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Assessment of Existing Weir Performance Index Integrated with Variability of Crop Productivity

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ABSTRACT

This research intends to assess the existing performance index of the weir that is integrated with the variability of crop productivity as a strategic effort in supporting the building of a weir performance index model scientifically which so far, the assessment now is based on the consensus result. The methodology consists of a field survey, inventory of weir physics, analysis of performance weight, and then determining the performance of each component of irrigation. The research result shows that of 28 weirs as the samples of research, only 1 (one) weir (3.60%) is in good condition, 18 (eighteen) weirs (64.3%) are in moderate condition, and 9 (nine) weirs (32.10%) are in bad condition. The dominant of weir's condition is on the moderate and bad conditions, it shows that there is a need to increase the effective and planned operation and maintenance activity. The performance index model of weirs and the relation between weir performance and variability of crop productivity can be used as the technical monitoring tool for detecting the decreasing of weir function and to support the formulation of technical effort in the activity of operation and maintenance as well as rehabilitation in order to increase the agricultural productivity and food resilience.

Keywords: Irrigation, Weir, Performance Index, Crop Productivity.

INTRODUCTION

To increase the crop productivity in achieving the national food resilience, irrigation has an important role. However, the success of irrigation system performance is mostly due to the irrigation system management. Therefore, to assess the irrigation system's performance is very essential by monitoring and evaluating the whole aspects of the irrigation system. It can be implemented by carrying out visual research of the irrigation network by reporting the field condition through documentation (Putri et.al, 2022 and Prayogo et.al, 2021). Some factors, including technical and non-technical ones are basically affecting the irrigation network management. Remembering that the irrigation system management intends to supply the irrigation water in agriculture which is implemented in an integrated, participatory, transparent, accountable, and environmentally-friendly (Nurdiyanto and Purkun, 2023). To maximize the potency of irrigated crop productivity to meet food demands, irrigation is just an essential factor. Although crucial in food demands, the irrigated crops have contributed to 21% of the total agricultural area and have consumed 69% of the withdrawn water resources worldwide (Zema et.al, 2018). By implementing the optimal management of irrigation assets, effective and efficient steps can be carried out to maintain and extend the asset conditions, to decide the asset priority that requires rehabilitation, and to predict the costs for rehabilitation (Elshaikh et.al, 2018 and Bravo-Urera et.al, 2020).

The irrigation water used for supplying water to other crops besides paddy crops (for example for fisheries etc.) can produce much higher profit returns if it is compared with growing paddy. Of course, the water use for irrigation would not change the existing irrigation infrastructure, so there are no problems if there is a return to cropping paddy to the original condition (Asmelita et.al, 2024), remembering that there is a food resilience program in Indonesia. Irrigation canals that are addressed in agriculture should be seen as an integrated and comprehensive unit (Pueppke et.al, 2020). However, the optimization of infrastructure on water resources is crucially necessary to increase the farmers' income (Cameira and Pereira, 2019). Whereas Blanchard et.al (2017) emphasizes the need to analyze the trade-offs between agriculture and the other commodities.

Weir is one of the main infrastructures in supporting the success of the irrigation system, especially in supplying water for irrigation. The optimal performance of the weir is very important because it indirectly influences the crop productivity. In addition, by evaluating the weir performance periodically, the effort to address the sustainability of weir benefits can be well maintained. In practice, the assessment of weir performance often experiences a constraint because there is a subjective factor when carrying out the assessment through the survey activity and inventory in the field. It can cause inaccuracy in the process of assessment or evaluation because every weir has a different characteristic if it is reviewed from structural, functional, and operational aspects.

In Central Java Province, there is one of the water structures types that has an important role in regional sustainability that is weir. According to Sosrodarsono (2008), a weir is a water structure that is built transversely for regulating the water flow in a river that works to increase the water elevation to achieve a certain level which allows the river water to be tapped and flowed by gravity to the area in need (Prasetio, 2022). In addition, weirs are also used for increasing the river water level so the height needed in order for the water to flow to irrigation channels and tertiary blocks (Astuti er.al, 2021 and Anugrah et.al, 2017). However, based on the data of Badan Pusat Statistik (Statistical Center Institution) (2024), Central Java Province in the period 2021-2023, the harvest area and paddy production in this province decreased. In 2021, the harvest area reaches 1,696,712.00 hectares, then decreases to 1,688,699.65 hectares in 2022, and decreases again to 1,642,761.23 hectares in 2023. From the paddy production aspect, in 2021, Central Java Province produced 9,618,657.00 tons. This production decreased to 9,356,445.49 tons in 2022 and continuously decreased to 9,084,107.53 tons in 2023. The crop productivity also shows the decreasing trend. In 2021, the productivity reached 56.69 quintals per-hectare, decreased to 55.41 quintals per-hectare in 2022, and then decreased again to 55.30 quintals per-hectare in 2023. Based on this condition, there is a need for an effective strategy and effort for implementing the management of irrigation assets sustainably.

One of the reasons for paddy productivity decreasing is due to the decreasing of weir function. The activity of operation and maintenance that is not good will have an impact on the danger to the weir, so to know the damage level of a weir, the determination of an index is needed to know how big the weir damage is and determination of a performance index (Idrat et.al, 2021 and Yekti er.al, 2020). The available index model is based on the Ministry Rule of Public Work and Housing (Permen PUPR) No. 12/PRT/M/2015 about the operation and maintenance of irrigation networks (Ardiansyah, 2023), however, in this rule, there has not yet been a specific regulation about the assessment of the performance index for weirs. So far, the assessment of the weir performance index still uses the rule for dams that is modified so it can be used in the implementation of the work of the weir's performance assessment. The further research intends to build the performance index of weir and the relation with the functional (Assegaf et.al, 2016 and Castelli et.al, 2018) to the crop productivity. In addition, this model can be used to periodically monitor the weir performance and its impact on the variability of crop productivity in irrigation areas that are served by the weir. Actually, this research intends to assess the existing performance index of weirs that can be used to validate the scientific performance index of weirs in further research.

MATERIALS AND METHODS

Location of Study

This research is conducted in the river region of Bengawan Solo, Central Java Province, Indonesia, which administratively includes some regencies/cities that are Klaten, Sukoharjo, Boyolali, Surakarta, Wonogiri, Karanganyar, Sragen, and Ngawi. Table 1 presents the research location of the weir location.

Table 1. Research Location of Weir Location.

No	Name of weir	Name of irrigation area	Location		
			Village	District	Regency
1	Bendung Dero	DI Pondok	Dero	Bringin	Ngawi
2	Bendung Ngabean	DI SIM	Keras Wetan	Geneng	
3	Bendung Padas	DI Pondok	Jatirejo	Kasreman	
4	Bendung Plesungan	DI Pondok	Sukowiyono	Padas	

No	Name of weir	Name of irrigation area	Location		
			Village	District	Regency
5	Bendung Sambiroto	DI Pondok	Sambiroto	Padas	
6	Bnedung Budengan	DI Budengan	Legundi	Karangjati	
7	Bendung Dupok	DI Asin Bawah	Sukorejo	Kebonsari	Madiun
8	Bendung Gombal	DI Asin Bawah	Mlilir	Delopo	
9	Bendung Gondrok	DI SIM	Bedoho	Jiwan	
10	Bendung Semawur	DI SIM	Teguhan	Jiwan	
11	Bendung Bollu	DI Asin Bawah	Jenangan	Jenangan	Ponorogo
12	Bendung Sungkur	DI Sungkur	Blembem	Jambon	
13	Bendung Sumoro Bangun	DI Sumoro Bangun	Wonogiri	Badegan	
14	Bendung Ducak	DI Sungkur	Karangan,Golan	Sukorejo	
15	Bendung Sampung/Pulo	DI Sampung	Janti Nglurup	Sampung	
16	Bendung Jejeruk	DI Jejeruk	Candirejo	Magetan	
17	Bendung Bedilan	DI SIM	Rejomulyo	Barat	
18	Bendung Purwodadi	DI SIM	Mangga	Barat	
19	Bendung Kerjo	DI Pacal	Mojosari	Kepohbaru	Bojonegoro
20	Bendung Klepek	DI Pacal	Klepek	Sukosewu	
21	Bendung Mekuris	DI Pacal	Kedungrejo	Sumberejo	
22	Bendung Kacangan	DI Nglambangan	Nglambangan	Nglambon	
23	Bendung Semen	DI Semen	Gading	Sale	Rembang
24	Bendung Pule	DI Semen	Mrayun	Sale	
25	Bendung Gadon	DI Semen	Mrayun	Sale	
26	Bendung Klapan	DI Semen	Mrayun	Sale	
27	Bendung Krinjo	DI Krinjo	Kebonharjo	Jatirogo	Tuban
28	Bendung Beringin	DI Beringin	Kembang	Kawedanan	Magetan

RESEARCH METHODOLOGY

There are several stages for analyzing this research as follows:

1) To carry out the preliminary study for knowing what any data are needed in this research
2) In the preliminary study, the study literature and field survey or study location are carried out as follows:

a) Literature study for knowing the variables of weir performance index assessment.
b) A field survey is carried out for determining the research locations so it can know the technical condition of the weir.
c) Data collecting:

- Physical aspect: main structure of weir, accessory structure, structure on primary channel, inspection road, sediment trap, flushing gate, flushing gate and intake, office, residence, and building.
- Aspect of crop productivity: irrigation water requirement, realization of crop area, productivity of paddy
- Aspect of P3A/GP3A/IP3A: participation of GP3A/IP3A, condition of institution, legal status
- Aspect of documentation: the availability of irrigation area data, map, and illustration
- Aspect of personnel organization: structure of O&P (Operation and Maintenance), quantity of staff
- Aspect of infrastructure and facility: equipment of O&P, transportation tool, office tool, communication tool, accessory structure

3) To carry out the assessment of the weir's existing condition.

Method of Weir Performance Assessment

Based on the Ministry Rule of Public Work and Housing (Permen PUPR) No. 12, 2015. about the exploitation and maintenance of irrigation networks the irrigation system performance is determined in index form that is assessed based on the 6 parameters that are physical infrastructure, crop productivity, supporting structure, personnel organization, documentation, and farmers' association for water users (P3A/GP3A/IP3A) which are presented in Figure 1.

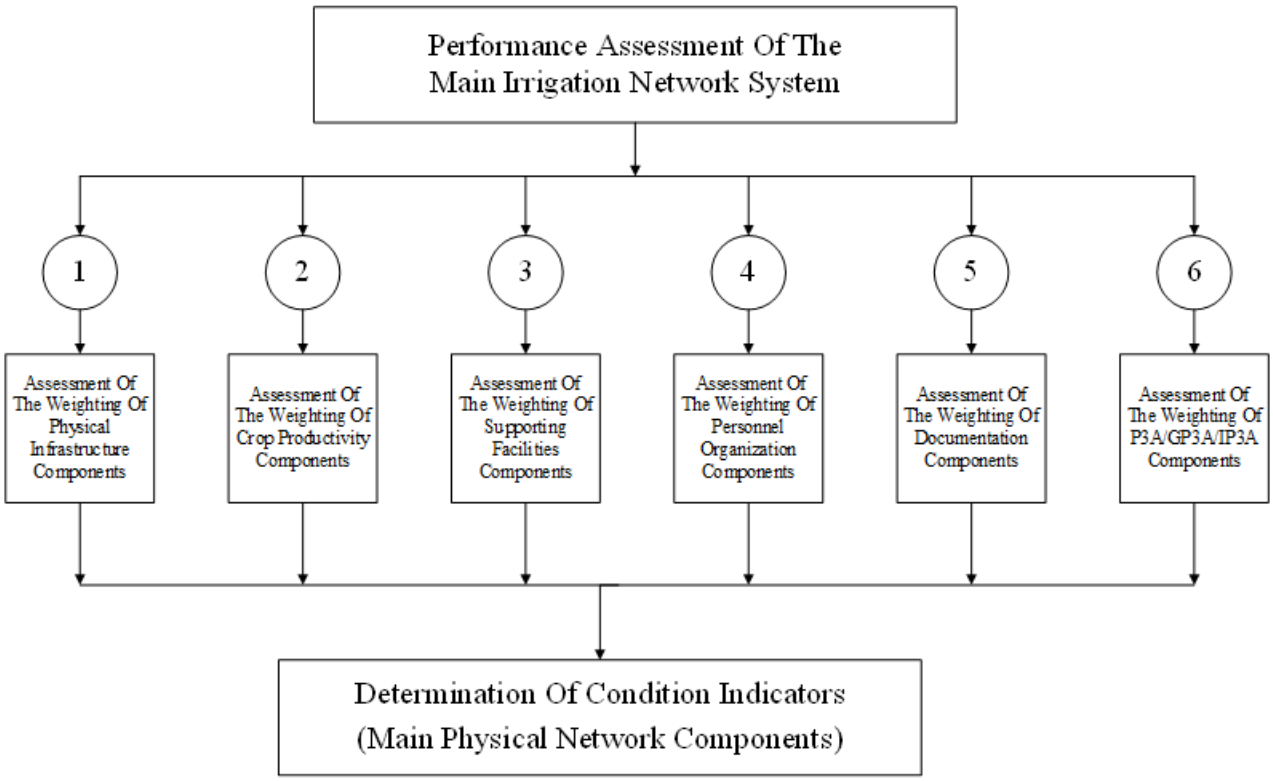

Figure 1. Performance Evaluation of Irrigation System Based on the Ministry Rule of General Work and Housing (Permen PUPR) No. 12/2015.

In accordance with this research aim, which is to obtain the solution so the weir performance can maximally work, that is reviewed from physical as well as non-physical aspects by carrying out the modification of Permen PUPR No. 12, 2015, so the assessment is carried out on the irrigation components that are the main building or weir until the primary channel. However, the assessment method is presented in Figure 2.

The weighting of each component is carried out in accordance with the technical guidance of implementation that is published by Directorate of Operation and Maintenance 2016 as presented in Table 2.

The performance index of irrigation system is number of every parameter with the classification as follows: a) 80– 100: very good performance; b) 70–79: good performance; c) 55–69: moderate performance; d) <55: bad performance.

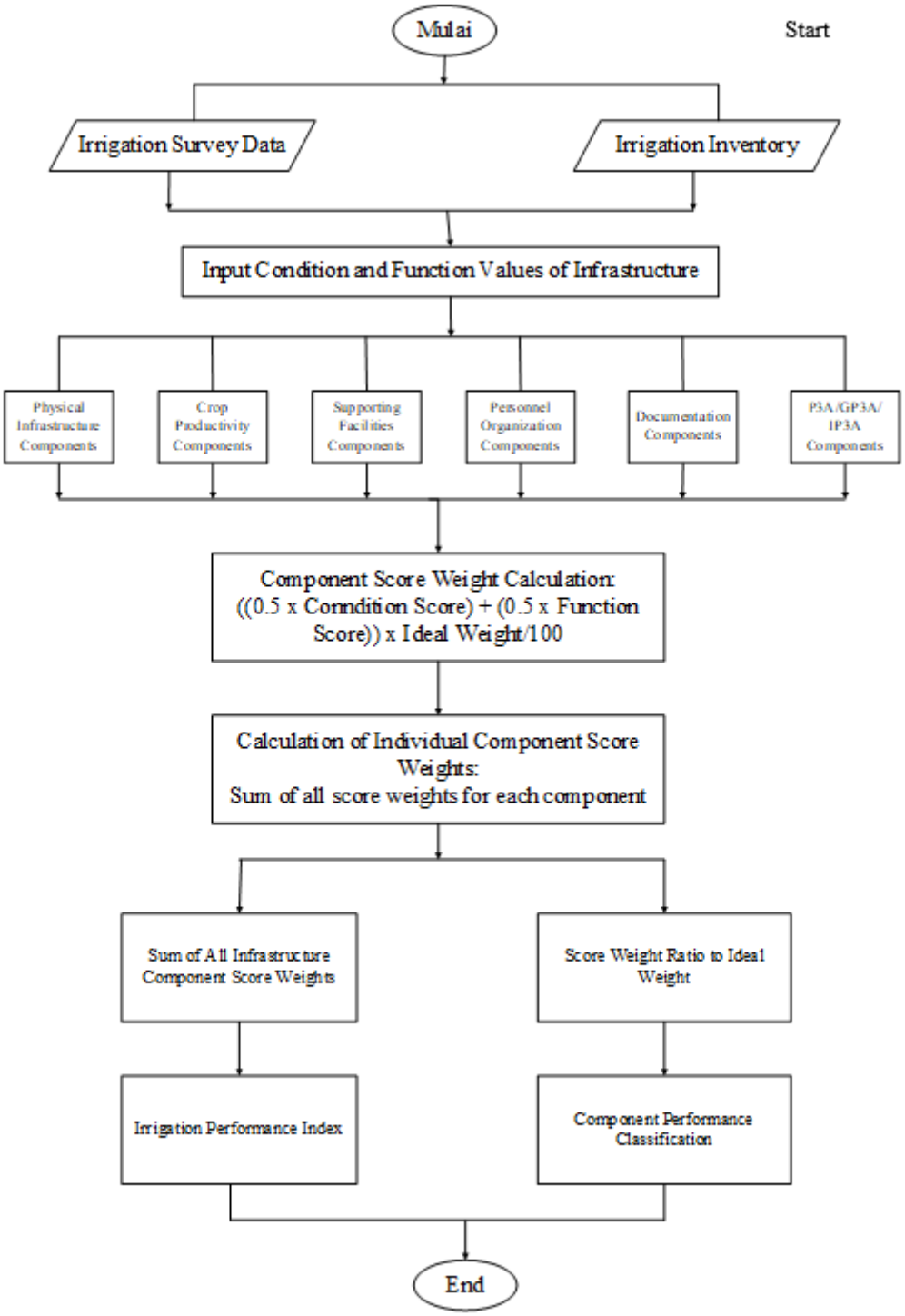

Figure 2. Evaluation Method of Irrigation Performance.

Table 2. Weight of Irrigation Performance.

No	Component	Weight
1	Physical Infrastructure	45%
2	Crop Productivity	15%
3	Supporting Facilities	10%
4	Personnel Organization	15%
5	Documentation	5%
6	P3A/GP3A/IP3A	10%
	Recapitulation	100%

Source: Permen PUPR No. 12, 2015

Method of Linear Regression

The statistical method of linear regression is used for analyzing the relation between a dependent variable (in this case is crop productivity) and one or more independent variables or the value of the weir performance index. The main aim of linear regression is to predict the dependent variable based on the independent variable, with the stages as follows: 1) To analyze the productivity of paddy due to the formulation that has been available in Permen PU; 2) To determine the category of assessment of the productivity of paddy; 3) To relate the performance index result and survey result of crop productivity (ton/ha) into graphic form with the x-axis as the independent variable (weir performance index) and the y-ordinate as the dependent variable (crop productivity); and 4) to analyze the coefficient of determination (R^2) as presented in Figure 3. Table 3 presents the percentage evaluation category of paddy productivity.

Table 3. Percentage Evaluation Category of Paddy Productivity.

Indicator	Condition			
	Very Good (90-100) %	**Good (80-90) %**	**Fair (60-80) %**	**Poor (< 60) %**
Crop Productivity	The ratio of actual to planned rice productivity for planting seasons I, II, and III ranges from 90% to 100%	The ratio of actual to planned rice productivity for planting seasons I, II, and III ranges from 80% to 90%.	The ratio of actual to planned rice productivity for planting seasons I, II, and III ranges from 60% to 79%	The ratio of actual to planned rice productivity for planting seasons I, II, and III ranges < 60%

Figure 3. Illustration of Relation Curve between Crop Productivity and Performance Index of Weir.

RESULTS AND DISCUSSION

Forms of Survey and Inventory of Weir Performance

Survey form of weir condition is presented in Table 4.

Table 4. Survey Form of Weir Condition.

No	Aspect	Component	Sub-Component
1	Physical	1. Fixed Weir	1. Mercu
			2. Upstream and downstream wings
			3. Downstream weir floor
			4. Upstream weir floor
		2. Flush gate and Intake	1. Intake
			2. Flush gate of weir

No	Aspect	Component	Sub-Component
		3. Sediment trap and flush gate	1. Sediment trap structure and flush gate
			2. Sediment trap has been cleaned
			3. Flush gate and gears of sediment trap
		4. Primary channel	1. Capacity of primary channel
			2. Height of embankment
			3. Implementation of channel improvement and maintenance
		5. Structure at primary channel	1. Distribution structure
			2. Intake distribution structure
			3. Discharge measurement structure
		6. Accessory structure	1. Syphon
			2. Culvert
			3. Gutter
			4. Cross Drain
			5. Bridge
			6. Waterfall
			7. Side spillway
			8. Laundry ladder
			9. Pet bathing station
			10. Prohibition sign
		7. Implementation of improvement and maintenance on primary channel	1. Improvement of regulator structure
			2. Ruler, scale liter, and water level mark
			3. Operation board
			4. Accessory structure
		8. Inspection Road	1. Inspection to main structure
			2. Inspection Road and footpath
			3. Accessibility of inspection and footpath
		9. Office, Residence, and Warehouse	1. Office
			2. Residence for staff/ employer
			3. Warehouse for activity
2	Fulfillment of irrigation demand	1. Fulfillment of irrigation demand	1. Fulfillment of irrigation water demand (K-factor)
			2. Realization of crop area
3	Supporting facility	1. Facility of OP (Operation and Maintenance) Supporting	1. Equipment of OP
			2. Transportation tool
			3. Availability of OP Implementor office equipment
			4. Availability of communication tool
			5. Accessory structure
4	Aspect of personnel organization	1. Personnel organization of OP implementation	1. Structure of OP organization
			2. Number and competence in accordance with demand
			3. Number of state officials
			4. Number of officers understand OP
5	Aspect of documentation	1. Documentation	1. Availability of data proof about irrigation area
			2. Availability of maps and figures
6	Aspect of P3A/GP3A/IP3A	1. Famers' Association for Water Users (GP3A/IP3A)	1. Legal status
			2. Institution condition
			3. Meeting of P3A/GP3A/IP3A with branch/ observer
			4. GP3A/IP3A active follows the network routing
			5. Participation of GP3A/IP3A in improvement of network and disaster handling
			6. Participation of GP3A/IP3A in planning cropping pattern

The Result of Survey and Inventory of Weir Performance

Result of survey and inventory of weir performance in field:

Name of weir: Gombal Weir, Location: Mlilir Village, Dolopo District, Madiun Regency, Name of irrigation area: Irrigation area of Asin Bawah, Irrigation area: 1,685 ha, length of primary channel: 4,500 m.

The results of the survey are presented in Tables 4, 5, 6, and 7.

Table 4. Result of Survey and Inventory of Main Structure.

No	Weir Structure	Condition of damage						Explanation
		(Good) (B)	Score	Moderate Damage (RS)	Score	Heavy Damage (RB)	Score	
1	Weir Crest	B	80%					The weir crest condition is still good
2	Cover of Weir Crest	B	80%					The condition of the weir crest cover is still good
3	Stilling basin	B	80%					The condition of the stilling basin is still good
4	Weir floor	B	80%					The weir floor is still good
5	Wing of upstream weir			RS	55%			The upstream weir wing on the right side is cracked with the following size: length: 1.5 m, width: 0.27 m, height: 1 m
6	Wing of downstream weir	B	80%					The wing of the downstream weir is still good

7	Information board	B	80%					There are information boards, discharge recording boards, and nomenclature, and all of them are still good
8	Peil Schaale			RS	70%			Part of the paint on the peil schaale is peeled off
9	Care home	B	80%					There is a care home, and the condition is still good
10	Approach slab	B	80%					The condition of the approach slab is still good
11	Safety fence	B	80%					The condition of the safety fence is still good
12	Flushing gate	B	80%					The flushing gate is in improvement and it is changed to an automatic one
13	Intake gate	B	80%					The intake gate is in improvement and it is changed to an automatic one
14	Pillar	B	80%					The condition of the weir pillar is still good
15	Weir roof	B	80%					The condition of the weir roof is still good
16	Baffle Block	B	80%					The condition of the baffle block is still good
17	Village floor	B	80%					The condition of the village floor is still good

Table 5. Survey Result and Inventory of Primary Channel

No	Sediment Trap	Condition of damage						Explanation
		Good (B)	Score	Moderate Damage (RS)	Score	Heavy Damage (RB)	Score	
1	Flushing gate	B	80%					The condition of the flushing gate is still good
2	Pillar	B	80%					The condition of the pillar is still good
3	Protective roof	B	80%					The condition of the weir roof is still good
4	Channel					RB	35%	The condition of the channel wall is land sliding and cracking

Table 6. Survey Result and Inventory of Primary Channel.

No	Size of damage on the right primary channel				Damage condition			Score	Explanation
	Right/left	P	L	T	B	RS	RB		
1	Left	0.3 m	1.5 m	0.3 m			RB	40%	Sinking
2	Right	5 m	0.3 m	0.3 m			RB	35%	Sinking
3	Right	1 m	0.4 m	0.2 m			RB	35%	Sinking
4	Right	0.5 m	0.3 m	0.2 m			RB	40%	Sinking
5	Right	5 m	0.3 m	1.5 m			RB	35%	Sinking
6	Left	0.9 m	0.3 m	1.2 m			RB	40%	Sinking
7	Left	5 m	0.2 m	1 m			RB	35%	Sinking
8	Right	30 m	0.2 m	1.2 m			RB	30%	Sinking
9	Right	15 m	0.2 m	1.2 m			RB	35%	Sinking
10	Right	14 m	0.2 m	1.5 m			RB	30%	Sinking
11	Left	30 m	0.2 m	1.5 m			RB	35%	Sinking
12	Right	20 m	0.2 m	1.5 m			RB	35%	Sinking

No	Primary Channel	Damage condition						Explanation
		Good (B)	Score	Moderate damage (RS)	Score	Heavy damage (RB)	Score	
1	Laundry ladder	B	80%					Laundry ladder is good
2	Channel wall					RB	35%	Most of the channel walls are landslides
3	Distribution structure	B	80%					Distribution structure is good
4	Syphon	-	-	-	-	-	-	There is no syphon
5	Culvert	-	-	-	-	-	-	There is no culvert
6	Gutter	-	-	-	-	-	-	There is no gutter
7	Waterfall	B	80%					Waterfall is good
8	Bridge	B	80%					Bridge is good
9	Peil Schaale	B	80%					Peil schaale is good
10	Prohibition sign	B	80%					Prohibition sign is good
11	Pole KM	B	80%					Pole KM of the primary channel is still good

Table 7. Performance Index Evaluaton of Weir.

No	Aspect	Weight	Sub-Component	Final weight %	Part score %	Condition index		Explanation
						available %	Maximum %	
			1. Fixed Weir	**89**	**100**	**2.46**	**2.75**	
1	Physic	45%	1. Weir Crest	33	36	0.91	1	The condition of the weir crest and the weir crest's cover is still good

No	Aspect	Weight	Sub-Component	Final weight %	Part score %	Condition index		Explanation
						available %	Maximum %	
			2. Upstream and downstream wings	24	27	0.65	0.75	The upstream weir wing on the right side is cracked with the size: length: 1.5 m, width: 0.27 m, height: 1 m
			3. Downstream weir floor	33	36	0.9	1	The weir floor is still good
			4. Upstream weir floor					
			2. Flushing gate and Intake	**23**	**100**	**1.8**	**8**	
			1. Intake Gate	11	50	0.9	4	The intake gate is in improvement and it is changed to an automatic one
			2. Flushing gate of weir	11	50	0.9	4	The condition of the flushing gate is good
			3. Sediment trap and flushing gate	**110**	**100**	**2.2**	**2**	
			1. Sediment trap structure and flushing gate	25	35	0.5	0.7	The condition of flushing gate is good
			2. Sediment trap has been cleaned	43	30	0.85	0.6	
			3. Flushing gate and sediment trap gears	43	35	0.85	0.7	
			4. Primary channel	**15**	**100**	**1.5**	**10**	
			1. Capacity of primary and secondary channels	5	50	0.5	5	
			2. Height of embankment	5	20	0.5	2	
			3. Implementation of improvement and maintenance of channel	5	30	0.5	3	
			5. Structure on the primary channel	**40**	**100**	**0.8**	**2**	
			1. Distribution structure	40	100	0.8	2	
			2. Tap distribution structure					
			3. Discharge measurement structure					
			6. Accessory structure	**100**	**100**	**0.8**	**0.8**	
			1. Syphon	100	100	0.8	0.8	
			2. Culvert					
			3. Gutter					
			4. Cross Drain					
			5. Bridge					
			6. Waterfall					
			7. Side spillway					
			8. Laundry ladder					
			9. Pet bathing area					
			10. Prohibision sign					
			7. Implementation of improvement and structure maintenance on the primary channel	**128**	**100**	**3.2**	**2.5**	
			1. Improvement of regulator structure	32	50	0.8	1.25	
			2. Ruler, scale liter, and water level mark	32	15	0.8	0.375	
			3. Operation board	32	20	0.8	0.5	
			4. Accessory structure	32	15	0.8	0.375	
			8. Inspection Road	**60**	**100**	**2.4**	**4**	
			1. Inspection Road to main structure	20	50	0.8	2	
			2. Inspection Road and footpath	20	25	0.8	1	
			3. Accessibility to inspection and footpath	20	25	0.8	1	
			9. Office, residence, and warehouse	**96**	**100**	**2.4**	**2.5**	
			1. Office	32	40	0.8	1	
			2. Residence for staff	32	20	0.8	0.5	
			3. Warehouse for activity	32	40	0.8	1	
Total: 1+2+3+4+5+6+7+8+9				**661**	**900**	**18**	**35**	
Score of physical Condition				**73**				**Moderate**

By the same method, they are carried out on the other weirs in order to obtain the value of the performance index on each weir, and the result is presented in Table 8.

Table 8. Recapitulation of Weir Performance Analysis Result.

No	Name of weir	Score	Explanation
1	Bendung Dero	65	moderate
2	Bendung Ngabean	47	bad
3	Bendung Padas	61	moderate
4	Bendung Plesungan	70	moderate
5	Bendung Sambiroto	70	moderate
6	Bnedung Budengan	42	bad
7	Bendung Dupok	62	moderate
8	Bendung Gombal	73	moderate
9	Bendung Gondrok	64	moderate
10	Bendung Semawur	48	bad
11	Bendung Bollu	71	moderate
12	Bendung Sungkur	74	moderate
13	Bendung Sumoro Bangun	74	moderate
14	Bendung Ducak	63	moderate
15	Bendung Sampung/Pulo	60	bad
16	Bendung Jejeruk	72	moderate
17	Bendung Bedilan	59	bad
18	Bendung Purwodadi	59	bad
19	Bendung Kerjo	58	bad
20	Bendung Klepek	81	good
21	Bendung Mekuris	73	moderate
22	Bendung Kacangan	70	moderate
23	Bendung Semen	56	bad
24	Bendung Pule	53	bad
25	Bendung Gadon	51	bad
26	Bendung Klapan	51	bad
27	Bendung Krinjo	69	moderate
28	Bendung Bringin	74	moderate

CONCLUSION

Based on the survey and inventory results in the field and analysis of performance weight in every component of irrigation, it can be concluded as follows: 1) Weirs in good condition: only 1 (one) weir (3.60%) is in the category of good condition, which is the Klepek weir with the highest performance value of 81. This condition shows that the existence of a truly optimal weir is very limited, and it can become the pilot model for the increasing of the other weirs; 2) Weir in the moderate condition: there are 18 (eighteen) weirs (64.3%) in the category of moderate condition with the performance value between 60 and 74. It indicates that most of the weirs in this category still do good work, but there needs to be an increase in efficient operation and maintenance to be able to achieve the optimal condition; 3) Weirs in bad condition: there are 9 (nine) weirs (32.10%) that have the performance value under 60 and are classified as being in bad condition. This condition reflects the functional decrease, so immediate rehabilitation action and the increasing of operation and maintenance activity are needed. This condition can directly impact the smoothness of the irrigation system and cause the decreasing of agricultural area productivity.

Generally, the condition of weirs that are dominated by moderate and bad categories show the nacessity of the increasing of weir management program systematically and sustainably. It is important to guarantee the reliability of consistent irrigation water supply, mainly in supporting the effort of increasing the srop productivity. In addition, the performance index model of weir that is integrated with crop productivity can become as an effective strategy in formulating the priority of technical action for supporting the food resilience and sustainability on the irrigatin system. This research results are very urgent for validating the scientific performance index model of weir that is integrated with crop productivity which will be developed in further research.

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