program in the sense that:

- (i) a number of tube wells have been abandoned for decades even though water is vital for sustaining the livelihood and agricultural activities in the region. Once the rehabilitation proves technically sound, it could be expanded to other abandoned wells in the Jordan Rift Valley area.

- (ii) most tube wells had been owned and operated by private owner(s) and historically, water rights had been granted individually to such owner(s). In the event that the well owner(s) and water users can reach an agreement for water utilization on a win-win basis, it will be an epoch-making advancement for the people, not only in the Jordan Rift Valley but also in Palestine and other Arab countries.
- (iii) the selected well is located in Area C and the pilot program has been executed with the goodwill, understanding and cooperation of the Israeli authorities concerned.

The well rehabilitation pilot started with the formation of the program team composed of experts from the MoA, MoL, PWA and JICA Study Team, as well as with discussions among well owners and land owners in the irrigable area, in November 2005. It is noteworthy that identifying the well and land owners was a laborious task due to the condition of record keeping for water rights and land ownership.

A cooperative of land owners was originally organized by 37 members, inclusive of the seven well owners originally and legally recognized in the official document. Subsequently, the original registered owners and the heirs of the deceased original owners withdrew from the cooperative and formed an independent association of well owners. In March 2006, the original cooperative of land owners and the newly formed association of well owners came to an agreement on utilization of water and division of charges and commissions based on the operation and maintenance costs as well as depreciation costs of the pump irrigation facilities.

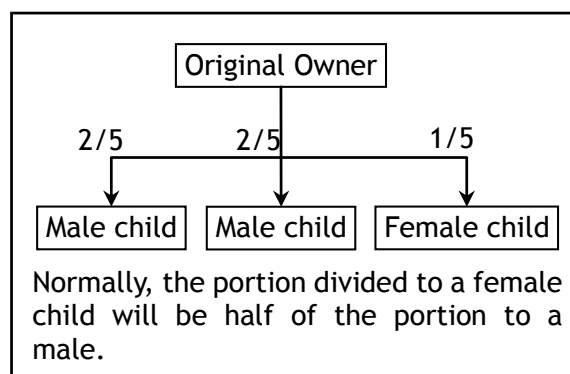


Discussion with Well Owners and Water Users Association Members

Despite such efforts of the well owners and farmers, as well as the efforts of the program team and the cooperation extended by the Israeli authorities, the pump test from a deeper aquifer at the well (with additional drilling from -135m to -155m) has resulted in limited water available (9 m³/hour). Since the available quantity of water at this well is insufficient for agricultural use, further operation of the well rehabilitation at this site has to be suspended.

Lesson 1: Well owners should be carefully identified and guided to share benefits accruable from the well rehabilitation.

In the West Bank and Gaza, the Courts decide how immovable properties like parcels of land are divided among the children after the original owners pass away and the children should follow the judgment. Since there is no record of inheritors on the PWA's well record, the identification of well owners is laborious decades after the well registration. Owners of the pilot well agreed to share benefits to accrue from the well rehabilitation after several discussions among the owners and with the authorities concerned.



Consequently, lessons are learned that the well owners' registration should be well maintained and updated, and that they should be well guided on the objectives of rehabilitation and how fairly the benefits accruable from the rehabilitation are to be divided among the owners and users.

Lesson 2: A fair judgment is indispensable to reach an agreement on the share of benefits accruable from the rehabilitation

In the course of the discussions, the JICA Study Team calculated the actual costs of operation and maintenance of pumping facilities, inclusive of depreciation costs. Thereafter, the benefit sharing system was discussed between the well owners and water users. Such a logical approach has been accepted by the parties concerned. Now, a lesson is learned that a fair judgment for mutual benefits is to be reached logically.

Lesson 3: Cooperation among the authorities concerned is indispensable in setting up a new mechanism for water utilization for the greatest benefit of stakeholders.

All the Palestinian authorities as well as the Israeli authorities concerned have extended their valuable assistance and cooperation for the execution of this Study. This assistance and cooperation has even extended to the actual execution of the well rehabilitation, which is a sizable order. Such cooperation and collaboration are indispensable for successful implementation of well rehabilitation in the Jordan Rift Valley. A lesson is learned that such cooperation and collaboration will break through any difficulty to be encountered in the course of program operations.

Lesson 4: Detail investigations should be conducted prior to the implementation of well rehabilitation works

For rehabilitation of the pilot well (No.19/17-050), the yield of the well was proved to be only 9 m³/hr in spite of the facts that the well used to produce around 85m³/hr in the 1980's, that the well was deepened by 20 m taking into account the trend of water level decreasing, and that the yield of existing adjacent well (No.19/17-047) producing 80 m³/hr from the same aquifer of 40 m in thickness (115 m~155 m).

The reasons for the unexpectedly smaller yield are assumed to include the followings:

- The capacity of aquifer has been declining because much water has been extracted upstream.
- Because of drawdown of static water level by around 20 m in the past, hydro-geological situation was changed. The aquifer has marl in the main components with low permeability.

The pilot well was selected under the criteria that (i) the well owners group or association is formulated; (ii) water quality is satisfied with the standard to be used for agriculture; and (iii) the project benefits farmers taking into account that the implementation period was quite short. However, the pilot well rehabilitation gave us a lesson that rehabilitation wells had to be selected prudently from the technical point of view. Prior to implementation, the following investigation should have been carried out.

- Study on existing hydro-geological data and in-situ tests;
- Removal of the existing pump and investigation of the inside condition of the well by a TV camera and well logging; and
- Development of the well and pumping test.

In addition, it has a risk to rehabilitate wells by deepening, because there is a possibility that caving occurs or gravel packing behind casing and screen is impossible.

(3) Lessons Learned from the Olive Oil Marketing Pilot Project

Some lessons learned from the community-based institutional building for the execution of the Olive Oil Marketing Pilot Project have been outlined previously in Section 7.1.4. Some lessons from the viewpoint of agricultural marketing are additionally presented in the following.

Lesson 1: Self-reliant efforts of individual actors should be respected in agribusiness.

Farmers, processors, traders, exporters and other actors have experience and expertise in their respective jobs and their efforts are to be respected in promoting agribusiness. Their experience and capacities should also be utilized fully in a holistic manner to attain a common goal. The public sector is to support the utmost utilization of such capacities in the private sector. Though the olive oil pilot had some difficulties at the initial stage of the socialization, it offers a lesson that the self-reliant efforts of individual actors should be respected by all means.

Lesson 2: Marketing Seminar offers a good opportunity for networking.

The olive oil pilot program offered seminars in the Tubas district, and farmers, the Olive Oil Council, oil distillers, bottling enterprises, processing enterprises, traders, shop owners and NGOs joined the seminars. The seminars served to form a value chain network among the participants. Information exchange and understanding of other actors were developed through the seminars. After the seminars, the project team started formulating a network for olive oil distribution based on a division of labor. The seminars thus gave us a lesson that such a gathering is effective in promoting a value chain network in respective products.

(4) Lessons Learned from agricultural production with brackish groundwater

Establishment of demonstration farm for brackish water agriculture was carried out to start challenges to utilize the brackish water for agriculture. Research and monitoring works will be continued by the association under the technical advice by the MoA.

8.2 Development Target and Strategies

8.2.1 Target of Agriculture and Agribusiness Development

Development frameworks for land and water resources in the Jordan Rift Valley area, as well as a macroeconomic framework, have been discussed in Chapter 5. Understandably, there exist limitations in land and water resource development in the region. Despite such limitations, a development target for agriculture and agribusiness should be set so that all stakeholders in the region could work together to surmount those limitations and attain the goal.

The growing concern about water shortage in this region clearly implies that future agriculture and water use policies must be formulated with a view toward making efficient use of the scarce resource. The high value-added crops produced in greenhouses, as well as cultivation of dates, has strong comparative advantage and high potential for export to neighboring countries.

The area of irrigated agriculture for these high value-added crops can be extended by developing water resources and diminishing loss of water. It is proposed that the availability of water for agricultural purposes be increased by means of improvement of the spring water conveyance channels, rehabilitation of existing non-functional wells, development of new wells, and implementation of storm water harvesting and wastewater reuse facilities.

With respect to animal husbandry, production can be increased by solving the major constrains for livestock feed, which include water, fodder, crop residues, and grazing pasture, by means of the introduction of a cycle-oriented farming system. The livestock industry is expected to be strengthened by extension services for improving genetic matters, breeding, nutritive management, and animal health care.

Agribusiness and apiculture related activities would be activated generally in proportion to the increase in agricultural outputs. For instance, olive farmers are found to be able to incense their profit margins by 80% through better marketing as a result of the olive oil marketing pilot program.

With the development frameworks in view, a development target for the agricultural sector is formulated depending on the progress of establishment or improvement of the said facilities and practices, as summarized in the following table:

Table 8.2.1 Development Target of Agriculture and Agribusiness

Scenario	Real GDP Growth Rate per Annum	Development Target in 2015
Low Growth (Status Quo Plus)	1.5%	1.2 times
Moderate Growth (Pre-Intifada)	4.5%	1.6 times
High Growth (Economic Recovery)	8.5%	2.3 times

The development strategies in the subsequent Section, as well as the development programs to be discerned in Chapter 8.3, are formulated with an overall target to double the value-added amount in the agriculture and agribusiness sector.

8.2.2 Strategies for Water Resources Development

To secure water for agriculture and other uses, several strategies are proposed in the water management and water allocation in the Jordan Rift Valley area.

(1) Water Management Strategy

As pointed out in Chapter 5.4 and as further discussed in Section 8.1.2, the main issues are (i) water quantity, (ii) water quality, and (iii) institution. These issues are related each together. To address the issues, the strategies are proposed for improvement in water resource management in the following manner.

(i) To make utmost use of potential water resources

To maximize the use of the limited water resources and minimize the waste as discussed in Chapter 5.4, the following measures are proposed in the Jordan Rift Valley area.

- Improvement in spring water conveyance channels,
- Rehabilitation of non-functioning wells,
- Development of new wells with approval of the JWC,
- Harvesting of storm water and artificial infiltration, and
- Water recycling

Of the new water resources, spring water will be allocated first for domestic use and then to satisfy irrigation demand and other activities to support the economic growth as shown in the following figure.

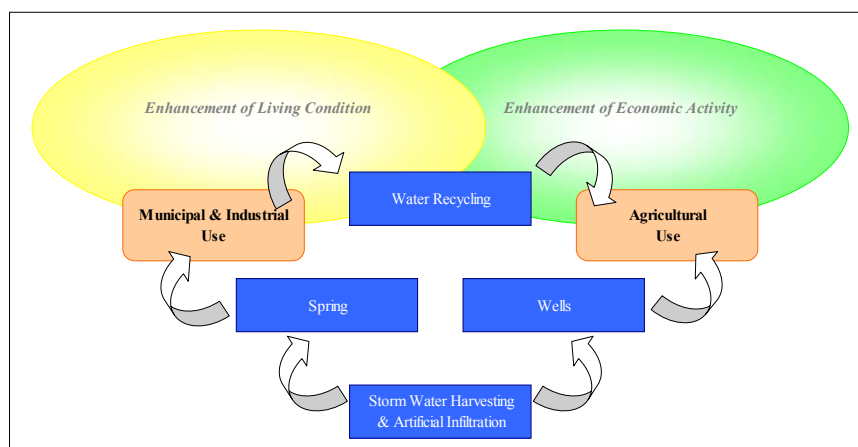


Figure 8.2.1 Comprehensive Water Resource Allocation

- (ii) To enhance water use efficiency in irrigation in order to attain economic growth in the agricultural sector

Water saving agriculture is to be promoted to the maximum extent in the region. More detailed approaches to save water, increase profit and maximize the efficiency of irrigation water use are discussed later in this Chapter.

- (iii) To minimize the environmental impacts

To minimize the negative environmental impacts and to secure water resources, it is necessary to develop a system for wastewater collection, disposal and treatment. In the most urbanized and populated areas in the Jordan Rift Valley, i.e., Jericho and Tubas Municipalities, it is urgent to develop a collection and treatment system. In other medium and small towns, black water should be collected and disposed of properly at the treatment plant in those larger municipalities. PWA has set a target for the percentage of the population connected to wastewater treatment plants in 2020 in the West Bank at 80%.

- (iv) To establish a water supply network

Water supply conveyance and network systems should be established in the region, not only for irrigation water supply, but also for domestic water supply to the communities (as discussed in Chapter 7.3).

- (v) To strengthen the governance on water resource management

The PNA should establish rules and regulations on water rights and water use in order to manage well owners in a sound manner. Meanwhile, water users should organize associations for proper distribution and management of water, inclusive of a water charge system. Without establishing good governance on water use, efficient and effective utilization of water potential will not be attainable.

(2) Area-wide Water Allocation Strategy

Water should be strategically allocated by sub-region in view of the characteristics of the land, irrigability, population, and domestic demand, as well as available water resources. As discussed in Section 5.3.4, the land suitable for agricultural development is assessed as summarized in the following table.

Table 8.2.2 Development Potential for Agricultural Land Extension in Three Sub-regions

1	2			3	4	5 = 3+4	6
Sub-Region	Area (km ²)			Existing Agricultural Area (Km ²)	Potential Agricultural Development Area for the future (Km ²)	Total Area for Agricultural Development (Km ²)	Natural Reserve Area (Km ²)
	Area A & B	Area C	Total				
Bardala /Kardala and Wadi Malih	0	275	275	21 (7.6%)	93 (33.8%)	114 (41.4%)	58 (21.0%)
Wadi al lFar'a and Al Jiftlik	87	129	216	110 (51.0%)	40 (18.5%)	150 (69.4%)	24 (11.1%)
Greater Jericho	69	278	347	87 (25.0%)	88 (25.3%)	175 (50.4%)	18 (5.1%)
Total	156	682	838	218	221	439	100

Source: JICA Study Team

On the other hand, population and available water resources in each sub-region are estimated to be as summarized in the following figure and table.

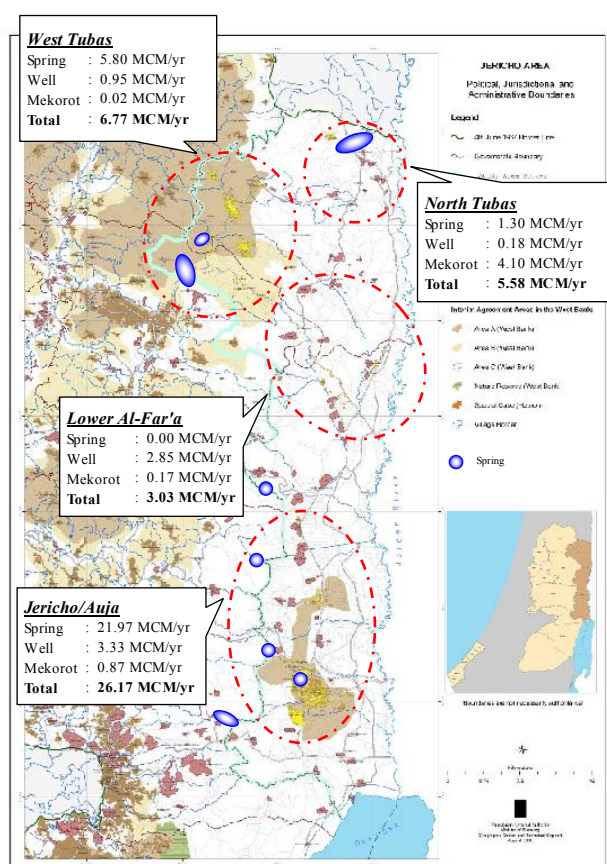
**Figure 8.2.2 Existing Water Resources**

Table 8.2.3 Characteristics of Focal Areas in Jordan Rift Valley

Area	Population	Basin	Water Resource (MCM/yr)	Characteristics
Jericho/Al 'Auja	35,514	Wadi al Qilt Wadi al 'Auja Wadi Nuwei'ma Wadi Ahmar	26.17	<ul style="list-style-type: none"> - Spring water is abundant. - Wells are brackish - There are wells which are not operated. - There is an urbanized area. - Majority of this region is area A, but some residential part is in area C. - This area has highest potential to receive immigrants. - Agricultural practices are extensive. - The precipitation is very low.
Lower Al Far'a	7,982	Wadi al Far'a	3.03	<ul style="list-style-type: none"> - There is no spring water. - Wells are brackish. - There are wells which are not operated. - It is necessary to get approval from the Israeli side to develop due to being in Area C. - The precipitation is very low.
West Tubas	50,023	Wadi al Far'a	6.77	<ul style="list-style-type: none"> - Spring water is abundant. - There are few wells. - Construction of a new well has been approved by the JWC. - The urbanized area is located in the highland. - There are wells which are not operated. - Rain-fed agriculture is practiced.
North Tubas	3,143	Wadi Marih	5.58	<ul style="list-style-type: none"> - Spring water is abundant compared with the population. - There is a brackish spring, and some springs are contaminated by NO₃. - There are wells which are not operated. - It is necessary to get approval from the Israeli side to develop due to its being in Area C.

Source: JICA Study Team

(i) Jericho/Al 'Auja area (Greater Jericho area)

The water resources in this area are relatively abundant, but spring water should be allocated for domestic use to meet the increasing requirements. Water for agricultural use is to be secured by the following sources in this area.

- Improvement in spring water conveyance channels,
- Rehabilitation of existing wells,
- Harvesting of storm water in wadis, and
- Development of water recycling through sewerage treatment.

(ii) Lower Al Far'a area (Wadi al Far'a and Al Jiftrik area)

The water resource in this area is quite limited. Spring water from the upper area is currently used for agriculture, but it would be allocated more for domestic use in the future. To secure domestic water, the existing wells in this area should be rehabilitated. Since the wells in this area are salinized to some extent, some measures are to be taken for desalination. Since this area is located in Area C, the program should take into account that agricultural development would be more dependent on the occupational position.

(iii) West Tubas area

Spring water is available but not in quantities adequate for domestic use. Spring water is to be pumped up to the highland area to meet the demand, but this scheme is not taken up in this master plan because the cost is too high. Development of the new well for domestic use in Tammun is on going. For agricultural use, harvesting of storm water in wadis and water recycling will be strategically developed.

(iv) North Tubas area (Bardala/Kardala and Wadi Malih area)

Water resource development for agriculture in this area will not be programmed in detail in this Study as it is located in Area C. Water supply for domestic use is planned as explained in Chapter 7.

8.2.3 Strategies for Irrigated Agricultural Development

Several strategies are proposed for development of irrigated agriculture in the Jordan Rift Valley area. Major strategies are discussed here and they would form the basis for the formulation of development programs. Rain-fed agriculture will be discussed in Section 8.3.2.

(1) Basic Strategies for Agriculture and Agribusiness Development

Prior to the discussion on the strategies for irrigated agriculture, an overall strategy is proposed for agriculture and agribusiness development in the Jordan Rift Valley area. Basically, agriculture and agribusiness are developed in line with a value chain from the production side to the sales of products to customers, as illustrated in the following diagram.

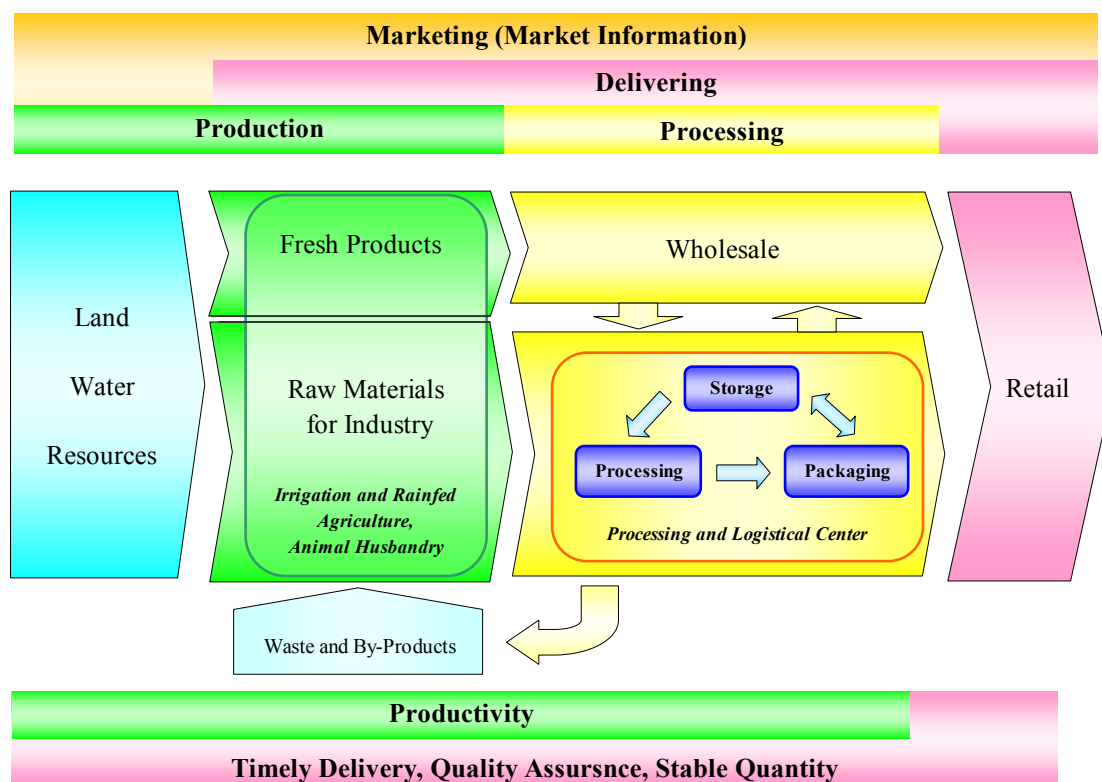


Figure 8.2.3 Concept of Value Chain in Agricultural Development

Economic value should be added at each phase of the product flow to the maximum extent possible. At the production phase, the value of fresh agricultural products and products for industrial raw materials should be maximized with the least possible cost in inputs and the highest return from outputs. Quality is an important factor in attaining higher returns, in addition to providing a stable supply to the markets. All stakeholders are guided to follow the principle of the value chain in the agricultural and agribusiness development in the region.

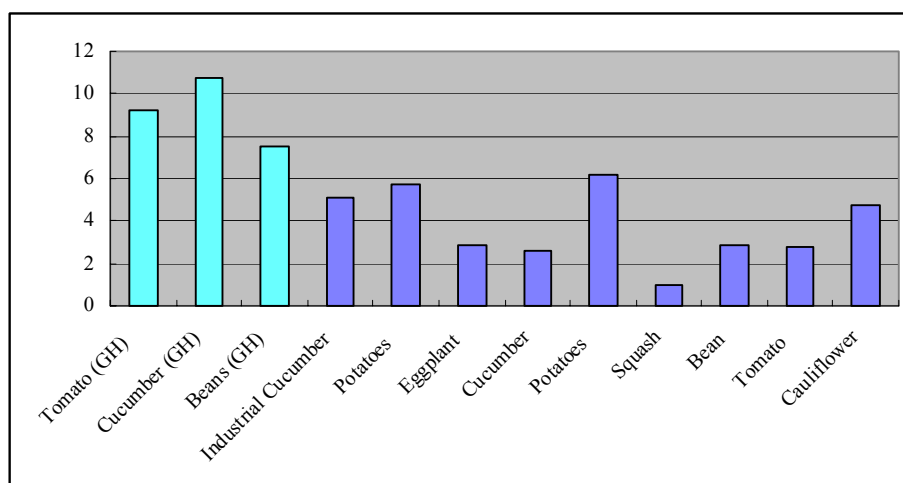
(2) Strategies for Irrigated Agriculture

For development of irrigated agriculture in the Jordan Rift Valley area, the following three strategies are to be adopted.

- (i) Water saving agriculture,
- (ii) Market-oriented agriculture, and
- (iii) Introduction of hydroponic systems for greenhouses.

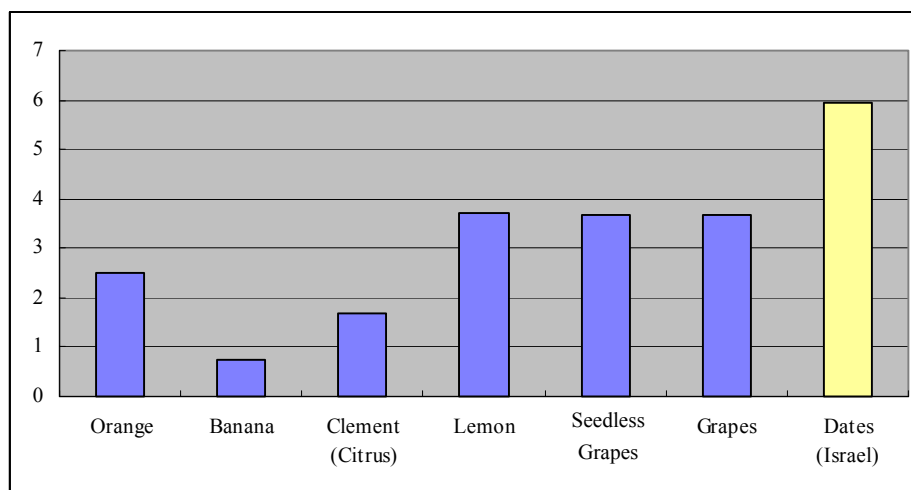
Water saving agriculture is to be promoted further in the Jordan Rift Valley area. Although drip irrigation has been introduced and knowledge of it disseminated, water application efficiency is still relatively low and much remains to be improved. Further, reuse of treated sewerage water should be introduced to the suburban agricultural land. Such a practice would also contribute to make liquid organic fertilizer from treated sewerage water.

In promoting water saving agriculture, water economy is to be taken into account. As explained in detail in Annex 3, gross margins of agricultural products per units of water required for cultivation differ by crop and farmers are guided to cultivate less water consumptive crops for water saving agriculture in addition to considering the marketability of the products. The gross margin per water unit required by crops has been analyzed as reproduced in the following figures (refer to **Annex 3**).



(Unit: NIS/m³)

Figure 8.2.4 Gross Margin per Water Unit Required by Crops



(Unit: NIS/m³)

Note: Israeli data is presented for dates, as no data is available for the Palestinian case.

Figure 8.2.5 Gross Margin per Water Unit Required by Fruit

As clear from the above figures, profitability of vegetables cultivated in green houses (GH) is much higher than the products cultivated outdoors. Water saving agriculture is therefore promoted strategically both for water efficiency and profitability from the crops.

Market-oriented agriculture is getting more and more vital for irrigated agriculture. In order to establish market-oriented agriculture, “quality”, “quantity” and “stable supply” are indispensable. Crop

diversification is one of the measures to cope with the consumers’ needs. Crop diversification will not be limited to variety diversification, but it will include diversification of product forms, e.g., half-processed products and processed products. Basically, a crop diversification target will be set for variety diversification for vegetables and product diversification for fruits. The following diagram shows a concept of introduction and establishment of forced vegetables and restrained vegetables.

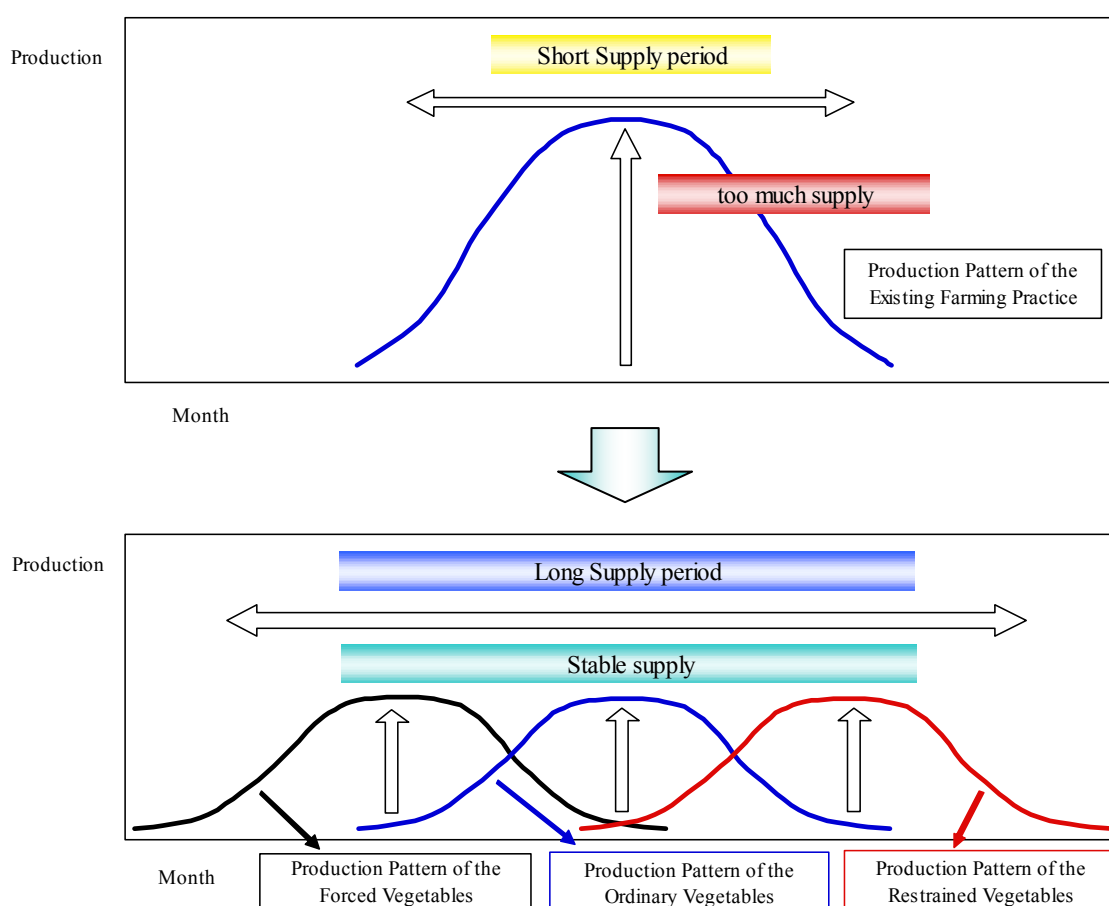


Figure 8.2.6 Strategic All Season Cropping (1) through Introduction of Forced Vegetable and Trestrained Vegetable

Enhancement of public support to farmers is essential for promotion of market-oriented agriculture in the Jordan Rift Valley area. Technical support to farmers and promotion of export marketing are to be encouraged. Particular attention should also be paid to the chemical compositions of agricultural products, in order to obtain consumers’ reliance on the quality of the products. Some quality indices, e.g., perfume, taste and sweetness, will offer useful information on “differentiation of products.”

Organic farming is another approach to market-oriented agriculture, as consumers are getting more and more sensitive to chemical contents in products. Besides, farmers in the Jordan Rift Valley area find it hard to obtain fertilizers and chemicals, due mainly to (i) lack of funds for farmers, (ii) increasingly high prices of agricultural inputs, and (iii) difficulty in transportation and marketing under Security controls.

Although the market for organic products is not yet large, it is a sound niche market. The organic or semi-organic products will give consumers a sense of healthy products.

Hydroponic cultivation is an integrated approach for water saving agriculture and stable supply of quality products, and it would be envisaged in the Jordan Rift Valley area in longer term. Most green houses in the Jordan Rift Valley and Israel commonly use perlite for cultivation. Since a hydroponic system saves more water in an easier manner, it will be envisaged for application in the Valley under the long term perspective.

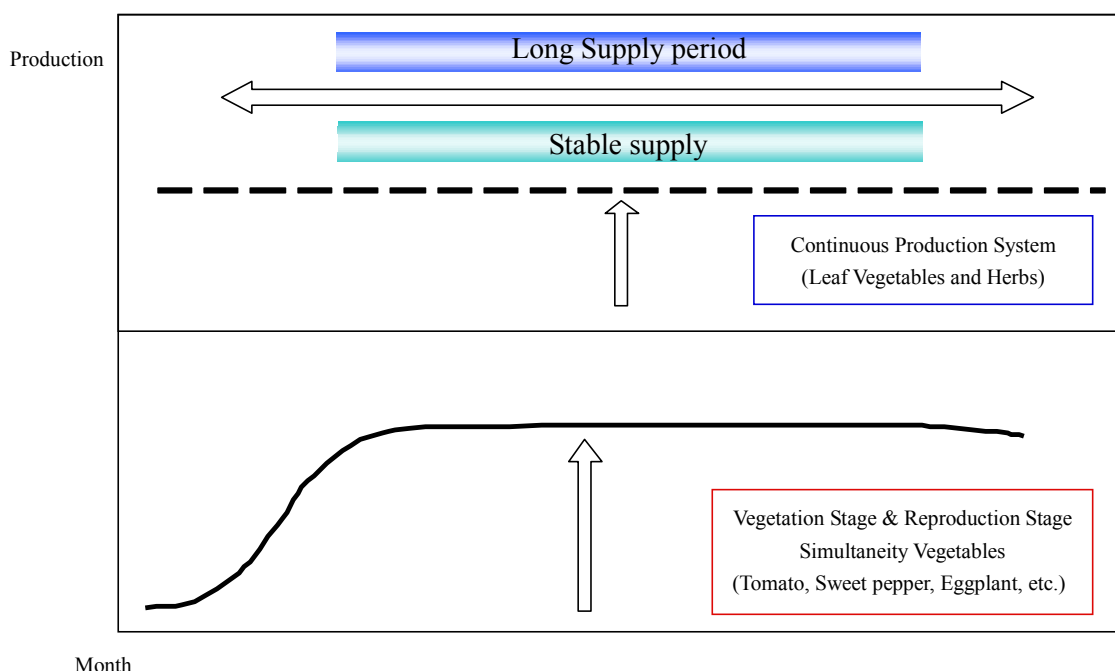


Figure 8.2.7 Strategic All Season Cropping (2) through Introduction of Plant Factory System with Hydroponics

(3) Strategic Selection of Promising Crops

To enhance the value added in production, promising crops are strategically selected in the light of the following factors.

- (i) Value: Water efficiency, labor efficiency, existing name value,
- (ii) Adaptability: Adaptability to the natural conditions,
- (iii) Diversification: Diversification of crops to be firmly established as new products based on consumers' demand, and
- (iv) Recapture of market: Local production of currently imported vegetables

Key crops are selected as a fundamental income source for farmers. Although there is a steady demand for such key crops, a rapid growth in marketing will not be expected. The following key crops appear to be promising in the study area.

Vegetables	Fruits
Key Crops	Key Crops
Squash, Tomatoes, Eggplant, Sweet corn, Cucumbers, Green beans	Bananas, Citrus, Olives
Utilization	Utilization
Perishable foods, raw material for processed food (pickles, canned foods, retort)	Perishable foods, raw material for processed food (juice, jam), oil extraction (olive)
Food Crops	Fodder Crops
Key Crops	Key Crops
Wheat, Barley, Chick-peas	Barley, Clover, Alfalfa, Vetch
Utilization	Utilization
Food material, fodder (by-products)	fodder

New (strategic) crops are additionally selected to accumulate experience through crop diversification, marketing, processing and supporting services. Such crops will include the following.

Vegetables	Fruits
New (Strategic) Crops	New (Strategic) Crops
Cherry tomatoes, herbs, leaf vegetables	Grapes, dates
Utilization	Utilization
Perishable foods, primary processed products, raw material for processed food (pickles, canned foods, retort food)	Perishable foods, raw material for processed food (juice, jam, wine, dry fruits), oil extraction (grape seeds)
Food Crops	Flowers
New (Strategic) Crops	New (Strategic) Crops
Potatoes, Onions	Flowers (Depending on the Trend), leaves as a foil
Utilization	Utilization
Food material, raw material for processed food (canned foods, retort foods)	Cut Flowers and leaves

Organic farming should be promoted as common technology which adds value to both key crops and new (strategic) crops. The varieties of processed foods will be diversified though the combination of vegetables and fruits and stock farm products such as meats and dairy products. In the case of flowers, it is essential that leaves as a foil which have stable demand should be introduced at the initial stage.

(4) Introduction of Cycle-oriented Agriculture

In the event that more vegetables and fruits are cultivated in the Jordan Rift Valley area, it is desirable that cycle-oriented agriculture be promoted to maximize the returns and minimize the environmental impacts. For instance, bee-culture will be promoted in the open fields of orchards and greenhouses to facilitate pollination. Residuals of vegetables and fruits will be dried and fed to livestock. Manure from livestock,

in turn, will be used for making composts that will be utilized for fertilizing vegetables and fruit as well as for expansion of forage cultivation. Such a cycle-oriented agriculture will not be limited to farming, but it will be expanded to the utilization of treated sewage water for irrigation and to the utilization of organic solid waste for composting. The following figure illustrates the image of cycle oriented agriculture to be promoted in the Jordan Rift Valley area.

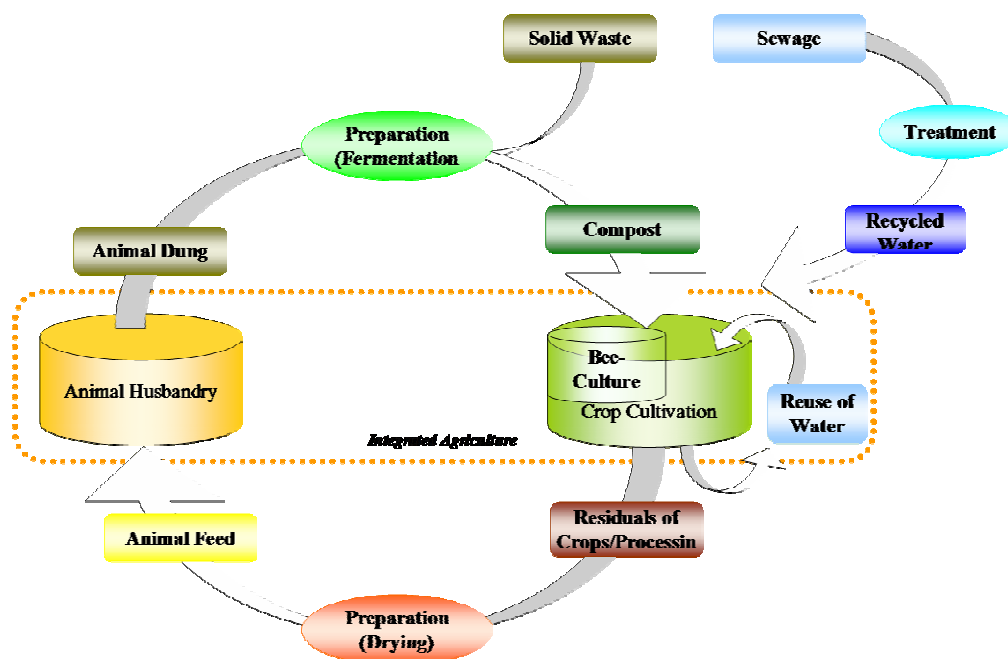


Figure 8.2.8 Cycle-oriented Agriculture Development

8.2.4 Strategies for Livestock Development

As pointed out in Section 8.1.2, the two most salient issues in animal husbandry are (i) limited supply of fodder under the restrictions applied to free grazing, and (ii) unnecessarily large veterinary service costs to the livestock farmers. These two factors account for 86% of livestock expenditures on an average, and their improvements should be well planned and promoted for development of agriculture in the region. The strategy for livestock development will therefore be proposed to concentrate on the countermeasures for such issues.

(1) Promotion of Water Saving Fodder Cultivation

Due to scarce rainfall and the restrictions applied to free grazing in the Jordan Rift Valley, the available fodder is insufficient for animal husbandry and livestock farmers have to purchase high-priced fodder imported from Israel. The volume of such purchases is increasing and expected to reach nearly half of the fodder requirements, as noted in Section 8.1.2. Water saving fodder cultivation is indispensable in the region.

One of the strategies to promote water saving fodder cultivation is to utilize the water that has been applied to but not taken up by the crops during cultivation. Pasture grass will be cultivated outside the irrigated crop cultivation land. Trees serviceable as fodder could also be cultivated further outside. The following figure illustrates the strategic use of the limited water for fodder crop cultivation in addition to the cash crop cultivation around the water source.

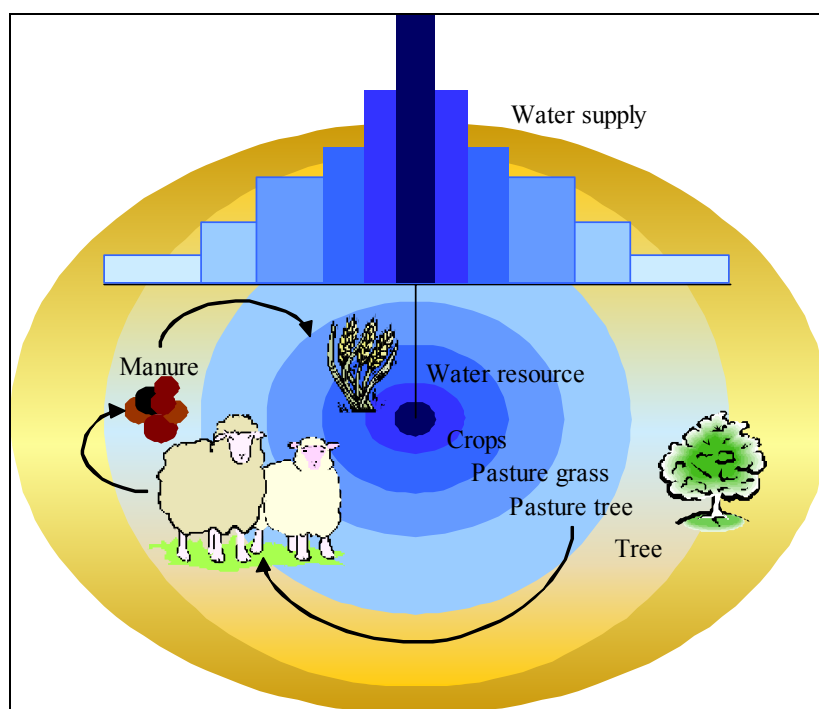


Figure 8.2.9 Water-saving Fodder Cultivation around Water Sources

Fodder production, on the other hand, is practicable even if rainfall is insufficient for crop cultivation. Seeding or plantation of fodder is possible within a short period from the rainy season to the beginning of the dry season. As a great deal of land is left uncultivated due to lack of water, labor and other constraints, small-scaled water harvesting can be executed in a number of locations in the Jordan Rift Valley and in the sloped area extending to the west. For instance, a simple terrace formation would harvest water in the rainy season for fodder cultivation. Fodder can be cultivated even if the soil moisture is available in adequate concentrations for as little as three weeks in a given place. If an attempt is made at wheat/barley cultivation but the crops are damaged by dryness, it can still be used for fodder in the highland area.

(2) Strategic Adoption of Fodder Varieties for Profitable Fodder Cultivation

Fodder sometimes has higher economic return than cash crop cultivation, as some kind of fodder can be harvested several times a year and it could be sold as green and fresh hay and silage to livestock owners. The variety of fodder should be selected strategically in view of its tolerance to salinity, soil fertility, heat and dryness. Cultivation of legumes is also recommendable as their nutritious values are high due to

high amounts of proteins that are absorbed and metabolized into milk and meat. True grasses have high fiber elements as carbohydrates that the livestock transform into energy.

In the course of this Study, some varieties of fodders have been planted as an experiment, including Macrotilium and Mekena.



Photo: Macrotilium



Photo: Mokena

Fodder cultivation and supply should be properly managed by means of the following measures.

- (i) Fodder cultivation with proper management in watering, fertilization, and fencing or protection against animals and wind,
- (ii) Fodder processing and storage with proper management for dry hay and silage,
- (iii) Utilization of crop residues combined with crop cultivation,
- (iv) Proper feed composition for livestock, and
- (v) Production of compost and organic fertilizers from dung.

(3) Improved Animal Health Care

Veterinary service and cost is the second largest issue to be addressed in livestock breeding. Livestock loss is attributable to (i) malnutrition, (ii) low immunity, (iii) lack of preventive management and vaccination and (iv) outbreaks of diseases. The veterinary services are not sufficiently available to farmers and their expense is increasing.

In the West Bank, the mortality rate of neonatal animals is reported to be more than 30%. Major diseases are diarrhea, pneumonia, malnutrition, and so on. Preventive medicine is much cheaper than medical treatment. Therefore, vaccination is to be promoted widely in the Jordan Rift Valley area. To this end, the more veterinary service should be made available in the region.

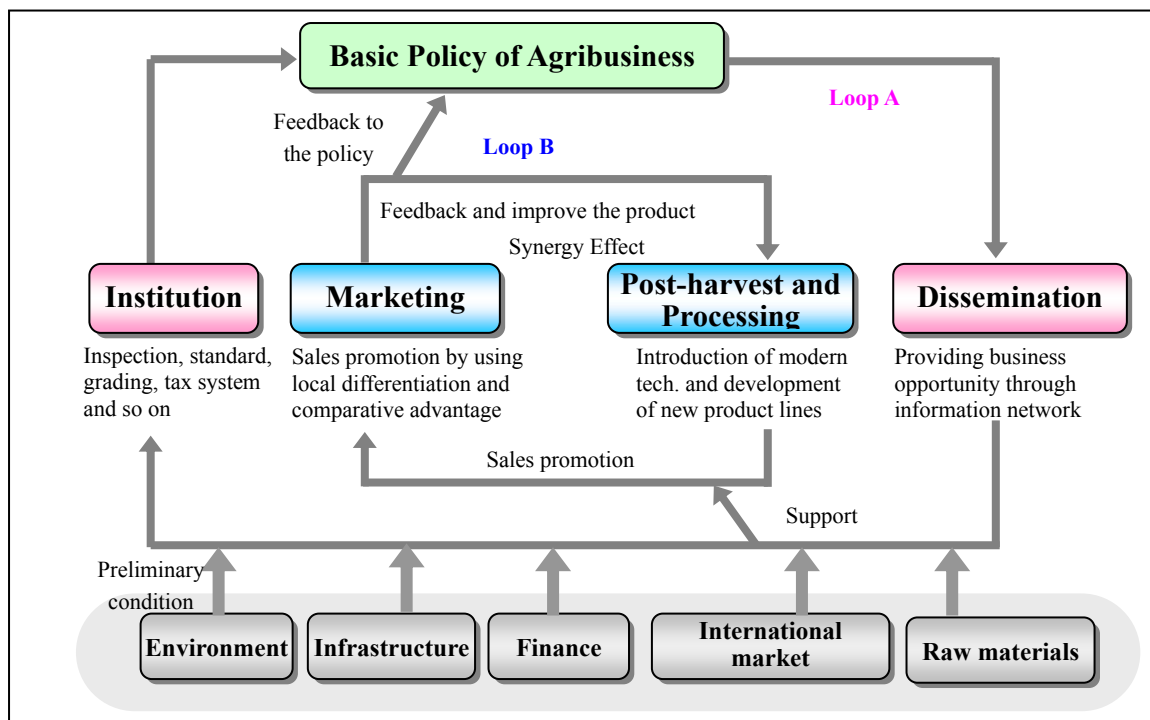
8.2.5 Strategies for Promotion of Agribusiness

Together with the adoption of water saving agriculture and a shift into high-value crop cultivation, as well as with the improvements in livestock breeding, agribusiness should be strategically promoted in the Jordan Rift Valley area. Some specific strategies are proposed as follows.

(1) Sustainable Development Model for Agribusiness

Regarding agro-processing, distribution and marketing, a versatile type of spiral model is developed, focusing on the (i) institutional enhancement, (ii) information dissemination and education, (iii) introduction of processing technology, and (iv) marketing and sales promotion. The public sector is responsible for (i) and (ii) while the private sector implements (iii) and (iv).

As illustrated in the figure, the external **Loop A** indicates the cycle of activities handled by the public sector and **Loop B** inside shows the cycle of activities to be implemented by the private sector. As the activity circulates step by step, the development level is expected to gradually improve to the upper stages.



Source: JICA Study Team

Figure 8.2.10 Promotion of linkages between Agribusiness and Other Sectors

This model emphasizes the self-reliant efforts of the private sector and the supporting system of the public sector. Development projects have started from the awareness of individual roles and functions in the development model.

(2) Promotion of Linkages between Agribusiness and Other Sectors

The following figure shows the linkage of development strategies for agribusiness in the region. The raw materials for agribusiness are strongly influenced by crop cultivation and water supply. When growers and traders develop their activities, they have to focus on the manufacturing sector as potential clients. In addition, development of the tourism sector is a good opportunity to enlarge the agribusiness markets. A harvest festival is also an idea to attract visitors. The manufacturing and tourism sectors should encourage agribusiness to develop new markets for local agriculture and agribusiness as well. The participants in the individual projects should be conscious of such synergetic effects within these sectors.

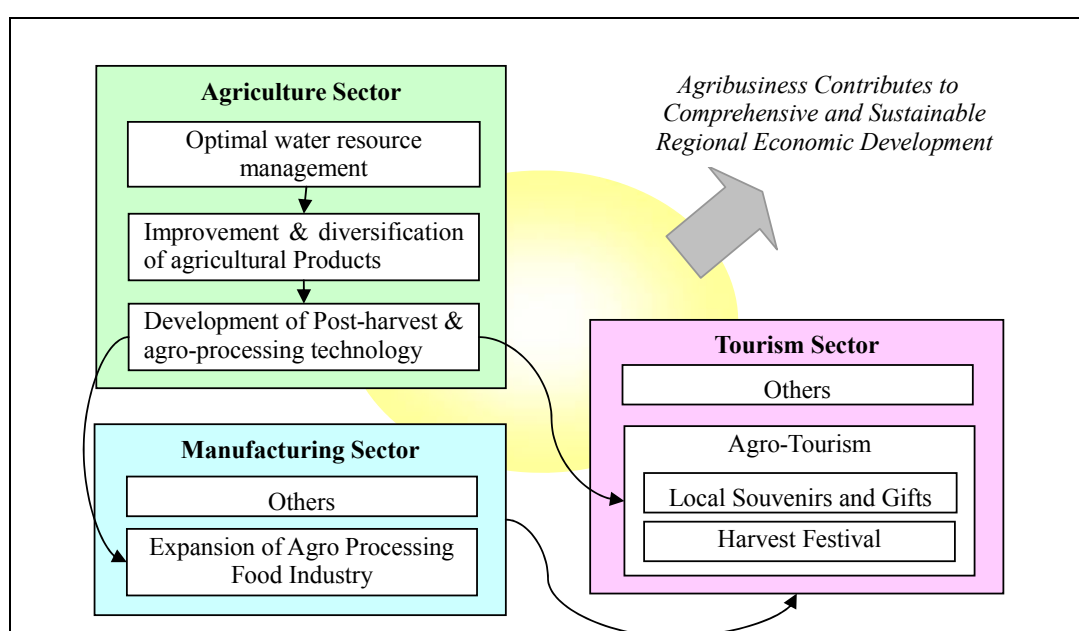


Figure 8.2.11 Linkage of Agribusiness with Manufacturing and Tourism Sectors

8.2.6 Agricultural Finance

Several studies have been conducted to assess the agricultural and rural finance situation in the West Bank and to examine alternative institutional arrangements to enhance farmers’ access to credit and to mobilize rural savings. Based on these studies, the MoA concluded that the establishment of a public agricultural credit bank is neither a viable nor desirable option, as previously pointed out. It also became clear that commercial banks would continue to be reluctant to provide agricultural/rural credit, particularly to small farmers, because of high risk and administrative costs and lack of guarantees.

In light of the above, the MoA has opted to promote Rural Finance Cooperatives (RFCs) as the main model to enhance farmers’ access to credit and mobilize rural savings. While requiring technical and financial support to become established, the RFCs are to operate on a commercial basis as independent lending and savings institutions. The boards elected by the members will establish lending and savings policies, including setting interest rates, requirements for loan approval, loan guarantees, loan collection and bad loan foreclosures, etc. It is envisioned that independent RFCs will be established throughout

Palestine and their activities will be coordinated by a federation of RFCs or, possibly, by a federation of micro-credit cooperatives operating in various sectors of the economy (i.e. not necessarily limited to rural cooperatives).

In the medium term, and until such a time when the proposed RFCs become financially viable and sustainable, their establishment and promotion will require a special rural/agricultural “revolving fund” financed by a soft loan from international lending agencies. The fund will be used to provide starting capital for the nascent RFCs to match the contributions of the members, provide low-interest loans to the RFCs, provide loan guarantees, etc.

To cope with the above, the MoA formulated a “Developing a Sustainable Rural Financing System” project. This project will establish 4-6 pilot RFCs to test the feasibility of such organizations in mobilizing rural financing for agricultural loans. The project will be implemented in two phases. Phase I will include a detailed feasibility study to assess the sustainability of the proposed model and to develop detailed recommendations on alternative modalities, legal organizations and operating guidelines for successful implementation. Phase II will involve the set-up of a pilot “revolving fund” and establishment of 4-6 pilot RFCs in selected districts/communities. Phase II will also include a thorough evaluation of the established pilot RFCs, based on which, a decision will be made on whether to launch a follow-up project that would see the gradual expansion of RFCs throughout Palestine. While the MoA is the implementing agency, individual RFCs should be completely privatized as they become sustainable, the owners being the beneficiaries they serve.

However, there can be no on-going or foreseeable activity in this program area unless donor assistance is received. Rural finance projects to date have been limited to feasibility studies on provision of credit to farmers and how to alleviate farmer’s losses from natural agricultural disasters. The MoA believes it is of crucial importance to act on the credit issue now. Many farm-based projects to improve productivity and conserve natural resources require investments by farmers, for example modern irrigation systems. Most farmers cannot afford these improvements without access to credit. The MoA has rejected the idea for a government agricultural credit window and recognized the unwillingness of private sector commercial banks to provide this credit. It proposes a project to test the feasibility of rural finance cooperatives as a means to mobilize rural savings for investment in agriculture. If successful, the pilot cooperatives will be used as a model to establish a national system.

8.3 Proposed Program for Water Resource Development

Based on the targets and strategies as discussed in Chapter 8.2, potential and available water in the Jordan Rift Valley area is assessed and several development programs are proposed for efficient water management in the region.

8.3.1 Future Potential of Water Resources

As assessed in Annex 2, the existing water resources in the four focal areas were estimated on the basis of available data for 2003, as summarized in the following table.

Table 8.3.1 Existing Water Resources

Area	Spring (MCM/yr)	Well (MCM/yr)	Mekorot (MCM/yr)	Total (MCM/yr)
Jericho/Al 'Auja	21.97	3.33	0.87	26.17
Lower Al Far'a	0.00	2.85	0.17	3.03
West Tubas	5.80	0.95	0.02	6.77
North Tubas	1.30	0.18	4.10	5.58
Total	29.07	7.32	5.16	41.55

Note: Excluding assumed losses.

Source: PWA database (2003)

Improvement in Spring Water Conveyance Channels

It is planned that 30% of water loss in conveyance from springs will be improved to 5%, and the volume of available water sources will be increased as estimated below.

Table 8.3.2 Future Volume to be Increased by Improvement of Spring Channels

Basin	Discharge	Assumed Loss		Available in 2003	Short Term (4 yrs)	Medium Term (+3 yrs)	Long Term (+3 yrs)	After 2016
	(MCM/yr)	(%)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)
Wadi al Qilt	19.96	30%	5.99	13.97	2.38	2.61	0.00	0.00
Wadi al 'Auja	11.42	30%	3.43	8.00	2.69	0.00	0.17	0.00
Wadi al Far'a	8.29	30%	2.49	5.80	0.00	0.00	1.47	0.61
Wadi al Malih	1.86	30%	0.56	1.30	0.00	0.00	0.00	0.47
Total	41.53		12.46	29.1	5.07	2.61	1.63	1.07
<i>Accumulated Volume to be increased</i>				29.1	5.07	7.68	9.31	10.38

Source: JICA Study Team estimate

Rehabilitation of Existing Wells

Available data are insufficient to identify wells to be rehabilitated. Therefore, the average of extraction licenses of wells in each area is applied to estimate the water volume that could be made available by means of well rehabilitation. According to the PWA database, the average volumes in each area are estimated as follows:

Table 8.3.3 Average of Licensed Volume of Not-Operated Wells

Area	Locality	Average Volume (m ³ /year/well)
Jericho/Al 'Auja	Jericho	89,818
	Al 'Auja	102,000
	Al Jiftlik	173,000
	Fasayil	95,000
Lower Al Far'a	Frush Beit Dajan	98,000
	Marj Na'ja	51,333
North Tubas	Bardala	284,000

Source: PWA

Water volume to be made available by rehabilitation of existing wells is now estimated as summarized in the following table.

Table 8.3.4 Future Volume to be Increased by Well Rehabilitation

Area	Short Term (4 yrs)	Medium Term (+3 yrs)	Long Term (+3 yrs)	After 2016
	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)
Jericho/Al 'Auja	0.71	1.22	1.73	0.83
Lower Al Far'a	0.40	0.61	0.83	0.09
West Tubas	0.00	0.00	0.00	0.00
North Tubas	0.00	0.27	0.54	1.62
Total	1.11	0.99	0.99	2.54
Accumulated Volume to be increased	1.11	2.10	3.09	5.64

Note: Excludes assumed loss of 5%.

Source: JICA Study Team estimate

Development of New Wells Already Approved by the JWC

The PWA has a plan to drill a new well in Tammun town in Tubas, and the plan has already been approved by the JWC. This new well is a new water source. It would produce 0.8 MCM/yr of water according to the analysis by the PWA. The available water volume will be 0.78 MCM/yr excluding the loss of 5 % in the short term.

Harvesting of Storm Water

The potential water volume to be made available by harvesting of storm water along the wades is estimated based on the following assumption.

- 70% of the average runoff volume will be captured.
- 50% of the captured volume can be used.

The total water made available by harvesting of storm water in wadis is estimated as summarized in the following table.

Table 8.3.5 Future Volume to be Increased by Storm Water harvesting

Catchement	Runoff	Runoff (Average)	Captured Volume	Usable Volume	Short Term 4 yrs	Medium Term +3 yrs	Long Term +3 yrs	After 2016
	(MCM/yr)	(MCM/yr)	70%	50%	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)
Maleh	1.0 - 1.0	1.00	0.70	0.35				0.35
Nuweima	1.0 - 2.0	1.50	1.05	0.53				0.53
Far'a	3.5 - 11.0	7.25	5.08	2.54	0.10	0.10	0.10	2.24
Ahmar	1.0 - 2.0	1.50	1.05	0.53				0.53
Al 'Auja	2.0 - 3.0	2.50	1.75	0.88		0.10	0.50	0.28
Qilt	3.0 - 11.0	7.00	4.90	2.45	0.10	0.50	0.50	1.35
Total	11.5 - 30.0	20.75	14.53	7.26	0.20	0.70	1.10	5.26
Accumulated Volume to be increased					0.20	0.90	2.00	7.26

Source: JICA Study Team estimate

Water Recycling

The potential water volume to be made available by water recycling is estimated on the basis of the following assumptions.

- 80% of domestic water used will be collected in the areas which have piped collection systems
- 5% of domestic water used will be collected in the areas in which tanker collection systems will be introduced.
- 70% of collected wastewater will be treated and reused.

The total water to be made available by recycling systems is estimated as summarized in the following table.

Table 8.3.6 Future Volume to be Increased by Water Recycling System

Area	Short Term (4 yrs)	Medium Term (+3 yrs)	Long Term (+3 yrs)	After 2016
	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)
Jericho/Al 'Auja	0.62	0.94	1.17	1.45
Lower Al Far'a	0.00	0.00	0.00	0.37
West Tubas	0.00	0.39	0.96	2.09
North Tubas	0.00	0.00	0.00	0.13
Other Governorates				8.45
<i>Accumulated Volume to be increased</i>	0.63	1.33	2.13	12.50

Note: Excludes assumed loss of 5%.

Source: JICA Study Team estimate

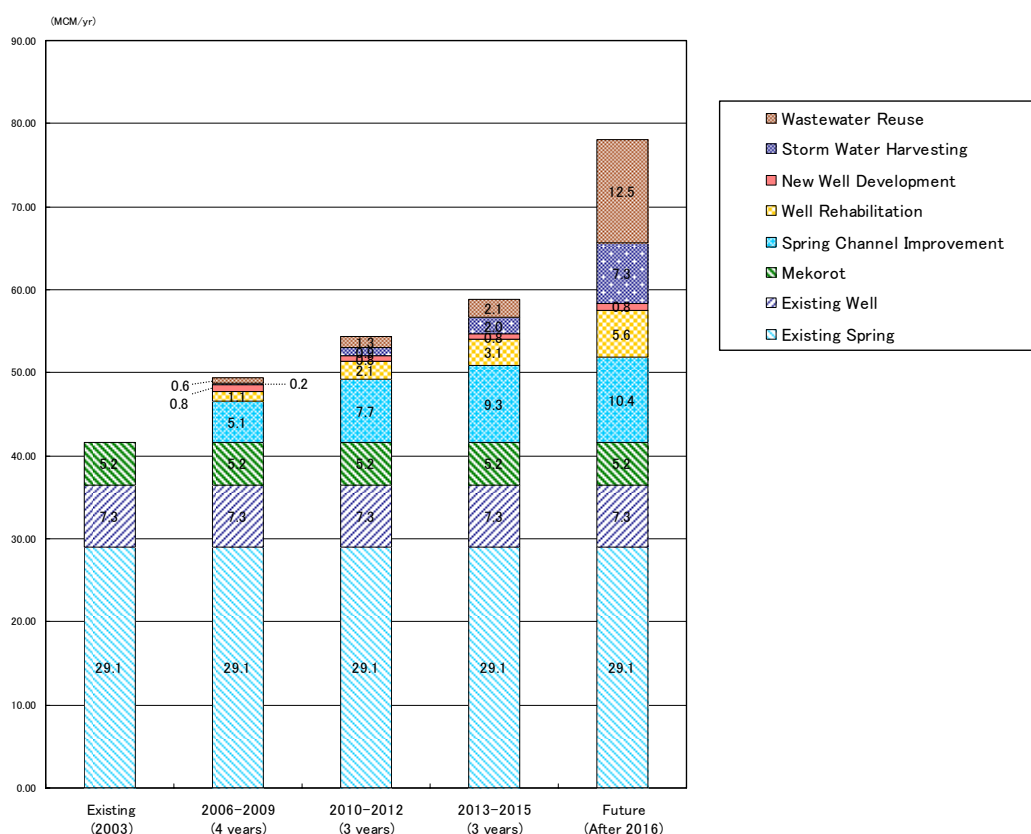
Total Available Water in Future

Total water volume made available in the Jordan Rift Valley in the future is thus estimated as summarized in the following table and figure.

Table 8.3.7 Future Volume Made Available in Jordan Rift Valley in the Future

Water Resource	Available Water Volume				
	Existing (2003)	2006-2009 (4 years)	2010-2012 (+3 years)	2013-2015 (+3 years)	Future (After 2016)
	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)
Existing Springs	29.07	29.07	29.07	29.07	29.07
Existing Wells	7.32	7.32	7.32	7.32	7.32
Mekorot	5.16	5.16	5.16	5.16	5.16
Spring Channel Improvement		5.07	7.68	9.31	10.38
Well Rehabilitation		1.11	2.10	3.09	5.64
New Well Development		0.76	0.76	0.76	0.76
Storm Water Harvesting		0.20	0.90	2.00	7.26
Wastewater Reuse		0.63	1.33	2.13	12.50
Total <i>(Comparing with the existing volume)</i>	41.55	49.31 <i>(+7.76)</i>	54.32 <i>(+12.77)</i>	58.85 <i>(+17.29)</i>	78.10 <i>(+36.54)</i>

Source: JICA Study Team estimate



Source: JICA Study Team

Figure 8.3.1 Future Volume of Water Resource in Jordan Rift Valley

8.3.2 Future Water Available for Agriculture

Since the highest priority for water allocation is given to domestic and industrial use, water available for agriculture in the future will be the remaining water. In this context, water allocation for domestic, industrial, tourism and livestock uses is to be taken into account first. Water demand for these purposes is called the municipal and industrial (M&I) demand and calculated in the following table.

Table 8.3.8 Future Municipal and Industrial Water Demand

Area	Population	Municipal & Industrial Demand (MCM/yr)					
		Dom.	Tour	Public	Livstck	Indst.	Total
			200 lpc	3%	10%	15%	
Short Term (2006-2009)							
Jericho/Al 'Auja	39,910	2.01	0.20	0.09	0.31	0.46	3.07
Lower Al Far'a	8,964	0.42	0.00	0.02	0.06	0.09	0.58
West Tubas	56,171	1.54	0.00	0.06	0.21	0.32	2.14
North Tubas	3,531	0.10	0.00	0.00	0.01	0.02	0.13
Others	797	0.02	0.00	0.00	0.00	0.00	0.03
Total	109,373	4.09	0.20	0.18	0.60	0.89	5.95

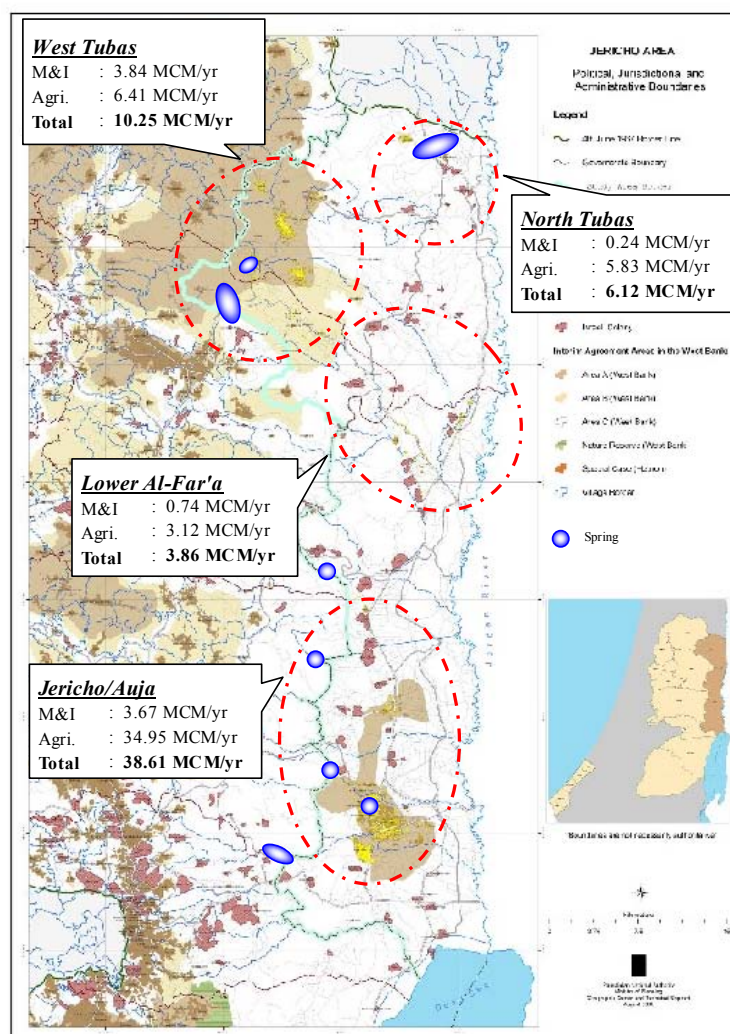
Area	Population	Municipal & Industrial Demand (MCM/yr)					
		Dom.	Tour	Public	Livstck	Indst.	Total
			200 lpc	3%	10%	15%	
Medium Term (2010-2012)							
Jericho/Al 'Auja	43,144	2.22	0.20	0.10	0.34	0.50	3.36
Lower Al Far'a	9,690	0.47	0.00	0.02	0.07	0.10	0.66
West Tubas	60,722	2.11	0.00	0.09	0.29	0.44	2.92
North Tubas	3,817	0.13	0.00	0.01	0.02	0.03	0.18
Others	862	0.03	0.00	0.00	0.00	0.01	0.04
Total	118,235	4.96	0.20	0.22	0.72	1.08	7.17
Long Term (2013-2015)							
Jericho/Al 'Auja	46,430	2.44	0.20	0.11	0.37	0.55	3.67
Lower Al Far'a	10,429	0.53	0.00	0.02	0.07	0.11	0.74
West Tubas	65,347	2.77	0.00	0.12	0.38	0.58	3.84
North Tubas	4,108	0.17	0.00	0.01	0.02	0.04	0.24
Others	927	0.04	0.00	0.00	0.01	0.01	0.06
Total	127,240	5.95	0.20	0.26	0.85	1.28	8.54

- Note: - It is assumed that the number of tourists will be 400,000 in a year and each tourist will stay for 2.5 nights in only the Jericho/Al 'Auja area.
- Public water demand is assumed to be 3% of M&I demand.
 - Livestock water demand is assumed to be 10% of M&I demand.
 - Industrial water demand is assumed to be 15% of M&I demand.
 - Domestic water demand is assumed under the target water supply level explained in Chapter 7.

According to the above estimate of the M&I water demand, water available for future agriculture is estimated as summarized in the following table and figure.

Table 8.3.9 Future M&I Water Demand and Water Available for Agriculture

Area	Population	2003 Current Volume (MCM/yr)			Potential Resources (MCM/yr)	M&I Demand (MCM/yr)	Available for Agriculture (MCM/yr)
		Dom.	Agri.	Total			
Short Term: 2006-2009 (4 years)							
Jericho/Al 'Auja	39,910				32.67	3.07	29.60
Lower Al Far'a	8,964				3.43	0.58	2.85
West Tubas	56,171				7.63	2.14	5.50
North Tubas	3,531				5.58	0.13	5.42
Others	797					0.03	
Total	109,373	2.52	39.04	41.55	49.31	5.95	43.36
Medium Term: 2010-2012 (3 years)							
Jericho/Al 'Auja	43,144				36.71	3.36	33.35
Lower Al Far'a	9,690				3.64	0.66	2.99
West Tubas	60,722				8.12	2.92	5.19
North Tubas	3,817				5.85	0.18	5.63
Others	862					0.04	
Total	118,235	2.52	39.04	41.55	54.32	7.17	47.15
Long Term: 2013-2015 (3 years)							
Jericho/Al 'Auja	46,430				38.61	3.67	34.95
Lower Al Far'a	10,429				3.86	0.74	3.12
West Tubas	65,347				10.25	3.84	6.41
North Tubas	4,108				6.12	0.24	5.83
Others	927					0.06	
Total	127,240	2.52	39.04	41.55	58.85	8.54	50.30



Source: Ministry of Planning and International Cooperation (MoPIC)

Figure 8.3.2 Available Water in 2015

8.3.3 Proposed Programs for Water Resource Management

In the light of water resources as assessed in the foregoing section, several programs are proposed for implementation. They will include, but not be limited to the following.

- (i) Feasibility-level Study on Water Resource Development and Management,
- (ii) Improvement in Conveyance Systems for Spring Water,
- (iii) Rehabilitation of Existing Wells,
- (iv) Development of Storm Water Harvesting Systems, and
- (v) Development of Water Recycling Systems.

(1) Feasibility-level Study on Water Resource Development and Management

Prior to the implementation of water resource development, it is necessary to conduct a feasibility-level study on development of water resources and improvement of water resource management systems. The objectives of this study are: (i) formulation of an implementation program for water resource development, and (ii) formulation of a management system for water rights and water allocation.

The study should cover all the water resource development plans, and it should also include the following.

Study on Water Resource Development

- Survey of potential volume of water resources
- Assessment of water resource development in terms of improvement of spring channels, rehabilitation of existing wells, harvesting of storm water in wadis and recycling of water through implementation of pilot projects.
- Assessment of water balance, feasibility of groundwater and an environmental assessment
- Assessment of the priority for development and carrying out of preliminary designs and cost estimates of projects to be proposed
- Technical and economical evaluation of projects
- Formulation of an implementation program

Study on Water Resource Management

- Survey of current institutional capacity
- Survey of current situation of water rights
- Formulation of management system for water rights and water allocation

The feasibility study will take about 24 months at an estimated cost of about US\$ 2 million.

(2) Improvement in Conveyance System for Spring Water

The objective of this program is to decrease water loss in the spring water conveyance systems. The program consists of the replacement of existing channels with pipelines in the Wadi al Qilt, Al 'Auja, Al Far'a and Al Malih basins. Ain Slutan and Ain Duyuk channels are excluded as they have been conducted by IFAD. The Channels from Ain Qilt and Al 'Auja have the highest priority because they currently have of the greatest losses. Improvement to the channels in Wadi al Far'a and Al Malih cannot be accorded with a high priority due to their location in Area C. This program should include capacity building of the operation and maintenance organization.

Table 8.3.10 Schedule for Improvement of Spring Water Conveyance System

Area	Basin	Spring Name	2006-2009 (4 years)	2010-2012 (+3 years)	2013-2015 (+3 years)
Jericho/Al 'Auja	Wadi al Qilt	Al Duyuk	□		
		Al Sultan	□		
		Al Qilt & Fawwar		■■■*	
		Others		■	
	Wadi Al 'Auja	Al 'Auja	■■■*		
		Fasayil			■*
Lower Al Far'a	-				
West Tubas	-				
North Tubas	-				

Note: ■ 1 year (* Indicative cost of Al 'Auja is US\$ 7 million, Fasayil is US\$ 3.5 million and Al Qilt is US\$ 12.3 million.)

□ Already completed or on-going projects funded by IFAD

Source: JICA Study Team

(3) Rehabilitation of Existing Wells

The objective of this program is to increase water resources for both domestic and agricultural uses. The program is to increase well depth and replace pumping units for non-operating wells. Some wells will not be completely rehabilitated because of the aged and damaged casing or lifting pipes, the drop of water level and/or caving. As revealed through the pilot rehabilitation of the well in Furush Beit Dajan, the available water in aquifers has changed remarkably¹. Detailed hydrogeological studies are needed to verify the drop of water level and other hydrogeological conditions in rehabilitating the existing wells.

The total number of non-operating wells, excluding abandoned wells and observation wells, is 53 but the number of wells assumed for rehabilitation works is 45. These wells will be operated by community based organizations or water users' associations, and capacity building is indispensable. An indicative cost of this program is shown in the following table.

Table 8.3.11 Schedule and Indicative Cost of Well Rehabilitation Program

(Unit: US\$)

Area	Short Term		Mid Term		Long Term	
	No. of Wells	Cost	No. of Wells	Cost	No. of Wells	Cost
Jericho/Al 'Auja	8	1,200,000	6	900,000	6	900,000
Lower Al Far'a	4	600,000	2	300,000	2	300,000
West Tubas		0		0		0
North Tubas		0	1	150,000	1	150,000
Total	12	1,800,000	9	1,350,000	9	1,350,000

Note: - The cost for one well is estimated to be US\$ 150,000 under the assumption that rehabilitation works include: (i) replacement of a pumping unit and lifting pipes, (ii) increase of the well depth, and (iii) pumping test
 - Not including the costs for supply system such as transmission lines and distribution lines.
 - Not including the cost for capacity building
 - In practice, the cost will vary by the method of rehabilitation.

Source: JICA Study Team

¹ Also refer to the static water level recorded by PWA as presented in Annex 2, Chapter 5, Figure 2.5.4.

(4) Development of Storm Water Harvesting Systems

The objectives of this program are to strengthen groundwater capacity and increase water resources for agricultural use through recharging and storing storm water in wadis. The project will cover (i) construction of recharge basins, (ii) construction of agricultural reservoirs, (iii) construction of dams, and (iv) capacity building for operation, maintenance and monitoring of recharging and storing systems. A small reservoir or recharge basin will preferably be constructed during the feasibility study stage as a pilot project. A study on water harvesting in Wadi al Far'a has been conducted by the EXACT program.² Water harvesting at Wadi al 'Auja and Qilt is recommendable for implementation with priority because of plentiful storm water and their location in Area A. A preliminary schedule and indicative cost are presented in the following table.

Table 8.3.12 Schedule and Indicative Cost for Development of Water Harvesting

(Unit: US\$)

Area	2006-2009 (4 years)		2010-2012 (+3 years)		2013-2015 (+3 years)	
	Jericho/Al 'Auja	1 site ^{*1}		6 sites	7,500,000	10 sites
Lower Al Far'a						
West Tubas	1 site ^{*2}		1 site	1,250,000	1 site	1,250,000
North Tubas						

Note: *1 To be planned in the feasibility study
 *2 Already planned by EXACT (the capacity is unknown)
 *3 the capacity for capturing water in a site is assumed to be 0.1 MCM/yr

Source: JICA Study Team

(5) Development of Water Recycling System

The objectives of this program are to improve the environmental condition and increase water resources for agricultural use by means of recycling of treated waste water. It will be composed of (i) construction of wastewater collection and treatment systems, (ii) construction of agricultural reservoirs and conveyance systems for irrigation, and (iii) capacity building for operation and maintenance of wastewater collection and treatment systems. The highest priority areas are Jericho and Tubas Municipalities which are the most urbanized and populated. It will be expanded to the suburban areas, such as 'Ein as Sultan Camp, Aqubat Jabar Camp and Tammun. Medium populated areas such as Al 'Auja and El Far'a Camp will be the third priority. From the environmental point of view, Al Badan and Taluza located in the upper Wadi al Far'a, where water supply potential is relatively high, are also in the third priority. A preliminary schedule and indicative cost are shown in the following table.

² Comprised of water experts from Israeli, Jordanian, and Palestinian water-management agencies, EXACT (Executive Action Team) implements the Water Data Banks Project, which was endorsed by the multilateral working group on water resources for the Middle East Peace Process.

Table 8.3.13 Schedule and Indicative Cost of Development of Water Recycling System

(Unit: Thousand US\$)

Area	Site	2006-2009 (4 years)		2010-2012 (3 years)		2013-2015 (3 years)	
		■		■		■	
Jericho/Al 'Auja	Jericho	■	12,000				
	'Ein Al Sultan Camp			■	300		
	Aqbat Jabar Camp			■	800		
	Al 'Auja					■	500
Lower Al Far'a	-						
West Tubas	Tubas			■	10,000		
	Tammun					■	1,400
	El Far'a Camp					■	800
North Tubas	-						

Note: ■ 1 year

Source: JICA Study Team

(6) Indicative Total Cost for Program

The indicative cost estimated for the water resource management programs will total as summarized in the following table.

Table 8.3.14 Summary of Program Cost

(Unit: US\$)

Program	2006-2009 (4 years)	2010-2012 (3 years)	2013-2015 (3 years)	Total
Feasibility Study on Water Resource Development and Management	2,000,000			2,000,000
Improvement of Spring Water Conveyance System	7,020,000	12,290,000	3,510,000	22,820,000
Rehabilitation of Existing Wells	1,800,000	1,350,000	1,350,000	4,500,000
Development of Storm Water Harvesting Systems	0	8,750,000	13,750,000	22,500,000
Development of Water Recycling Systems	12,000,000	11,100,000	2,700,000	25,800,000
Total	22,820,000	33,490,000	21,310,000	77,620,000

Source: JICA Study Team

8.3.4 Institutional Strengthening for Water Management

The Palestinians and Israelis have been using the same aquifers in the West Bank. Both sides have responsibility to jointly solve the issues on the decline of the aquifers, starting with an investigation on the current extraction volume and license volume of all wells located in the West Bank, as well as an assessment of the capacity of the aquifers and sustainable extraction volume.

The National Water Council of Palestine was revived in 2006, and the institutional framework of the water sector has been set as illustrated in the following figure.

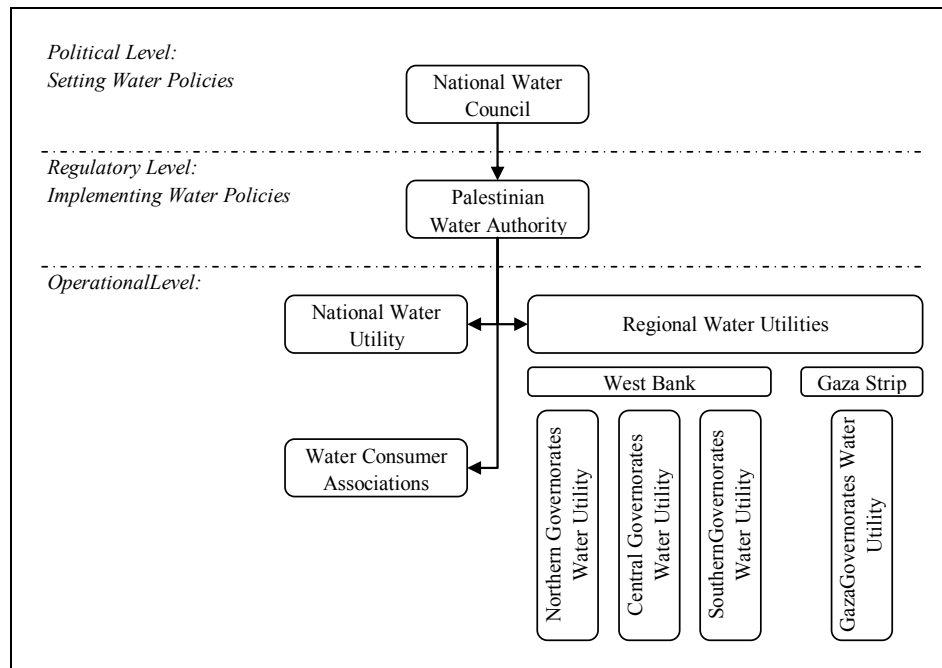


Figure 8.3.3 Institution Framework of Water Sector

The duties and prerogatives of the National Water Council are stipulated in Article 9 of Water Law No.3 of 2002, as summarized in the following.

- Sanction the general water policy
- Sanction the policy for development and utilization of water resources and the different uses
- Ratify plans and programs aimed at organizing the usage of water, preventing waste, and directing consumption
- Ratify the tariff policy
- Confirm the allocation of funds for investment in the water sector
- Approving the periodic reports concerning the activities of the Authority and its work
- Approve the Authority's guidelines and confirm to any international regulations that govern its administration and operations
- Confirm the appointment of the Board of Directors of the regional utilities
- Approve the annual budget of the Authority and present it to the Council of Ministers to confirm it
- Implement the financial regulations prevailing in the Palestinian National Authority
- Any other tasks which are delegated to it according to the provisions of this law.

The Palestinian side should establish a system and relationship under this framework to properly execute their duties at all levels (Legal and institutional framework for water management is further discussed in Section 8.4.5).

8.4 Proposed Program for Crop Production

Based on the strategies as discussed in Section 8.2.3, crop production in the Jordan Rift Valley area is programmed for (i) rain-fed agriculture in the highland area, (ii) sustainable land and water management, (iii) proposed cropping pattern and water management, (iv) proposed programs for crop production, and (v) institutional framework for land and water management.

8.4.1 Sustainable Land Development for Rain-fed Agriculture

Although the rain-fed area makes up 88% of all cultivated area, it contributes only 25.5% of total agricultural value added. Olives occupy the largest rain-fed area followed by field crops, other fruit trees and vegetables. Stone fruits (like almonds, peaches, and apricots) are other major crops in the rain-fed highlands; most of these plantations are not properly looked after. Despite the fact that their area is comparatively large, profitability is declining. Rain-fed crops include wheat and barley as the most common grain crops. Although these crops are quite important for food security, their productivity is low due to low and vulnerable rainfall and thus they contribute to only a small percentage of locally consumed quantities. In this regard, it is necessary to introduce well adapted improved varieties of field crops, especially wheat, barley, chick-peas, lentils and sorghum.

(1) Land Reclamation Program

The land reclamation program aims at reclaiming at least 10,000 cultivable dunums of land for wheat cultivation in the Tubas highland where annual rainfall ranges between 350 mm and 450 mm. The program targets privately owned land, especially in the hilly areas. Steep slopes, shallow soils and the presence of a profusion of rocks and stones characterize these areas. There is an increasing demand by farmers to reclaim more land. In the past few years, the MoA has responded to this demand by implementing land reclamation projects in the Nablus, Hebron, Ramallah and Bethlehem governorates. In executing land reclamation projects, the MoA has contracted local NGOs and organized farmers' active participation. This program will build on the past expertise of the MoA by expanding the scope of work and extending it to cover the Tubas highland.

The project also proposes job creation through the development of the arable lands, since the activities such as land clearing, construction of retaining walls, improvement of soils, and planting of suitable wheat and fruit trees are labor-intensive. Specific objectives of the program will include the following.

- (i) Increase the area of cultivable land for staple foods (wheat and barley) and fruits,
- (ii) Job creation to alleviate unemployment,
- (iii) Increase utilization of water resources (rain),
- (iv) Increase awareness of water and land conservation issues among farmers, and
- (v) Promote the active participation of farmers in water and land management.

(2) Program for Rehabilitation of Degraded Arable Lands

The program for rehabilitation of degraded arable lands aims at improving the land's physical characteristics, soil fertility, water holding capacity and vegetation cover through terracing and contour fencing in the hilly areas of the Tubas highland over an area of about 5,000 dunums. The area has a good average annual rainfall ranging from 350 mm to 450 mm. Rocky tops and big stones characterize the mountain and hilly areas, while the slopes and the bottom parts of these slopes contain areas of fertile soils. These areas are considered to be the fruit basket of Palestine. They contain not only fruits, but also field crops (wheat) and vegetables.

Although part of land area has fallen under Israeli occupation, there still remains potential for rehabilitating the arable lands to improve their production and protect them from soil erosion and negative impacts on human activities. The Tubas highland is climatologically diverse, making it possible to use the rehabilitated lands to introduce improved and well-adapted varieties characterized by high yield, and disease, pest and drought resistance. The rehabilitated lands should be planted with improved fruit and wheat species which will yield a higher net income to farmers, compared to the low yield varieties currently planted. This program will enhance the sustainability of the agricultural sector and improve the production of mountainous and hilly slopes of the Tubas highland.

The essential contribution to improving food security and reducing poverty lies in ways that improve the production process, which will yield the economic benefits of income generation and employment in rural areas. In order to secure this goal, the present proposal is to improve living standards for those that do not have a dependable food supply and the unemployed workers through the support of income generating programs. This program aims at improving the socioeconomic conditions and living standards for these people. Specific objectives are thus summarized as follows:

- (i) Creation of new job opportunities,
- (ii) Increase of needed agricultural products for the local market,
- (iii) Improvement of the target groups' (those lacking adequate food) access to food,
- (iv) Increase utilization of water resources (rain),
- (v) Introduction of improved and well-adapted crop varieties of wheat and fruit trees, and
- (vi) Train farmers in rehabilitation techniques that improve land productivity.

8.4.2 Sustainable Land and Water Management**(1) Sustainable Land Development**

The most effective way to enhance productivity of non-cultivated and rain-fed lands is through irrigation, and above all, introduction of plastic houses. It is expected that the water saved by means of (i) replacement of existing conveyance canals with pipelines, (ii) rehabilitation of wells which are not operational, (iii) new well development, (iv) storm water harvesting, (v) wastewater reuse, and (vi)

raising irrigation efficiency could allow for expansion of the current irrigated areas, as discussed in Chapter 8.3. It is estimated that if additional water resources are made available, the long-term potential exists for expanding irrigated areas by an additional 4,000 dunums of plastic houses (from the present 786 dunums to the proposed 4,857 dunums) even after deducting the increasing water demand for other purposes in the Jordan Rift Valley area. The MoA should give high priority to conduct a comprehensive inventory and assessment of agricultural lands suitable for irrigation including plastic houses to be newly built. Based on this assessment, the MoA and PWA should develop future plans jointly for the short and long-term potential expansion in irrigated areas.

Increasing soil and water salinity constitute one of the main factors currently affecting the productivity in some of the most fertile irrigated lands, particularly in the Jordan Rift Valley. The expected substantial increase in the use of brackish water could accelerate soil salinization and may result in a sharp decline in productivity. Proper irrigation and cultivation practices and the appropriate application of fresh water to leach excess salts will be essential to control and prevent soil salinization. The MoA should give priority to conduct a detailed soil survey in the Jordan Rift Valley. These soil surveys should aim primarily at identifying areas most endangered by soil salinization and areas most suitable for potential use of brackish water. Based on this survey, the MoA should initiate a well-targeted extension program to increase the awareness of concerned farmers about the crucial importance of proper irrigation practices and leaching to control salinization.

In the Tubas highland, soil erosion and desertification constitute key land degradation factors affecting the productivity of rain-fed agriculture. Based on the comprehensive soil survey, the MoA should assess the extent of soil erosion and desertification and identify priority actions and areas where mitigation measures are most needed. Based on this, the MoA should give priority to initiate an extension program targeting farmers in identified priority areas to promote appropriate cultural practices, crop rotations and crop mixes most suitable to control land degradation. The MoA should also give high priority to set up an effective mechanism for the regular monitoring of soil erosion and desertification.

(2) Enhancement of Water Efficiency

The rehabilitation of existing infrastructure, such as wells, springs, ponds and canals should continue to receive high priority. On-farm irrigation efficiency should draw greater attention, particularly in the Jordan Rift Valley where use of such modern irrigation techniques remains limited. The MoA should initiate a comprehensive program for the promotion of such techniques, including extension services, training and the provision of long-term credit.

By applying water application efficiency of 75% (considered to be optimum water use under the present conditions), water deficit/surplus in the two districts is calculated as shown in the following table:

Table 8.4.1 Available Water and Optimum Water Use for Various Agricultural Patterns

Area	Actual Water Use	Optimum Water Use		Actual Water Use	Optimum Water Use		Actual Water Use	Optimum Water Use	
		Without LR	With LR		Without LR	With LR		Without LR	With LR
	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)
	Open Fields			Fruit Trees			Field Crops		
Tubas	5.30	4.04	4.55	6.11	4.66	5.25	-	-	-
Jericho	17.36	16.50	18.28	6.04	5.74	6.40	2.63	2.50	2.77
Study Area	22.66	20.54	22.83	12.15	10.40	11.65	2.63	2.50	2.77
Area	Low Plastic Tunnels			Plastic Houses			High Plastic Tunnels		
Tubas	0.04	0.03	0.04	0.32	0.24	0.27	0.02	0.02	0.03
Jericho	0.13	0.13	0.14	1.06	1.01	1.12	0.03	0.03	0.04
Study Area	0.17	0.16	0.18	1.38	1.25	1.39	0.05	0.05	0.07

Source: Agricultural Statistics, PCBS, 2003/04 and Water resources and Irrigated Agriculture, Applied Research Institute, March 1998

It is seen in the above table that there are small differences between the available water and the optimum use of water for various cropping patterns in Jericho governorate. On the other hand, in Tubas district, there is a considerable surplus of irrigation water, especially for open field crops even applying low on-farm irrigation efficiency.

(3) Land and Water Management Program

There is an acute water crisis because of the area's aridity coupled with a rapidly growing population with high water demand. Unless substantial improvements are made in water use efficiency and/or additional supplies of fresh water are made available, the Jordan Rift Valley area will soon face a serious water crisis. It is essential to give farmers incentive to adopt modern irrigation methods and to invest in plastic house production and related technology and management practices that generate greater economic returns with less water consumption. Salinization of the soil and water is also becoming a major problem that can not be resolved without production of fresh water for leaching. Consequently, it is proposed to initiate two short-term projects, i.e., greenhouse horticulture and sustainable saline agriculture, of which the concepts are outlined below:

(i) Greenhouse Horticulture

Palestine's comparative advantage lies in production of vegetables and other high value crops. The analysis made by the MoA indicates that irrigated agriculture, mainly in the Jordan Rift Valley using advanced production technologies such as plastic tunnels and greenhouses, makes efficient use of scarce resources and generates good income. Greenhouses cover more than 1,795 dunums in the Jordan Rift Valley area. That area has been continuously increasing in recent years. Greenhouses allow good climate control allowing year-round planting vegetables in the Jordan Rift Valley area.

The growing concern about water shortage in the region clearly implies that future agriculture and water use policies must be formulated with a view toward making efficient use of the scarce water resources.

Non-traditional crops such as strawberries, selected varieties of tomatoes, herbs, leaf vegetables and cut flowers are crops with strong competitive advantage and high potential for export to the Gulf, EU and Israeli markets. The objectives of this program, therefore, are to (i) encourage farmers to adopt modern production technologies, (ii) guide agricultural production in order to meet the needs of the market, particularly exports, (iii) encourage farmers to engage in contractual production, (iv) provide studies and marketing information for producers and exporters, and (v) encourage joint ventures to expand exports of horticultural produce.

(ii) Sustainable Saline Agriculture

The program addresses the MoA's general objective of optimal exploitation of agricultural resources to ensure sustainability. It supports the PNA's policy to manage irrigation water in a manner that maximizes the return by benefiting from brackish water for irrigation and intensify and strengthen extension and research activities and transfer technology. It also aims at diversifying agricultural production and achievement of integrated agricultural systems by developing alternatives for current production systems and developing and intensifying agricultural extension services and applied research. The objectives of this program are to (i) identify saline tolerant crops that will allow farmers to continue profitable farming and livestock breeding, (ii) increase farmer income through the introduction of higher yielding crops recommendable for saline areas, (iii) increase agricultural area and production by expanding cultivation areas, and (iv) maximize conservation and utilization of land and brackish water.

For the implementation of the above short-term programs, as well as for the enhancement of market oriented cultivation practices and livestock breeding practices, it is recommended that the capacity of the MoA's Jericho branch and its extension services be strengthened with support from the international agencies.

8.4.3 Proposed Cropping Patterns and Water Requirements

Table 8.4.2 shows the prevailing cropping patterns for all crops within the cultivated land areas of irrigated agriculture in the Jordan Rift Valley area for outdoor vegetables, plastic house (greenhouse) vegetables, fruit trees and field crops, which are based on the Agricultural Statistics of 2003/04 published by the PCBS. It is seen in the table that the irrigated area is 65,310 dunums, while the gross margin of irrigated agriculture gained from crop production in the region is estimated to be approximately NIS 119 million per year according to the same statistical data.

With respect to the water demand for the current cropping pattern, it is estimated at 39.03 MCM per year, which is calculated by applying optimum water use for each crop and corresponding cropping area on the basis of existing cropping patterns as discussed previously. The volume of water currently available for irrigation is estimated to be 39.04 MCM per year, which is calculated by deducting the domestic water demand of 2.52 MCM per year from the total available water of 41.55 MCM per year. Water demands estimated by the two different methods are consistent.

Discussions made in Section 8.3 indicate that there is a possibility of increasing availability of water for domestic and industrial use as well as agricultural purposes in future by means of improvement of spring water conveyance systems, rehabilitation of existing wells, development of new wells, development of storm water harvesting systems, and development of water recycling systems. Such increase in available water for agriculture can be allotted to irrigation of profitable horticultural crops such as high value added crops produced in greenhouses as well as date trees, as briefed in the subsequent paragraph.

As discussed previously, it is understood that irrigated agriculture, mainly in the Jordan Rift Valley, using advanced production technologies such as plastic tunnels and greenhouses with improved irrigation systems, as well as increase in the area of date production, will make efficient use of water resources and generate good profits. In this context, it is proposed to increase indoor cultivation, especially high value added crop cultivation in greenhouses and date cultivation. To cope with this, it is proposed to decrease irrigated areas of traditional crops correspondingly. Based on the key crops as recommended in the above, a future cropping pattern to be established by 2015 is proposed as shown in Tables 8.4.3.

Table 8.4.2 Present Cropping Pattern of Major Crops

Jordan Rift Valley	Present Cropping Pattern						
	Area (Dunums)	Area Share (%)	Gross Mar (NIS)	Production Share (%)	Water Req. (MCM)	Water Share (%)	Gross Mar./ m ³ Water Req.
Green House Vegetables							
Tomatoes	249	0.38%	2,986,753	2.51%	0.324	0.83%	9.23
Cucumbers	1,153	1.77%	11,185,253	9.42%	1.038	2.66%	10.78
Beans	325	0.50%	1,473,550	1.24%	0.195	0.50%	7.56
Others	68	0.10%	258,400	0.22%	0.045	0.12%	7.56
Outdoor Vegetables							
Ind. Cucumbers	4,344	6.65%	8,842,646	7.45%	1.738	4.45%	5.09
Potatoes	113	0.17%	293,122	0.25%	0.051	0.13%	5.76
Eggplants	5,635	8.66%	13,148,878	11.07%	4.522	11.59%	2.91
Cucumbers	2,060	3.15%	2,643,804	2.23%	1.030	2.64%	2.57
Potatoes	113	0.17%	244,871	0.21%	0.040	0.10%	6.19
Squash	11,946	18.29%	5,841,594	4.92%	5.376	13.77%	0.98
Beans	5,246	8.03%	5,943,718	5.00%	2.098	5.38%	2.83
Tomatoes	5,504	8.43%	9,054,080	7.62%	3.302	8.46%	2.74
Cauliflower	1,585	2.43%	3,790,369	3.19%	0.793	2.03%	4.78
Maize	6,867	10.51%	10,987,200	9.25%	2.060	5.28%	4.78
Others	5,483	8.40%	7,676,200	6.46%	1.645	4.21%	4.78
Fruits							
Oranges	592	0.91%	1,136,729	0.96%	0.529	1.36%	2.52
Bananas	2,287	3.50%	2,235,733	1.88%	5.718	14.65%	0.73
Clement	123	0.19%	155,085	0.13%	0.123	0.32%	1.68
Lemons	382	0.58%	1,090,427	0.92%	0.382	0.98%	3.73
Grapes	571	0.87%	1,590,521	1.34%	0.571	1.46%	3.67
Olives	2,812	4.31%	2,357,018	1.98%	2.812	7.20%	3.67
Dates	1,115	1.71%	9,759,417	8.22%	1.862	4.77%	5.93
Others	149	0.23	298,000	0.25%	0.149	0.38%	3.67
Field Crops	6,570	10.06%	15,768,000	13.28%	2.628	6.73%	
	65,310	100%	118,761,369	100.00%	39.031	100.00%	3.04

Source: Agricultural Statistics of 2003/04, PCBS

Table 8.4.3 Assumed Future Cropping Pattern under Water Saving Agriculture

Jordan Rift Valley		Assumed Future Cropping Pattern (2015)						
Crop	2015 Area Share (%)	Area (Dunum)	Gross Mar (NIS)	Mar Share (%)	Water Req. (MCM)	Water Share (%)	Gross Mar./m ³ Water Req.	
Green House Vegetables								
Tomatoes	5.00%	3,266	39,169,673	32.98%	3.919	10.04%	9.23	
Cucumbers	5.00%	3,266	31,678,616	26.67%	2.939	7.53%	10.78	
Beans	5.00%	3,266	14,805,777	12.47%	1.959	5.02%	7.56	
Others	0.00%	0	0	0.00%	0.000	0.00%		
Outdoors Vegetables								
Ind. Cucumbers	6.00%	3,919	7,976,702	6.72%	1.567	4.02%	5.09	
Potatoes	6.00%	3,919	10,164,848	8.56%	1.763	4.52%	5.76	
Eggplants	5.50%	3,592	8,355,108	7.04%	2.847	7.36%	2.91	
Cucumbers	4.50%	2,939	3,771,848	3.18%	1.469	3.76%	2.57	
Potatoes	5.00%	3,266	7,076,339	5.96%	1.143	2.93%	6.19	
Squash	5.00%	3,266	1,596,830	1.34%	1.633	4.18%	0.98	
Beans	3.00%	1,959	2,219,887	1.87%	0.784	2.01%	2.83	
Tomatoes	5.00%	3,266	5,371,748	4.52%	1.959	5.02%	2.74	
Cauliflower	5.00%	3,266	7,809,117	6.58%	1.633	4.18%	4.78	
Maize	4.00%	2,612	4,179,840	3.52%	0.784	2.01%	4.78	
Others	0.00%	0	0	0.00%	0.000	0.00%		
Fruits								
Oranges	2.50%	1,633	3,135,125	2.64%	1.306	3.35%	2.52	
Bananas	2.50%	1,633	1,596,149	1.34%	4.734	12.13%	0.73	
Clement	2.00%	1,306	1,646,922	1.39%	1.045	2.68%	1.68	
Lemons	3.50%	2,286	6,525,005	5.49%	1.829	4.69%	3.73	
Grapes	3.00%	1,959	5,457,630	4.60%	1.824	4.72%	3.67	
Olives	4.50%	2,939	2,463,428	2.07%	0.903	2.32%	3.67	
Dates	11.00%	7,184	62,811,278	52.95%	11.926	30.55%	5.93	
Field Crops								
	7.00%	4,572	10,972,080	9.24%	2.743	7.03%		
		100.00%	65,310	238,853,948	201.12%	50.754	130.04%	4.71
Comparison with Present Production				201.12%		130.04%	154.67%	

Source: JICA Study Team

It is understood from the table that the irrigated area is 65,310 dunums, or the same as the currently irrigated land area. Gross margin of irrigated agriculture gained from the crop production in the region is estimated to be approximately NIS 239 million per year, which is as high as double the present margin. Regarding water demand, the same procedures are practiced for its estimation. As a result of such changes in the proposed cropping pattern, water demand will amount to 50.75 MCM per year as seen in Table 8.4.3, which is almost equal to the allocated volume of 50.30 MCM per year (see Table 8.3.9).

Furthermore, the input of employed workers is estimated to be around 7.0 million man/hours under the current cropping pattern. This input would be increased to about 9.2 million man/hours under the assumed future cropping pattern with water saving agriculture. Likewise, the required employed workers for agricultural machineries would be increased from 119,000 man/hours to 163,000 man/hours. This will be equivalent to additional employment of about 3,000 workers in cultivation.

8.4.4 Proposed Development Program

Section 8.3 details the program for water resources development and management. Availability of water for domestic, tourism, public, livestock and industrial purposes can be increased by improvement of the existing water supply facilities and development of storm water harvesting systems and water recycling systems. Study results indicate that the increase in available water for crop production will be

approximately 11.26 MCM per year (increased from 39.04 MCM to 50.30 MCM per year, as estimated in Table 8.3.9).

Corresponding to the development of water resources management, the possibility of improvement of present farming systems was examined in the foregoing section. It is clear that the limitation of water resources is a major constraint to agriculturally based economic development. The focal point to cope with this is how to raise the water efficiency in order to maximize the productivity in the agricultural sector. Therefore, the basic concepts are the improvement of the cropping pattern by the introduction of advanced production technologies such as plastic tunnels and greenhouses with improved irrigation systems and an increase in date cultivation for raising the profitability of the irrigated lands in the Jordan Rift Valley.

A comparison is made for the major indicators between the present cropping pattern and the proposed future cropping pattern in proportion to the increase in available water for crop production of 11.26 MCM per year. The estimate in the foregoing section indicates that the cropping area of greenhouse horticulture and date trees will increase from the present 1,795 dunums to 9,798 dunums and 1,115 dunums to 7,184 dunums, respectively. Gross margin and gross margin/m³ of water required will increase from NIS 118,761,369 to NIS 238,853,948 and NIS 3.04 to NIS 4.71, respectively (refer to Tables 8.4.2, 8.4.3 and 8.4.4).

On the assumption that such increase in indicators is proportional to the increase of available water for crop production, the following table will be borne out:

Table 8.4.4 Increase in Water vs. Increase in Indicators

Major Indicators	Present Status	Short Term	Medium Term	Long Term
Water for Agriculture (MCM)	39.04	43.36	47.15	50.30
Greenhouses (dunums)	1,795	4,868	7,557	9,798
Date Cultivation (dunums)	1,115	3,445	5,485	7,184
Gross Margin (mil NIS)	118.761	164.872	205.223	238.854
Gross Mar./m ³ Water Req. (NIS)	3.04	3.68	4.24	4.71

Source: JICA Study Team

Costs for on-farm development are estimated in such a manner that construction of greenhouses and replacement of drip irrigation systems will be conducted for non-traditional horticultural crops, whereas micro-sprinkler systems will be introduced for date cultivation. Based on the above table, on-farm development costs are estimated as shown in the following table:

Table 8.4.5 Cost Estimate for On-farm Development

Work Items	Short Term	Medium Term	Long Term	Total
Increase in Available Water (MCM)	4.32	3.79	3.15	11.26
Greenhouses (dunums)	3,073	2,689	2,241	8,003
Date Trees (dunums)	2,330	2,040	1,699	6,069
Total (dunums)	5,403	4,729	3,940	14,072
Costs for Greenhouses (US\$)	24,584,000	21,512,000	17,928,000	64,024,000
Costs for Irrigation Systems (US\$)	4,430,000	3,878,000	3,231,000	11,539,000
Total On-farm Dev. Costs (US\$)	29,014,000	25,390,000	21,159,000	75,563,000

Unit cost of greenhouses including net: NIS 8,000 per dunum

Replacement of the existing irrigation systems with modern systems: NIS 820 per dunum

Source: JICA Study Team

Construction costs for infrastructure for development of water management have been estimated previously (refer to Table 8.3.14). In addition to this, construction costs for on-farm development are estimated above (refer to Table 8.4.5). As a result, total costs needed for each development term are calculated as summarized in the following table;

Table 8.4.6 Total Costs in Each Development Term

Construction Costs	Short Term	Medium Term	Long Term	Total
Water Development Costs (US\$)	22,820,000	33,490,000	21,310,000	77,620,000
On-farm Dev. Costs (US\$)	29,014,000	25,390,000	21,159,000	75,563,000
Total Construction Costs (US\$)	51,834,000	58,880,000	42,469,000	153,183,000

Source: JICA Study Team

Increase in gross profit in the respective development terms in relation to the increase in water availability is thus estimated in the following table:

Table 8.4.7 Increase in Gross Margin in Each Development Term

Increase of Gross Margin	Short Term	Medium Term	Long Term	Total
Availability of Water (MCM)	4.32	3.79	3.15	11.26
Gross Margin (mil NIS)	46.111	40.351	33.631	120.093
Gross Margin (US\$)	10,024,000	8,772,000	7,311,000	26,107,000

Source: JICA Study Team

With an increase in agricultural production, marketing of farm inputs and outputs would expand, and agribusiness and other agro-based industry would flourish at the village level, as well as regional level. The increase in the gross margin from primary products shows that farmers' income would substantially improve through enhancement of productivity and profitability.

8.4.5 Legal and Institutional Framework for Land and Water Management

(1) Land Management

The confused legal situation with respect to land ownership continues to create a high level of uncertainty and acts as a serious disincentive for farmers to invest in maintaining or enhancing the productivity of their land. This uncertain legal environment often hinders the use of land as mortgage for loans. This

situation is even more critical and confused with respect to state-owned and communal lands. Moreover, inheritance laws have resulted in a serious problem of land fragmentation, which hinders economies in land management and agricultural production, as noted in Section 8.1.4.

Therefore, the Palestinian authorities should give highest priority to finalizing a unified law for land ownership for the West Bank and Gaza. Appropriate legal frameworks are also urgently needed to regulate access to and management of communal and state lands. Equally high priority should be given to the establishment of a modern land-registry system and to the initiation of a comprehensive program to register all lands within the shortest time possible. A comprehensive study is needed to assess the extent of the fragmentation problem and to develop alternative regulatory and other mechanisms to address this problem.

Also, the MoA should work closely with LGUs to introduce appropriate zoning regulation to control the use of high quality agricultural land for non-agricultural purposes. In this regard, the MoA should give high priority to compiling a comprehensive GIS-based land use database. This will contribute to the basis for future comprehensive land use planning for all districts. Equally, high priority should be given to training MoA staff in land use planning methods including the use of GIS and other planning tools.

(2) Water Management

Economic development and population increase in the last decade have expanded the demand for water resources. In the irrigation field, which is the largest user consuming more than 90% of the total available water resources, it has become an urgent task to increase the efficiency of water use, to recover the function of currently inoperable irrigation facilities and to realize sound management of facilities in order to attain sustainable irrigation operation. Under such circumstances, the government should formulate a new development strategy based on the following concepts:

- (i) Water previously regarded as a “social good” is now to be regarded as an “economic entity,”
- (ii) Water management, previously undertaken on a “supply driven” basis should become “demand driven,”
- (iii) Water planning and sustainability must be based on the “user concept” rather than the “supply concept,” and
- (iv) The Palestinian government must develop policy in terms of “enabling strategies” rather than through a strategy based on “provision.”

Although water and environmental protection laws have been recently developed, weak enforcement constitutes a major problem in the West Bank and Gaza. In the West Bank, over-pumping is currently not a problem given the strict Israeli ban on well drilling and enforcement of pumping quotas. However, the PWA and MoA should collaborate closely to develop contingency plans to ensure that well-drilling and other regulations will be strictly enforced as soon as these responsibilities are transferred to Palestine.

High priority should be given to adequate training to ensure proper management of existing and future regulations.

The water regulations should provide an adequate legal framework to regulate privately owned wells and springs, which constitute the majority of currently available water resources in the West Bank and Gaza. There exist several wells and springs, particularly in the Jordan Rift Valley, that are either communally owned or have no clear ownership rights. Sustainable management of these resources will likely require collective or cooperative ownership and/or management with water users associations (WUAs) being the most promising model. Such associations could end up playing an increasingly important role in the future, particularly if large irrigation projects are initiated based on the eventual availability of additional water and land resources.

To cope with the above, the following approaches are to be involved:

- (i) Study on duties and responsibilities of organizations concerning irrigation water management (Structure of irrigation water management institutions for better individual farmer participation, with better regulation and farmer empowerment programs),
- (ii) Strengthening of WUAs (Empowerment of WUA by adopting social and local culture aspects and better environmental consideration enabling farmers to establish legal associations), and
- (iii) Provision of sustainable irrigation systems (Sustainable maintenance of water resources and prevention of land conversion from irrigated areas to other uses so that irrigation systems can be sustained).

In order to strengthen the water management system, the government should prepare the guidelines for establishing new WUAs based on the concept that the territories of WUAs should coincide with administrative boundaries.

In order to realize the above-mentioned development strategy, the WUAs need to be financially self-sufficient. From this viewpoint, the government has to encourage the WUAs to conduct economic activities such as group procurement of farm inputs, and group sales of agricultural products without limiting the WUAs activities to only water management.

8.5 Proposed Program for Livestock Development

The livestock sector contributes substantially to the regional agriculture as reviewed in Annex 3, Chapter 3. Breeding of cattle, sheep and goats, poultry and work animals, as well as processing for meat and milk production, is widely practiced in the Jordan Rift Valley area. In view of the fact that many sheep and goats are grazed in the Jericho area, the programs for livestock development will be formulated paying attention to (i) production of the meat and milk of sheep/goats, (ii) increased production of fodder

to feed an increased number of sheep/goats, and (iii) a program to set up a breeding center to support livestock development in the Jordan Rift Valley area.

8.5.1 Program to Increase Meat and Milk Production

In 2005, the Jericho area had a total of 88,500 head of sheep and goats. It is reported that the average number of sheep and goats per owner is 107 head (80 head of sheep and 27 head of goats). This leads to an estimate that the number of households with sheep and goats will be around 830 owners. On the assumption that a net income per head of sheep/goats is US\$50, the net income per breeder is estimated to be around US\$5,350 per household per year.

A program has been formulated to increase the number of sheep and goats in accordance with the macroeconomic framework as discussed in Section 5.1.4. With the low, moderate and high growth scenarios, it is planned that the number of sheep and goats would increase as projected in the following table.

Table 8.5.1 Projected Number of Sheep and Goats

(Unit: head)

Year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Estimated Growth Rate	1.5%	88,500	89,828	91,175	92,543	93,931	95,340	96,770	98,221	99,695	101,190
	4.0%	88,500	92,040	95,722	99,550	103,532	107,674	111,981	116,460	121,118	125,963
	8.5%	88,500	96,023	104,184	113,040	122,648	133,074	144,385	156,658	169,973	184,421

Source: JICA Study Team

With the increased number of sheep and goats, the production of meat and milk would increase as estimated in the following tables.

Table 8.5.2 Projected Meat Production

(Unit: ton)

Year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Estimated Growth Rate	1.5%	2,182	2,215	2,248	2,282	2,316	2,351	2,386	2,422	2,458	2,495
	4.0%	2,182	2,269	2,360	2,454	2,553	2,655	2,761	2,871	2,986	3,106
	8.5%	2,182	2,367	2,569	2,787	23,024	3,281	3,560	3,862	4,191	4,547

Source: JICA Study Team

Table 8.5.3 Projected Milk Production

(Unit: ton)

Year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Estimated Growth Rate	1.5%	6,807	6,909	7,013	7,118	7,225	7,333	7,443	7,555	7,668	7,783
	4.0%	6,807	7,079	7,362	7,657	7,963	8,282	8,613	8,958	9,316	9,688
	8.5%	6,807	7,386	8,013	8,695	9,434	10,235	11,105	12,049	13,074	14,185

Source: JICA Study Team

Statistics show interesting indicators in the unit market prices of meat and milk. As shown in the following table, meat from sheep and goats is double the price of beef and 4 times that of broiler meat. Sheep and goat milk is 1.5 times the price of cow's milk. This shows the advantages to breeding sheep and goats. In addition, the initial investments are much lower than breeding cows. Moreover, the

fertility is rate higher in sheep and goats than cows, and the gestation period is shorter (155 days) compared with cows (285 days).

Table 8.5.4 Market Price of Meat and Milk (2001-2002)

Price	US\$	
Milk (per lit.)	Sheep and Goats	0.68
	Cow	0.44
Meat (per kg)	Broiler meat	1.10
	Goat	4.15
	Sheep	3.93
	Beef	2.20

Source: PCBS

The statistics also show that the total production of livestock amounted to US\$ 11.7 million in Jericho (US\$ 7.28 million in meat production and US\$ 4.05 in milk production), while it was US\$ 13.4 million in Tubas (US\$ 8.3 million in meat and US\$ 4.4 million in milk). The livestock production in Jericho and Tubas totaled US\$ 25.1 million in 2005. Based on the statistics and the projected meat and milk production as discussed above, the production in Jericho and Tubas would amount to US\$ 52.2 million under the high growth scenario and US\$ 28.6 under the low growth scenario, as shown in the following table

Table 8.5.5 Estimated Combined Production Value of Meat and Milk

(Unit: US\$ 1,000)

Year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Estimated Growth Rate	1.5%	25,055	25,431	25,812	26,199	26,592	26,991	27,396	27,807	28,224	28,648
	4.0%	25,055	26,057	27,099	28,183	29,311	30,483	31,703	32,971	34,289	35,661
	8.5%	25,055	27,185	29,495	32,002	34,723	37,674	40,876	44,351	48,121	52,211

Source: JICA Study Team

8.5.2 Program to Increase Production of Fodder

To feed the increased number of sheep and goats as projected above, a substantial increase in fodder production would be necessary. This program will see how the production could be increased in the Jericho and Tubas area.

It is estimated that an adult sheep or goat with an average body weight of 50 kg will require 3 kg of hay per day, the requirement would be about 1.1 tons of hay per year (3 kg x 365 days = 1,095 kg). With a total number of 88,500 head of sheep and goats in the Jericho area in 2005, the annual requirement would be around 97,000 tons per annum. As noted in Section 8.1.2 (Figure 8.1.2), livestock breeders in the region are purchasing about 45% of the hay required to feed their livestock. On the assumption that the price of hay is NIS 1.0 per kilogram, such a purchase would amount to about NIS 44 million per annum. This amount should be reduced as much as possible by cultivating as much fodder as possible in the Jordan Rift Valley area. With the estimated fodder consumption per sheep and goat, the annual requirement of fodder is estimated as calculated in the following table.

Table 8.5.6 Requirement of Fodder to Breed Sheep and Goats

(Unit: ton)

Year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Estimated	1.5%	96,900	98,354	99,829	101,326	102,846	104,389	105,955	107,544	109,157	110,794
Growth	4.0%	96,900	100,776	104,807	108,999	113,359	117,894	122,609	127,514	132,614	137,919
Rate	8.5%	96,900	105,137	114,073	123,769	134,290	145,704	158,089	171,527	186,107	201,926

Source: JICA Study Team

It would not be an easy task to produce the required volume of fodder under the current situation of the security zoning in Areas A, B, and C. Efforts should be concentrated on the measures to cultivate as much fodder as possible. In line with the strategies as discussed in Section 8.2.4, the program for fodder cultivation should include the following.

- (i) Promotion of water saving fodder cultivation,
- (ii) Strategic adoption of fodder varieties for profitable fodder cultivation,
- (iii) Fodder processing and storage with proper management for dry hay and silage,
- (iv) Utilization of crop residues combined with crop cultivation,
- (v) Proper feeding composition for livestock, and
- (vi) Production of compost and organic fertilizers from dung in order to increase productivity of fodder cultivation.

8.5.3 Program for Genetic Improvement and Breeding Center

In addition to the increase in the number of head of livestock, sheep and goats in particular, the productivity and quality of products are to be improved in the Jordan Rift Valley area to attain higher value added through livestock development. In this context, genetic improvement will play a significant role. Breeders are aware of the importance of genetic improvement but it has not yet been fully introduced in the region.

Shami goat, Awassi sheep and Asaf sheep are pure races in Palestine. Shami goats are known to produce as much as 500 liters of milk per year. Pure Shami goats are sold at a high price in the market (above US\$ 5,000 per head). Adult body weight of Awassi sheep reaches as much as 80 kg. They mate naturally in the field as artificial insemination is not a common practice in the region.

One of the objectives to setting up an animal breeding center is to produce pure breeds of sheep and goats to increase their numbers for genetic improvement. The increased number of pure bred sheep and goats will mate with the local breeds for reproductive improvement. Cross-bred sheep and goats may be rented or sold to breeders in the region. In view of the fact that the improved breed of sheep in the Jericho area accounts for less than 10% of the total number of sheep, the genetic improvement at the center will play a vital role in regional livestock development.

The breeding center would preferably be equipped with facilities for training in animal husbandry. Extension workers will be trained at the center by specialists mobilized from the Veterinary Service Office of the MoA, laboratories, animal clinics, universities, slaughter houses and so on. Although the training programs are to be defined in the light of farmers' demands, curricula of training would include the following.

- (i) **Practical information on livestock improvement**
Basic practice information is to be disseminated regarding anatomy, physiology, reproduction and parturition, handling of control, feeding and nutrition, housing, protection, diseases and medication.
- (ii) **Practice in animal health care**
Practice in prevention of malnutrition, low immunity and outbreaks of diseases, as well as preventive management and vaccination should be taught to decrease the high mortality rate (the mortality rate of neonatal animals is as high as 30% at present)
- (iii) **Practice in genetic improvement and reproduction**
Importance of genetic improvement should be demonstrated, and practices in reproduction taught including artificial insemination and modern hormone treatments in accordance with the demand of breeders.
- (iv) **Practice in feeding and composition of diet**
Appropriate feeding with nutritive fodders and proper diets should be taught, including fodder and crop residue management, water harvesting for fodder cultivation, as well as composting of dung and feces.
- (v) **Practice in food processing**
To enhance value added in animal husbandry, practical knowledge should be disseminated for milk processing (e.g., yogurt and cheese) and meat processing (e.g., cutting, packing, smoking)

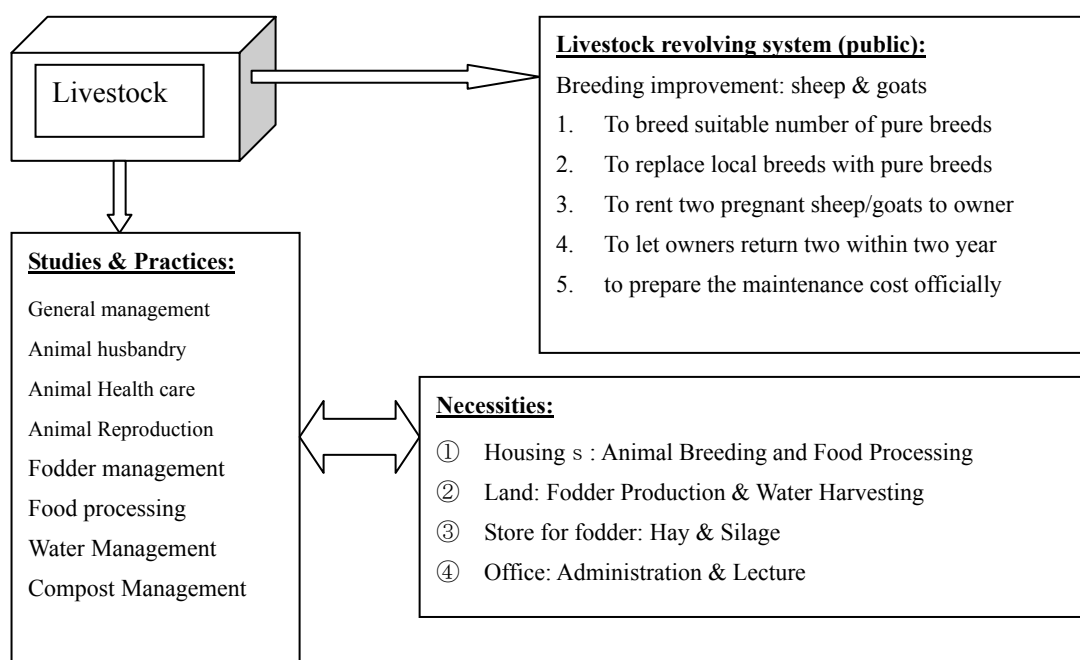


Figure 8.5.1 Functional Concept of Livestock Breeding Center

8.6 Proposed Program for Agribusiness Development

To follow a value chain of crop and livestock production, agribusiness is to be encouraged for the enhancement of value added practices in the Jordan Rift Valley area, as well as for the diversification of regional products and the creation of employment opportunities. It is proposed that the Agribusiness Development Program be composed of three sub-programs, i.e., (i) agribusiness action sub-program, (ii) logistic and transportation network sub-program, and (iii) institutional support sub-program, all as illustrated in the following.

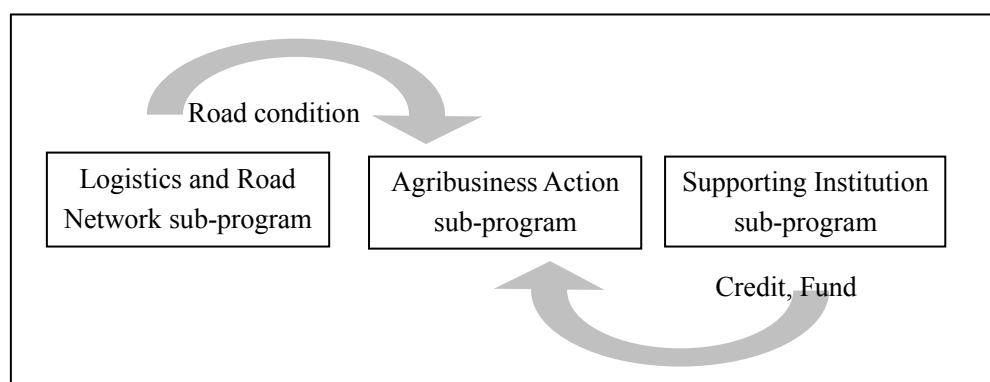


Figure 8.6.1 Composition of Agribusiness Development Programs

For promotion of agribusiness in the West Bank and Gaza, a USAID assisted program called Palestinian Agribusiness Partnership Activity (PAPA) is in operation at the moment. It is a challenging program to assist Palestinians in setting up new agribusiness through technical and financial support. Some

agribusiness enterprises have been set up in the Jordan Rift Valley area for processing and marketing the local products. Since the program is in the initial stage of operations, it is premature to evaluate or draw lessons from it. It is noted that the PAPA program focuses primarily on individuals to start agribusiness with the least amount of public intervention.

As discussed in Section 8.2.5, a slightly different strategy with a versatile spiral model is proposed for the promotion of agribusiness under this Study. While processing and marketing is led by the private sector, institutional enhancement and dissemination of information are led by the public sector, in general. This strategy has been worked out on the basis of the experience in the pilot/demonstration program operations for olive oil marketing promotion. Most of the farmers have remained uninformed of marketing trends and away from dissemination and training in advanced but practical technologies. They are not organized into associations and/or cooperatives, and most individuals are not empowered. Although talented individuals might be encouraged by the PAPA program, untalented individuals would be left unattended. It appears that the PAPA program is more oriented to an individual approach, while our strategy is more oriented to a collective approach. The two approaches would be mutually complementary in promoting agribusiness in the Jordan Rift Valley area.

8.6.1 Agribusiness Promotion Program

It has been learned from the pilot olive oil marketing project that a basic principle for promoting agribusiness is to respect self-reliant efforts of individual actors and their unique capacities and experience, while in parallel, civil servants are to indirectly support and give advice to make private businesses function more actively. It was also learned that seminars are effective in disseminating knowledge regarding technologies and management as well as in networking for running such businesses. Farmers have recognized the limitation of individual efforts and are motivated to work collectively. Such a collective approach will be more effective in encouraging moderately or less talented individuals for the promotion of agribusiness.

Major actors of the proposed agribusiness promotion program are farmers' associations, groups and cooperatives in the private sector and the related agencies in the public sector. Promotion of some commodities will be identified. Such commodities would include the following.

Table 8.6.1 Example of Commodities for Agribusiness Promotion

	Process	Potential	Production area	Market
Vegetables	Fresh (packaged)	Fresh vegetables are most profitable if properly packed by grade (size).	Jericho, Al 'Auja	Palestine and EU
	Dried and/or pickled	Some vegetables are suitable for drying and pickles; therefore, the surplus should be processed rather than dumped.	Jericho, Al 'Auja	EU and Asia
Olive	Milled	Olive oil could be exported if quality control and packaging methods are improved. By-products such as soap have potential as well.	Tubas	EU, USA, Gulf, Asia
	Pickled	Pickled olives are high value-added products, so the development of this product expected.	Tubas	EU, USA

	Process	Potential	Production area	Market
Dates	Dried	Dates are not only marketable but require little water, so they are suitable for the Jordan Rift Valley.	Al 'Auja	Local, EU
Livestock	Slaughtered		Tubas	
	Processed		Tubas, Jericho	

The program will be implemented in three stages. At the initial stage (about 6 months), implementation programs are formulated through working groups formed by the interested individuals and civil servants. The implementation program will identify development models, target commodities and sites, as well as the extent of activities and other issues to make the program more sustainable. Seminars will also be held for the interested individuals and groups on post-harvest, quality control, and marketing. An overall program management structure is formulated by the private and public sector, as shown in the following example.

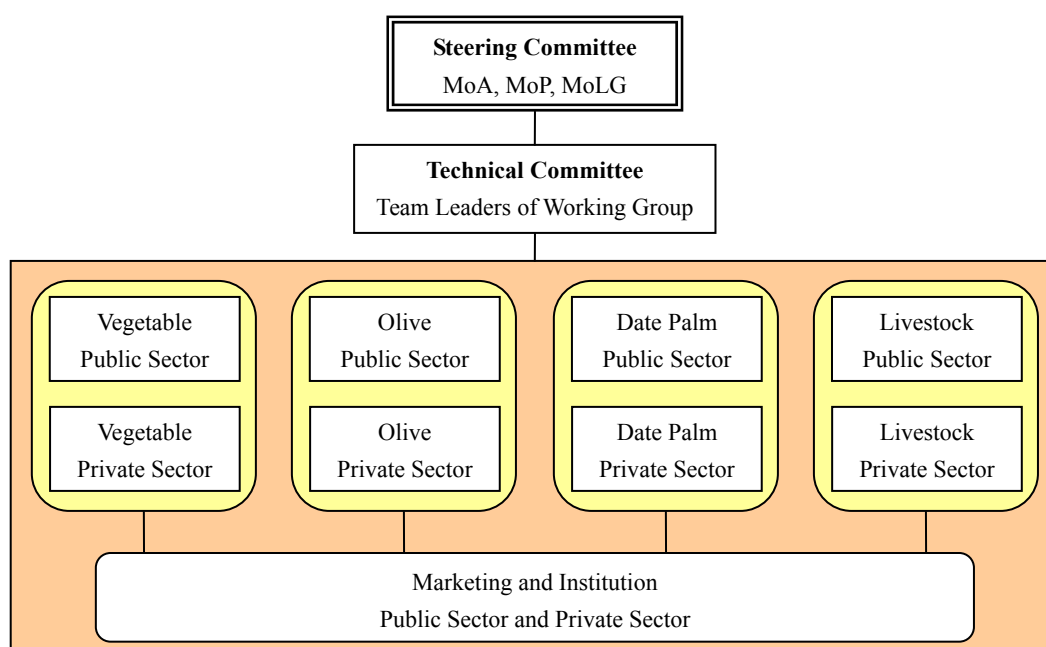


Figure 8.6.2 Possible Program Organization Structure

The second stage of the program (at least twelve months) will be concentrated on actions required for (i) post-harvesting and processing, primarily by the private sector, (ii) marketing to identify potential markets, local brands of new products, financial accounting and management, (iii) dissemination of information by the public sector regarding marketing, matching producers and buyers, logistical services, and monitoring systems, and (iv) institutional strengthening through guidelines on standards and grades, regulations on hygiene and inspection, regulations under the Paris Protocol, registration in public offices, etc.

The third and final stage (about six months) will evaluate and refine the program design through reviewing the activities during the second stage of program operation. It would also formulate new dissemination plans to expand agribusiness in the region.

The proposed program will also be coordinated with the implementation of the Community Empowerment Program (CEP) as discussed and proposed in Chapter 7.4. Several community-based organizations (CBOs) formed for promotion of income generation activities might be interested in joining the Agribusiness Promotion Program. At the same time, the working groups formed for the Agribusiness Promotion would extend advice on CBO-based income generation activities.

8.6.2 Collective Location of Processing and Logistic Enterprises

In the event that individuals are assisted in setting up agribusiness and other processing industries, they would be apt to set up their factories and other facilities rather independently, making the transportation, logistical and other services rather ineffective. It is also feared that this might invite some negative environmental impacts. In this context, too, some public interventions are desired. The public authorities concerned would intervene in such fields as land use zoning for industrial location, preparation of plans for collective location of processing and logistic centers, promotion of investments jointly with the local enterprises, and so on. Such a collective location of industries would also serve in the promotion of industrial clusters in the Jordan Rift Valley area. It would also complement the PAPA program that is currently in operation.

In view of the regional spatial plan as discussed in Chapter 6.4, as well as in the light of potential agricultural development strategies as discussed in Chapter 8.2, some locations are identified to be highly potential for collective locations of processing and logistical enterprises. The following figure illustrates such potential locations in the Jordan Rift Valley area.

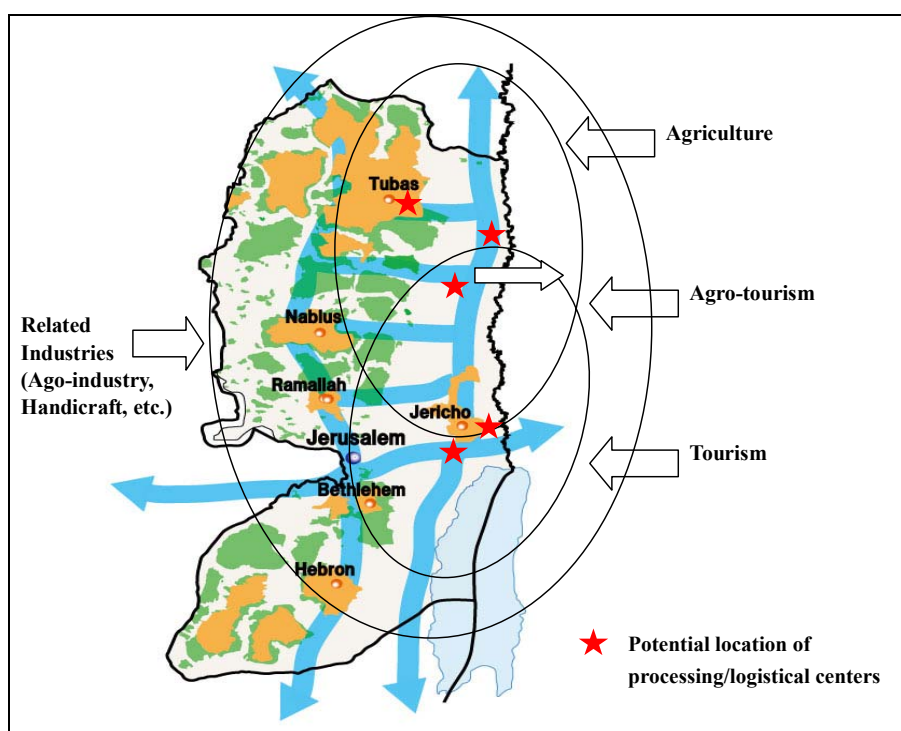


Figure 8.6.3 Potential Collective Location of Processing and Logistical Centers

In central Jericho city, there exists an agricultural marketing center. It is causing congestion in traffic and few facilities are provided for storage, grading or packing and hygiene inspection for exports is lacking. It is suggested that this marketing center should be relocated to the outskirts of the city and equipped with such facilities required for better marketing and promotion of agribusiness. The land surrounded by the highway to the King Hussein Bridge and Jericho city would also be ideal for location of an industrial and logistic center. Agro-processing industries would be guided to locate in this center.

Lower Al Far'a is proposed as a center for agricultural development, as discussed in Chapter 6.4. In the event that the Damiya Bridge is rehabilitated and transport to the Jordan side is facilitated, the land around the crossroads of the Jordan-Damiya-Tubas corridor and the north-south corridor along Route 90 will offer favorable sites for collective location of agro-processing industries and logistical services. If and when the security situation permits, it is suggested to make a feasibility-level study on the establishment of such an industrial-cum-logistic center near the Damiya Bridge in collaboration with the Jordanian counterparts.

The logistical centers are necessary to provide functional facilities composed of warehouses, distribution centers and place for handling export formalities as illustrated in the following figure. The warehouse should have storage and deposit functions. The distribution center is to be utilized for sorting and transshipment of goods. The export formalities will have different functions, depending on the political situation. Based on the present security conditions, the export formalities should include a computerized system, X-ray inspection system, and tamper-proof sealing system to ensure security and customs measures work smoothly. In addition, a truck terminal with maintenance and repair facilities will be needed in the logistic center to park and maintain trucks. To formulate a plan for the logistic center and agro-processing zones, further study should be implemented.

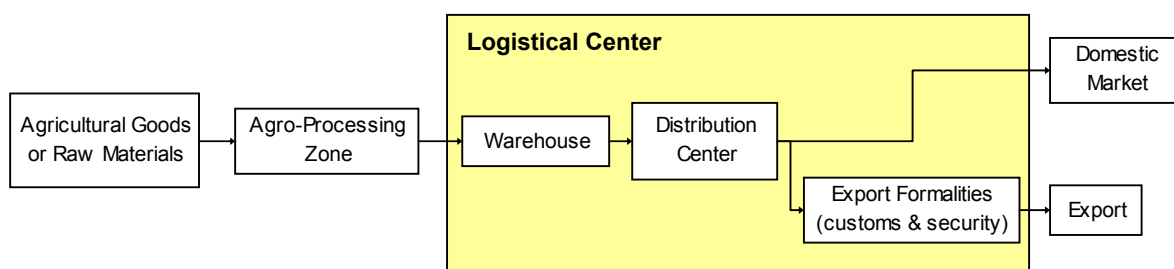


Figure 8.6.4 Function for Logistical Center

Tubas highland also has potential for a collective location for agribusiness and industries, though the scale of development would be rather limited in view of the agricultural development potential. State owned land should be made available for a collective location for industries in this area. North Tubas, or Bardala/Kardala/ Malih area, is another potential site for a collective location for industries when the land is returned to Palestinian administration and agricultural development is put into operation as planned under this Study.

With the above in view, it is recommended that a feasibility-level study be conducted on collective

locations for agribusiness, processing and logistic centers in pace with the advancement of agribusiness and industrialization in the Jordan Rift Valley area.

8.6.3 Improvement in Other Infrastructure to Support Agribusiness

Along with the agribusiness promotion program and study on collective locations for processing and logistic centers, it is suggested to execute other studies on the improvement of regional infrastructure to support agribusiness development.

Road and transportation networks have been relatively well developed in the Jordan Rift Valley area, due to the improvement works done by the Israeli authorities concerned. However, as discussed in Chapter 6.2, seven corridors hold potential for accelerating social and economic activities in and around the Jericho area. Improvements along these corridors should be envisaged under the regional development plan. Attention is particularly drawn to the improvement in the Haifa-Amman Corridor via Damiya Bridge, Lower Al Far'a and Tubas. This corridor would play a significant role in promoting agribusiness and processing industries around the Bridge, Lower Al Far'as and Tubas. To realize the full potential of the corridor and facilitate the transport of goods and people, the following improvement programs are required:

(1) Construction of Damiya Bridge

The construction of Damiya Bridge will include a bridge along with approach roads and access roads on both the West Bank side and the Jordanian side as well as border facilities on both sides. Since there are existing access roads and a border facility on the Jordanian side, rehabilitation or improvement work will be the main tasks. It should be noted that the legal and legislative matters are to be approached through collaboration with all the parties concerned. In addition, a great deal of coordination will be necessary among the parties in the formulation of the implementation plan, construction staging, operation and maintenance, and the border control after the opening of Damiya Bridge.

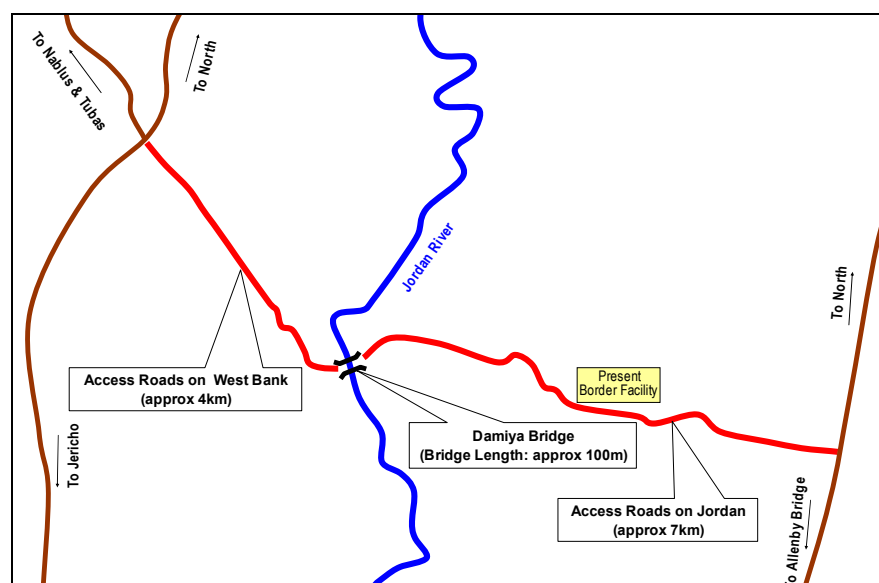


Figure 8.6.5 Location of Damiya Bridge and Access Road

(2) Road Rehabilitation between Hamra and Nablus

To ensure adequate accessibility to the Haifa-Amman Corridor, the rehabilitation of the road between Hamra and Nablus (Route 57) should be implemented. The total length is approximately 24 km. Because part of the road section is in Area C, some coordination with Israel will be required.

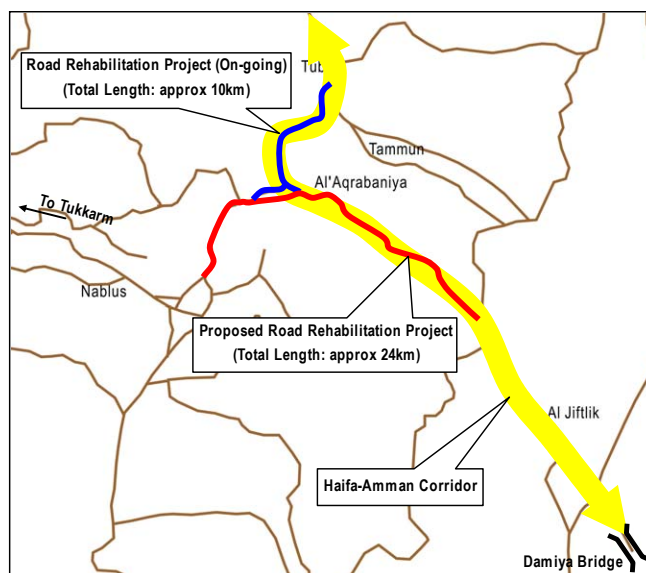


Figure 8.6.6 Proposed Road Rehabilitation along Rt. 57

Supply of electric power in the region should also be stabilized for promoting agribusiness and other industries, as well as for domestic use in urban and rural areas. Improvement in the power supply would include (i) expansion of transmission lines to the Northern West Bank (estimated cost of around US\$ 60 million), (ii) a distribution network in the Northern West Bank (estimated cost of US\$ 20 million), (iii) rehabilitation of the distribution system and rural electrification in the West Bank (estimated cost of US\$ 8.2 million), and (iv) institutional support for the Northern Electricity Distribution Company (NEDCo).

8.7 Overall Agriculture and Agribusiness Development Program

The following figure shows the proposed overall implementation strategies for agriculture and agribusiness development program in the Jordan Rift Valley area.

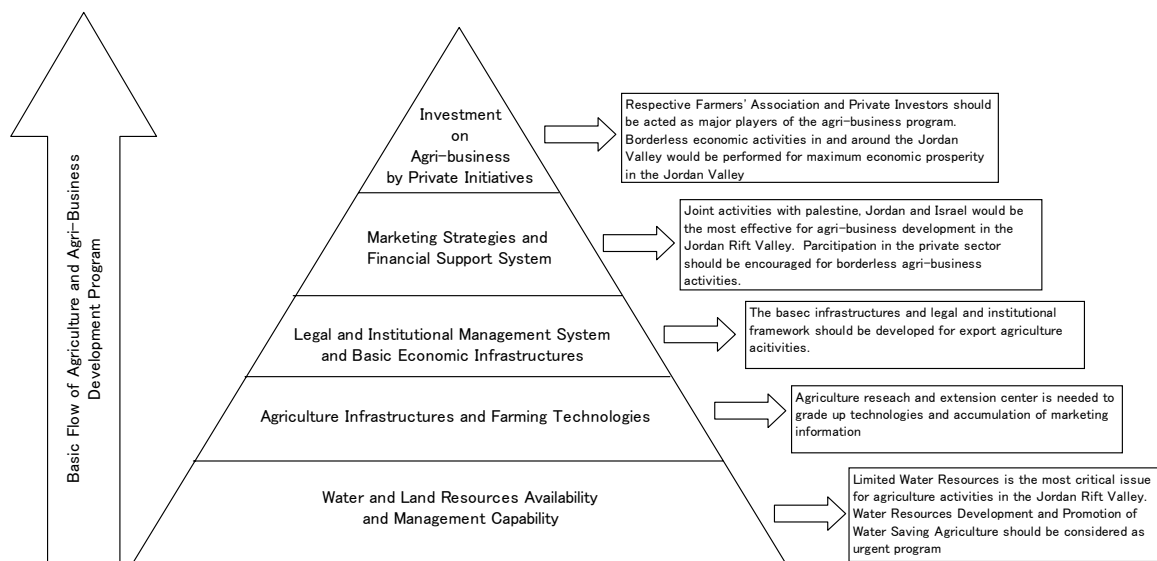


Figure 8.7.1 Basic Strategy for Agriculture and Agribusiness Program Implementation

Agriculture and Agribusiness Development Program for the Jordan Rift Valley area consists of three major components; i.e., (i) water resources development and management program, (ii) agriculture and livestock development program, and (iii) agribusiness and economic corridor development program.

Water resources development and management is considered as a basic program, since the limitation of water availability is the most critical issue in the agriculture sector. The existing spring water would be gradually allocated to municipal and industrial uses for which water demand is inevitably increased in future. Consequently, practical water resources development, such as rehabilitation of agriculture wells, improvement of spring water conveyance system, and promotion of water saving agriculture should be the most urgent and fundamental program to realize the further activities for agribusiness and economic corridor development in the Jordan Rift Valley.

Agriculture and livestock development program is defined as a core program for development of the Jordan Rift Valley area. The production activities should always be in active and sustainable to realize economic development in this region. In this respect, an agriculture research and extension center will play an important role to transfer the modern technologies and cooperative activities to farmers by strengthening networks between the public sector and farmers' organizations.

Agribusiness and economic corridor development program is considered as another target program under the master plan. Without this program, no significant development would be attained in the region. However, implementation of the basic programs for water resources management and agriculture and livestock development should be well advanced for successful implementation of the agribusiness and economic corridor development program. Development of basic economic infrastructures would be needed together with the establishment of legal and institutional frameworks, as well as financial assistance to farmers' association and private investors.

The following figure summarizes the proposed projects under the Agriculture and Agribusiness Development Program:

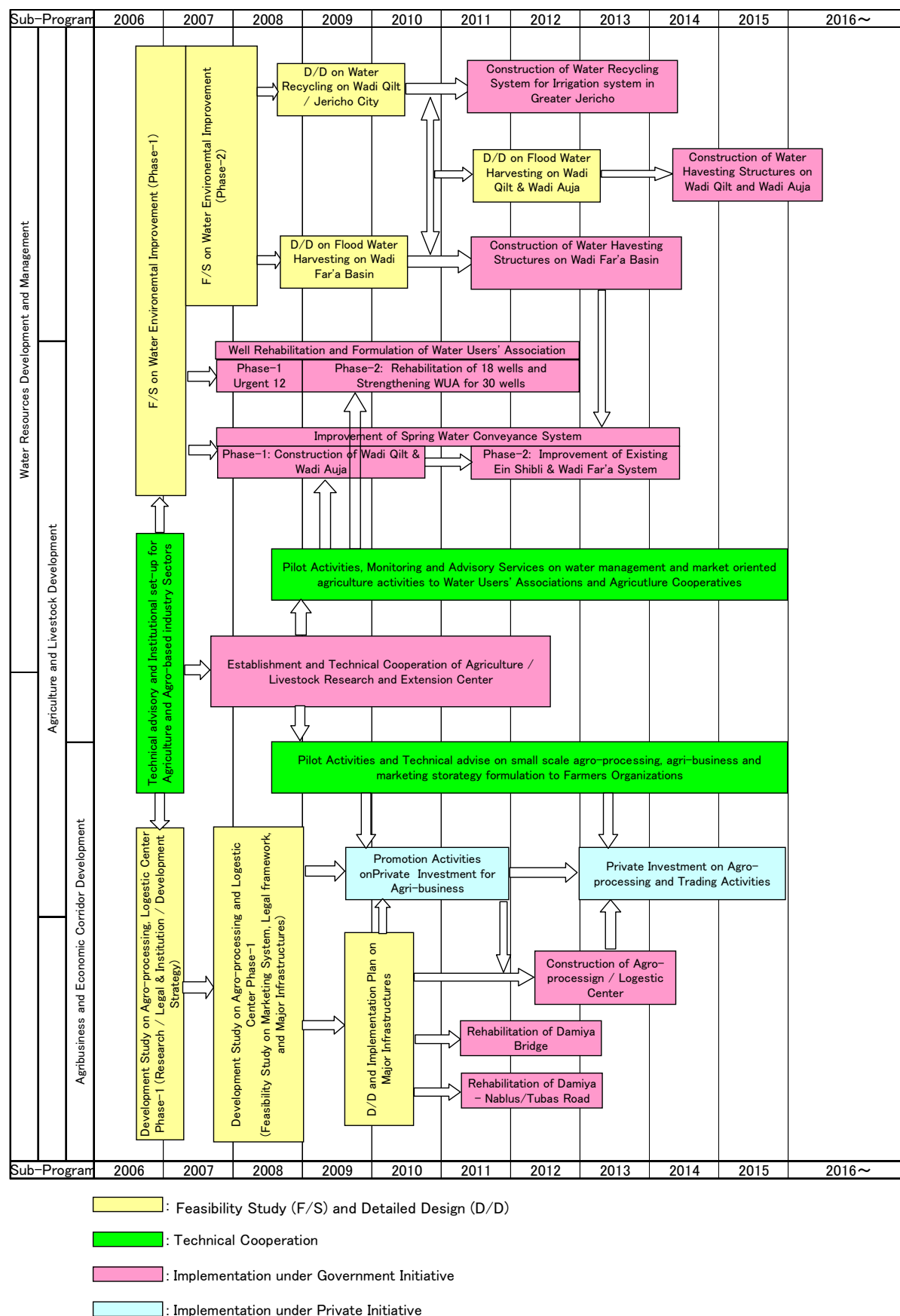


Figure 8.7.2 Proposed Project Implementation for Agriculture and Agribusiness Program