APPLICATION OF MASSCOTE APPROACH IN MODERNIZATION OF IRRIGATION SYSTEM - A CASE STUDY FOR TANJUNG KARANG RICE IRRIGATION SCHEME, MALAYSIA

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CONTENTS

INTRODUCTION

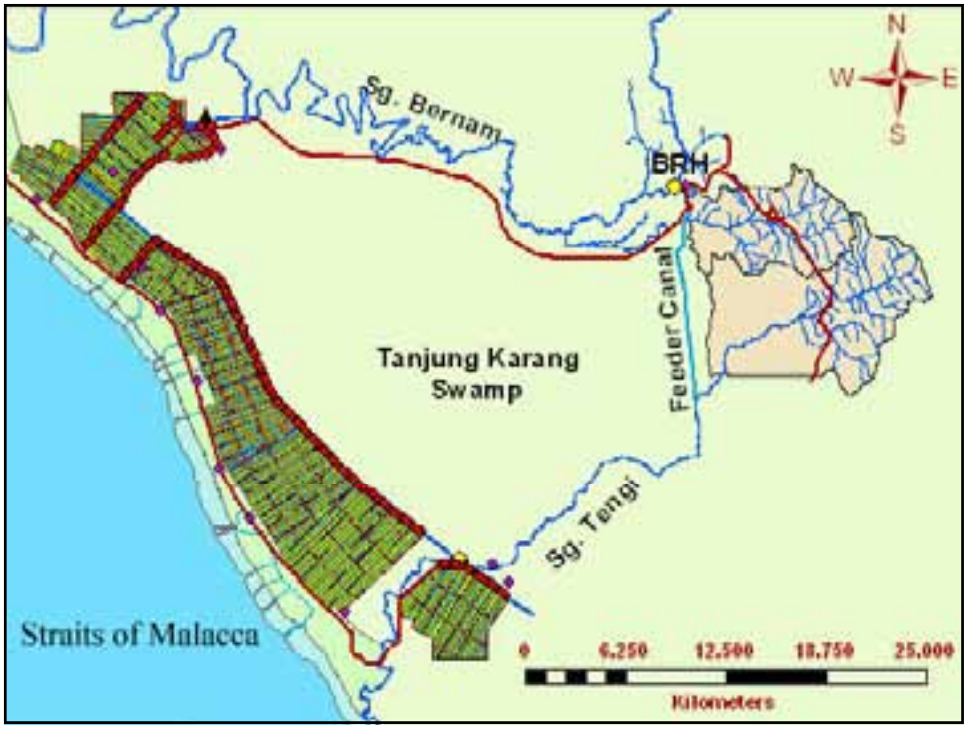
- With the total command area of 19 000 ha and average yield of 5.0 t/ha each season and cropping intensity of 200 percent annually, this scheme is considered as the most productive and progressive scheme in Malaysia.
- To achieve a new target of average rice yield of 10 t/ha per season, this scheme needs to be modernized in terms of irrigation infrastructures and rice production management.
- The modernization is critically required to ensure the scheme's ability to support double cropping of rice cultivation with high yielding variety, and fully mechanized production, increase water use efficiency for economical and environmental sustainability.

INTRODUCTION (cont.)

- The Irrigation and Agricultural Drainage Division Ministry of Agriculture and Agro-based Industry Malaysia envisage reforms in the scheme management and infrastructure development to modernize the production system and water resources, irrigation and drainage systems.
- The MASSCOTE approach has been used to generate practical options and solutions for services and operation of the scheme.
- TAKRIS has been selected as a pilot project for the irrigation and farm management modernization program which will then be replicated in other rice granary areas in Malaysia.
- This presentation will elaborate on the method, concept, planning and execution of the MASSCOTE approach for Irrigation Modernization of the Scheme.

DESCRIPTION OF THE PROJECT AREA –TAKRIS

1	Gross command area (ha)	19,000
2	Net command area (ha)	18,800
3	Secondary Canals (no./length in km)	6/33
4	Tertiary canals (no./length in km)	113/493
5	Main canal Off-takes to secondary canal (no.)	5
6	Main canal and Secondary canal Off-takes to tertiary canal (no.)	113
8	Direct field off-takes on tertiary canal (no.)	16,000
9	Drainage system (length in km)	800
10	Diversion and intake structures	1
11	Main Pumping Station(no of pumps)	3



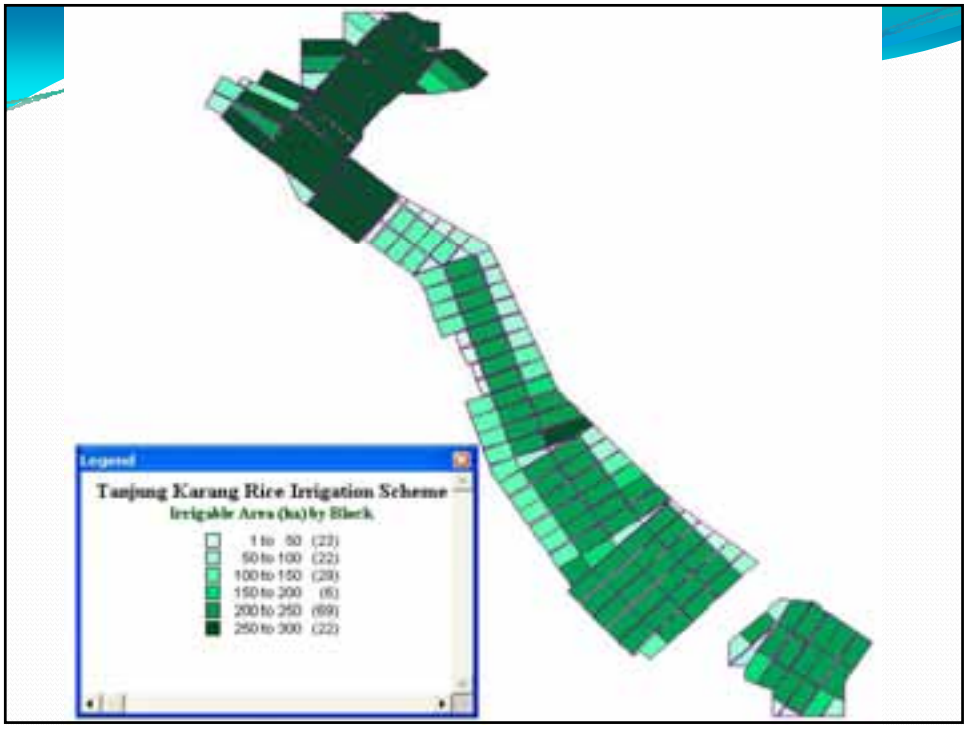

BERNAM RIVER HEADWORKS


FEEDER CANAL


SECONDARY CANAL


TERTIARY CANAL (DELIVERY CANAL)


Legend
Tanjung Karang Rice Irrigation Scheme
Net Irrigable Area (ha) by Compartment
1,471 (1)
2,041 (1)
1,483 (1)
1,886 (1)
1,839 (1)
2,308 (1)
2,813 (1)
3,288 (1)


Legend
Tanjung Karang Rice Irrigation Scheme
Irrigable Area (ha) by Block
1 to 50 (23)
50 to 100 (22)
100 to 150 (29)
150 to 200 (6)
200 to 250 (69)
250 to 300 (22)

METHODOLOGY

- Rapid Appraisal Procedure (RAP) evaluation of TAKRIS was conducted in September 2007 to evaluate the performance of the scheme and utilize the outcome of the evaluation for making the recommendations for the modernization plans of the project.
- In the same year, FAO produced Irrigation and Drainage Paper No. 63 on Modernization Irrigation Management – the MASSCOTE approach.
- As to ensure appropriate investment of the allocated fund and anticipated future allocation, Irrigation and Agricultural Drainage Division, Ministry of Agriculture and Agro-based Industry took the proactive action to provide appropriate irrigation modernization programs for the current and future 5 years National development plans.
- MASSCOTE approach for irrigation modernization has been utilized to plan the irrigation modernization programs of the scheme.

RAP OPENING CEREMONY BY DIAD DIRECTOR

RAP WORKSHOP PARTICIPANTS

RAP - INTERVIEW WITH FARMERS

RAP - FARMER GROUP

RAP - THIRD LEVEL CANAL EVALUATION

EXTERNAL INDICATORS	MADA	KADA	PNG	KRN	SGM	BLS
Output Per Cropped Area (USD/ha)	1471	651	792	847	478	1032
Output Per Unit Irrigation Supply (USD/m^3)	0.120	0.069	0.055	0.035	0.017	0.016
Relative Water Supply	6.4	4.2	4.85	6.14	6.9	6.9
Relative Irrigation Supply	2.4	1.7	2.1	2.1	4.7	4.6
Main Canal Water Delivery Capacity (%)	123	131	134	66	59	52
O and M fees collected (%)	0.6	0.0	0.0	0.0	0.0	0.0
Irrigation Efficiency (%)	42	45	39	48	17	19

1. Rapid Appraisal Procedure (RAP) in TAKRIS – External Indicators

- RAP external indicators indicated the comparatively good output per unit area
- Indicators relating water use, such as output per unit irrigation supply, relative water supply, relative irrigation supply, main canal delivery capacity and irrigation efficiency are all far below expectation.
- Thus, apart from improving crop yield, water use efficiency should be given emphasis.
- There are also lack of farmers' participation and contribution in management, operation and maintenance of the scheme.

RAP'S INTERNAL INDICATORS

ELEMENTS EVALUATED	MAIN CANAL	SECONDARY CANAL	TERTIARY CANAL
CANAL CROSS REGULATOR HARDWARE	1.7	1.3	1.0
TURN-OUT FROM CANAL	2.7	2.7	1.7
REGULATING RESERVOIR	0	0	0
COMMUNICATION ALONG CANALS	2.6	3.4	2.4
GENERAL CONDITIONS OF CANALS	2.8	2.8	1.8
OPERATION OF CANALS	2.9	3.0	2.

WATER DELIVERY SERVICE INDICATORS

	INDICATORS
ACTUAL WDS BY MAIN CANAL TO SEC. CANAL **A) FLEXIBILITY** **B) RELIABILITY** **C) EQUITY** **D) CONTROL OF FLOW RATE**	**2.0** **1.0** **3.0** **2.0** **2.0**
ACTUAL WDS AT THE MOST D/S POINT OPERATED BY PAID EMPLOYEES **A) NO OF FIELD D/S OF THIS POINT** **B) MEASUREMENT OF VOLUME** **C) FLEXIBILITY** **D) RELIABILITY** **E) APPERENT EQUITY**	**1.2** **0** **2.0** **1.0** **1.0** **1.0**
WDS TO INDIVIDUAL UNITS **A) MEASUREMENY OF VOLUME** **B) FLEXIBILITY** **C) RELIABILITY** **D) APPERENT EQUITY**	**2.5** **3.0** **2.0** **3.0** **2.0**
SOCIAL ORDER	**1.5**

9 Mapping options for canal operation improvements and sub unit improvement

A. Proposed improvements for TAKRIS

a) Water management improvement strategy to increase water productivity

- Water management strategy for the main canal system requires the improvement of the feeder canal and Tengi River conveyance and the main canal conveyance and structures.
- The aim of water management strategy is to increase water productivity and efficiency through minimizing water losses, managing perturbations and consolidation of flow control throughout the scheme.
- The existing regulator, located at the end of the ISA 1 is unable to provide the required water control to meet the requirement of these two compartments. Additional regulator is required to improve water management for the two compartments.
- At the unit level, the existing practice differed with the original design where the tertiary canal supply based on rotational supply between head and tail-end users. The pre-saturation period is reduced to less than 14 days to suit the new farm operation and crop water requirements.
- The larger plastic siphons have been widely used to tap water from the tertiary concrete canals. The indiscriminate use of siphons has caused the low equity along tertiary canals and waste of water through runoff flows from the field to drains.
- The new strategies are required for water management at the scheme and tertiary canal level.

9 Mapping options for

9. Mapping options for canal operation improvements and sub unit improvement

c) Improvement for cost effectiveness

- Operation accounts for a major cost of irrigation management.
- Options as to improve cost effectiveness are through reducing frequency of adjustments of new design of regulator and off-take structures, automate or mechanize the gate operation of main gated structures and utilize an effective information management system

9. Mapping options for canal operation improvements and sub unit improvement

d) Conjunctive use of water

- The proposed conjunctive use of irrigation water, rainfall and recycling of water from drainage canals or regulating reservoir for the scheme through the construction of regulating reservoirs and storages, recycling water from drainage system and separation of irrigation canal and drainage system to prevent the inflow of acidic water from the swamp area

9. Mapping options for canal operation improvements and sub unit improvement

e) Improving sub unit operation

- Water management for tertiary system requires extra attention due to its important role to provide excellent water delivery service to support new high yielding rice cultivation and associated farm management.
- Tertiary canal water management is closely related to on-farm water use and management, hence should be considered together.
- For this purpose, research through a pilot project was proposed to indentify the most appropriate design of the structures and management system at this level.
- Conjunctive use of water from drainage system through the provision of recycling pumping stations at the tertiary canal system is proposed to increase water productivity and fast response to crop water needs.

10. Integrating service oriented management options

a) Aggregating the rationale of sub units at upper level

- The rationale of water management, service, and operation at the compartment and tertiary canal level is subjected to the current and future needs for cultivation of high yielding rice cultivation, application of precision farming and irrigation, utilization of modern farm machineries to increase farm efficiency, increase water use efficiency at tertiary and on farm level, optimization of “effective rainfall” and control of chemical flow to the drainage system through surface runoff and seepage. This will require equitable, reliable and flexible supply from the main canal and secondary canal systems.
- The water management and service delivery from the main canal to secondary and tertiary canals need to be improved through various physical and managerial interventions.

10. Integrating service oriented management options

b) Reaching a compromise between costs and service

- Reaching a compromise between technical opportunities and constraints, farmers' desires influenced by the agricultural system, and cost of operation incurred are very difficult to achieve within the limited time frame.
- This will require extensive negotiation between farmers and the government, represented by the Irrigation and Agricultural Drainage Division, Ministry of Agriculture and Agro-based Industry.
- As to encourage farmers to increase rice production, various incentives have been introduced by the government, including provision of better irrigation and drainage infrastructures to support the drive.
- Taking this opportunity, the plan for modernization through government allocation is targeted to increase water delivery service quality to make it convenient for the farmers to accept the responsibility and obligations after benefiting from the better service provided.

10. Integrating service oriented management options

c) Service agreements

- To date, there is no proper service agreement in the scheme between the users and service provider.
- This will take some time as the WUG that will represent the users is still in the formation process. Negotiation will only possible when the farmers are appropriately represented in the process.

11. MODERNIZATION PLANS FOR TAKRIS (2008 - 2020)

- For TAKRIS, the vision of the scheme and irrigation modernization covering the agriculture and water management domains has been decided by the management as:

"Tanjung Karang Rice Irrigation Scheme to become national and world leader in RICE producing industry through the application of latest technology for high yielding rice, creation of progressive, united and commercial farmers, efficient and effective water management and project economic and environmental sustainability by the year 2020"

- Modernization Plan for TAKRIS is divided into three phases:

a) Phase 1 Ninth Malaysia Plan (2006 to 2010); and

b) Phases 2 & 3 (Tenth and Eleventh Malaysia Plan (2011 to 2020).

a) Phase 1 - Ninth Malaysia Plan (2006 to 2010) – allocation MR100 million (about USD25 million)

i. Redesign and construction of feeder canal and Tengi River with the provision of appropriate canal section, continuous bunds and drains

ii. Desilting of main canal system and provision of farm road and continuous bund along the main canal

iii. Design and construction of a new cross regulator at Sungai Burung Irrigation Compartment. New modernized design should include features such as mechanized gate lifting and long crested side weirs

iv. Construction of a regulating reservoir.

v. Construction of electrical submersible pumping stations for drainage water recycling

a) Phase 1 - Ninth Malaysia Plan (2006 to 2010) – allocation MR100 million (about USD25 million)

vi. Pilot project on improvement of tertiary canal and on farm infrastructures and water management for higher land and water productivity and good control of chemical and rainfall optimization

vii. Provision of real time SCADA system for water management of main canal system with the installation ADFM for flow measurement and water level monitoring equipment, rainfall stations and other ancillary facilities

viii. Feasibility study for the construction of main reservoir close to the scheme area.

ix. Planning and design of storage system for Bagan Terap Pumping Station

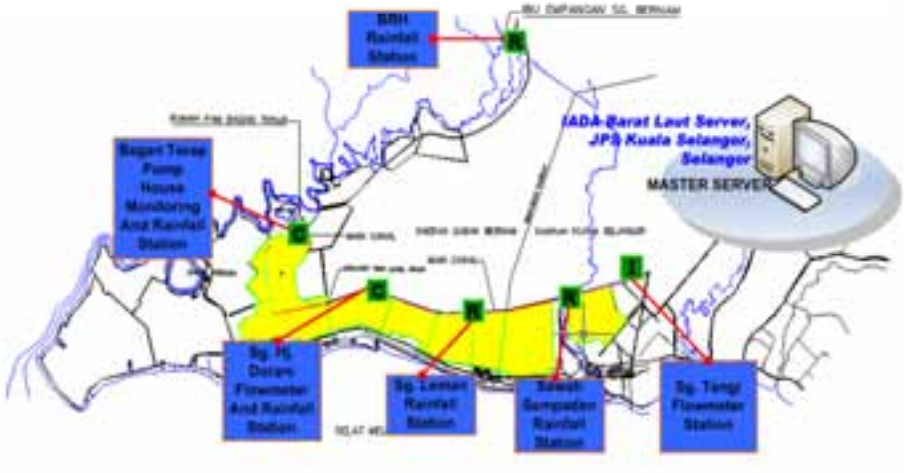
x. Rehabilitation and upgrading of existing concrete lined secondary canals

xi. Training for managers, operators and farmers

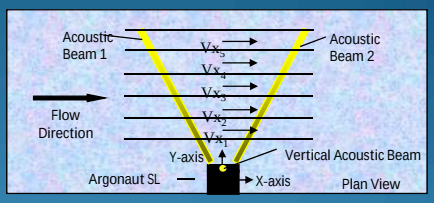
New regulator provided with long side weirs to reduce canal and structure's sensitivity

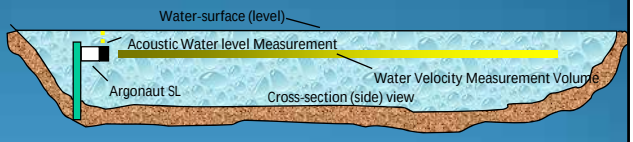
New regulator provided with long side weirs to reduce canal and structure's sensitivity

SCADA SYSTEM COMPONENTS



Principles of Doppler Sensor





SCADA SYSTEM - Sg. Tengi Station

Stesen Sg. Tengi

SCADA SYSTEM - Sg. Tengi Station

Pilot project:
Flowmeter for tertiary canal connected to SCADA system

UPGRADING OF SECONDARY CANALS

UPGRADING OF SECONDARY CANALS

PERMANENT RECYCLING PUMPING STATIONS AT TERTIARY CANAL LEVEL

RECONSTRUCTION AND UPGRADING OF FEEDER CANAL AND TENGI RIVER CONVEYANCE SYSTEMS

RECONSTRUCTION AND UPGRADING OF FEEDER CANAL AND TENGI RIVER CONVEYANCE SYSTEMS

DESILTING AND FORMATION OR BUNDS ALONG THE MAIN CANAL

Construction of regulating reservoirs

Construction of regulating reservoirs

b) Phases 2 and 3 – Tenth and Eleventh Malaysia Plan (2011 to 2020)

i. Constructions of the two cross regulators along main canal.
ii. Construction of the main reservoir.
iii. Construction of storage system for Bagan Terap Pumping Station
iv. Improvement of tertiary canal and on farm infrastructures as recommended by the pilot study
v. Extension of real time SCADA system for water management to the secondary canal systems with the installation of ADFM for flow measurement and water level monitoring equipment, rainfall stations and other ancillary facilities
vi. Design and construction of secondary canal upgrading to tertiary canal to improve water delivery service and reduce losses
vii. Training for managers, operators and farmers

MONITORING AND EVALUATION

- For the purpose of monitoring and evaluation of TAKRIS, three activities have been planned:

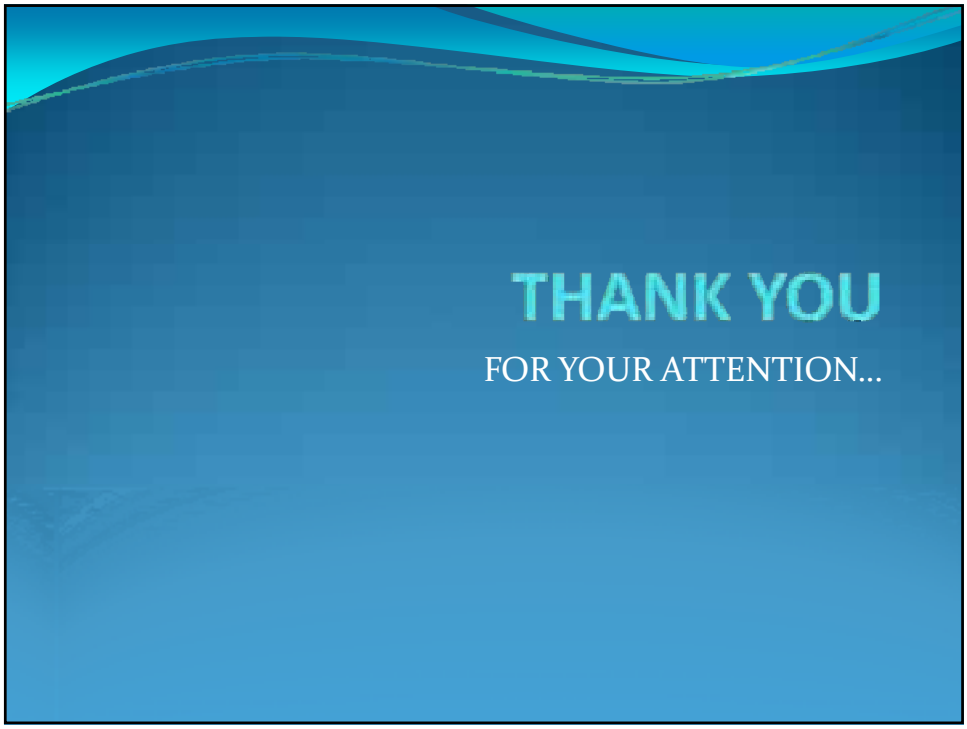
i. Conducting RAP three months after the end of each Development Plan and Mid Term Review of the plans

ii. Benchmarking of the scheme every year

iii. Continuous monitoring for all aspects of irrigation management.

CONCLUSIONS

- Application of MASSCOTE for irrigation modernization of TAKRIS has successfully provided the stakeholders a clear picture on the type and method of irrigation modernization, aspect and areas to be given priorities, planning and scheduling of modernization plans and finally the required continuous monitoring and evaluation of the modernization programs.
- With the clear insight of the modernization related factors, the appropriate management intervention and financial investments and physical development can be properly scheduled, implemented and monitored.
- TAKRIS is an example of the application of this approach in irrigation modernization with clear vision on the future agriculture and water management of the scheme.
- As modernization is a long term and continuous process, the implementation plans, continuous monitoring and evaluation, continuous improvement through corrective actions will ensure the achievement of the scheme's vision.


THANK YOU
FOR YOUR ATTENTION...