The Fourth International Conference on Sustainable Infrastructure and Built Environment
March 8-9, 2022

Analysis of the five pillars of irrigation modernization with the masscote method in the macan irrigation area.

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Abstract

Macan Irrigation Area is part of Jatiluhur Irrigation Area which is included in the scope of irrigation modernization in Indonesia. Irrigation modernization consists of five pillars, the first pillar of water availability, the second pillar of irrigation infrastructure, the third pillar of irrigation management system, the fourth pillar of irrigation management institutions, the fifth pillar of human resources. To find out the readiness of irrigation modernization in Indonesia, one way to measure it is with the Irrigation Modernization Readiness Index (IKMI). The readiness of irrigation areas can be categorized into 4 (four) categories, > score 80: predicate is sufficient and modernization can be applied, score 50-80: predicate is sufficient, modernization is delayed, improvements are made according to the results of IKMI 1 - 2 years, < value 50: predicate less, modernization is delayed, irrigation system improvements are carried out for 2-4 years, < value 30: predicate is very bad. This paper is about analyzing the five pillars of irrigation modernization with the MASSCOTE (Mapping System and Service for Canal Operation Technique) method in the Macan Irrigation Area which is part of the Jatiluhur Irrigation Area. The MASSCOTE and RAP (Rapid Appraisal Process) methods are correlated with the five pillars of irrigation modernization with the results of pillars one 10.4, pillar two 29.2, pillar three 50.3, pillar four 6.7, and pillar five 3.4. Based on this, what must be improved is the fifth pillar, human resources.

Keywords: Irrigation Modernization, MASSCOTE, Five Pillars of Irrigation Modernization

1. Introduction

Macan irrigation area is part of jatiluhur irrigation area which is irrigation modernization. Modernization of irrigation in Indonesia has been encouraged since 2015[1]. Irrigation modernization in Indonesia consists of five pillars where the first pillar of water availability, the second pillar of irrigation infrastructure, the third pillar of irrigation management system, the fourth pillar of irrigation management institutions, the fifth pillar of human resources. [1]. Readiness of irrigation modernization is valued by the index of modernization readiness (IKMI) [1] with the following assessment category. Categorized into 4 (four) categories, > score 80: predicate is sufficient and

modernization can be applied, score 50-80: predicate is sufficient, modernization is delayed, improvements are made according to the results of IKMI 1 - 2 years, < value 50: predicate less, modernization is delayed, irrigation system improvements are carried out for 2-4 years, < value 30: predicate is very bad.

To know the readiness of irrigation modernization, of course, an assessment of the five pillars of irrigation modernization must be carried out. This paper analyzes the five pillars of irrigation modernization in the Macan irrigation area which is part of the Jatiluhur irrigation area with the MASSCOTE (Mapping System and Service for Canal Operation Technique) and RAP (Rapid Appraisal Process) methods that will be correlated with irrigation modernization consisting of five irrigation modernization pillars. To know which pillars to improve.

2. Method

The method used in this study is an interview and questionnaire given to irrigation actors that contain about the relationship of the five pillars of irrigation modernization with the MASSCOTE Method that is correlated with RAP (Rapid Appraisal Process).

Preparation of MASSCOTE RAP questionnaire with irrigation modernization. The survey was conducted to irrigation actors including agencies related to management in Macan irrigation areas irrigation officers and farmers/water users such as P3A / IP3A / GP3A. For the preparation of the MASSCOTE RAP questionnaire was conducted following the standards of RAP MASSCOTE questions and rapid appraisal process (RAP) and benchmarking explanation and tools [2]guidelines that are adjusted to irrigation management patterns in Indonesia.

The results of the RAP MASSCOTE assessment will be compared with the results of the RAP IKMI assessment based on the pillars of irrigation modernization in Indonesia to find out what needs to be improved.

3. Result and Discussion

3.1. Mapping System and Service for Canal Operation Technique (MASSCOTE)

MASSCOTE is a method that evaluates the performance of processes running on an irrigation project and develops the project in the framework of modernization [3]. MASSCOTE is carried out based on rapid appraisal process (RAP) with a focus on solutions to improve the operation process and irrigation management in order to create a service-oriented irrigation management by assessing internal and external indicators . The internal and external indicators valued by RAP MASSCOTE are as follows:

Table 1 Internal and external indicators valued by RAP MASSCOTE

Internal Indicators	External Indicators
Irrigation Service Capacity	Efficiency of water delivery
Reliability	Efficiency of irrigation land
Flexibility	Land productivity (ton/ha)
Justice	Irrigation productivity (m3/d/m2)

(*Source : Burt,2001*)

3.2. IKMI (Indeks Kesiapan Modernisasi Irigasi)

IKMI have Categorized into 4 (four) categories, > score 80: predicate is sufficient and modernization can be applied, score 50-80: predicate is sufficient, modernization is delayed, improvements are made according to the results of IKMI 1 - 2 years, < value 50: predicate less, modernization is delayed, irrigation system improvements are carried out for 2-4 years, < value 30: predicate is very bad. For the weight of the IKMI assessment of each Pillar is as follows:

Table 2. Weight of the IKMI assessment of each Pillar

Pillar Substance	Weight
1. Availability of water	20
2. Irrigation infrastructure	25
3. Irrigation management system	15
4. Managing institutions	20
5. Human resources	20
Total value	100

Source : Ministry of Public Work and Housing 2014

3.3. RAP MASSCOTE

RAP MASSCOTE analysis aims to provide an assessment of performance indicators of system management and irrigation services based on several key indicators in the form of answers from respondents. The answer is given by respondents in the form of an assessment of the performance indicators of the management of irrigation systems and services with a value of 0-4, where 0 is very bad/low / unsatisfactory and 4 is very good/high / satisfactory. The answers to the question are then weighted based on the calculation RAP MASSCOTTE and grouped several main indicators. After obtaining a performance assessment of the management of RAP MASSCOTE irrigation systems and services, each MASSCOTE RAP sub-indicator is grouped into five pillars of irrigation modernization to get a percentage of the performance assessment value of irrigation system management and services based on the Five Pillars of Irrigation Modernization[4][5].

Table 3 Comparison of Aspects of Irrigation Modernization and MASSCOTE

No	Pillars of Irrigation Modernization	Aspects of the Criteria of Irrigation Modernization Pillar MASSCOTTE
1	Availability of water	Water Balance Indicator Service level and quality of secondary and tertiary channel primary channel bends Single & Multi cropping Density of water user receiver Water theft
2	Irrigation infrastructure	Physical Infrastructure
3	Irrigation management system	Operation Instructions on the structure Communication Monitoring and evaluation
4	Managing institutions	The activeness of the related perpetrators
5	Human resources	Quality and Type of training program Understanding the concept of service

Source : Literature Study
Main indicators and weighting values, and the grouping of RAP MASSCOTE sub-indicators into the five pillars of Irrigation modernization.

The main indicator consist of irrigation services and social conditions, primary channel, secondary channel, tertiary channel, budget, officer & association of water users and capacity of irrigation system in the face of irrigation modernization.The main indicator irrigation services and social conditions consist of actual irrigation services to Farmers/water users, standard irrigation services to farmers/water users, actual irrigation services at the most downstream secondary channels, irrigation service standards on the most downstream secondary channels, actual irrigation services from primary channels to secondary channels, irrigation service standards from primary channels to secondary channels and social conditions along the irrigation network.

The following are the results of the calculation of the main indicator (irrigation services and social conditions) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization.

Table 4 Calculation main indicator (irrigation services and social conditions) and sub-indicator of the RAP MASSCOTE rap into the five pillars of irrigation modernization

No		Main Indicator	Sub-Indicator	Value (1-4)	Weight
		Irrigation Services and Social Conditions			
I-1		Actual Irrigation Services to Farmers/Water Users		2.3	
I-1	A		Water Measurement	2.0	1.0
I-1	B		Flexibility	2.5	2.0
I-1	C		Reliability	2.5	4.0
I-1	D		Justice	2.0	4.0
I-2		Standard irrigation services to farmers/water users		2.5	
I-2	A		Water Measurement	2.5	1.0
I-2	B		Flexibility	2.5	2.0
I-2	C		Reliability	2.5	4.0
I-2	D		Justice	2.5	4.0
I-3		Actual Irrigation Services at the most downstream secondary Channels		2.4	
I-3	A		Number of plots downstream	3.0	1.0
I-3	B		Water Measurement	2.5	4.0
I-3	C		Flexibility	2.5	4.0
I-3	D		Reliability	2.5	4.0
I-3	E		Justice	2.0	4.0
I-4		Irrigation service standards on the Most Downstream secondary channels		2.15	
I-4	A		Number of plots downstream	2.5	1.0
I-4	B		Water Measurement	2.0	4.0
I-4	C		Flexibility	2.5	4.0
I-4	D		Reliability	2.0	4.0
I-4	E		Justice	2.0	4.0
I-5		Actual Irrigation services from Primary channels to secondary channels		2.6	
I-5	A		Flexibility	2.5	1.0
I-5	B		Reliability	2.5	1.0
I-5	C		Justice	3.0	1.0
I-5	D		Flow debit measurement	2.5	1.5
I-6		Irrigation Service Standards from Primary channels to secondary channels		2.7	
I-6	A		Flexibility	2.5	1.0
I-6	B		Reliability	2.5	1.0
I-6	C		Justice	3.0	1.0
I-6	D		Flow debit measurement	2.8	1.5
I-7		Social conditions along the Irrigation network		2.6	
I-7	A		Level of compliance with water flow conditions	2.5	2.0
I-7	B		The absence of illegally constructed irrigation buildings	3.0	1.0
I-7	C		incompatibility of building damage /irrigation canals	2.5	1.0

Source : Results of Analysis

The following are the results of the calculation of the main indicator (primary channel) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization. Main indicator primary channel consists of regulatory building, divider buildings, communication, general conditions and operation.

Table 5 Calculation main indicator (primary channel) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization

No	Main Indicator	Sub-Indicator	Value (1-4)	Weight
	Primary channel			
I-8	Regulatory Building		2.4	
I-8 A		Ease of operation of regulatory buildings in meeting operating targets	2.5	1.0
I-8 B		Maintenance level of regulatory buildings	2.5	1.0
I-8 C		Fluctuations in water	2.2	3.0
I-8 D		flow debit travel time	2.5	2.0
I-9	Bagi Buildings		2.5	
I-9 A		Ease of operation of the building in meeting the target of operation	2.5	1.0
I-9 B		Building maintenance level	2.5	1.0
I-9 C		Building discharge capacity	2.4	1.0
I-11	communication		2.3	
I-11 A		Frequency of communication with higher operating rates	2.0	2.0
I-11 B		Frequency of communication from officers/interpreters/observers with farmers/water	3.0	2.0
I-11 C		Dependence on audio communication devices (telephone/radio)	2.0	3.0
I-11 D		Dependence on communication tools Frequency of field trips by higher levels of officers (observers / halls / services)	2.5	1.0
I-11 E		Presence and frequency of monitoring at important channel points and/or downstream of the channel	2.5	1.0
I-11 F		Inspection road conditions	2.0	2.0
I-12	General Conditions		2.7	
I-12 A		Basic maintenance level and channel edge	2.0	1.0
I-12 B		Conditions of seepage that are not allowed	2.5	1.0
I-12 C		The existence of the number of tools and officers to maintain the condition of the channel	3.0	2.0
I-12 D		Travel time from tool storage location & Basecamp officer to the furthest location of the channel	2.9	1.0
I-13	Operation		2.4	
I-13 A		The frequency of the main building responds to feedback from officers in real-time	1.7	2.0
I-13 B		The existence and effectiveness of water demand procedures in meeting actual water needs	2.5	1.0
I-13 C		Clarity and accuracy of instructions to officers	3.0	1.0
I-13 D		Frequency of reporting channel checking to the manager's office	3.0	1.0

Source : Results of Analysis

The following are the results of the calculation of the main indicator (secondary channel) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization. Main indicator Secondary consists consist of regulatory building, divider buildings, communication, general conditions and operation.

Table 6 Calculation main indicator (Secondary Channel) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization

No	Main Indicator	Sub-Indicator	Value (1-4)	Weight
	Secondary channel			
I-14	Regulatory Building		2.6	
I-14 A		Ease of operation of regulatory buildings in meeting operating targets	3.0	1.0
I-14 B		Maintenance level of regulatory buildings	2.5	1.0
I-14 C		Fluctuations in water levels	2.5	3.0
I-14 D		flow debit travel time	2.5	2.0
I-15	Bagi Buildings		2.5	
I-15 A		Ease of operation of the building in meeting the target of operation	2.5	1.0
I-15 B		Building maintenance level	2.5	1.0
I-15 C		Building discharge capacity	2.4	1.0
I-17	communication		2.2	
I-17 A		Frequency of communication with higher operating rates	2.0	2.0
I-17 B		Frequency of communication from officers/interpreters/observers with farmers/water	2.8	2.0
I-17 C		Dependence on audio communication devices (telephone/radio)	2.0	3.0
I-17 D		Dependence on communication tools Frequency of field trips by higher levels of officers (observers / halls / services)	2.5	1.0
I-17 E		Presence and frequency of monitoring at important channel points and/or downstream of the channel	2.5	1.0
I-17 F		Inspection road conditions	2.0	2.0
I-18	General Conditions		2.26	
I-18 A		Basic maintenance level and channel edge	2.0	1.0
I-18 B		Conditions of seepage that are not allowed	2.5	1.0
I-18 C		The existence of the number of tools and officers to maintain the condition of the channel	2.0	2.0
I-18 D		Travel time from tool storage location & Basecamp officer to the furthest location of the channel	2.8	1.0
I-19	Operation		2.5	
I-19 A		The frequency of the main building responds to feedback from officers in real-time	2.0	2.0
I-19 B		The existence and effectiveness of water demand procedures in meeting actual water needs	2.5	1.0
I-19 C		Clarity and accuracy of instructions to officers	3.0	1.0
I-19 D		Frequency of reporting channel checking to the manager's office	2.8	1.0

Source : Results of Analysis

The following are the results of the calculation of the main indicator (tertiary channel) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization. Main indicator tertiary channel consist of regulatory building, divider buildings, communication, general conditions and operation.

Table 7 Calculation main indicator (Tertiary channel) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization

No	Main Indicator	Sub-Indicator	Value (1-4)	Weight
	Tertiary channel			
I-20	Regulatory Building		2.4	
I-20 A		Ease of operation of regulatory buildings in meeting operating targets	2.5	1.0
I-20 B		Maintenance level of regulatory buildings	2.5	1.0
I-20 C		Fluctuations in water levels	2.2	3.0
I-20 D		flow debit travel time	2.5	2.0
I-21	Bagi Buildings		2.0	
I-21 A		Ease of operation of the building in meeting the target of operation	2.0	1.0
I-21 B		Building maintenance level	2.0	1.0
I-21 C		Building discharge capacity	2.0	1.0
I-23	communication		2.3	
I-23 A		Frequency of communication with higher operating rates	2.5	2.0
I-23 B		Frequency of communication from officers/interpreters/observers with farmers/water	2.0	2.0
I-23 C		Dependence on audio communication devices (telephone/radio)	2.5	3.0
I-23 D		Dependence on communication tools Frequency of field trips by higher levels of officers (observers / halls / services)	2.5	1.0
I-23 E		Presence and frequency of monitoring at important channel points and/or downstream of the channel	2.5	1.0
I-23 F		Inspection road conditions	2.0	2.0
I-24	General Conditions		2.0	
I-24 A		Basic maintenance level and channel edge	1.5	1.0
I-24 B		Conditions of seepage that are not allowed	2.0	1.0
I-24 C		The existence of the number of tools and officers to maintain the condition of the channel	2.0	2.0
I-24 D		Travel time from tool storage location & Basecamp officer to the furthest location of the channel	2.5	1.0
I-25	Operation		2.2	
I-25 A		The frequency of the main building responds to feedback from officers in real-time	2.0	2.0
I-25 B		The existence and effectiveness of water demand procedures in meeting actual water needs	2.0	1.0
I-25 C		Clarity and accuracy of instructions to officers	2.5	1.0
I-25 D		Frequency of reporting channel checking to the manager's office	2.5	1.0

Source : Results of Analysis

The following are the results of the calculation of the main indicator (Budget, Officer & Association of Water Users Budget, Officer & Association of Water Users) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization. Main indicator budget, officer & association of water users consist of budget, officers, water users association, efficiency of op officers, use of computers to record dues and management data, and use of computers in channel operations.

Table 8 Calculation main indicator (budget, officer & association of water users) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization

No	Main Indicator	Sub-Indicator	Value (1-4)	Weight
	Budget, Officer & Association of Water Users			
I-26	Budget		2.5	
I-26 A		Percentage of budget collection and/water dues that water user associations can collect against the budget of the manager'	2.5	2.0
I-26 B		Adequacy of existing budgets in maintaining sal conditions & irrigation services	2.5	2.0
I-26 C		Budget adequacy used for upgrading buildings or irrigation services compared to rehab & OP budgets	2.5	1.0
I-27	Officers		2.1	
I-27 A		The frequency and adequacy of training mid-level officers and managers (not secretaries and drivers) covers all officers a	2.5	1.0
I-27 B		Availability of performance rules in writing	2.5	1.0
I-27 C		The officer's ability to make a disconnect	2.0	2.5
I-27 D		The ability of irrigation system managers in laying off officers who should be dismissed	2.0	2.0
I-27 E		Tributes to exemplary officers	1.0	1.0
I-27 F		Officer's salary relative to day freelancer	2.5	2.0
I-28	Water Users Association		2.2	
I-28 A		Percentage of water user associations that functionally and formally participate in water distribution	2.0	2.5
I-28 B		The actual ability of water user associations to influence real-time water delivery	2.0	1.0
I-28 C		The ability of the water user association in relying on outside help for rule enforcement	2.0	1.0
I-28 D		Legal basis of the Water Users association	3.0	1.0
I-28 E		Financial Strength of the Water Users Association	2.0	1.0
I-29	Efficiency of OP Officers	Mobility and efficiency of officers based on the ratio of officers to the number of officers in Bagi Building		
I-30	Use of computers to record dues and management data	The extent to which computers are used in recording water dues data and management data		
I-31	Use of computers in channel operations	The extent to which computers are used in the operation of channels (both central and institutional)		

Source : Results of Analysis

The following are the results of the calculation of the main indicator (capacity of irrigation system in the face of irrigation modernization) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization. Main indicator capacity of irrigation system in the face of irrigation modernization consist of performance of irrigation farmers/watermarks / water users in dealing with methods of meeting the needs of higher irrigation services, changes needed to support methods of meeting higher irrigation service needs, and complexity in receiving and using feedback doesn't always have to be automated

Table 9 Calculation main indicator (capacity of irrigation system in the face of irrigation modernization) and sub-indicator of the RAP MASSCOTE into the five pillars of irrigation modernization

No	Main Indicator	Sub Indicator	Value (1-4)	Weight
	Capacity of Irrigation System in the Face of Irrigation Modernization			
I-32	Performance of irrigation services to farmers / water users in dealing with methods of meeting the needs of higher irrigation services		2.5	
I-32 A		Measurement and regulation of water volume	2.0	1.0
I-32 B		Flexibility	2.5	1.0
I-32 C		Reliability	3.0	1.0
I-33	Changes needed to support methods of meeting higher irrigation service needs		2	
I-33 A		Procedures and management	2.0	1.0
I-33 B		Heavy device	2.0	1.0
I-34	Complexity in receiving and using feedback Doesn't always have to be automated			

Source : Results of Analysis

Color Information :

: Availability of water
: Irrigation infrastructure
: Irrigation management system
: Managing institutions
: Human resources

MASSCOTE RAP recapitulation and weighting percentage based on five pillars of irrigation modernization as shown in the following table 10

Table 10 Masscote RAP Weighting Percentage Table based on The Five Pillars of Irrigation Modernization

No	Pillar	Sub indicator	Max score x weight	%
1	Availability of water	7	46	10.4
2	Improvement of irrigation facilities and infrastructure	28	129.15	29.2
3	Improvement of irrigation management system	53	222.3	50.3
4	Strengthening of irrigation management institutions	9	29.5	6.7
5	Empowerment of irrigation management human resources	6	15	3.4
	Total	103	441.95	100

Source : Results of Analysis

4. Conclusion

The weighting of RAP MASSCOTE is based on the five pillars of irrigation modernization for the Macan irrigation area for each pillar, pillar one 10.4, pillar two 29.2, pillar three 50.3, pillar four 6.7, and pillar five 3.4. Pillar five aspects of human resources have the smallest value among the other pillars[6] for example in the main indicators of the MASSCOTE RAP in irrigation modernization, one of which is the capacity of Irrigation System in Face of Irrigation Modernization which is still very lacking. Based on this, what must be improved is the fifth pillar, namely human resources. It needs to be improved on the aspect of human resources because humans are the drivers of irrigation modernization itself. What needs to be improved in the Macan irrigation area is training, understanding in dealing with irrigation modernization [7].in every irrigation stakeholders from the start such officers, farmers/waters users such as P3A / IP3A / GP3A, agency because irrigation modernization that pillars one and the other are interrelated. And human resources are the main drivers[8].

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