DIRECTORATE GENERAL OF WATER RESOURCES
MINISTRY OF PUBLIC WORKS AND HOUSING
THE REPUBLIC OF INDONESIA

THE PROJECT ON FORMULATION OF IRRIGATION DEVELOPMENT AND MANAGEMENT STRATEGY FOR FOOD SECURITY IN THE REPUBLIC OF INDONESIA

FINAL REPORT

(APPENDIX Vol.1/2)

MAY 2022

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
SANYU CONSULTANTS INC. (SCI)

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FOR
THE PROJECT ON FORMULATION OF IRRIGATION DEVELOPMENT AND MANAGEMENT STRATEGY FOR FOOD SECURITY
IN
THE REPUBLIC OF INDONESIA
AGREED UPON BETWEEN
MINISTRY OF PUBLIC WORKS AND HOUSING
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Jakarta, 16th January, 2019

For
Japan International Cooperation Agency (JICA)

Mr. Kosei Hashiguchi
Team Leader/ Irrigation and Drainage Planning, JICA Project Team,
SANYU Consultants Inc.

For
Ministry of Public Works and Housing (PUPR)

Mr. Hari Suprayogi
Director General of Water Resources,
Ministry of Public Works and Housing

Witness

Mr. Takuji Tanaka,
Technical Advisor,
Rural Development Department, JICA

I. INTRODUCTION

With respect to the Project on Formulation of Irrigation Development and Management Strategy for Food Security in the Republic of Indonesia (hereinafter referred to as "the Project"), the Project Team organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") and representatives from JICA had discussions with representatives from the Ministry of Public Works and Housing (hereinafter referred to as "MPWH") and members of the Joint Coordinating Committee (JCC) in a meeting chaired by Mr. Hari Suprayogi, Director General of Water Resources, MPWH on January 16th, 2019 at the DG's meeting room. The list of attendants to the meeting is attached as Annex 1.

The followings are the subjects discussed and agreed upon between the Indonesian and Japanese sides in the meeting.

II. RESULTS OF DISCUSSION

1. Acceptance of the Inception Report

Japanese side submitted eight (8) copies of the Inception Report to the Indonesian side, and the Indonesian side accepted the Report. With the report delivered, the Japanese side explained the contents of the report, including differences of those between the Record of Discussion for the Project (hereinafter referred to as "RD") and the Inception Report with reasons for such modifications. Main points discussed, comments and agreements on the Inception Report are attached as the Annex 2.

2. Relation between the "National Mid Term Development Plan (2020 to 2024)" and the Project

Both sides confirmed that the Project results would be reflected to the fourth mid-term development plan (2020 - 2024) and in its irrigation sector plan. Matters to be confirmed and the future considerations based on the schedule and contents of utilizing the output of the Project are described in the M/M of RD.

DGWR requested the JICA Project Team that the Project implementation schedule should be shortened taking into account effective reflection of the Project outputs into the fourth mid-term development plan. The Project Team will consider revising the schedule as much as possible based on the request.

3. Information on water balance, water demand, etc. of the Kedung Ombo dam/ Tuntang River

JICA side raised an issue of diverting irrigation water to other purposes such as

domestic water supply due to urbanization and industrial usage along with the economic growth taking place in recent years. As one of the examples, the use of water resource in the Kedung Ombo dam may have to be more diversified and/or the water resources should further be developed with trans-basin diversion from the neighboring Tuntang River basin in near future.

Based on the results of the study on Kedung Ombo dam by Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Japan, namely, Basic Information Collection and Pre-Feasibility Study for Prospective International Disaster Risk Reduction and Water Infrastructure Cooperation Projects, it is noted that water available in the Kedung Ombo dam has been almost fully utilized, and therefore trans-basin diversion from the neighboring basin(s) may be the most potential option in that there are 3 basins around the Serang basin (Kedung Ombo dam catchment). Of them, K.Juwana basin located northern side cannot avail of water due to its lower elevation. Begawan Solo point (Simo) is somewhat urbanized already, whereby inviting environmental impact in its development. Further in addition, the topographic condition represented by farmlands extending over tolling hilly areas to the Kedung Ombo dam basin will incur difficulties in constructing diversion channel due to compensation and environmental impact. Thus, the Tuntang River basin located western side from the Kedung Ombo dam could be the most appropriate option to develop trans-basin diversion by a means of diversion tunnel.

Given such issues of more diversified needs of water and/or new development of water resources in Indonesia, both sides agreed upon that there should be a need to examine such diversified needs of water, including probable reallocation of water from irrigation sector to others, e.g. urban use and industry use and also possibility of availing of water with trans-basin diversion. Thus, DGWR has requested JICA to take up the case of Kedung Ombo dam/ Tuntang River, which also could be referred to in estimating the water available only for irrigation purpose in the Formulation of Irrigation Development and Management Strategy as example of considering other sectors' water use. JICA mission will deliver the request to JICA HQs for its consideration.

4. Inter-visiting between Land Improvement District (LID) and Indonesian Counterparts

Japanese side and Indonesian side exchanged opinions and confirmed the whole picture of the mutual visit, i.e., officials of the Land Improvement District (LID) in Japanese side to Indonesia, and the officials concerned with irrigation maintenance and management in Indonesian side to Japan, including the schedule, content for knowledge sharing, etc. of the first visit of the LID to Indonesia with Ministry of Agriculture, Forestry and Fisheries of Japan on 19th – 21st Feb. 2019. Issues and matters agreed upon are in the attached Annex-2.

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5. Members of Joint Coordinating Committee

Following the M/M of RD, both sides agreed to establish the Joint Coordinating Committee (hereinafter referred to as "JCC") for smooth implementation of the Project, and it is agreed that the JCC meeting will be held at such opportunities of the presentation of the Progress Report, Interim Report, and Draft Final Report. JCC is comprised of the members as stated in the M/M of RD, to which there is an addition of the Team Leader of the JICA Project Team.

ANNEX 1: List of the Participants in the Meeting (1st JCC)
ANNEX 2: Main Points Discussed for Inception Report

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ANNEX 1: List of the Participants in the Meeting (1st JCC)

Government of Indonesia

Mr. Edy Juharsyah	Directorate of Water Resources Development, DG of Water Resources, Ministry of Public Works and Housing
Mr. M. Tahid	Sub Directorate of Irrigation and Lowland Planning, Directorate of Irrigation and Lowland, DG of Water Resources
Mr. Bambang Heri M	Sub Directorate of Irrigation Operation and Maintenance
Mr. Muradi	Directorate of Irrigation and Lowland
Mr. Hamlin A.S.	Experimental Station for Irrigation Research Center for Water Resources
Mr. Dadang Ridwan	Sub Directorate of Irrigation and Lowland O&M
Mrs. Nita	Sub Directorate of Technical Guidance of Irrigation and Lowland
Mr. M Ramdani	Sub Directorate of Technical Guidance of Irrigation and Lowland West Region, Directorate of Irrigation and Lowland
Mr. Pathurachman	Sub Directorate of O&M Planning, Directorate of O&M
Mrs. Pratiwi Nursusilowati	Bureau of Budget Planning & International Cooperation
Ms. Raihana PH	Bureau of Budget Planning International Cooperation
Mr. Gatot Teguh	Ministry of Economics
Ms. Katlyn	Directorate of Irrigation and Lowland, Directorate General of Water Resources
Ms. Vina	Directorate of Irrigation and Lowland, Directorate General of Water Resources
Mrs. Ayu Prima Yesuari	Ministry of Land Affairs and Spatial Planning
Aris Kurniawan	Directorate of Water Resources and Irrigation, Ministry of National Development Planning / Bappenas
Mr. Juari	Directorate of Water Resources and Irrigation, Ministry of National Development Planning / Bappenas
Mr. Ichiro TSURUSAKI	JICA Expert in Ministry of Agriculture
Ms. Luh Eka	Secretary JICA Expert JICA-Ministry of Agriculture

JICA Project Team

(JICA Head Quarters)	
Mr. Takuji TANAKA	Executive Technical Advisor to the Director General
(JICA Project Team)	
Mr. Kosei HASHIGUCHI	Team Leader, JICA Project Team
Mr. Takahito MISAKI	Agriculture Policy and Socio-economy,

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	JICA Project Team
Mr. Togo SHINOHARA	Agriculture Production and Farming, JICA Project Team
Mr. Hajime KITA	Hydrology / Water Resources Assessment, JICA Project Team
Mr. Ryo INOUE	Food Security, JICA Project Team
Mr. Taketo EGUCHI	Land Resources Assessment / GIS / Satellite Image Analysis, JICA Project Team
Ms. Moe NONOSHITA	Food Security / Secretary, JICA Project Team
Mr. Ahmad Sahab	Project Assistant, JICA Project Team

JICA Indonesian Office

Mr. Ryo OGAWA	Senior Representative
Mr. Hiroshi BINGO	Representative
Mr. Ryoya FUSE	Representative
Ms. Nindita Paromastuti	Program Officer

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Annex-2: Main Points Discussed for Inception Report

In response to the questions and comments on the ICR of the Project on Formulation of Irrigation Development and Management Strategy for Food Security, the JICA Project team has agreed on the following;

1) Assessment of Land Potential

- ✓ To consider the actual spatial planning to be available in the Ministry of Land Affairs and Spatial Planning.
- ✓ To consider the land conversion based on the past trend to assess the land potential and evaluate the food supply. Moreover, since the land conversion issues are very important in Indonesia, its policy making and enforcement example in Japan will be shared during the inter-learning visit.
- ✓ To consider the large difference in rice productivity by island.

2) Operation & Maintenance of the Irrigation Facilities

- ✓ To encourage the participatory irrigation management both with central/regional government and WUAs, which can keep the motivation of the regional government for O&M.

3) Economical Rice Price

- ✓ To increase welfare of farmers and to attract young people become farmers that could be provided, for examples the subsidy program including that on fertilizer in Japan and other countries, showing the pros and cons of them as the reference to find the better subsidy program in Indonesia.

4) Supply and Demand Scenarios

- ✓ To consider the zero-import case for rice in usual years, while such case will not be considered under specific event, e.g., severe drought during El Niño.

5) Young Farmers Generation

- ✓ To encourage the modernization of irrigation facilities and also farm mechanization, which could be one of the solutions to keep the young generations in farming.

6) Other

- ✓ To participate seminar(s), which undertake issues of national food security.

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MINUTES OF MEETING
ON
JOINT COORDINATING COMMITTEE (2nd), AND NATIONAL SEMINAR
FOR
THE PROJECT ON FORMULATION OF IRRIGATION DEVELOPMENT AND MANAGEMENT STRATEGY FOR FOOD SECURITY
IN
THE REPUBLIC OF INDONESIA
AGREED UPON BETWEEN
MINISTRY OF PUBLIC WORKS AND HOUSING
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Jakarta, 5th August, 2019

For
Japan International Cooperation Agency (JICA)

Mr. Kosei Hashiguchi
Team Leader/ Irrigation and Drainage Planning, JICA Project Team,
SANYU Consultants Inc.

For
Ministry of Public Works and Housing (PUPR)

Mr. Hari Suprayogi
Director General of Water Resources,
Ministry of Public Works and Housing

I. INTRODUCTION

With respect to the Project on Formulation of Irrigation Development and Management Strategy for Food Security in the Republic of Indonesia (the Project), the JICA Project Team organized by Japan International Cooperation Agency (JICA) had arrived in Indonesia on January 3, 2019 at the first time, and since then the Team has conducted a series of surveys and studies.

With the outputs from above surveys and studies, the Team has produced Progress Report and delivered 8 copies of the Report including soft data to the Directorate General of Water Resources (DGWR) as specified in the RD agreed upon and signed on March 9, 2018 between DGWR and JICA.

Further with the Report prepared, the DGWR and the Team had arranged a national seminar on the Project, inviting central, Balay, provincial and district officers engaged in irrigation development in Indonesia (for the participants, see Attachment-1). Also, stakeholders for the Project were invited, hence the seminar had served for the 2nd Joint Coordination Committee meeting.

At the inception of the national seminar, JICA senior representative, Mr. Ogawa, delivered welcoming speech to all the participants stating very much thanking Indonesian government and DGWR for the supports and initiative for the Project, and also expectation the outputs to be referred to the DGWR's next mid-term development plan (2020-2024).

Having followed the welcoming speech by the JICA senior representative, Mr. Tahid, Head of Sub-directorate of Planning, DILL, delivered, on behalf of the Director General of DGWR, thanking remarks for JICA's technical cooperation and supports concerning the Project, and officially opened the seminar.

II. PRESENTATION AND COMMON UNDERSTANDINGS

The JICA team presented the following to the floor, and the participants have had common understandings and agreed upon below thereof as:

1) The JICA team, as has been presented during the seminar, recommends the base scenario of lowest rice demand in the future, all interventions in irrigation sector having been done, yield to increase as per logarithmic nature approximation, and land conversion from 100,000 ha/year in 2015-19 to 40,000 ha/year after the years 2030-2034.

2) To recommend the irrigation development area-size in future, there should be a safety factor to be applied. With this, the Team proposes 10% safety factor, whereby 110% of the net required irrigation areas should be recommended and referred to in the DGWR's next mid-term development plan (2020-2024). Following table summarizes the recommended irrigation development by area-size respective to each of the 5-year development terms with remarks below:

Table 1 Required Irrigation Development by Nation Wide, ha

Rice Demand	Conditions	2015-19 1st term	2020-24 2nd	2025-29 3rd	2030-34 4th	2035-39 5th	2040-44 6th
Lowest Rice Demand Scenario	**Base Case**						
	LC from 100,000 to 40,000 ha/year	261,673	236,914	225,106	252,555	256,538	255,277
	Above x 1.1 (safety factor)	**287,840**	**260,605**	**247,617**	**277,809**	**282,192**	**280,805**
	1st term carried over to the 2nd term	-	**548,446**	**247,617**	**277,809**	**282,192**	**280,805**
	Reference (safety factor not considered)						
	LC of 100,000 ha/year to continue	261,673	327,815	481,582	589,019	588,962	584,784
	1st term carried over to the 2nd term	-	589,488				

3) As the areas indicated in 2015-2019 should have been developed to date, this backlog should be carried over to the next mid-term development period 2020-2024. Therefore, the Team recommends DGWR to incorporate the nation-wide total development of 548,446 ha, say approximately 550,000 ha development, into the next 5-year mid-term development plan (2020-2024) at national level.

4) Likewise, if the policy implementers think that it is difficult to control land conversion within a short period of time, i.e., reducing the current probable 100,000 ha/year conversion to 40,000 ha/year over 10 years to come, 589,448 ha of nation-wide total irrigation development, or say 600,000 ha of development, may be suggested in the next 5-year mid-term development plan.

5) To support the development of approximately 550,000 to as much as about 600,000 ha of paddy irrigation areas for the next 5-year development term, it should be confirmed if there are enough land and water potentials. Having explored the potential of land and water, as shown below, there are still lots of potentials which can accommodate the above necessary development scale of 550,000 to 600,000 ha for the next 5-year development plan period:

Table 2 Irrigation Development Potential in Indonesia Nationwide

Island	Potential of Rain-fed Paddy, ha	Potential of Fully Suitable (area basis), ha	Potential of Conditionally Suitable (area basis), ha	Marginally Suitable Area (area basis), ha	Total
Sumatera	1,026442	875,181	1,285,494	2,658,711	5,845,829
Java	74,923	326	1,333	9,465	86,047
Bali Nusa Tenggara	34,879	6,895	1,650	32,204	75,628
Kalimantan	890,923	1,019,232	1,579,606	3,189,278	6,679,039
Sulawesi	278,154	368,537	137,430	1,083,647	1,867,768
Maluku & Papua	48,991	354,380	949,123	3,047,380	4,399,874
Indonesia	2,354,312	2,624,552	3,954,635	10,020,685	18,954,186

Note: above potential shows area basis potential, and therefore the potentials for Fully-suitable, Conditionally suitable, and Marginally suitable are counted as double when looking into the harvest area (200% cropping intensity can be realized in those new development areas).

III. DISCUSSIONS, CLARIFICATIONS, AND RESPONSES

The following are issues raised, discussed and clarified upon between the participants and JICA team during the seminar:

1) Land Conversion: A participant raised an issue on the land conversion, for which JICA team presented several research results showing minimum around 40,000 ha/year conversion to as much as 100,000 ha/year conversion. As the participant pointed out that the conversion in future may be different from what was reported by JICA team, the Team stressed that the land conversion should be monitored and according to the progress of conversion, future irrigation development should be adjusted. Further, the Team mentioned that as much as 100,000 ha/year conversion seems to be big, nullifying a benefit of investment, there should be a strong policy and, if required, law enforcement in order to reduce the scale of land conversion.

2) Technical Improvement: A participant asked the Team if there were any technical improvement considerations in formulating the irrigation development; namely, technical improvement in future would contribute to increasing the production, and then may reduce the scale of irrigation development. The Team shared its idea, in which in a direct way the Team has not undertaken such technical improvement but rather the Team is of the opinion that irrigation can be a base of promoting any technical improvement. For example, high yielding seeds can perform its designed function only with good cropping environment, e.g. on time water delivery that is supported by irrigation, and good responses to fertilizer that is also enhanced by irrigation.

3) Climate Change: A participant asked the Team if the team had considered effect of climate change in the formulation of irrigation development required in future. The Team replied that there was not specific consideration of climate change in line with the formulation of irrigation development; however, the Team thinks that the irrigation itself can and should serve in mitigating the negative impacts from the climate change as the irrigation could guarantee planned water delivery even under climate change. In addition, the Team suggested that there should be enough storage of rice to enhance resiliency against the negative effects of climate change (e.g. rice supply from the storage for calamitous draught.)

4) Population Increase: The Team presented four scenarios on the future population projection, to which a participant raised difficulty of forecasting the future population though the government has been trying to control the increase through family planning. The Team shared the basic idea that there is always difficulty of forecasting future scenarios with high accuracy, and therefore the Team had presented four scenarios in the population projection in future. This means to request the Indonesian counterparts to monitor the level of population growth every year, and with reference to the actual growth ratio to be monitored, the DGWR should refer to the most probable one out of four scenarios, which is close to the actual population growth ratio. The Team stressed the important role of the monitoring not only on the population but also others, e.g. land conversion.

5) Import Quota: A participant shared an issue of rice import saying there may be difficult to restrict import of rice probably due to the existence of Asian free trade agreement under which any member countries can export/import rice within the Region. The Team thanked the information, and mentioned that the Team's base scenario is to establish self-sufficiency of rice at 100% ratio according to a government policy upholding food security.

6) Land Potential Assessment: The team made a presentation about the methodology and result on land potential area for irrigation development, showing the result by Island and River Territory. A participant raised a concern that approximately 90% of rainfed paddy areas detected by land suitability assessment might be irrigated paddy to some extents, and therefore the determination of the project site should be careful. The Team thinks physical confirmation with detail surveys on the ground should be necessary to proceed to next step.

7) Water Potential Assessment: The Team made a presentation about the methodology and result on water potential areas for irrigation development, showing the result by Island and River Territory. A participant mentioned that Ministry of Agriculture is now pursuing the goal to make Indonesia a country of world rice granary, and this Project should take it into consideration. The Team answered that there is abundant potential that can afford not only all the Indonesian but also foreigners according to the result of the potential assessment. On the other hand, limited potential was found in Java, Bali Nusa Tenggara islands which have been developed in terms of irrigation. Therefore, in order to achieve the goal, rehabilitation of facilities for efficient water use should also be considered even in the areas with less potentials.

8) Irrigation Development Potential: The Team made a presentation on the methodology and the result regarding the irrigation development potential areas and harvested potential areas by comparing the result of the land and water potential assessment. Participants made comments that more factors such as workforce, farmers demand, situation of land conversion and current rice yield should be considered before the Team determines the development site. For example, a participant mentioned the yield in Sumatera Selatan is lower than the ones in Sulawesi Selatan, although the irrigation development potential is higher. As another opinion during the discussions, the farmers in Sumatera Utara (Kabupaten Asahan) are willing to produce rice rather than palm oil and taking action for land conversion from palm tree plantation to paddy

field. The Team answered that those social and environmental consideration are to be examined in the next stage, and therefore, the opinions in this seminar including the group work from the local officers are appreciated to consider them. The Team also answered that the development sites will be discussed with DGWR headquarters considering the results of the group work, and make a decision for new development sites.

ANNEX 1: List of the Participants in the Seminar cum 2nd JCC

ANNEX 1: List of the participant in the seminar (5th August 2019)

Central Government

Mr. Dedi M.	Head of Water Resources Division, Ministry of Public Works and Housing
Ms. Khusnidzar	Sub Directorate of East Irrigation and Lowland, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Ilham	Sub Directorate of East Irrigation and Lowland, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Rizky Herdianto	Sub Directorate of Institutional, Directorate of Water Resources Management, DG of Water Resources, Ministry of Public Works and Housing
Mr. Ferdi P.	Sub Directorate of Irrigation and Lownland, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Habib Ansari	Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Sulistyo Widodo	Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Harun Al Rasyid	Head Section of East Lowland, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Aris Kurniawan	Directorate of Water Resources and Irrigation, BAPPENAS
Ms. Yanti Ermawati	Directorate of Agricultural Irrigation, DG of Infrastructure and Facilities, Ministry of Agriculture
Mr. Ahmad Arselan	Directorate of Agricultural Irrigation, DG of Infrastructure and Facilities, Ministry of Agriculture

B/BWS

Mr. Ade Prima	BWS Kalimantan II
Mr. Sumargono	BWS Kalimantan II
Mr. Luqman F.	BBWS Cimanuk Cisanggarung
Mr. M. Ramdan	BBWS Cimanuk Cisanggarung
Mr. Budi M.	Head of Program Section, BBWS Ciliwung Cisadane
Mr. Dadang M. Y	Commitment-making Official, BBWS Ciliwung Cisadane
Mr. Feriyanto	Head of Division of Water Utilization Network Implementation, BBWS Citarum
Ms. Anantri	PPU Staff, BBWS Cidanau Ciujung Cidurian
Ms. Juniferanne	Section Chief of Water Utilization Network Implementation, BBWS Ciliwung Cisadane
Mr. Teguh Aribawa	Section Head of General Planning, BBWS Cidanau Ciujung Cidurian
Mr. Eddy S	BBWS Citanduy
Ms. P. Maudy Kusumah	BBWS Citanduy
Mr. Zakariya A. A. P	BBWS Citanduy
Mr. Ruhban R.	BBWS Pemali Juana
Ms. Dyah Perdhani	BBWS Pemali Juana

Mr. Supriyono	Section Chief of PPU, BWS Sumatera VI
Mr. Syahlam Efendi	BWS Sumatera III
Mr. Surya Edi P.	BBWS Mesuji
Mr. Seta A.D	BBWS Mesuji
Ms. Lili Sari	BWS Sumatera V
Mr. Jhon Siaripar	BWS Sumatera III
Mr. Harmedi Hasibuan	BWS Sumatera V
Mr. Musdiyanto	BWS Sumatera II
Ms. Janeny Mamoto	BWS Sulawesi I
Mr. Teddy Sorey	BWS Sulawesi I
Mr. Henri Rindengon	BWS Sulawesi I
Mr. Adenan Rasyid	BWS Sulawesi II
Mr. Edison	BWS Sulawesi III
Mr Arief Sidik	BWS Sulawesi IV
Mr. Kasim Sareino	BWS Sulawesi IV
Mr. Made Mira	BWS Nusa Tenggara I
Mr. Fadjar Syah	BWS Nusa Tenggara II
Mr. Gede Lanang Sunu P.	BWS Bali-Penida
Ms. Sri Utami	BWS Nusa Tenggara I
Mr. W. Suteja	Section Chief of Implementation, BWS Bali-Penida
Mr. Sudarto	BBWS Serayu Opak
Mr. Rachmat Ciptadi	BWS Papua Merauke
Mr. ME. Tomasila	BWS Papua Merauke
Mr. Hayatuddin T	BWS Maluku
Mr. Abdul Muis	BWS Maluku Utara
Mr. Edwin Hehamahwa	BWS Papua Barat
Mr. Suryadarma Hasyim	BBWS Pompengan Jeneberang

Province

Mr. Isran Taufi	Head of Division of Water Utilization Network Implementation
Mr. Dikky	Head of Division, Department of Water Resources West Jawa
Mr. R. Wahyu	Department of Public Works, Water Resources, and Spatial Planning Central Java
Mr. Siswo	Department of Public Works, Water Resources, and Spatial Planning Central Java
Ms. Dian P.D	Department of Public Works and Housing, Energy and Mineral Resources Special Region of Yogyakarta
Mr. Agus Budi P.	Department of Public Works and Housing, Energy and Mineral Resources Special Region of Yogyakarta
Mr. Rudy N.	Department of Public Works and Water Resources East Jawa
Mr. Pramoro Heri	Department of Public Works and Water Resources East Jawa
Mr. Sucipto	Water Resources Technical Planning Section, Department of Public Works and Housing Central Kalimantan
Mr. A Yudi Saputra	Head of Subdivision of Planning, Department of Water Resources Management South Sumatera
Mr. Muhammad Fauzi	Head of Department, Department of Public Works and Housing Jambi
Mr. Nasrul	Head of Water Resources Division, Department of Public Works and Housing Jambi
Mr. Lukman	Department of Public Works and Housing Jambi

Mr. Herianto	Head of Irrigation Section
Mr.Rezki Mulyono	Department of Public Works and Housing Riau
Mr. Efendi S	Department of Public Works and Housing Riau
Mr. Romen S. Lantuq	Head of Water Resources Division, Department of Public Works and Housing Gorontalo
Mr. Abdul Razak	Dinas Cipta Karya dan Sumber Daya Air Central Sulawesi
Mr. Satya Wicana	Dinas Cipta Karya dan Sumber Daya Air Central Sulawesi
Mr. A. Darmawa	Head of Department, Dinas Cipta Karya dan Sumber Daya Air Central Sulawesi
Mr Ahmadi	Department Secretary, Department of Public Works and Housing Nusa Tenggara Barat
Ms. Mirzah Achmad	Department of Public Works and Housing Maluku Utara

Kabupaten

Mr. Adi Adrian	Department of Public Works and Spatial Planning Kabupaten Garut
Mr. Taufik A	Department of Public Works, Housing and Settlement Kabupaten Gunung Kidul
Ms. Yessiana	Tasks Executor of Department Head, Dinas Pekerjaan Umum, Bina Marga, dan Sumber Daya Air Kabupaten Jember
Mr. Widodo	Head of Water Resources Division, Department of Public Works and Housing Kabupaten Ogan Komering Ulu Timur
Mr. Surya D. Ginting	Department of Public Works and Housing Kabupaten Langkat
Mr. A. E. Tunrisukki	Department Secretary, Department of Water Resources Management Kabupaten Bulukamba
Mr. Eka N. F	Department of Water Resources Management Kabupaten Bulukamba
Ms. Ruhaedah Habib	Department of Public Works and Housing, Kabupaten Gowa
Mr. Hendrea H	Department of Public Works and Spatial Planning Kabupaten Luwu
Mr. Askar	Department of Water Resources Management Kabupaten Bone
Ms. Mirsanuddin	Head of Water Resources Section, Department of Public Works and Spatial Planning Kabupanten Ogan Komering Ulu Selatan

JICA

Mr. Ogawa Ryo	Senior Representative
Mr. Ryora Fuse	Representative
Ms. Monika Kristyana	Prog. Officer
Ms. Titis R.	Prog. Assistant
Ms. Nindita P.	Program Officer
Mr. Kosei Hashiguchi	Team Leader / Irrigation and Drainage Planning
Mr. Takanori Takatsuka	Irrigation and Drainage Facilities
Mr. Hajime Kita	Hydrology / Water Resources Assessment
Mr. Ryo Inoue	Food Security

MODERATOR (CHAIRMAN)

Mr. M. Tahid	Head of Sub Directorate of Planning, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing

FACILITATOR

Ms. Vina Noviandini Londang	Head of West Planning Section, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Ms. Barbara Katlyn	Head of East Planning Section, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Ms. Rubai'ah Darmayanti	Head of West I Region Irrigation Section, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Julianto Silalahi	Head of West II Region Irrigation Section, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Ibdillah	Head of East I Region Irrigation Section, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Hendra Kurniawan	Head of East II Region Irrigation Section, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Andi Wildaniah	Head of West Lowland Region Section, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing
Mr. Harun Al Rasyid	Head of East Lowland Region Section, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing

MASTER OF CEREMONY

Ms. Meliani Magdalena	Sub Directorate of Planning Staff, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing

COMPUTER OPERATOR

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PRAYER READER

Mr. Amos Budianto	Sub Directorate of Lowland Staff, Directorate of Irrigation and Lowland, DG of Water Resources, Ministry of Public Works and Housing

CONDUCTOR

Ms. Tengku Julianti	Administration Staff, Ministry of Public Works and Housing

MINUTES OF MEETING
ON
JOINT COORDINATING COMMITTEE MEETING (3rd)
FOR
THE PROJECT ON FORMULATION OF IRRIGATION DEVELOPMENT AND MANAGEMENT STRATEGY FOR FOOD SECURITY
IN
THE REPUBLIC OF INDONESIA
AGREED UPON BETWEEN
MINISTRY OF PUBLIC WORKS AND HOUSING
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Jakarta, 26th November, 2019

For
Japan International Cooperation Agency (JICA)

Mr. Kosei Hashiguchi
Team Leader/ Irrigation and Drainage Planning, JICA Project Team,
SANYU Consultants Inc.

For
Ministry of Public Works and Housing (PUPR)

Mr. Hari Suprayogi
Director General of Water Resources,
Ministry of Public Works and Housing

I. INTRODUCTION

With respect to the Project on Formulation of Irrigation Development and Management Strategy for Food Security in the Republic of Indonesia (the Project), the JICA Project Team organized by the Japan International Cooperation Agency (JICA) had first time arrived in Indonesia on January 3, 2019, and since then the Team has conducted a series of surveys and studies.

With the outputs from the above surveys and studies, the Team has produced an Interim Report and delivered 8 copies of the Report including soft data to the Directorate General of Water Resources (DGWR) as specified in the RD agreed upon and signed on March 9, 2018, between DGWR and JICA.

Further with the Interim Report prepared, the DGWR and the Team had arranged the 3rd JCC meeting on 26th November 2019 on the Project, inviting concerned DGWR officers, DILL officers and staff, and relevant JCC members all engaged in the food security and/or irrigation development sector in Indonesia (for the participants, see Attachment-1).

At the inception of the 3rd JCC meeting, the Chairperson of the meeting, Mr. Tahid, Head of Sub-directorate of Planning, DILL, delivered, on behalf of the Director General of WR and the Director of DILL, thanking remarks for JICA's technical cooperation and supports concerning the Project, and officially opened the 3rd JCC meeting.

II. PRESENTATION AND COMMON UNDERSTANDINGS

The JICA team presented the following to the participants, and the participants have had common understandings and agreed upon below thereof as:

1) The JICA team, as has been presented during the meeting, recommends the base scenario of lowest rice demand in the future, all on-going (i.e. one-million ha development) and approved investment (i.e. premium/dam development) in irrigation sector having been done, yield to increase as per logarithmic nature approximation, and land conversion from 100,000 ha/year in 2015-19 to 40,000 ha/year after the years 2030-2034.

2) With above, the JICA team recommends the DGWR to develop 498,587 ha, say 500,000 ha, for the coming 5-year mid-term development period of RPJMN/RENSTRA, or if DGWR should consider a safety factor, e.g. 10% more, the target is to be 548,446 ha, say 550,000 ha. The following table summarizes the recommended irrigation development by area-size respectively to each of the 5-year development terms with remarks below:

Table 1 Required Irrigation Development by Nation-wide, ha

Rice Demand	Conditions	2015-19	2020-24	2025-29	2030-34	2035-39	2040-44	Note
		1st term	2nd	3rd	4th	5th	6th	
Lowest Rice Demand Scenario	Base Case							
	LC from 100,000 to 40,000 ha/year	261,673	236,914	225,106	252,555	256,538	255,277	
	1st term carried over to the 2nd term		**498,587**	**225,106**	**252,555**	**256,538**	**255,277**	**A**
	Above x 1.1 (safety factor)	287,840	260,605	247,617	277,809	282,192	280,805	
	1st term carried over to the 2nd term	-	**548,446**	**247,617**	**277,809**	**282,192**	**280,805**	**B**
	Reference (safety factor not considered)							
	LC of 100,000 ha/year to continue	261,673	327,815	481,582	589,019	588,962	584,784	
	1st term carried over to the 2nd term	-	589,488	481,582	589,019	588,962	584,784	C

3) As the areas indicated in 2015-2019 should have been developed to date to meet the rice 100% self-sufficiency, this backlog should be carried over to the coming mid-term development period 2020-2024. Therefore, the Team recommends DGWR to incorporate the nation-wide total development of 500,000 ha (see Row A of above table), or 550,000 ha with 10% safety

factor (see Row B) into the next 5-year mid-term development plan (2020-2024) of RPJMN/RENSTRA.

4) Likewise, if the policy implementers think that it is difficult to control land conversion within a short period, i.e., reducing the current probable 100,000 ha/year land conversion to 40,000 ha/year over 10 years to come, 589,448 ha of nation-wide total irrigation development, or say 600,000 ha of development, may be suggested in the next 5-year mid-term development plan. Further, should the land conversion of as much as 100,000 ha/year continue in the future, required irrigation development could be a range of around 500,000 – 600,000 ha per 5 year (see Row C of above table).

5) To support the development of approximately 500,000 to as much as about 650,000 ha of paddy irrigation areas for the next 5-year development term of RPJMN/RENSTRA, it should be confirmed if there are enough land and water potentials. Having explored the potential of land and water, as shown below, there are still lots of potentials which can accommodate the above necessary development scale of 500,000 to 600,000 ha for the next 5-year development plan period:

Table 2 Irrigation Development Potential in Indonesia Nationwide

Island	Potential of Rain-fed Paddy, ha	Potential of Fully Suitable (area basis), ha	Potential of Conditionally Suitable (area basis), ha	Marginally Suitable Area (area basis), ha	Total
Sumatera	1,110,128	1,593,016	2,313,634	2,077,248	7,094,027
Java	55,375	0	0	0	55,375
Bali Nusa Tenggara	27,801	34,631	6,745	15,172	84,348
Kalimantan	890,923	1,654,223	3,272,662	1,898,420	7,716,228
Sulawesi	249,904	554,947	281,278	976,039	2,062,167
Maluku & Papua	48,991	958,378	1,761,249	1,910,068	4,678,686
Indonesia	2,383,122	4,795,194	7,635,568	6,876,947	21,690,832

Note: above potential shows area basis potential, and therefore the potentials for Fully-suitable, Conditionally suitable, and Marginally suitable are counted as double when looking into the harvest area (200% cropping intensity can be realized in those new development areas).

6) With respect to rehabilitation, the JICA team has incorporated the concept of asset management in the planning in order to maintain all the irrigation schemes in Indonesia sustainable under optimal investment. Three cases had been examined, i.e., major rehabilitation to be conducted every 10 years, every 20 years and every 30 years. Of them, the Team recommends the first case (see the case 1 of the table below), under which the rehabilitation in the coming 5-year mid term development period should cover 2.5 million ha, and thereafter about 2.5 million to 3.8 million ha of rehabilitation should be undertaken as per 5-year development term in the future. Note that though scale of rehabilitation area for the case 2 and case 3 are often smaller than those of case 1, total cost in rehabilitation could be the smallest.

Table 3 Rehabilitation Area Recommended based from 2020 to 2024, '000 ha

No	Rehabilitation	2020-2024	2025-2029	2030-2034	2035-2039	2040-2044	Total
1	Every 10 yrs	2,500	3,020	2,470	3,790	3,270	15,050
2	Every 15 yrs	2,500	520	3,020	2,470	1,290	9,800
3	Every 20 yrs	2,500	520	520	3,020	2,470	9,030

Note: Though the area of Case 1 is the biggest, e.g. 15,050 ha in total, rehabilitation cost could be the minimal amongst 3 cases. This is because every 10-year rehabilitation will incur less rehabilitation cost as the rehabilitation is undertaken before the facilities would become deteriorated very much recuing higher rehabilitation cost.

III. DISCUSSIONS, CLARIFICATIONS, AND RESPONSES

The following are the issues raised, discussed and clarified upon between the participants and the JICA team during the meeting:

1) Import of Rice: A participant gave a question of why the Team has not included rice import in estimating the rice supply. The Team replied that the imports of rice condition had already been checked as it was found that about 3-4% of rice total demand has come from imported ones, e.g. from Vietnam, however, the Team's basic assumption employed in the simulation was to reduce the imports to zero, targeting 100% rice self-sufficiency as per the government priority policy. Hence, the Team recommended such new irrigation development area of 500,000 ha (or 550,000 ha with safety factor) in order to make the import zero, and further added that, of course, should the Indonesian government allow imports, Indonesia could reduce the development of 500,000 ha (or 550.000 ha) as per the import volume.

2) Selection of Phase-2 priority Areas: A participant asked that to formulate irrigation development and management strategy, why the Team has not taken into account the supply chain of rice by examining the rice demand and rice supply because the supply chain of rice was not shown during the presentation. The Team replied that the team had actually already looked into that issue by the province, by river territory and then by the island, so that we can know which areas are in a deficit while which other areas are in surplus for rice supply and demand. However so far, the Team has not made the distribution map of rice supply-demand, and therefore towards Phase 2 and in the course of finalizing the Strategy, the Team is to prepare for such maps.

3) Examination on Fertilizer: A participant asked the Team if the fertilizer has been considered in line with paddy supply in future Indonesia. The Team replied that the current conditions on the fertilizer supply in Indonesia had been analyzed, and it was found that as a matter of fact, approximately 70% of fertilizer available in Indonesia has been covered by subsidies. The Team further commented that as the Indonesian government puts high priority on the agriculture and food security, the Team has selected the current subsidy on fertilizer to continue whereby the paddy yield is to increase according to, e.g., logarithmic nature approximation; however, as a reference case the Team also examined such case under which fertilizer subsidy were revoked or reduced, whereby no yield increase takes place. As the Team has examined many cases including fertilizer subsidy to continue and the subsidy to be revoked, there are already alternative scenarios in the Interim Report, from which DGWR could adjust the future development of irrigated paddy lands.

4) Social Conditions in selecting Priority Areas: A participant inquired if social conditions were considered in formulating the priority areas for irrigation development. The Team has in fact examined socio-economic conditions in putting priority on the areas for irrigation development of newly irrigated paddy lands; yet, the Team is of the opinion that to find out the potential of irrigation, one must first look at environmental conditions, whether the soil and water are feasible to develop irrigation, and later we should consider social conditions. The Team continued that it is true the social conditions are important, but no matter how good social conditions are, where there is no water, irrigation development cannot be implemented, and thus social conditions were considered after the natural conditions were met.

5) Irrigation Network Performance: A participant asked that Team that if the irrigation performance result included irrigation networks from all of authorities/schemes. The Team clarified that the performance results had covered only the Central Government managed schemes, covering 283 central government schemes as the performance survey had been

conducted only for the central government schemes.

6) Fishpond: A participant gave a question to the Team if irrigation to fishponds had been considered in the formulation of irrigation development and management strategy. The Team replied that the Strategy covers the irrigation development only for paddy production, thus not covering fishponds.

7) Selection of Phase 2 Priority Areas: The Chair raised an issue in the selection of top 4 priority areas to be undertaken in Phase 2 for preliminary feasibility study: though the Team has presented such 4 top priority areas as Sumatra Selatan/ Lampung, Kalimantan Selatan (including part of Tengah), Jawa Tengah and Sulawesi Selatan, the last 2 areas (Jawa Tengah and Sulawesi Selatan) may have to be changed if the 2 areas are to target rehabilitation since there are already programs a lot in these areas. The Team requested the DGWR more discussions on the selection of Phase 2 priority areas.

ANNEX 1: LIST OF THE PARTICIPANTS IN THE 3rd JCC

Indonesian Side:

Mr. M. Tahid	Head, Sub-directorate of Planning, Directorate of Irrigation and Lowland (DILL), Directorate General of Water Resources (DGWR), Ministry of Public Works and Housing (MOPWH)
Mr. Adjat Koesijono	Head, Sub-directorate of Irrigation in West Area, DILL, DGWR, MOPWH
Ms. Suri Sudarmadiyah	Head Section of Operational and Maintenance of Irrigation and Lowland East Area, Sub-directorate of Irrigation and Lowland, DILL, DGWR, MOPWH
Dr. Barbara Katlyn	Head, East Planning Section, Sub-directorate of Planning, DILL, DGWR, MOPWH
Mr. Ilham HM	ISDA EKON (Government Agency) under Economic Coordinating Ministy
Mr. A. Muh. ILhansyah	Sub-directorate of Cooperation, Directorate of Water Network Development, DGWR, MOPWH
Mr. Sigit Marwanto	Sub-directorate of Planning, DILL, DGWR, MOPWH
Mr. Riqi Noverin A	Directorate of Dam Center, DGWR, MOPWH
Mr. Fahmi Rizam	Directorate of Dam Center DGWR, MOPWH
Mr. Eko Setia Budi	Directorate of Irrigation and Lowland, DGWR, MOPWH
Mr. Fadel Ratna	Directorate of Irrigation and Lowland, DGWR, MOPWH

Japan International Cooperation Agency (JICA)

Mr. Ishijima Mitsuo	Executive Technical Advisor, JICA HQ
Ms. Togo Chisa	Assistant Director, ICA HQ

JICA F-IDAMS Team

Mr. Hashiguchi Kosei	Team Leader, JICA F-IDAMS Project
Mr. Kita Hajime	Team Member, JICA F-IDAMS Project
Mr. Inoue Ryo	Team Member, JICA F-IDAMS Project
Ms. Kawai Sarii	Team Member, JICA F-IDAMS Project
Mr. Jailani	Team Assistant, JICA F-IDAMS Project
Ms. Ayu Rahmawati	Team Assistant, JICA F-IDAMS Project
Mr. Hanif E. Cahyono	Translator, JICA F-IDAMS Project

KEMENTERIAN PEKERJAAN UMUM DAN PERUMAHAN RAKYAT
DIREKTORAT JENDERAL SUMBER DAYA AIR
Jl. Pattimura No.20 Kebayoran Baru, Telp. 021-7396616 Fax. 021-7208285

Konsep ini setelah dikirim, harap dikembalikan kepada:	Pejabat yang perlu memberikan konfirmasi : 1. Direktur Irigasi dan Rawa ..... 2. Direktur Sistem dan Strategi Pengelolaan SDA ..... 3. Direktur Bina Operasi dan Pemeliharaan	Supaya diajukan lagi tanggal : ..... Ditetapkan : Direktur Jenderal Sumber Daya Air

Jumlah Lembar
No :.....

Kode Klasifikasi..
.....

Pemeriksa Teknis :

1. Ka Sub Dit. Wilayah I, Dit. Irigasi & Rawa
   Parlinggoman Simanungkalit, S.T., MPSDA
2. Ka Sub Dit Wilayah II, Dit. Irigasi & Rawa
   Ir. Hj. Novia Rosalita, Sp-1
3. Ka Sub Dit. Wilayah III, Dit. Irigasi & Rawa
   Asmelita, S.T., Sp-1
4. Ka Sub Dit Perencanaan Teknis, Dit Irigasi & Rawa
   Rahmat Suria Lubis, S.T., M.T.
5. Ka Sub Dit Pengelolaan Pinjaman dan Hibah Luar Negeri, Dit SSPSDA
   Ari Setyorini, S.T., M.Tech
6. Ka Sub Dit Perencanaan Teknis Operasi & Kelembagaan, Dit Bina OP
   Sigit Irawan, S.T., M.T.

Diketik oleh :

Number :
Appendix : 2 (two) sets

Jakarta, 22 February 2022

To be signed by the representative of DGWR (the DG or Director of DILL on behalf for the DG), and the Team leader of JICA Project Team as indicated in the attached MM (draft)

Subject : MINUTES OF MEETING ON JOINT COORDINATING COMMITTEE OF DRAFT FINAL REPORT PRESENTATION FOR THE PROJECT ON FORMULATION OF IRRIGATION DEVELOPMENT AND MANAGEMENT STRATEGY FOR FOOD SECURITY

I. INTRODUCTION

With respect to the Project on Formulation of Irrigation Development and Management Strategy for Food Security in the Republic of Indonesia (the Project), the JICA Project Team organized by the Japan International Cooperation Agency (JICA) had first time arrived in Indonesia on January 3, 2019, and since then the Team has conducted a series of surveys and studies.

With the outputs from the above surveys and studies, the Team has produced a Draft Final Report and delivered 20 copies of the Report including soft data to the Directorate General of Water Resources (DGWR) as specified in the RD agreed upon and signed on March 9, 2018, between DGWR and JICA.

Further with the Draft Final Report prepared, the DGWR and the Team had arranged the last JCC meeting on 22nd February 2022 on the Project, inviting concerned DGWR officers, DILL officers and staff, and relevant JCC members all engaged in the food security and/or irrigation development sector in Indonesia (for the participants, see Attachment-1).

At the inception of the last JCC meeting, the Chairperson of the meeting, Mr. Suparji, Head of Directorate of Irrigation and Lowland, delivered, on behalf of the Director General of WR, thanking remarks for JICA's technical cooperation and supports concerning the Project, and officially opened the last JCC meeting.

II. PRESENTATION AND COMMON UNDERSTANDINGS

The JICA team presented the following to the participants, and the participants have had common understandings and agreed upon below thereof as:

1) The JICA team, as has been presented during the meeting, explained the output of Phase1 study, the masterplan for long-term irrigation development and management strategy to achieve rice self-sufficiency as a review. As shown in the table below, 498,587 ha, say 500,000 ha for new development and 2.5 million ha for rehabilitation are required to achieve the rice self-sufficiency until 2024.

JICA Project Team;
Sanyu Consultants Inc.

Expedisi tanggal :

Dikirim tanggal:

Table 1 Required Irrigation Development by Nation-wide, ha

Development Type	2015-19	2020-24	2025-29	2030-34	2035-39	2040-44
	Term 0	Term 1	Term 2	Term 3	Term 4	Term5
New Development	261,673	236,914	225,106	252,555	256,538	255,277
	-	**498,587**	**225,106**	**252,555**	**256,538**	**255,277**
Rehabilitation	-	**2,500,000**	**3,020,000**	**2,470,000**	**3,790,000**	**3,270,000**

2) Upon completion of the Phase 1, the Team moved to Phase 2 of the project, which is the preliminary feasibility study on the selected 4 priority areas (provinces); Lampung and East Kalimantan for new irrigation development, and South Sulawesi and Central Java for rehabilitation/modernization. The pre-feasibility study has continued to date, presenting the DFR.

3) Out of the pre-feasibility study for Lampung Province, the Team concluded and recommended to develop a new irrigation network within Komering Extension area No.4-1 which is in Tulang Bawang with 58,886 ha of net beneficiary area. This development could be supported with the discharge from Perjaya Headworks to realize cropping pattern of 7,415 ha paddy + 49,471 ha palawija in October – January period and 56,886 ha (full paddy) in February – May period.

4) The pre-feasibility study for East Kalimantan Province showed that among several potential areas, only KT-2 (Kutai Kartanegara), KT-31, KT-32 (both in Kutai Timur), and KT-4 (Berau) should be the first priority to develop considering the size of available land, which net area is 53,915 ha in total. What should be considered is to develop the not-yet-planted land within plantation concession areas. However, this requires changing the land use regulation or a mutual agreement between the government and the plantation companies who are authorized for the concession area.

5) The pre-feasibility study for South Sulawesi Province showed the overall soundness ranking of 3.02 (according to Japanese indicator introduced by the Team) for the irrigation structure condition which refers to be needing 'Perbaikan Sedang' (moderate rehabilitation) in Indonesian indicator. With the lowest score of the selected 5 irrigation schemes being 2.87, the Team concluded that basic rehabilitation is required than modernization as the deterioration has moderately progressed in the whole schemes. The Team assumed that irrigation efficiency would improve from the current 50% to 55% after rehabilitation work done.

6) The pre-feasibility study for Central Java province showed the overall soundness ranking of 3.62 for the irrigation structure condition which refers to be needing 'Perbaikan Sedang' (moderate rehabilitation) in Indonesian indicator. Here, different from the case in South Sulawesi province, modernization should be implemented as well as rehabilitation especially in the premium irrigation schemes of Sidorejo, Sedadi, and Klambu. Irrigation efficiency is assumed to improve from 50% to 55% after rehabilitation and again to 60% after modernization.

7) In regard to the modernization plan in Central Java, all 5 modernization pillars will be followed-up and if the targeted areas need some rehabilitation work, it shall be done in addition to or together with the modernization program. Moreover, the Team proposed the utilization of satellite image analysis for irrigation management improvement in producing a better and on-time water distribution. Furthermore, to pursue the 4th and 5th modernization pillars of strengthening institutional management and human resource empowerment, the recommendation is to conduct active Irrigation Management Transfer (IMT) or Participatory Irrigation Management (PIM), in which the farmer organization is included to do regular operation and maintenance duty for secondary canals. This will lead to the reduction of OM budget as well.

8) The budget estimation for the 4 top priority areas reached around IDR 23.3 trillion or equals to USD 1.7 billion. As the current project only covers the completed formulation and pre-feasibility study, the Team encouraged DGWR to follow through with the feasibility study stage.

III. DISCUSSIONS, CLARIFICATIONS, AND RESPONSES

The following are the issues raised, discussed and clarified upon between the participants and the JICA team during the meeting:

1) Water management for Komering Extension: Perjaya Headworks which will receive additional discharge from Tiga Dihaji Dam is located in Komering Ulu, South Sumatera Province. Meanwhile, the new development area proposed under this project is located in Tulang Bawang, Lampung Province. Since the water source and beneficiary area are under different authorized office, the regulation or permit should be well-considered and discussed until it reaches mutual agreement between BBWS Mesuji Sekampung (Lampung) and BBWS Sumatera VIII (South Sumatera). This will also relate to the paddy production data collection for the extension area; whether it should be included into Lampung data or South Sumatera data.

2) OM issue for Komering Extension: It should be made clear whether operation and maintenance works are to be conducted by staff from Lampung Province or South Sumatera Province. One of the reasons is related to the OM budget allocation; whether it should be from Lampung Province or South Sumatera Province. The Chairperson responded that OM issue must wait for the decision after FS stage, in which in-depth study and discussions would be conducted. As for its funding, the sources are still currently unclear. The irrigation management or committee should follow the respective kabupaten (district) or province. However, since Komering Extension new development is under a cross-province case, the committee should be under central DGWR arrangement. There has been a plan to set irrigation committee in the central government level.

3) New development VS existing yet undeveloped scheme in East Kalimantan: A representative from BWS Kalimantan Timur IV commented that East Kalimantan indeed has a large area to be developed and agreed with the factors considered by the Team when deciding on suitable area to develop new irrigation scheme(s). However, there is actually an existing potential in East Kalimantan, which is Telake Irrigation Scheme (DI Telake). Relating also to the land conversion concern, if DI Telake existing area is not utilized well, the land might be converted into palm since palm plantation is growing fast in there. This DI has existing paddy land, but not supported fully with technical irrigation. The local people would greatly welcome the previous construction or dam/weir which would benefit them; thus, it would be bad if Telake potential is slowed down or even converted into plantation farm. Taking this into account, it is indeed great to push new development agenda in East Kalimantan, but do not make that agenda harms the existing irrigation scheme that should be better developed and is facing the possibility of going through a land conversion.

4) Prioritized schemes, rehabilitation design, and modernization plan in South Sulawesi: Representatives from BBWS Pompengan Jeneberang expressed interest in the soundness ranking result presented by the Team and agreed that DI Lamasi needs urgent repair through rehabilitation. However, the priority list still should be re-discussed since DI Kelara-Karalloe now has a newly constructed dam and it should be connected to the primary canal immediately. The option of narrowing the existing canal floor if complete lining is done might be an issue. It might not be compatible with the initial intake water planning and the water might overflow. The Team responded that if that option is not desirable, they should consider utilizing existing regulator gate(s) or installing additional ones. Another inquiry is regarding any opportunity to also conduct modernization especially in premium irrigation scheme Kelara-Karalloe. The Team emphasized that basic rehabilitation should be the outmost priority for South Sulawesi, but on top of that, modernization can always be considered (after rehabilitation is done) as it does not cost much investment.

5) Focus of rehabilitation and modernization in Central Java irrigation schemes: A representative of BBWS Pemali Juana noted that almost all schemes, especially Pemali, Klambu, Sidorejo, Sedadi, and Sungapan, have been rehabilitated. As for Gung, Kumisik, and Rambut, those schemes have not been given any rehabilitation work for the last 10 years. Therefore, the target for rehabilitation must be discussed once again to focus more on which schemes that urgently need the rehabilitation.

For the premium irrigation schemes, the focus is not on water deliverability or giving lining for irrigation canals, but to upgrade the division and off-take structures for a more efficient water distribution method. In addition, it is important to prevent automatization with expensive tools and equipment that the local people and farmers cannot utilize and maintain well, leading them to be abandoned and damaged. The Team agreed with this comment as the best option for modernization in Central Java is to utilize existing facilities as much as possible, not jump to the high-tech solution immediately.

6) Lessening OM staff: Continuing the discussion of modernization, another huge concern that was brought to the floor was the lessening OM staff on the field. The OM staff from BBWS and provincial offices are decreasing with many of them retiring from the job. Meanwhile, the new recruitment of regeneration has not been optimally done to fulfil OM demand. The human resource needs capacity development as well. To this, the Team gave a case in the Philippines as an example in which there is a contract between P3A and the central MOPWH that the maintenance budget for secondary canals is given to P3A to do the secondary canal maintenance. This kind of contract arrangement can be adopted, leading to a possibility of coping with the lessening of OM staff. This way, the farmers will be very keen to smoothly operate and maintain the irrigation facilities.

7) Additional suggestion for FS stage: A comment from the Chairperson of the meeting was that the existence of a potential land for about 165,000 ha in Palangkaraya, Central Kalimantan to be converted back into paddy land after being abandoned/not well-maintained with the small population there. Perhaps the Team could consider this potential and it could be discussed later during the beginning of the FS stage.

ANNEX 1: LIST OF THE PARTICIPANTS IN THE JCC

Indonesian Side:

Mr. Suparji	Director, Directorate of Irrigation and Lowland (DILL), Directorate General of Water Resources (DGWR), Ministry of Public Works and Housing (MOPWH)
Mr. Rahmat Suria Lubis	Head, Sub-directorate of Planning, Directorate of Irrigation and Lowland (DILL), Directorate General of Water Resources (DGWR), Ministry of Public Works and Housing (MOPWH)
Mr. Ir. Djaya Sukarno	Head, BBWS Pompengan Jeneberang, South Sulawesi Province
Mr. Alexander Leda	Head, BBWS Mesuji Sekampung, Lampung Province
Mr. Dery Indrawan	Head, Technical Irrigation Office, DGWR, MOPWH
Ms. Ir. Susi Hariany	Head Division of Water Resource Infrastructure Development, BBWS Mesuji Sekampung, Lampung Province
Mr. Riza Fahlefi	Head Division of Implementation of Water Utilization Network, BBWS Mesuji Sekampung, Lampung Province
Mr. Tesar Hidayat Musowir	Head Division of Implementation of Water Utilization Network, BBWS Pemali Juana, Central Java Province
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Ms. Rahayu	Head Division of Water Resource Infrastructure Development, BBWS Pompengan Jeneberang, South Sulawesi Province

	Mr. Arman Efendi	Head Section of Irrigation Planning Implementation, BWS Kalimantan IV, East Kalimantan Province
	Mr. Harold Latski	Sub-coordinator, Sub-directorate of Region I, DILL, DGWR, MOPWH
	Mr. Maulana Hidayat	Sub-coordinator, Sub-directorate of Region II, DILL, DGWR, MOPWH
	Mr. Pathurachman	Sub-coordinator, Sub-directorate of Region III, DILL, DGWR, MOPWH
	Ms. Devi S. Maulana	Sub-coordinator II, Sub-directorate of Region III, DILL, DGWR, MOPWH
	Ms. Barbara Katlyn	Sub-coordinator, Sub-directorate of Planning, DILL, DGWR, MOPWH
	Mr. Segel Ginting	Technical Irrigation Office, DGWR, MOPWH
	Mr. Anggara Cahyo Wibowo	Technical Lowland Office, DGWR, MOPWH
	Mr. Budi M. H.	BBWS Mesuji Sekampung, Lampung Province
	Ms. Penny Dwiadhiputri	BBWS Mesuji Sekampung, Lampung Province
	Ms. Imbar Indrianie W.	BBWS Pemali Juana, Central Java Province
	Mr. Bagus Adi Irawan	BBWS Pemali Juana, Central Java Province
	Ms. Siti Robiatul Adawiyah	BBWS Pemali Juana, Central Java Province
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	Mr. Ono Nozomu	Senior Representative, JICA Indonesia Office
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APPENDIX I-II

FOOD SECURITY PLICIES

Appendix I-II FOOD SECURITY POLICIES

I-II.1 Tables and Figures

Table II- 1. National Development Planning System

National Development Framework of Indonesia

National Development and planning activities are covered all over Indonesia from Long Term Development Plan to Medium/Short Term Development Plan in terms of timeframe, and from Central Government to Regional Governments (Provinces and Regencies/Cities) in terms of authority, based on the National Development Planning System Law enacted in 2004. At present, the third National Mid Term Development Plan (RPJMN2015-2019) is the Plan on which every Ministry /Agency is working toward achieving its targets.

According to the National Long Term Development Law, at the third year of the each RPJMN, part time evaluation need to be done, and the last year of the plan, final evaluation will be done.

Irrigation is one of the most important development activities for achieving Food Security through development/improvement of irrigation systems. Therefore, Irrigation related targets have been set in both Second RPJMN (2010-2014) and Third RPJMN (2015-2019).

National Development Planning System

Central Government	Regional Governments	Period
National Long Term Development Plan (RPJPN)	Regional Long Term Development Plan (RPJPD)	20 years (2005-2025)
National Mid Term Development Plan (RPJMN)	Regional Mid Term Development Plan (RPJMD)	Every 5 years (Present: 2015-2019)
Strategic Plan of Ministry/Agency (Renstra-K/L)	Strategic Plan of Regional Government Work Unit (Renstra-SKPD)	Every 5 years (2015-2019)
Government Work Plan (RKP)	Regional Government Work Plan (RKPD)	Every year
Ministry/Agency Work Plan (Renja-KL)	Regional Government Work Unit Work Plan (Renja-SKPD)	Every year

Source: National Development Planning System Law (Law No. 25, 2004)

Table II- 2. Evaluation on the Construction and Rehabilitation of Irrigation Framework (RPJMN 2010-2014)

Evaluation of Irrigation Related Activities in the Second PRJMN (2010-2014)

For the former National Mid Term Development Plan or 2nd PRJMN (2010-2014) , Evaluation activities were made by the BAPPENAS in collaboration with the related Ministries.

Regarding the Irrigation, three target indicators were set, namely, 1) Increased Raw Water Capacity, 2) Irrigation and Swamp Network Construction / upgrading, and 3) Irrigation and Swamp Network Operation and Maintenance.

First Target, increase of Raw water capacity was achieved at 50.88 m3/s against 43.40 m3/s, and Third Target O & M of Irrigation Network was also achieved at 4.07 Million ha against 3.525 Million ha. However, Second Target, or Construction of Irrigation and Swamp Network was not achieved at 6,192 thousand ha against 1,050 thousand ha target.

Evaluation on the Construction and Rehabilitation of Irrigation Network (PRJMN 2010-2014)

No.	Indicator	Unit	Target in 2014	Achievements					Results
				2010	2011	2012	2013	2014	
1	Increased Raw Water capacity	m^3/sec	43.40	6.31	8.60	14.94	13.90	7.13	Achieved
2	Irrigation and Swamp Network constructed/upgraded	'000 Ha	1050.00	123.08	136.76	143.84	117.17	98.36	Not achieved
3	Irrigation and Swamp Network which have been operated /maintained	'000 Ha	3525.00	3422.99	3183.59	3197.00	3781.88	4071.74	Achieved

Source: EVALUASI PRJMN 2010-2014 (BAPPENAS 2015)

Food Sovereignty
in the third PRJMN (2015-2019)

a. Third RPJMN is the reflection of the Newly elected President's Policy, Nawa Cita. Targets related to Irrigation in the Plan were incorporated in the development Target group of Food Sovereignty (see Figure).
b. There are eight policy groups, of which three groups are closely related to irrigation, i.e.; at the top, "Opening 1 million ha of paddy lands", and clockwise, "Irrigation canal development and repairs (rehabilitation)", and at the point of 9 o'clock, "Increasing the ability of farmers (P3A empowerment might be in this policy group)".
c. Other groups have, to some extent, influences on irrigation development, such as " Stop conversion of productive land", etc.

Figure: Food Sovereignty Policy groups in PRJMN (2015-2019)

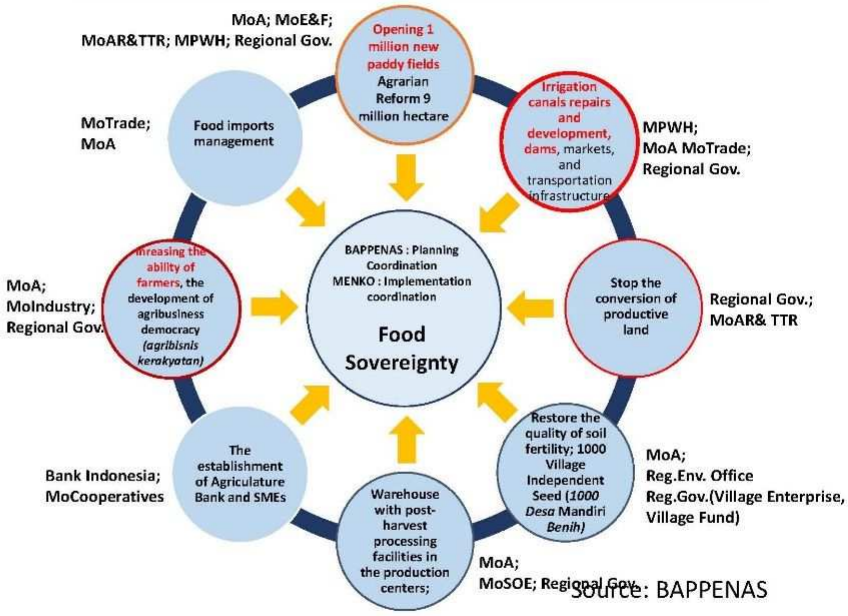


Figure II- 1. Food Sovereignty Policy Group in PRJMN (2015-2019)

Table II- 3. Part-time Evaluation of the 2015-2019 PRJMN Food Sovereignty Target (Related to Food)

PRJMN(2015-2019) Evaluation for Food Sovereignty (Food Production and Consumption)
Food Sovereignty Targets were evaluated at the mid of the planning period, titled Part-time evaluation as the Table below; Paddy and Corn Production Volume are both on track to achieve 2019 Target production, on the other hand, Soybean, Sugar, Beef and Fish are evaluated as " Difficult to achieve", or " Need hard work". Consumption targets are all on track.

Part-time evaluation of the 2015-2019 PRJMN Food Sovereignty Target (Related to Food)

	Unit	2014	2015		2016		2019	Achievement prediction (notification)
		Baseline	Target	Realized	Target	Realized*	Target	
1. Production								
a. Paddy	Mt	70.60	73.40	76.23	75.40	79.14	82.00	Achieved/on track
b. Corn	Mt	19.10	20.00	21.35	19.60	23.16	24.10	Achieved/on track
c. Soybean	Mt	0.92	0.90	1.82	0.96	0.88	2.60	Difficult to achieve
d. Sugar	Mt	2.60	2.90	2.49	3.27	2.22	3.80	Need hard work
e. Beef meat	'000t	452.70	476.80	540.00	590.00	560.00	755.10	Need hard work
f. Fish	Mt	10.76	13.60	10.87	14.80	11.81	18.76	Need hard work
2.Consumption								
a. Calorie consumption	Kcal	1,967	2,011	2,096	2,040	2,040	2,150	Achieved/on track
b. Fish consumption	Kg/cap/y	38.14	40.90	41.11	43.88	43.88	54.49	Achieved/on track
3. Desirable Dietary Pattern	PPH	81.80	82.90	85.20	86.20	86.20	92.50	Achieved/on track

Source: EVALUASI PARUH WAKTU PRJMN 2015-2019 (BAPPENAS 2017)
Source: Central Statistics Bureau, Ministry of Agriculture, Ministry of Marine and Fisheries, Min. of Public Works and Housing

Table II- 4. Part-time Evaluation of the 2015-2019 PRJMN Target (Related to Irrigation)

PRJMN(2015-2019) Evaluation for Food Sovereignty (Development and Rehabilitation of Irrigation)

There were 6 (six) irrigation related targets set in the PRJMN (2015-2019) as shown in the Table below; Development and improvement of Irrigation Networks Target was 0.99 Million ha (9.89 Million ha – 8.90 Million ha) and achievement is predicted. Similarly, Rehabilitation of Irrigation Networks of 3.01 Million ha, pond irrigation of 304.75 Thousand ha, Number of Construction of Reservoir are all on track, except Irrigation water distributed from Reservoirs might not be achieved.

Part-time evaluation of the 2015-2019 PRJMN Target (Related to Irrigation)

	Unit	2014	2015		2016		2019	Achievement prediction
		Baseline	Target	Realized	Target	Realized*	Target	
4. Development, Improvement and Rehabilitation of Irrigation (cumulative)								
a. Development and Improvement of surface-water, groundwater and swamp Irrigation networks (cumulative)	Million hectare (Mha)	8.90	8.94	9.11	9.20	9.26	9.89	Achieved/on track
b. Rehabilitation of surface, groundwater and swamp irrigation networks (per year)	Mha	2.71	0.05	1.46	1.89	1.21	3.01	Achieved/on track
c. Development and improvement of pond irrigation	'000 ha	189.75	1.60	4.24	5.58	1.85	304.75	Achieved/on track
d. Construction of reservoirs (new)	Unit	0	13	13	8	8	49	Achieved/on track
e. Construction of reservoirs (continued)	Unit	16	16	16	24	24	39	Achieved/on track
f. Irrigation water available from Reservoirs (Water Resilience Target)	%	11	11	11	11	11	19	Need hard work

Source: EVALUASI PARUH WAKTU PRJMN 2015-2019 (BAPPENAS 2017)

Source: Central Statistics Bureau, Ministry of Agriculture, Ministry of Marine and Fisheries, Min. of Public Works and Housing

Table II- 5. National Budget 2016-2019 (Income, Billion Rp.)

National Budget (Revenue)

Indonesia's state incomes between 2016 and 2019 (plan) are shown in the Table below. its characteristics are;
a. Around 80% of incomes is from Tax, remaining 20% is from Non-Tax such as, oil and gas revenue, revenue from State Owned Company, public service company etc..
b. APBN has been gradually increasing from 194.1 trillion Rp in 2000, 992.4 trillion Rp in 2010, and 2,165 trillion Rp in 2019.
c. According to the financial statements records in 2016 and 2017, Actual Revenue(LKPP) were 1,555.9 trillion Rp (2016) and 1,666 trillion Rp (2017), that means 13% decrease in 2016 and 5 % decrease in 2017 compared to the Revised state Budget (APBNP, Revised APBN) .

National Budget 2016-2019 (Income, Billion Rp.)

	2016		2017			2018	2019	
	APBNP	LKPP	APBN	APBNP	LKPP	APBN	APBN	Percent
State Revenue and Grant	1,786,225.0	1,555,934.1	1,750,283.4	1,736,060.1	1,666,375.9	1,894,720.3	2,165,111.8	100.00
I. Domestic Revenue	1,784,249.9	1,546,946.5	1,748,910.7	1,732,952.0	1,654,746.1	1,893,523.5	2,164,676.5	99.98
1. Tax Revenue	1,539,166.2	1,284,970.1	1,498,871.6	1,472,709.9	1,343,529.8	1,618,095.5	1,786,378.7	82.51
a. Domestic Tax	1,503,294.7	1,249,499.5	1,464,796.5	1,436,730.9	1,304,316.3	1,579,395.5	1,743,056.9	80.51
b. International Trade Tax	35,871.5	35,470.7	34,075.1	35,979.0	39,213.6	38,700.0	43,321.8	2.00
2. Non-tax Revenue	245,083.6	261,976.3	250,039.1	260,242.1	311,216.3	275,428.0	378,297.9	17.47
II. Grant	1,975.2	8,987.7	1,372.7	3,108.1	11,629.8	1,196.9	435.3	0.02

Source; Ministry of Finance Database, APBN = State Budget, APBNP = Revised State Budget, LKPP = Central government financial statements (realization)

Table II- 6. Food Sovereignty Related Budget 2010-2018 (Trillion Rp.)

Food sovereignty related Budget between 2010 and 2018 is shown in the Table below, its characteristic points are;

a. The budget abruptly increased in 2015, or new regime started and continuously has kept at the level of around 100 Trillion Rp.
b. Irrigation budget of Ministry of Public Works and DAK(Regional) Irrigation are both increased in PRJMN 2015-2019.
c. Food Subsidy and Fertilizer Subsidy keeps both high amount at around 20 Trillion Rp And 30 Trillion Rp respectively.
d. Food Subsidy transferred fully from BULOG (State Own Enterprise) to Ministry of Social Affairs from 2017. This is the reason of Ministerial Budget sudden increase.

FOOD SOVERIGNTY RELATED BUDGET 2010-2018 (Trillion Rp.)

Description	2010	2011	2012	2013	2014	2015	2016	2017	2018
	Results	Results	Results	Results	Results	Results	Results	Results	Plan
I. Ministry	**13.0**	**23.9**	**27.7**	**27.0**	**23.1**	**44.1**	**31.2**	**36.6**	**59.3**
1. 018 Ministry of Agriculture	8.0	16.0	18.2	15.9	13.2	28.7	21.1	21.9	23.8
2 032 Ministry of Marine Affairs and Fisheries	1.9	3.7	4.4	4.8	4.3	6.7	4.6	4.2	4.3
3. 033 Ministry of Publick Works and Housing	3.1	4.2	5.1	6.3	5.7	8.6	5.5	8.9	10.3
4. 027 Ministry of Social Affairs	-	-	-	-	-	-	-	1.6	20.8
II. Non Ministry/Agency	**39.2**	**37.6**	**40.8**	**42.4**	**44.2**	**66.1**	**68.2**	**56.7**	**39.4**
1. Subsidies	**35.7**	**33.0**	**33.1**	**38.3**	**39.5**	**53.3**	**49.4**	**49.1**	**28.5**
a. Food Subsidies	15.2	16.5	19.1	20.3	18.2	21.8	22.1	19.5	-
b. Fertilizer Subsidies	18.4	16.3	14.0	17.6	21.0	31.3	26.9	28.8	28.5
c. Seed Subsidies	2.2	0.1	0.1	0.4	0.3	0.1	0.4	0.8	-
d. Warehouse receipt credit interest subsidies	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Miscellaneous Expenditure	**1.0**	**1.5**	**4.5**	**-**	**-**	**1.5**	**3.4**	**2.5**	**5.0**
a. Government Rice Reserves	1.0	1.0	2.0	-	-	1.5	2.0	2.5	2.5
b. Food Price Stabilization Reserves and Food Security	-	-	1.4	-	-	-	1.4	-	2.5
c. National Seed Reserves	-	0.5	0.3	-	-	-	-	-	-
d. Food Security Reserves	-	-	0.7	-	-	-	-	-	-
3. Transfer to Regions(DAK)	**2.5**	**3.1**	**3.2**	**4.0**	**4.7**	**11.4**	**15.5**	**5.1**	**5.9**
a. DAK Irrigation	1.0	1.3	1.3	1.6	2.2	-	12.0	3.6	4.3
b. DAK Agriculture	1.5	1.8	1.9	2.5	2.5	-	3.4	1.5	1.7
Total	52.2	61.4	68.5	69.4	67.3	110.2	99.4	93.3	98.7

Source:Ministry of Finace

Table II- 7. Volume and Budget of Development and Rehabilitation of Irrigation Network during PRJMN 2015-2019

Volume and Budget of development and rehabilitation of irrigation network during PRJMN 2015-2019

Table below shows Volumes of Area developed and/or rehabilitated and its budget (to be)implemented by PUPR during 2015 and 2019.
a. Row I and II are the achievement and allocated budget by the Central Government, and III indicates the achievement by regional Governments using allocated budget (DAK, Special allocation fund from National Budget, APBN) .
b. Basically, those figures refer to the Main Irrigation system (Primary and Secondary Irrigation system) and Tertiary canal system development is not included.
c. Total Achievement of Irrigation Network development is 989,282 ha, and those of Rehabilitation is 3,144,503 ha, both figures suffice PRJMN 2015-2019 Target.

Irrigation Network Development and Rehabilitation (Volume and Budget) 2015-2019

No.	Description	2015		2016		2017		2018		2019		TOTAL 2015-2019	
		Vol (Ha)	Budget (MRp.)	Vol (Ha)	Budget (MRp.)	Vol (Ha)	Budget (MRp.)	Vol (Ha)	Budget (MRp.)	TARGET (Ha)	Budget (MRp.)	Acheived (Ha)	Budget (MRp.)
I	IRRIGATION NETWORKS DEVELOPMENT	152,472	4,026,448	50,476	2,369,006	61,042	4,304,293	39,939	4,769,901	47,200	4,430,515	351,129	19,900,164
II	Irrigation Network Rehabilitated	482,618	3,983,433	286,966	3,179,526	264,478	4,926,550	155,832	4,112,550	247,134	4,564,310	1,437,029	20,766,370
III	Implemented by Region (DAK)		5,469,941		3,702,248		3,997,663		4,246,177		13,169,852		30,585,881
a	Development Irrigation Network	4,028	604,200	1,718	257,700	6,767	1,015,050	28,706	1,435,300	8,442	422,100	49,661	3,734,350
b	Improvement Irrigation Network	114,122	1,255,342	84,424	928,664	157,728	1,735,008	143,250	1,289,250	88,968	800,712	588,492	6,008,976
c	Rehabilitation Irrigation Network	685,033	3,610,399	290,629	2,515,884	294,816	1,247,605	158,161	1,521,627	278,835	11,947,040	1,707,474	20,842,555
Total Achievement of Development (I+IIIa+IIIb)		270,622	5,885,990	136,618	3,555,370	225,537	7,054,351	211,895	7,494,451	144,610	5,653,327	**989,282**	**29,643,490**
Total Achievement of Rehabilitation (II+IIIc)		1,167,651	7,593,832	577,595	5,695,410	559,294	6,174,155	313,993	5,634,177	525,969	16,511,350	**3,144,503**	**41,608,925**
Total Achievement of Irrigation		1,438,273	13,479,822	714,213	9,250,780	784,832	13,228,506	525,888	13,128,628	670,580	22,164,677	4,133,785	71,252,414

Source: Project Team compiled from PUPR data, as of Jan. 2019

Table II- 8. Budget of General Directorate of Agricultural Infrastructure and Facilities FY 2014-2018

For the Tertiary Irrigation system, Water User Farmers Association or P3A must be organized and P3A is responsible for the development and management of the tertiary system according to regulations of the Government.

However, many farmers do not have adequate knowledge, Know-how, nor capital resources for tertiary Irrigation system, therefore Governments (Either Central or Regional one) may assist farmers.

Table below is the Budget of Directorate of General of agricultural Infrastructure of the MoA between 2014 and 2019. In 2014 and 2015 the share of the Irrigation water management budget was relatively high among the six sub-sectors (17% and 33% respectively), however, in recent years, its share has plunged from 15% (2016) to 5%(2016) and 7% (2018).

Agricultural Land Extension Budget has also dropped down from 46% (2014) to 10% (2018).

Instead, share of the system management of Agricultural machineries sub sector in the budget has soared from 16% (2014) to 41% (2016) and 61% (2018).

Budget of General Directorate of Agricultural Infrastructure and Facilities FY2014-2018

Unit: Thousand Rp.

Program /Activities / Output		2014	2015	2016	2017	2018 (plan)
TOTAL		3,294,030,743	14,392,200,941	9,109,711,454	6,926,098,850	6,030,828,749
1	Irrigation Water Management for Agriculture	563,964,660	4,698,371,684	1,338,995,554	352,076,836	393,889,225
2	Agricultural Land Extensification	1,500,036,176	4,105,466,518	2,816,231,515	1,788,005,840	594,572,366
3	System Management of Agricultural Machineries and Monitoring	538,142,841	3,304,212,546	3,713,222,513	3,719,570,697	3,676,938,437
4	Support for Management and Technology	168,241,332	1,299,685,351	713,723,134	796,463,057	855,636,771
5	Facilitation of Fertilizer and Pesticides	283,222,150	460,739,892	342,104,253	82,028,460	84,657,850
6	Agricultural Finance Service	240,423,584	523,724,950	185,434,485	187,953,960	425,134,100

Source: Ministry of Agriculture

Table II- 9. Major Laws and Regulations related to Irrigation Water, Agriculture, and P3A

There are many Laws and Regulations for the development and Management of Irrigation and Agriculture issued by the Government, President, Ministries.
The basic conditions are as follows;
a. Responsibility of development and management of Irrigation system is clearly demarcated between Governments (central and regional) and farmers, in particular, tertiary or farm-level system development and management is responsibility of farmers,
b. However, Governments may support farmers, and farmers may participate in the upper level system management.
c. At this moment, two Regulations of MPWH and MoA specify basic conditions mentioned a) and b) above.

Major Laws and Regulations related to Irrigation Water, Agriculture, P3A etc.)

Name of Laws and Regulations	Category	Number and Year of Issuance	Ministry in Charge	Remarks
Water Resources Law	Law	NO.7/2004	Government	Void by Constitutional Court in 2013
Irrigation Regulation	Gov. Regulation	No20/2006	Government	close relation with the Law No.7/2004
Irrigation Law	Law	No.11/1974	Government	Replaced for the Law No.7/2004 on Water Resources
Regulation on Criteria and Irrigation Area status	MPWH Regulation	No.14 /2015	Ministry of Public Works	Demarcation of Irrigation Dev. And Management between Authorities
Regulation on Development and Empowerment of Water User Associations (P3A)	MoA Regulation	No.29/2012	Ministry of Agriculture	Guideline for empowerment of P3A who is responsible for development and management of tertiary plots

Table II- 10. Ratio of Rice Production to Domestic Utilization in ASEAN Countries (Self-Sufficiency Ratio) 2015-2019

AFSIS (ASEAN Food Security Information System) which was established in 2003 at the First ASEAN +3 Agricultural Minister Meeting, issues bi-annually the Agricultural Commodity Outlook Reports which provides agricultural data on Production, Harvested Area, Price for Rice, Maize, Cassava, Soybean and Sugar cane in ASEAN member countries.
AFSIS provides data on Rice, Self-Sufficiency Ratio (Production/Domestic Use) is calculated as shown in the Table below;
It is quite a interesting data that the countries whose self-sufficiency rate is over 100%, are Cambodia, Myanmar, Thailand, Vietnam and Indonesia, since those countries are all Rice exporting countries except Indonesia.
There is a news that the Rice Production figures of Indonesia should be adjusted (decreased) and Figures after year 2016 have not been officially announced. If production volume figure is decreased by 30%, Ratio of Indonesia is changed to 92% in 2016, 102% in 2017, 103% in 2018, and 106% in 2019.

Ratio of Rice Production to Domestic Utilization in ASEAN Countries (Self-Sufficiency Ratio) 2015-2019 Unit: Ton

Country	2015	2016	2017	2018			2019		
	Ratio (%)	Ratio (%)	Ratio (%)	Production	Domestic Utilization	Ratio (%)	Production	Domestic Utilization	Ratio (%)
ASEAN	**118.93**	**129.34**	**133.82**	**142,566,668**	**105,766,131**	**134.79**	**146,991,139**	**107,372,290**	**136.90**
Brunei	5.95	4.66	N/A						
Cambodia	224.91	229.72	158.73	6,670,250	4,384,839	152.12	6,902,615	4,398,240	156.94
Indonesia	**98.68**	**131.91**	**145.67**	**51,863,595**	**35,388,431**	**146.56**	**54,165,070**	**35,920,736**	**150.79**
Lao PDR	106.90	106.44	94.56	2,540,401	2,657,079	95.61	2,578,650	2,740,837	94.08
Malaysia	90.77	69.33	67.44	1,773,013	2,379,970	74.50	1,926,995	2,554,319	75.44
Myanmar	131.61	126.75	122.41	17,451,204	14,673,785	118.93	17,489,439	14,705,935	118.93
Philippines	92.63	91.73	90.27	12,144,149	13,562,420	89.54	12,169,344	13,899,503	87.55
Singapore	-	-	-	0	304,266	-	0	315,194	-
Thailand	170.51	147.93	194.65	21,533,844	10,916,000	197.27	22,899,025	11,327,000	202.16
Vietnam	131.90	138.84	128.57	28,590,212	21,499,340	132.98	28,860,000	21,510,526	134.17

Source: Agricultural Commodity Outlook Reports by ASEAN Food Security Information System (AFSIS) Secretariat

APPENDIX I-III

AGRICULTURE, IRRIGATION AND DRAINAGE

Appendix I-III-1 Statistical Analysis to Clarify Factors Affecting Paddy Yield

As the first step of predicting the future rice supply, the factors that determine the rice yield are analyzed using statistical procedures. In the statistical analysis, after confirming the influence of irrigation, cultivar, and fertilizer input on paddy yield, and the existence of interaction between each factor, the extent of the influence shall be revealed. Thus, the identified factors will be taken into consideration when setting the reference value and target value of yield in the future prediction of rice supply.

(1) Farmer's Household Survey on Food Crops (SURVEI UBINAN TANAMAN PANGAN)

For analysis of the factors that affect paddy yield, micro data (data per household survey) obtained by the farmer household survey (SURVEI UBINAN TANAMAN PANGAN) on food crops conducted regularly by BPS can be utilized. Micro data for the last three years (2014, 2016 and 2017) from BPS have been obtained. The variables used for statistical analysis and their details are shown in Table III.2.1.

Table III.2.1 List of variables for factorial analysis

Variable	Data	Remarks
Province	34 different provinces	
Crop type	1) Wetland paddy or 2) Upland paddy	1) is used for analysis
Land type	1) Irrigated rice fields, 2) Rain-fed rice fields, 3) Tidal swamp rice fields, 4) Non-tidal swamp rice fields or 5) Non-wetland	1) and 2) are used for analysis
Cultivation method	1) Monoculture or 2) Intercropping	1) is used for analysis
Used seed variety	1) Hybrid, 2) Superior (non-hybrid) or 3) Local	
Plot size for fertilizer input	Specific m^2	Converted to ha
Fertilizer type and amount used	1) Urea, kg, 2) TSP/SP36, kg, 3) KCL, kg, 4) NPK, kg, 5) Solid organic fertilizer, kg, and/or 6) Liquid organic fertilizer, L	Converted to kg/ha
Plot size for yield sampling	1) 6.25m^2 or 2) Specific m^2	Converted to ha
Yield per plot	1) kg/6.25m^2 or 2) kg/Specific m^2	Converted to kg/ha

Source: UBINAN QUES SUB-S, SURVEI UBINAN TANAMAN PANGAN KETERANGAN HASIL UBINAN (BPS, 2012)

In order to understand the factors that determine the yield of paddy rice, the statistical analysis is conducted targeting to rice farmers who cultivated both irrigated paddy fields and rainfed paddy fields. As for the cultivation method, single cropping of rice is targeted, and mixed cropping and intercropping are excluded.

To give an overview of the data, details of the micro data provided for statistical analysis are shown in Table III.2.2. Sample sizes are 55,000, 63,000, and 68,000 in 2014, 2016 and 2017, respectively. The number of samples in each survey year varies widely by island and province, and the number of samples of Mark-Papua is smaller than the number of samples of other islands.

Table III.2.2 Details of micro data (number of sample households by island and province)

Province	【2014】		【2016】		【2017】	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
Aceh	903	53	1,765	72	1,894	14
Sumatera Utara	7,276	663	6,405	845	6,327	705
Sumatera Barat	2,652	195	4,699	235	3,106	136
Riau	265	218	474	240	821	299
Jambi	682	296	923	293	1,040	246
Sumatera Selatan	1,357	989	2,154	739	1,939	721
Bengkulu	430	63	1,131	142	1,284	128
Lampung	1,872	277	2,146	515	1,899	414
Bangka Belitung	89	104	335	216	379	162
Kepulauan Riau	35	0	70	7	49	15
Sumatera	**15,561**	**2,858**	**20,102**	**3,304**	**18,738**	**2,840**
DKI Jakarta	59	3	52	1	60	2
Jawa Barat	9,234	560	7,856	867	9,406	578

Province	【2014】		【2016】		【2017】	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
Jawa Tengah	8,439	566	9,626	776	10,788	675
DI Yogyakarta	792	190	775	208	798	214
Jawa Timur	8,779	960	8,693	1,245	10,050	1,258
Banten	1,298	137	1,141	156	1,438	152
Java	**28,601**	**2,413**	**28,143**	**3,253**	**32,540**	**2,879**
Bali	1,195	34	1,441	34	1,510	4
Nusa Tenggara Barat	1,149	268	1,602	306	1,914	265
Nusa Tenggara Timur	840	216	1,217	463	1,213	392
Bali/Nusa Tenggara	**3,184**	**518**	**4,260**	**803**	**4,637**	**661**
Kalimantan Barat	693	320	657	347	1,284	467
Kalimantan Tengah	200	506	454	972	397	811
Kalimantan Selatan	1,187	1,076	1,309	1,578	1,494	1294
Kalimantan Timur	502	166	166	56	240	36
Kalimantan Utara	78	24	102	151	143	99
Kalimantan	**2,660**	**2,092**	**2,688**	**3,104**	**3,558**	**2,707**
Sulawesi Utara	293	33	252	29	247	44
Sulawesi Tengah	1,504	0	1,262	184	811	173
Sulawesi Selatan	1,356	71	3,792	309	4,681	208
Sulawesi Tenggara	287	105	1,095	131	1,150	97
Gorontalo	387	7	448	12	475	11
Sulawesi Barat	309	44	576	97	609	86
Sulawesi	**4,136**	**260**	**7,425**	**762**	**7,973**	**619**
Maluku	238	19	108	32	101	38
Maluku Utara	141	58	83	53	34	24
Papua Barat	19	0	83	12	84	4
Papua	11	5	38	3	15	0
Maluku-Papua	**409**	**82**	**312**	**100**	**234**	**66**
Indonesia	**54,551**	**8,223**	**62,930**	**11,326**	**67,680**	**9,772**

Source: JICA Study Team summarized the data from SURVEI UBINAN TANAMAN PANGAN 2014, 2016, 2017 (BPS, 2014, 2016, 2017)

Among the micro data used for statistical analysis, the sample number of irrigated paddy field and rainfed paddy field by island is shown in Table III.2.3. As mentioned above, the number of samples in each survey year varies widely among islands and provinces, and in general, the number of farmers who conduct irrigated paddy cultivation is greater than the number of farmers who are cultivating rainfed paddy, except for Kalimantan.

Table III.2.3 Details of micro data (number of irrigation and non-irrigation samples by island)

Island	【2014】		【2016】		【2017】	
	Irrigation	Non-irrigation	Irrigation	Non-irrigation	Irrigation	Non-irrigation
Sumatera	9,454	6,107	13,164	6,938	12,455	6,283
Java	19,344	9,257	19,656	8,487	24,771	7,769
Bali/Nusa Tenggara	2,859	324	3,705	555	4,065	572
Kalimantan	324	2,336	426	2,262	997	2,561
Sulawesi	2,905	994	5,215	2,210	5,553	2,420
Maluku-Papua	351	58	204	108	140	94
Indonesia	35,237	19,077	42,370	20,560	47,981	19,699

Source: JICA Study Team summarized the data from SURVEI UBINAN TANAMAN PANGAN 2014, 2016, 2017 (BPS, 2014, 2016, 2017)

Among the micro data used for statistical analysis, the sample number of rice cultivars by island is shown in Table III.2.4. The cultivars are divided into three, hybrid seeds, superior seeds and local seeds. Although the number of samples varies widely among islands and provinces in any survey year, it was found that the majority of surveys are generally the number of rice farmers who use superior seeds.

Table III.2.4 Details of micro data (number of rice cultivar samples by island)

Island	【2014】			【2016】			【2017】		
	Hybrid	Superior	Local	Hybrid	Superior	Local	Hybrid	Superior	Local
Sumatera	1,263	9,264	5,034	3,341	16,253	508	1,911	13,060	3,767
Java	1,271	24,710	2,620	2,119	25,809	214	1,902	28,904	1,732

Island	【2014】			【2016】			【2017】		
	Hybrid	Superior	Local	Hybrid	Superior	Local	Hybrid	Superior	Local
Bali/Nusa Tenggara	249	2,347	588	759	3,472	29	329	3,809	499
Kalimantan	102	1,273	1,285	404	2,202	82	257	2,183	1,118
Sulawesi	260	2,097	1,542	1,344	5,936	145	763	5,319	1,980
Maluku-Papua	50	122	237	58	252	2	15	181	38
Indonesia	3,195	39,813	11,306	8,025	53,924	980	5,177	53,456	9,044

Source: JICA Study Team summarized the data from SURVEI UBINAN TANAMAN PANGAN 2014, 2016, 2017 (BPS 2014, 2016, 2017)

The fertilizer application amounts are summarized by type (Urea, TSP / SP36, KCL, NPK, Solid organic fertilizer, Liquid organic fertilizer). In this analysis, the total input of inorganic fertilizer has been used except solid organic fertilizer and liquid organic fertilizer. Among the aggregated data for total input of inorganic fertilizer, data for which exceeds 1,000 kg/ha will be excluded as outliers. Table III.2.5 shows the quartile range[1] of total inorganic fertilizer input by island. Half of the farmers are included between the 1st quartile range value (25th Percentile) and the 3rd quartile range value (75th Percentile). In the surveyed farmers, the range of fertilization amount differs depending on the island, and the amount of fertilization by rice farmers in Java is large in any survey year, while the amount of fertilizer application by rice farmers in Kalimantan tends to be small. The average value in Indonesia as a whole is almost constant regardless of the survey year, and half of the farmers are included in the range of 280 to 600 kg/ha of inorganic fertilizer input.

Table III.2.5 Details of micro data (quartile range of fertilizer input by island)

Island	【2014】				【2016】				【2017】			
	Valid N	Percentile			Valid N	Percentile			Valid N	Percentile		
		25th	50th	75th		25th	50th	75th		25th	50th	75th
Sumatera	14,261	200	350	500	18,711	204	367	526	17,163	208	391	549
Java	24,561	389	500	659	24,027	400	526	675	27,876	395	519	667
Bali/Nusa Tenggara	3,001	286	400	500	3,951	286	400	516	4,348	256	400	500
Kalimantan	2,571	57	200	346	2,602	56	179	303	3,344	75	200	346
Sulawesi	3,623	200	333	500	6,942	229	366	500	7,485	214	357	500
Maluku-Papua	398	250	350	450	264	150	300	400	212	121	267	400
Indonesia	48,415	286	429	595	56,497	279	429	600	60,428	286	438	600

Note: Percentiles are described with Tukey's Hinges.
Source: JICA Study Team summarized the data from SURVEI UBINAN TANAMAN PANGAN 2014, 2016, 2017 (BPS, 2014, 2016, 2017)

(2) Three-Way ANOVA and Post Hoc Test (Simple Main Effects and Multiple Comparisons)

Since a sufficient number of samples are required to perform analysis of variance (ANOVA), it was decided to pool the data sampled for each province by island for statistical analysis and treat the island as a blocking factor[2]. In this statistical analysis, an experimental design for three-way ANOVA is aimed at clarifying the difference between irrigation and non-irrigation, the difference between rice cultivars, the difference in the amount of fertilizer application, and the interaction between each factor (Table III.2.6). The level of each factor is 2 levels for irrigation condition with/without irrigation, 3 levels for rice cultivars with hybrid seeds, superior seeds and local seeds, and 4 levels for total input fertilization rate with less than 280 kg/ha, 280-430 kg/ha, 430-600 kg/ha, and more than 600 kg/ha. In addition, it was decided to exclude the yield data as outliers for the data exceeding 12 ton/ha. ANOVA and post hoc test (simple main effects and multiple comparison) were conducted using 2017 micro data which is the most recent updated data and with a large number of samples.

Table III.2.6 Experimental design for factorial analysis

Blocking Factor (Island)	*Sumatera*	*Java*	*Bali/Nusa Teng*	*Kalimantan*	*Sulawesi*	*Maluku-Papua*
Fixed Factors	Fertilizer	Fertilizer	Fertilizer	Fertilizer	Fertilizer	Fertilizer

[1] Quartile range: In descriptive statistics, an indicator that represents the variation in a data set. When the data is arranged in order, the value located at 25% from the bottom, the value located at 50%, and the value located at 75% are so called the first quartile, the second quartile and the third quartile, respectively.
[2] Blocking factor: A factor used for control to improve the accuracy of the experiment, and the investigator is not interested in the difference of the blocking factor itself.

Land Type	Cultivar	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Irrigation	Hybrid				Treatments, Land use x Rice Variety x Fertilizer, are randomly assigned experimental units such that each treatment occurs in each block (island)																				
	Sperio																								
	Local																								
Rainfed	Hybrid				Treatments, Land use x Rice Variety x Fertilizer, are randomly assigned experimental units such that each treatment occurs in each block (island)																				
	Sperio																								
	Local																								

Note: Fertilizer amount of 1 is less 280 kg/ha, 2 is from 280-430 kg/ha, 3 is from 430-600 kg/ha and 4 is more than 600 kg/ha
Source: JICA Study Team (2019)

The ANOVA table is shown in Table III.2.7. As a result of ANOVA, statistically significant differences were found in all three factors of irrigation condition, rice cultivars and fertilization. Also, the interaction between irrigation and rice cultivars was significant. Based on the result of ANOVA, a simple main effect test for rice planting variety under different irrigation conditions and multiple comparison test for each factor were conducted as a post hoc test.

Table III.2.7 ANOVA table (2017)

Source	Type II SS	df	MS	*F*	Sig.
Island (Block)	8,754.027	5	1,750.805	803.539	.000
Irrigation (I)	2,432.678	1	2,432.678	1,116.487	**.000**
Variety (V)	1,991.415	2	995.708	456.984	**.000**
Fertilizer (F)	3,283.345	3	1,094.448	502.301	**.000**
I x V	49.937	2	24.968	11.459	**.000**
I x F	13.808	3	4.603	2.112	.096
V x F	23.505	6	3.917	1.798	.095
I x V x F	17.784	6	2.964	1.360	.226
Error	131,459.825	60334	2.179		
Total (Corrected)	163,231.363	60,362			

Note: Instead of Type III SS, Types II SS was applied since the sample sizes are different among groups (unbalanced data sets)
Source: JICA Study Team (2019)

a) Irrigation

As a result of ANOVA, it was revealed that the paddy yield under irrigation conditions was significantly higher than that under non-irrigation conditions in the survey year in 2017. The yield under irrigation condition is 6.4 ton/ha on average, which is about 16% higher than the average yield of 5.5 ton/ha under non-irrigation condition. Also, as shown in the Figure III.2.1, average paddy yield in the surveys as of 2014 and 2016 show the same trend as yield obtained in 2017.

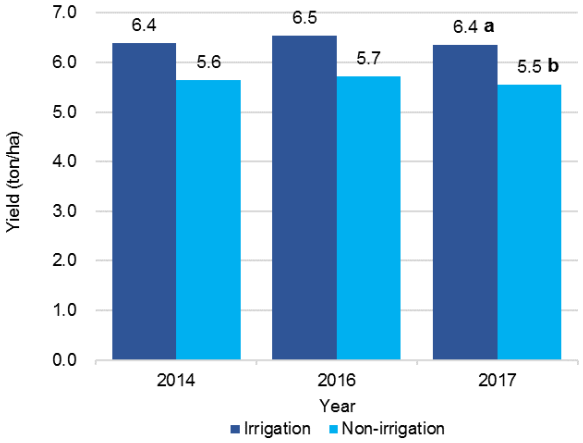


Fig. III.2.1 Paddy yield under irrigated and non-irrigated conditions (2014, 2016 and 2017)

Note: Means on the top of bar followed by different letters are significantly different, ANOVA, p = 0.05.
Source: JICA Study Team (2019)

b) Quality Seed

As a result of ANOVA, interaction was observed between irrigation and rice cultivars, so in order to clarify the effect of rice cultivars on paddy yield under different irrigation conditions, simple main effect test was performed (Table III.2.8). As a result of simple main effect test, significant differences were found under both irrigation and non-irrigation conditions. Post hoc multiple comparison (Bonferroni test[3]) was conducted. From the results of the multiple comparison, it became clear that the yield response of the cultivar differs under irrigation and non-irrigation conditions (Fig. III.2.2). While the yield of superior seeds was significantly higher than that of hybrid seeds under irrigation conditions, there was no difference between the yield of superior seeds and hybrid seeds under

[3] Bonferroni test: which is one of the multiple comparison tests and type I error can be adjusted by dividing the significance level of the whole test by the test number.

non-irrigated conditions. This indicates that the use of hybrid seeds can be expected to be expressed more yield characteristics under non-irrigated conditions than under irrigation conditions.

Table III.2.8 F test on simple main effect of rice cultivars (2017)

Source		SS	df	MS	*F*	Sig.
Irrigation	Contrast	1,131.071	2	565.536	259.555	**.000**
	Error	131,459.825	60,334	2.179		
Non-irrigation	Contrast	663.651	2	565.536	152.293	**.000**
	Error	131,459.825	60,334	2.179		

Note: Each F tests the simple effects of Var within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.
Source: JICA Study Team (2019)

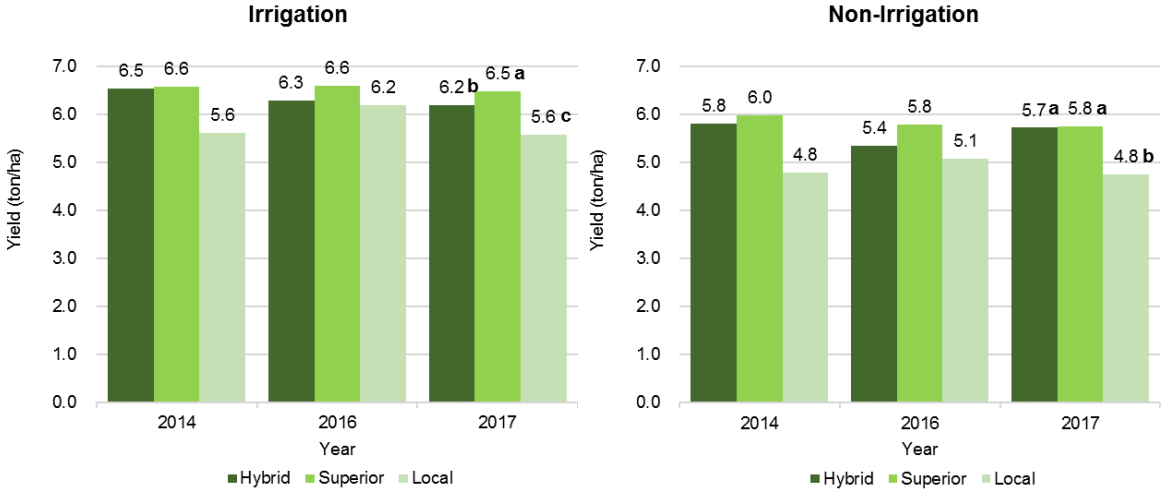


Fig. III.2.2 Paddy yield in different cultivars under irrigation and non-irrigation conditions (2014, 2016 and 2017)

Note: Means on the top of bars followed by different letters are significantly different, Bonferroni test, p = 0.05.
Source: JICA Study Team (2019)

c) Fertilizer Inputs

From the results of ANOVA, a significant difference was found in the amount of fertilizer input. Furthermore, a multiple comparison (Scheffe's test[4]) was conducted to clarify differences among fertilization levels (among four different fertilization amounts). From the results of the multiple comparison, it was revealed that statistical difference was obtained among all the fertilization levels, and the higher the fertilization amounts, the higher the yield could be obtained. By applying fertilizer more than 430 kg/ha, paddy yield can reach 6.5 ton/ha on average, and it is approximately 22% higher than the average yield of 5.3 ton/ha by applying fertilizer less than 280 kg/ha. It is possible to confirm the increase in the yield of paddy by the appropriate fertilizer input (Fig. III.2.3).

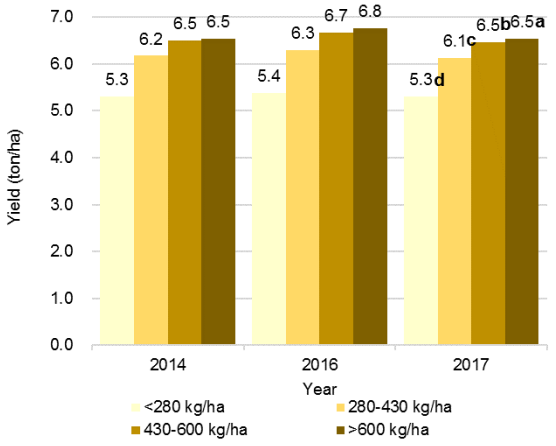


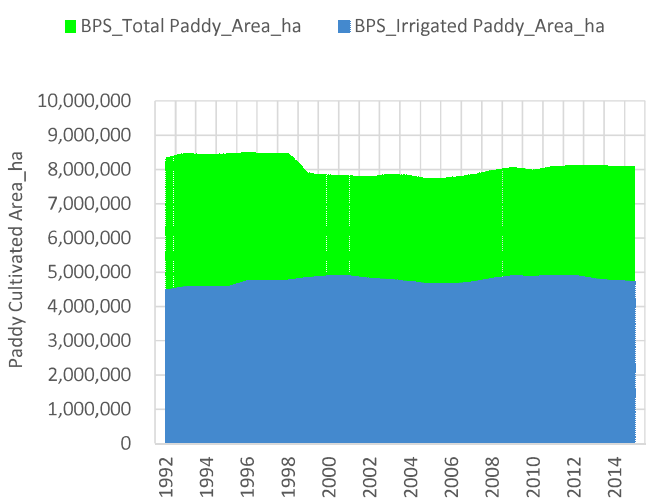
Fig. III.2.3 Paddy yield at different fertilization rates (2014, 2016 and 2017)

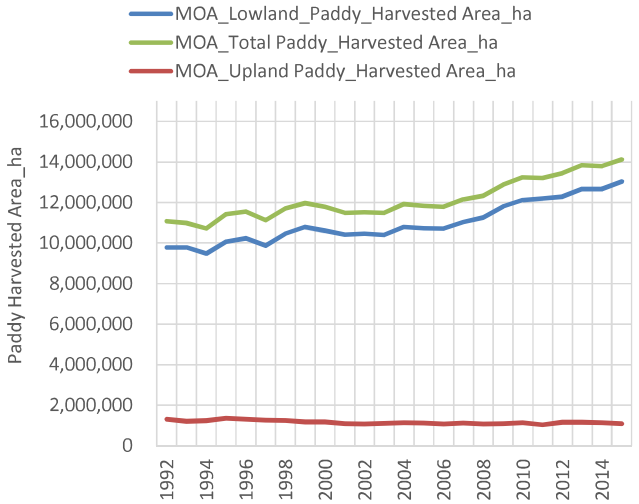
Note: Means on the top of bar followed by different letters are significantly different, ANOVA, p = 0.05.
Source: JICA Study Team (2019)

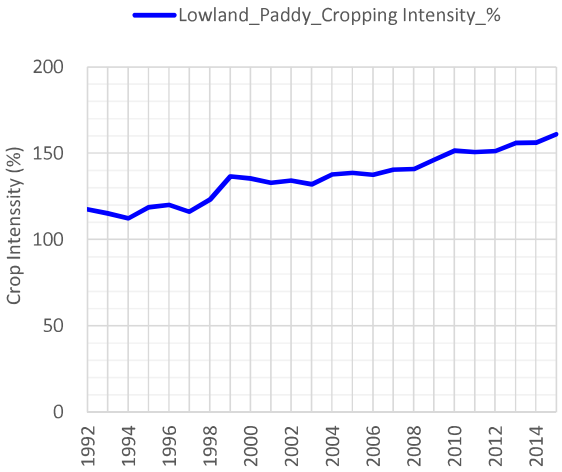
[4] Scheffe's test:

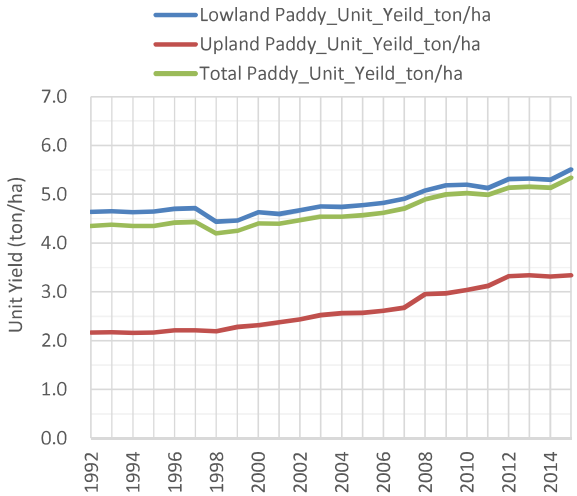
III-2 Statistics regardig Paddy Field by Island

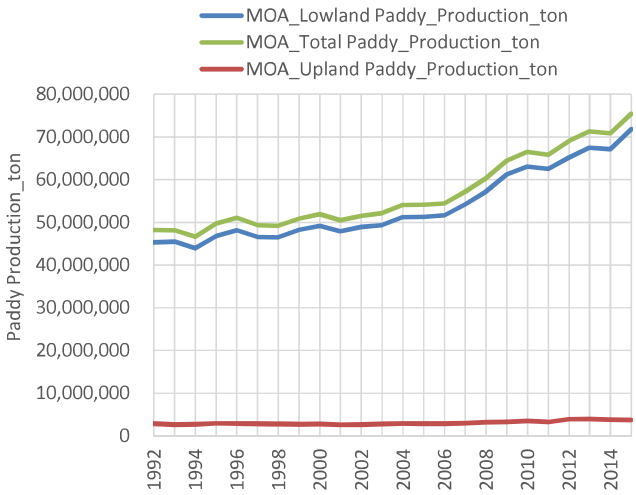
Island ID: 7 Island Area: 5,377,020,678 ha
Island: **Indonesia**





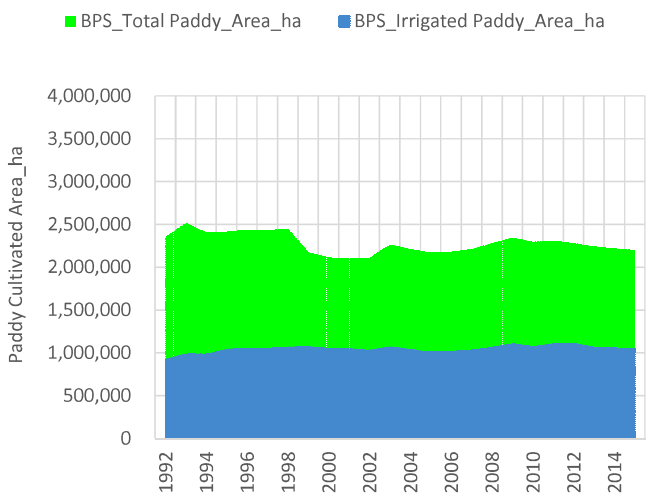


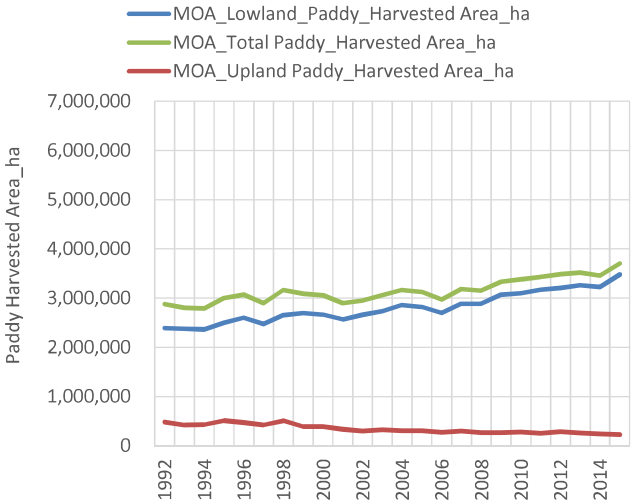


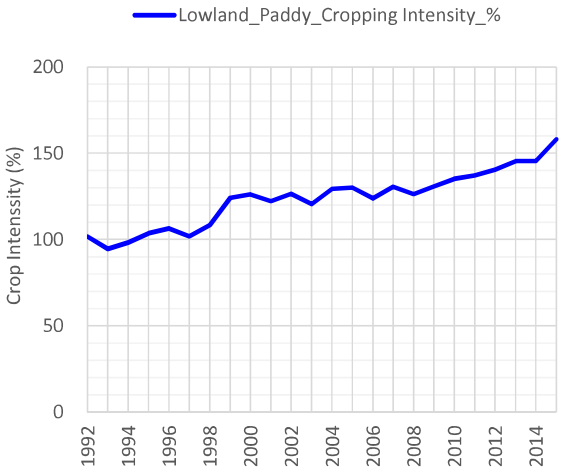


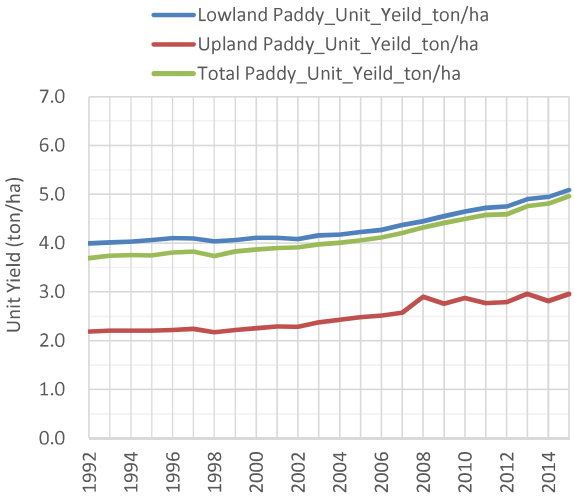
Island ID: 1 Island Area: 47,355,856 ha

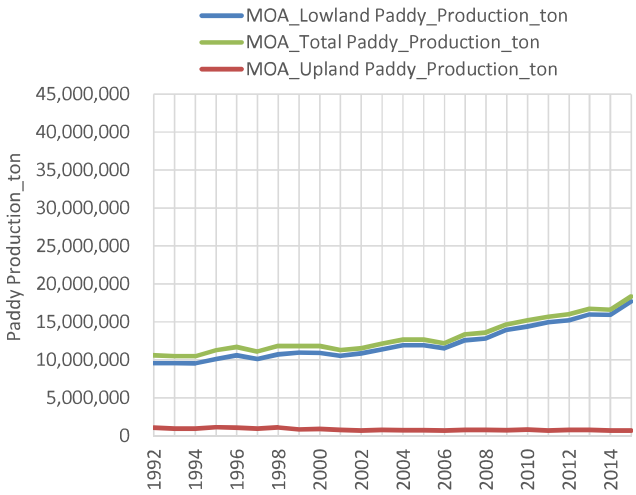
Island: **Sumatera**





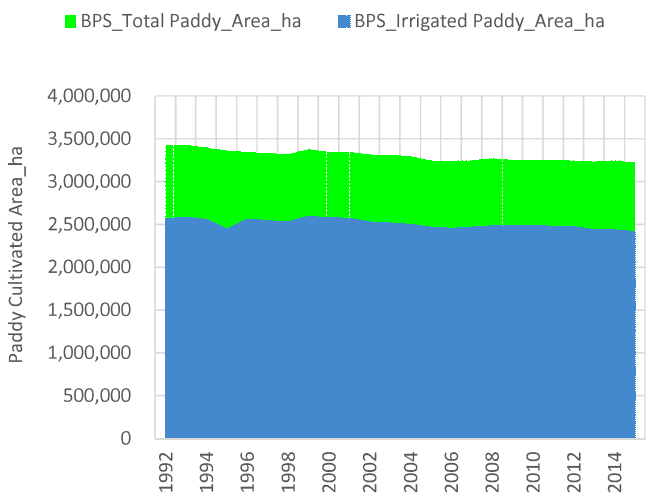


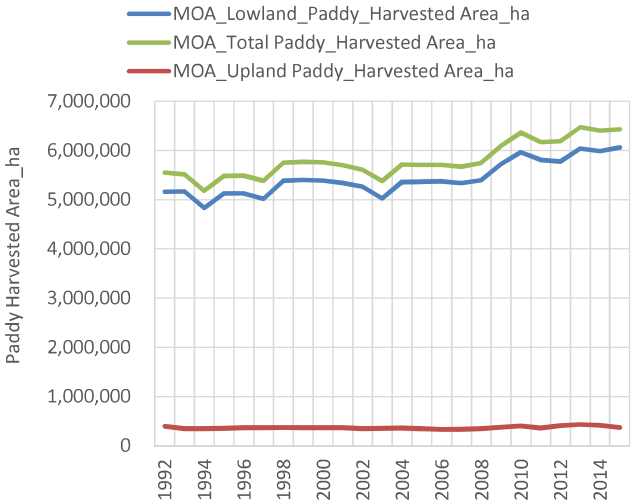


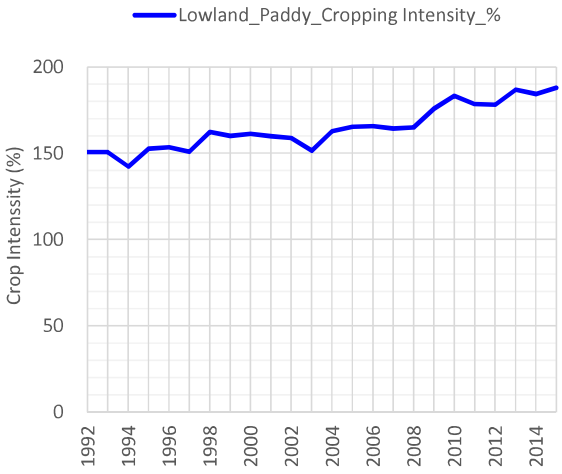


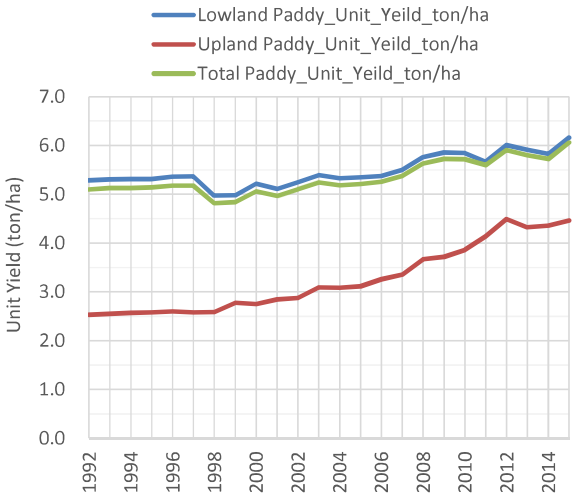
Island ID: 2 Island Area: 13,244,814 ha

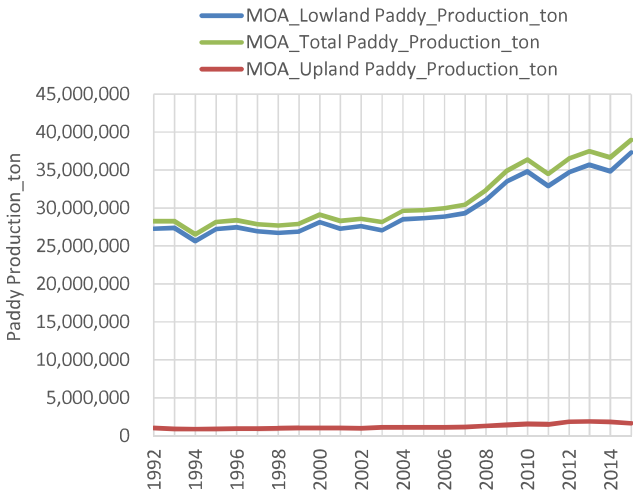
Island: **Java**





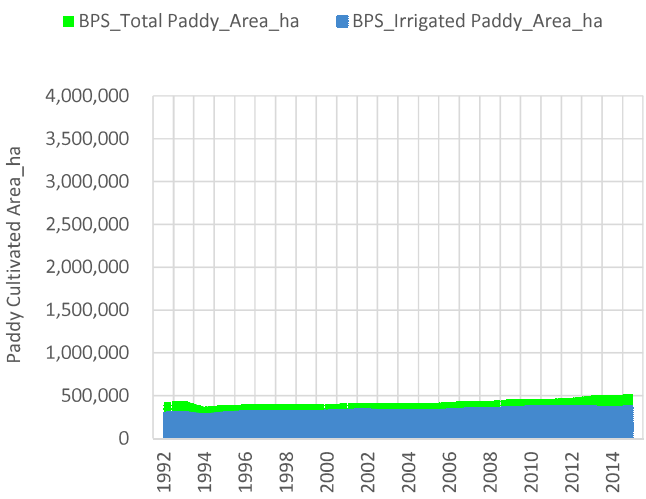


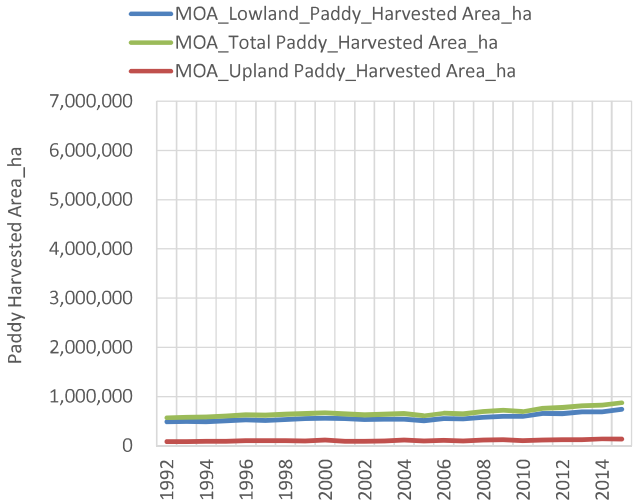


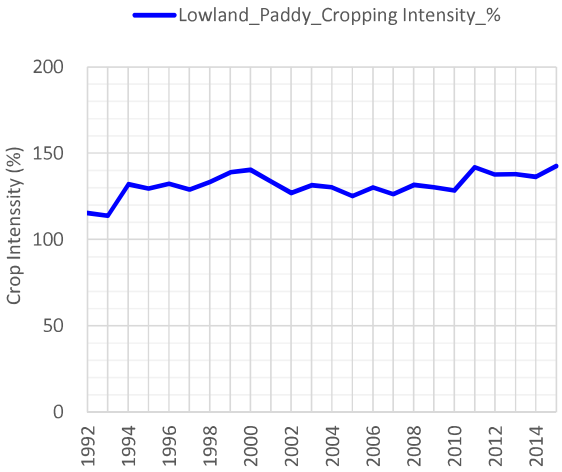


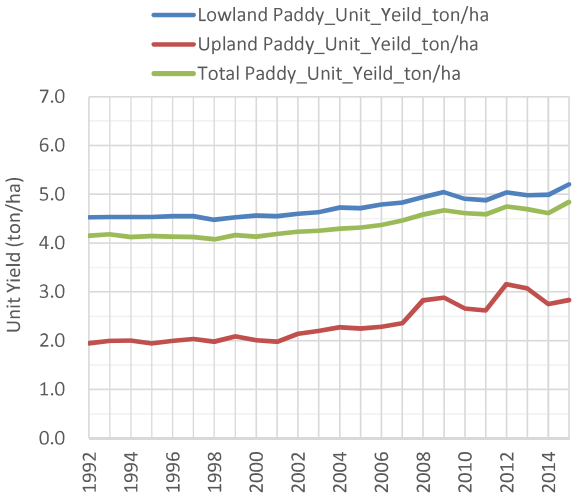
Island ID: 3 Island Area: 7,150,286 ha

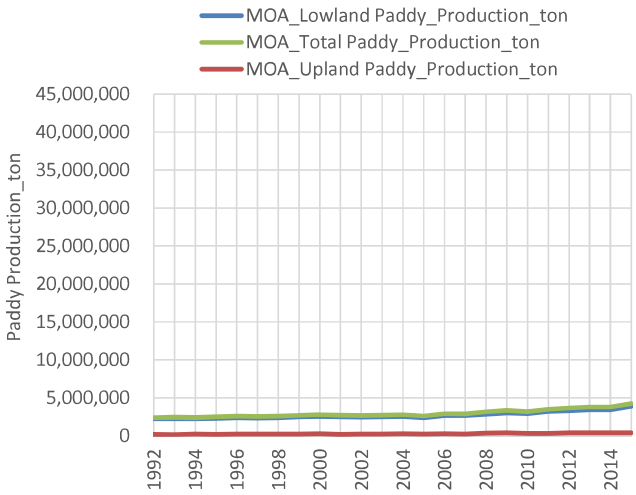
Island: **Bali Nusa Tenggara**





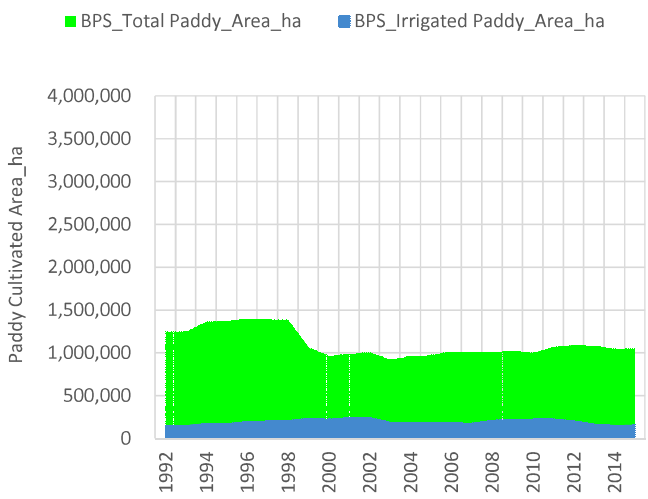


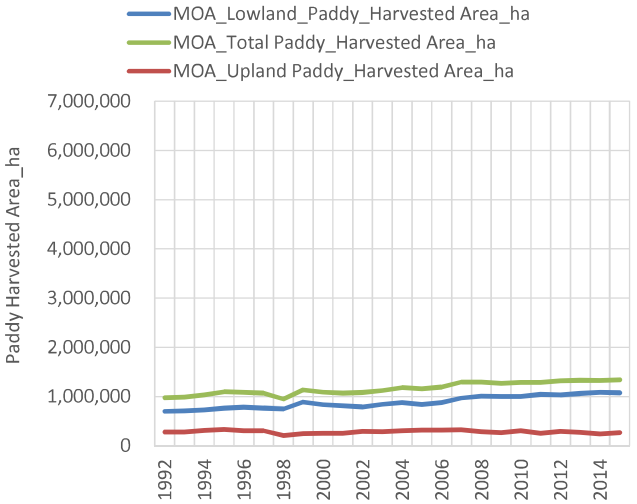


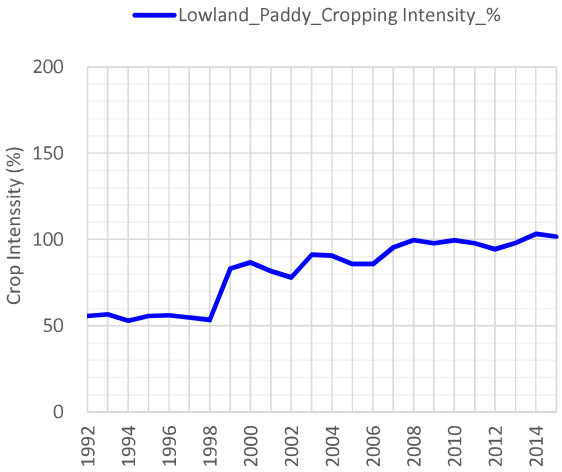


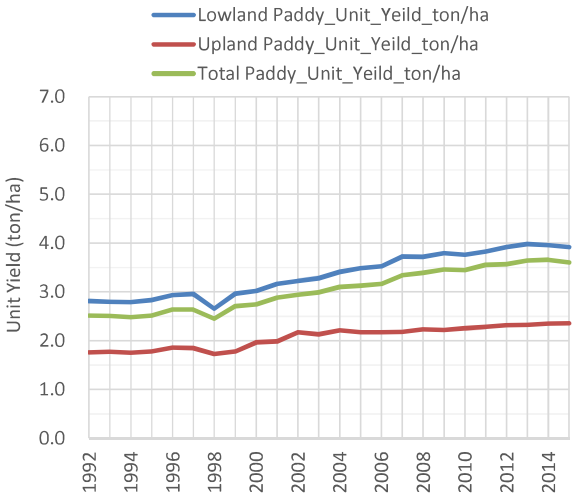
Island ID: 4 Island Area: 53,418,695 ha

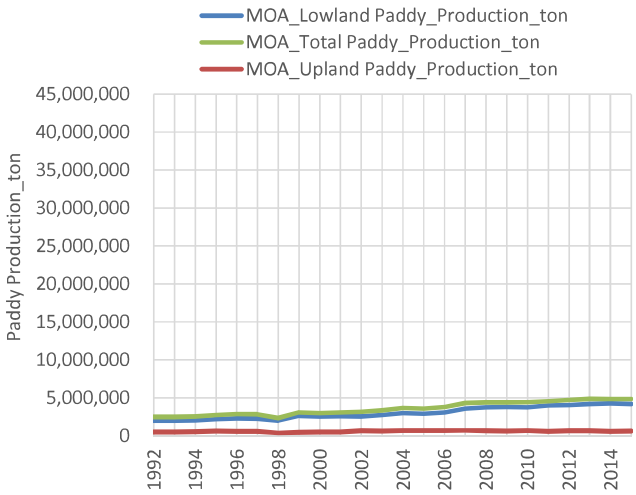
Island: **Kalimantan**





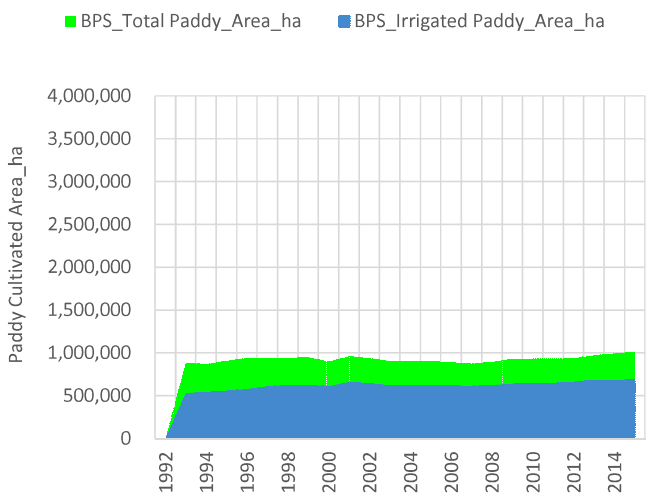


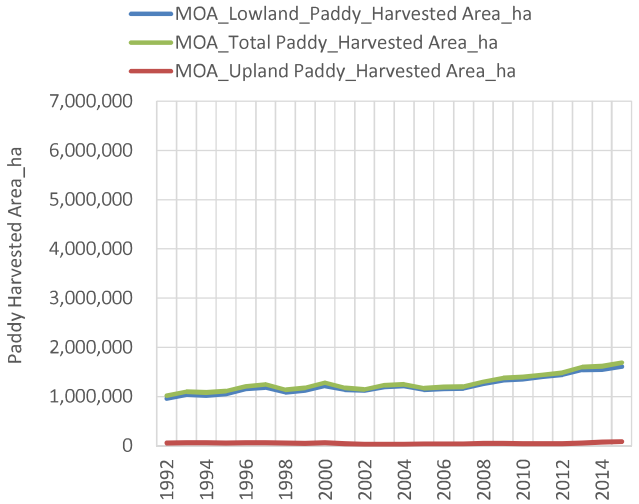


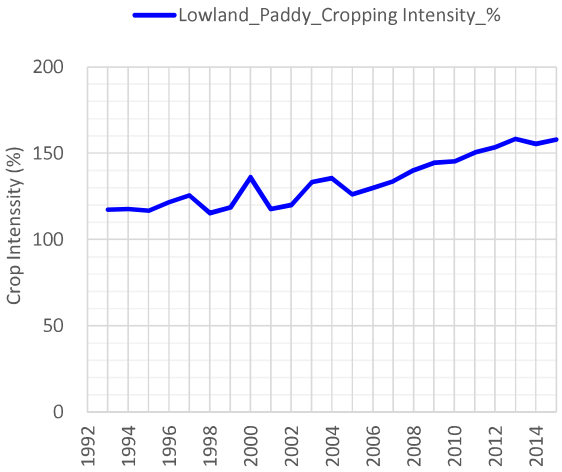


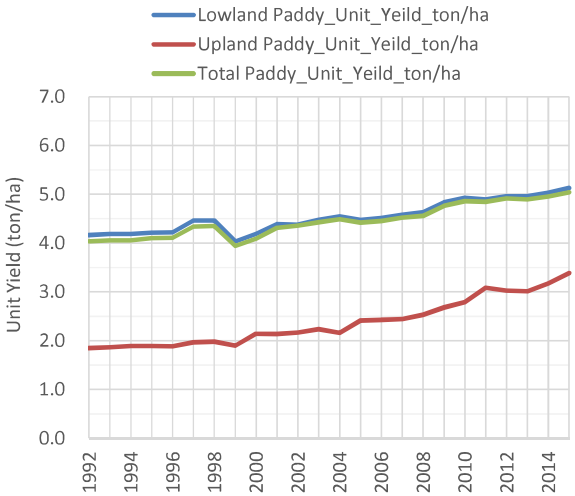
Island ID: 5 Island Area: 18,559,085 ha

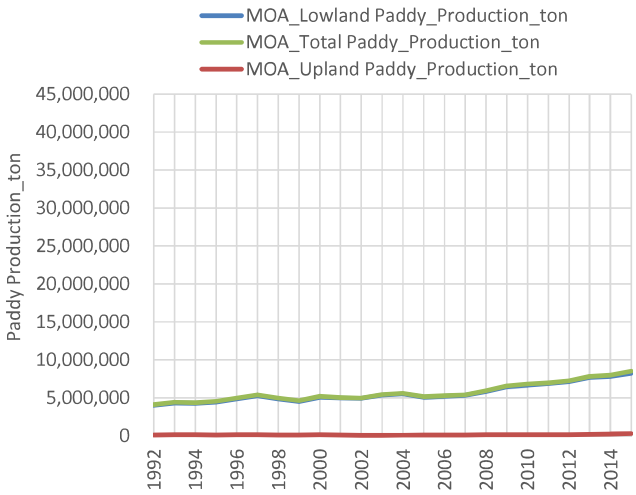
Island: **Sulawesi**











Island ID: 6 Island Area: 48,769,619 ha

Island: **Maluku/Papua**