Project Saklay (Saklolo Sa Palay) – A Problem Identification Framework: A Basis for Action Proposal

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Abstract: - Sustainability of irrigated agriculture is being questioned both economically and environmentally. Since water is essential for the growth of the crops, it is important that there is sufficient water which can sustain the crop period. With this, the demand of having sustainable irrigation becomes high. In the Philippines, irrigation is a great necessity which is being managed by the National Irrigation Administration under Republic Act (RA) 3601. Since most of the Filipinos depend on agriculture as their source of living, irrigation systems are always subjected for rehabilitation and improvement. Based on the related literatures, previous studies, and dissertations, the most common irrigation problems being experienced in an irrigation system are: infrastructural, environmental, management, and performance. However, it is apparent that there is no sole method of identifying irrigation problems. As a result, the primary goal of this study, known as Project SakLay (Saklolo sa Palay), is to identify irrigation problems as the foundation for a solution proposal. In this paper, the underlying causes of the problems were determined, and possible solutions were developed through formulating a problem identification framework and the pilot-testing of Project SakLay in Barangay Dampe, Floridablanca, Pampanga. The results were validated by the National Irrigation Administration engineers and personnel, and farmers of the study area through focus group discussion. It was agreed that there were problems in the Infrastructural, Environmental, and Performance component of the irrigation facility; which was reflected on the results of the data gathering. In conclusion, Project SakLay can be used by the NIA, barangay officials, and farmers as immediate response report about their irrigation facility. Adapting Project SakLay will significantly improve the situations of the irrigation facilities across the Philippines.

Key Words— ***Irrigation, problem tree analysis, Project SakLay.***

I. INTRODUCTION

Irrigation is a process through which crops are sprinkled or replenished with water through pipes, canals, pumps, sprinklers or any artificial features instead of solely relying on rainfall. [1]

Manuscript revised November 28, 2022; accepted November 29, 2022. Date of publication November 30, 2022.

This paper available online at www.ijprse.com

ISSN (Online): 2582-7898; SJIF: 5.59

Since water is essential for the growth of the crops, it is important that there is a sufficient amount of water which can sustain the crop period especially in areas where irregular precipitation occurs. However, irrigated agriculture's economic and environmental sustainability is being called in doubt. [2] Therefore, in order to achieve high yields and improve crop growth and quality, there is a growing demand for sustainable irrigation. [3]

In the Philippines, irrigation is a great necessity since most of the Filipinos depend on agriculture as their source of living. The National Irrigation Administration, established under Republic Act (RA) 3601, oversees the country's irrigation system. The operation, management, and development of irrigation systems in the Philippines are the primary responsibilities of this body.

Since irrigation is a crucial component for the agricultural system of the Philippines, irrigation systems are always subjected for rehabilitation and improvement. Through renovating large-scale and small-scale irrigation systems, irrigation is subjected to advancements and development which is important in sustaining maximum productivity and profitability in crops. [4] However, albeit most of the investments of the government are being given every year, the performance of irrigation systems in the Philippines are underperforming. [5]

There is evidently no sole method in identifying such irrigation problems. For this reason, this study aims to identify the irrigation problems as basis for solution using problem identification framework. In this paper, the underlying causes of the problems will be determined and possible solutions will be developed with the application of the method Project SakLay (Saklolo sa Palay). Adapting Project SakLay will significantly improve the situations of irrigation facilities across the Philippines.

II. METHODOLOGY

The data gathering procedure was done in three phases:

Phase 1: Formulation of the Problem Tree Analysis

The formulation of the problem identification framework was done by (1) identifying major existing problems; (2) identifying essential and causes of the main problems; and (3) reviewing, verifying, and adjusting the problem tree.

The framework Project SakLay can only be adapted by the NIA and the barangay's cooperative operation management as a methodology in determining the irrigation problems experienced in the area in order to maximize its applicability. The framework will use English and Filipino language so that the officials who may want to use the framework can understand comfortably the questions in their preferred language.

Using Cronbach's Alpha, the reliability of the framework or assessment tool was tested. Cronbach's Alpha is a method in evaluating reliability by means of contrasting covariance to the items which make up the whole instrument to the overall variance.

Table 1. Assessment Tool Reliability

Cronbach's Alpha	No. of Items
0.9036	36

The reliability of the assessment tool based on Cronbach's Alpha result is 0.9036 shown in Table 1 which is very highly reliable. Thus, the framework or assessment tool will be able to gather the necessary data to achieve the objectives of the study.

Phase 2: Pilot-Testing of Project Saklay in Barangay Dampe, Floridablanca, Pampanga

This study utilized Mixed-Methods Sequential Explanatory which is qualitative and quantitative type of research. The purpose of this type of research is to maximize the qualitative results in order to explain and interpret quantitative results further. The second phase of the study is the pilot-testing of Project SakLay in Barangay Dampe, Floridablanca, Pampanga, to identify irrigation problems that may emerge in accordance with the problem identification framework formulated. The framework will be used only during the operations and maintenance phase of the irrigation system in the study area.

The gathering of data was conducted through site inspection, surveys, as well as accumulated data from the NIA office regarding the experiences of farmers, residents and the NIA personnel in managing the irrigation facility. In identifying the sample size of the population, Slovin's formula was used to achieve a certain confidence interval when sampling a population.

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = sample size

N = number of populations

e = allowable error (0.05)

Substituting the values:

$$n = \frac{43}{1 + 43(0.05)^2}$$

$$n = 38.83 \; say \; 39 \; farmers \; as \; respondents$$

$$n = \frac{25}{1 + 25(0.05)^2}$$

$$n = 23.53 \; say \; 24 \; NIA \; engineers \; and \; personnel \; as \; respondents$$

To choose the final respondents of the study, simple random sampling was applied to give the respondents an equal chance of being included in the sample. The respondents were the farmers who are said to be residing the area since the irrigation facility was constructed and the NIA engineers and personnel. The study also utilized a diagnostic research design in identifying the irrigation problems and investigate the underlying cause of the irrigation facility's current condition.

Project SakLay framework consists of Infrastructural, Environmental, Management and Performance of the irrigation facility. Both Infrastructural and Environmental components were evaluated through the formulated framework, site investigation, and interviews of NIA personnel together with the data accumulated from the NIA office. Whereas, the Management and Performance irrigation components of the irrigation facility were assessed through the formulated framework and interview.

The gathered data from the responses were statistically treated using descriptive statistics in order to show the occurrence of the scaled answers from the survey-questionnaire. The following were the statistical tools that were used in presenting data according to the responses given by the respondents: Area Mean, Likert Scale, Percentage, and Pearson's Correlation Coefficient.

Phase 3: Validation of Results through Focus Group Discussion

The third phase of the study will be the validation the results from the pilot-testing of Project SakLay in Barangay Dampe, Floridablanca, Pampanga, through Focus Group Discussion. Focus Group Discussion is a qualitative assessment tool which sought to gain in-depth discussion around a specific topic.

The main purpose and objectives of Project SakLay, its significance, methodology, and the whole pilot-testing in Barangay Dampe, Floridablanca, Pampanga were discussed to the participants during the group discussion. The results based from the analyses of data gathered during the pilot testing of Project SakLay framework, specifically about the irrigation components, were also discussed so that comments, opinions, and suggestions were gathered. In this way, possible revisions were determined on what will make the framework more effective.

III. Results And Discussion

The Project Saklay framework sought to identify irrigation problems in 4 components namely Infrastructural, Environmental, Management, and Performance. The study responses have garnered a total of thirty-nine (39) responses from the farmers of Barangay Dampe, Floridablanca, Pampanga, while the twenty-four (24) respondents are the National Irrigation Administration engineers and personnel.

3.1 Infrastructural Component

The Infrastructural Component of the framework evaluated the physical condition and sustainability of dam, reservoir, canals, pumps, water control and distribution facilities, and other irrigation facility requirements. Shown in Table 5 is the assessment of the Infrastructural Component based on the perspective of both the farmers of Barangay Dampe, Floridablanca, Pampanga and the NIA engineers and personnel.

Table 2 shows that the Infrastructural Component of the irrigation facility of Brgy. Dampe is noted to have problems in the physical condition of the Caulaman Dam and Caulaman River, the canals and pumps built, the continuity of water from the source, the filtration and treatment facility, public stands/stub outs/water meters, and there is loss of water because of its current condition.

With a grand mean of 2.48 based on the perspective farmers, and 2.49 from NIA engineers and personnel, it is concluded that the Infrastructural Component of the irrigation of Brgy. Dampe have problems.

Table.2. Comparison of the Perspective of Farmers and NIA Engineers and Personnel in Infrastructural Component

Infrastructural Component		Farmers		NIA	
	Statements	Mean	VI	Mean	VI
1	The Caulaman Dam still functions well as one of the water sources of Brgy. Dampe irrigation facility.	1.74	D	2.21	D
2	The Caulaman River is still responsible for the transport of water from Caulaman Dam to Brgy. Dampe irrigation facility.	2.08	D	4.00	A
3	The pumps built within the Brgy. Dampe irrigation facility has little to no physical damage.	2.38	D	2.46	D
4	Barricades, covers, and protective measures to pumps, canals, and other masonry works are present.	3.51	A	3.63	A
5	The water that flows from the source of water to Brgy. Dampe irrigation facility through canals is continuous.	2.31	D	2.79	N/U
6	The filtration and treatment facilities in Brgy. Dampe irrigation facility are functioning well.	1.90	D	2.42	D
7	The water control and distribution facility of Brgy. Dampe irrigation facility are functioning well.	2.54	N/U	2.96	N/U
8	There is no loss in water due to the current physical condition of Brgy. Dampe irrigation facility.	1.90	D	2.46	D
9	Electrical works such as electrical posts inside Brgy. Dampe irrigation facility are built safe from electrical accidents.	4.05	A	3.38	A
10	Public stands/stub outs/water meters in Brgy. Dampe irrigation facility are still in good condition.	2.38	D	2.46	D
	Overall	2.48	D	2.49	D

3.2 Environmental Component

The Environmental Component of the framework evaluated the vulnerability to risks, man-made exposure and disturbances, and climate variability of the irrigation facility. Shown in Table 3 is the assessment of the Environmental Component based on the perspective of both the farmers of Barangay Dampe, Floridablanca, Pampanga and the NIA engineers and personnel.

It is both noted by the stakeholders there are problems when it comes to the obstruction of non-hazardous wastes to canals and pumps, and climate variability (rainy and summer season). With a grand mean of 3.29, it was decided by the farmers that there are problems present in the Environmental Component of the irrigation facility, whereas the NIA engineers and personal agreed nor disagreed with a grand mean of 2.72.

Table.3. Comparison of the Perspective of Farmers and NIA Engineers and Personnel in Environmental Component

Environmental Component		Farmers		NIA	
	Statements	Mean	VI	Mean	VI
1	Brgy. Dampe irrigation facility is not close to a national highway which decreases the risk of possible physical damage.	4.31	A	3.54	A
2	The farmers and residents near Brgy. Dampe irrigation facility dispose waste with proper measure.	3.28	N/U	2.54	N/U
3	Hazardous wastes such as pesticides, herbicides, and other chemicals that are detrimental to human health and to Brgy. Dampe irrigation facility are not present.	2.56	N/U	2.54	N/U
4	Non-hazardous wastes such as plastic, paper, glass, and cardboard do not obstruct the physical condition of canals and pipes inside Brgy. Dampe irrigation facility.	1.97	D	1.79	D
5	The disinfection facility in Brgy. Dampe irrigation facility regularly maintains cleanliness and prevents chemicals and toxic in the facility.	4.05	A	3.50	A
6	The sanitary facility in Brgy. Dampe irrigation facility improves the sanitation and waste management plan of the irrigation facility.	4.46	A	3.54	A
7	The water that flows into Brgy. Dampe irrigation facility is not easily contaminated by chemicals, toxic, and non-hazardous wastes such as plastic, paper, glass, and cardboard.	3.36	N/U	2.79	N/U
8	Environmental-friendly practices and reminders are being promoted by officials and personnel assigned in Brgy. Dampe irrigation facility.	4.18	A	3.58	A
9	During rainy season, flooding does not occur in Brgy. Dampe irrigation facility.	2.31	D	1.71	D
10	There is no scarcity in water in Brgy. Dampe irrigation facility during summer season.	2.46	D	1.63	D
	Overall	3.29	D	2.72	N/U

3.3 Management Component

The Management Component of the framework evaluated the operations and maintenance phase of the facility and the involvement of officials, agencies, and other stakeholders. Shown in Table 4 is the assessment of the Management Component based on the perspective of both the farmers of Barangay Dampe, Floridablanca, Pampanga and the NIA engineers and personnel.

Overall, it is agreed by both the stakeholders that there are no problems present in the Management Component of the irrigation facility with a grand mean of 3.94 and 3.86. Despite the occurring non-operational Caulaman Dam and River, the management of NIA, officials, and other stakeholders are proactive in keeping the beneficiaries in-tuned with the updates and reports of what is coming up next for the irrigation facility's development.

Table.4. Comparison of the Perspective of Farmers and NIA Engineers and Personnel in Management Component

Management Component		Farmers		NIA	
	Statements	Mean	VI	Mean	VI
1	Site inspection, meetings, field visits, and interviews are being conducted by the administration regularly in Brgy. Dampe irrigation facility.	4.23	A	4.58	SA
2	The technical personnel who oversee the maintenance and operation are present when problems in Brgy. Dampe irrigation facility arise.	4.56	SA	3.79	A
3	Reports of the current condition of Brgy. Dampe irrigation facility are distributed to farmers and other affiliations.	4.21	A	3.67	A
4	The personnel assigned in Brgy. Dampe irrigation facility are employed, trained, and equipped with technical and immediate response to problems.	3.82	A	3.63	A
5	There is an effective and reliable formation of committees and task forces.	3.97	A	3.54	A
6	Officials and personnel of Brgy. Dampe irrigation facility assists farmers to modernization of agricultural activities.	3.77	A	4.41	A
7	The officials of Brgy. Dampe irrigation facility set goals and standardize rules and regulations which sustain the condition of the irrigation facility.	3.67	A	3.79	A
8	Planning and looking at both short-term and long-term objectives are prioritized by the officials of Brgy. Dampe irrigation facility.	3.74	A	3.58	A
9	The officials of Brgy. Dampe irrigation facility improve the institutional setting including bureaucracy, policies, rules, and regulations.	3.64	A	3.79	A
10	The officials of Brgy. Dampe irrigation facility increase the knowledge of farmers, provide technical support or training courses for water use and cultivation.	3.79	A	3.79	A
	Overall	3.94	A	3.86	A

3.4 Performance Component

The Performance Component of the framework evaluated the water distribution and agricultural productivity in crop yield with the aid of the irrigation facility. Shown in Table 5 is the assessment of the Performance Component based on the perspective of both the farmers of Barangay Dampe, Floridablanca, Pampanga and the NIA engineers and personnel.

Overall, it is decided that there are problems in the Performance Component of the irrigation facility having a grand mean of 2.36 and 2.23. The problems that arose are the non-improvement of the quality of water and water services, no reduction in managerial costs, and decrease in agricultural crop productivity.

Table.5. Comparison of the Perspective of Farmers and NIA Engineers and Personnel in Performance Component

Performance Component		Farmers		NIA	
	Statements	Mean	VI	Mean	VI
1	There is improvement in quality of water because of Brgy. Dampe irrigation facility.	2.26	D	1.45	SD
2	There is improvement in water services because of Brgy. Dampe irrigation facility.	2.38	D	2.38	D
3	There is cost-recovery of water fees because of Brgy. Dampe irrigation facility.	2.67	N/U	2.54	N/U
4	Brgy. Dampe irrigation facility reduces the managerial costs of the administration.	2.38	D	2.45	D
5	The on-farm profitability of farmers increases because of Brgy. Dampe irrigation facility.	2.62	N/U	3.17	N/U
6	There is an increase in crop productivity because of Brgy. Dampe irrigation facility.	1.87	D	1.42	SD
	Overall	2.36	D	2.23	D

3.5 Problem Tree Analysis

In order to map out the causes and effects of the problems identified in the Barangay Dampe irrigation facility, problem tree analysis was used. In here, the problems are divided into 'causes' and 'effects,' each of which is united by a core, or focal, problem. Since the main objective of the study is to formulate an assessment tool/framework to identify irrigation problems present in an irrigation facility, problem tree analysis is an effective method to use in order to have an easier understanding of the flow of the cause and effect relationships of each problem identified in the irrigation facility obtained through utilizing the framework formulated. First, the tree is divided into four (4) focal factors wherein problems mostly occur within these components; (1) Infrastructural; (2) Environmental; (3) Management and; (4) Performance. These major components were identified based from all the literatures reviewed concerning problems occurring on irrigation facilities. Next is to formulate the causes of these problems. Once the causes have been formulated, then the effects can already be identified.

In the case of Infrastructural, two (2) major causes were identified. One is Caulaman River and Dam are not responsible for the sourcing of water and the other is dams are not working. These causes were formulated through careful analysis based on the assessment tool/framework formulated. These causes resulted to the loss of water due to its physical condition as well as both the treatment and filtration 16allowances are not working. The second because that was identified was the pumps and canals are not working which resulted to its deterioration.

According to the NIA engineers and personnel, the siphon of the irrigation was also washed out because it did not withstand the large volume of water when the heavy rain poured. The farmers noted that in order for the irrigation facility to function again, the Caulaman River and Dam together with the siphon shall be constructed immediately.

As to the Environmental Component, according to the farmers and NIA engineers and personnel that were interviewed and answered the survey questionnaire which became the assessment tool/framework, it can be noted that the rainy and summer seasons affect the quality of water. During rainy seasons, flooding occurs in Brgy. Dampe irrigation facility meanwhile scarcity of water happens during summer season. Also, non-hazardous wastes such as plastic, paper, glass, and cardboard are present inside Brgy. Dampe irrigation facility hence these wastes obstruct the physical condition of canals and pipes. The NIA engineers and personnel stated that aside from Brgy. Dampe irrigation facility, climate variability has always been a major problem because of its unpredictability.

In terms of the Performance Component, the cause and effect of the major problems were also identified through the analysis based on assessment tool/framework formulated, conducted focus group discussion, and casual interview. It was evident that dams and rivers are not functioning resulting in a reduction in managerial costs. There has also been no noticeable improvement in the cost of water quality. Due to the washout of dams and rivers, there is no water source for irrigation. As problems arise in the irrigation facility, the crop productivity is also affected. There is a decrease in crop productivity because of the absence of the irrigation facility. Due to the lack of a facility, farmers were forced to utilize diesel water pumps, which increased their costs. As a result, farmers are also affected by the rise of oil prices.

It can also be observed that the Management Component was not included in the problem tree analysis since there are no issues identified. Through the assessment tool and casual interview conducted, it showed that the irrigators association as well as the NIA were hands on in managing the irrigation facility. Moreover, they always keep the farmers and beneficiaries in-tuned with the updates, reports of the current condition of the irrigation facility, and modernizations. The NIA engineers and personnel emphasized that the technical personnel who oversee the maintenance and operation of the irrigation facility are always present when problems arise, and they were trained and equipped with skills for immediate response. The officials also made sure that there is a structured and strong formation of committees and task forces to support and increase the knowledge of farmers in cultivating water and agriculture.

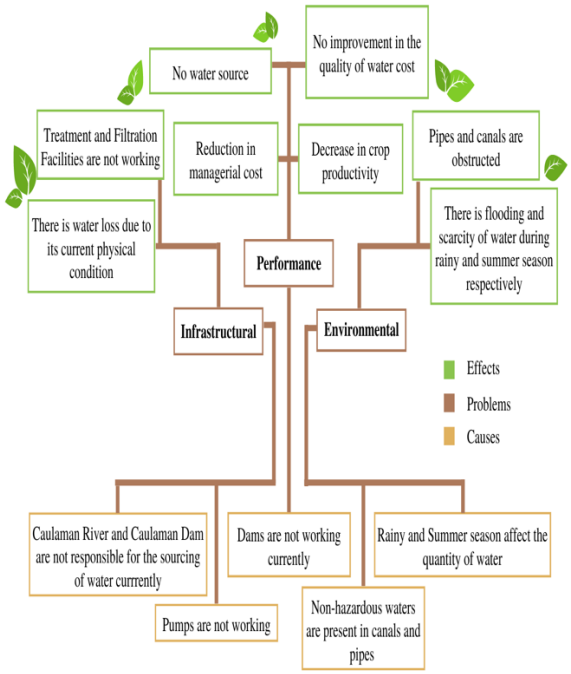

Fig.1. Problem Tree Analysis Based on the Results of the Assessment using Project Saklay Framework

3.6 Validation of Results through Focus Group Discussion

The last phase of the data gathering procedure of the study is the validation of the results using the formulated assessment tool/framework via focus group discussion with the farmers and barangay officials of Barangay Dampe, Floridablanca, Pampanga, and the NIA engineers and personnel. The discussion was done face-to-face and in clusters considering the availability of both the stakeholders.

The following were discussed during the Focus Group Discussion:

- Introduction about Project Saklay (Saklolo sa Palay)
- Objectives of the study
- Components of the Assessment Tool/Framework

- Walkthrough of the Developed Assessment Tool/Framework
- Who will use the Assessment Tool/Framework
- Results of the Assessment Using Project Saklay Framework

In the latter part of the Focus Group Discussion, an open forum was held. The farmers and NIA engineers and personnel shared similar perspectives on the viability and usage of Project Saklay framework. They stated that the developed assessment tool/framework can be used as an immediate response report that can be used by the Barangay officials on a monthly or quarterly basis. This significantly answers the problem of the study which is having no sole method of identifying problems in an irrigation facility. Engr. Yleson Ingal of the NIA-PAMBAT IMO stated that the only method that they use is site inspection. Furthermore, the engineers and personnel of NIA acknowledged the specificity and flexibility of the assessment tool/framework based on its structure. Both the farmers and the NIA engineers and personnel suggested that the assessment tool/framework should be reviewed by other experts thoroughly before it can be adopted by the barangay and the NIA.

When it comes to the results of the assessment using Project Saklay framework, both the participants agreed that the problems resulted are actually occurring presently. They rigorously examined the statistical and problem tree analysis, and signed a letter of agreement stating that the results of the assessment using Project Saklay framework are true and valid.

3.7 Action Proposal

Consequently, this study, together with the shared inputs of the farmers and NIA engineers and personnel, developed an action proposal based on the Project Saklay problem identification framework. The following are the proposals:

- Proposal of the Power Solar Power Pump
- Construction of the New Caulaman
- Additional Assistance from the Government
- Develop and Adopt Project Saklay as an Assessment Tool/Framework together with the Proposed Form for Agriculture Survey of NIA

IV. Conclusion And Recommendation

Since water is essential for the growth of the crops, it is important that there is a sufficient amount of water which can sustain the crop period especially in areas where irregular precipitation occurs. Without irrigation, it would be impossible to stabilize food production and feed the world's growing population. The Philippine irrigation system experiences a variety of causes/problems which contribute to its poor performance. Some of which are improper designs, inadequate operation and maintenance budgets, and a lack of funds for timely rehabilitation of facilities damaged by seasonal floods and typhoons, the majority of existing irrigation systems are old and deteriorated. However, it is unfortunate that there is no sole method of identifying such irrigation problems. Project Saklay framework significantly answers the problem of the study.

Based on the conclusion, the following recommendations are hereby made:

- It is advised to use the assessment tool/framework formulated since all experts, including NIA engineers, personnel, barangay officials, and farmers, agreed on the value and usefulness of the tool. Because of its usefulness and impact, the instrument may be used by the NIA, barangay officials, and farmers in identifying irrigation problems. Different irrigation facilities can adopt this assessment tool/framework to utilize as an immediate measure to resolve irrigation problems.
- The experts advise future researchers to continue performing studies regarding the irrigation facility in order to get new insights and enhance the instrument when new demands develop. The methods to be utilized may vary based on the irrigation problems encountered.
- Future researchers may compare the effectiveness of the assessment tool/framework by using different analysis approaches to identify irrigation problems.
- Future researchers may equalize the number of questions per component in the assessment tool. Moreover, other statistical method such as rating scale may be adapted to assess the components further.
- It is advised to include other experts in irrigation in the data gathering procedure to avoid certain biases.

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