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What We Learn from Innovation Failure: A Review of Clean Water Postpaid Service in Remote Island Indonesia Using Sea Water Reverse Osmosis (SWRO) Technology

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FOREWORD by EDITOR-in-CHIEF

We are very pleased to inform the readers that Journal of *Science, Technology, & Innovation Policy and Management* (STIPM Journal) Vol. 5, No. 1, July, 2020 is now ready for public reading and views.

STIPM Journal is an online research journal managed by the Research Center for Science, Technology, Innovation Policy and Management, Indonesian Institute of Sciences (P2KMI-LIPI). This journal in fact provides scientific information needed mostly by the research scholars. As a peer reviewed journal, STIPM provides free access to research thoughts, innovation, and original discoveries.

In this edition, the STIPM Journal contains six articles dealing with science, technology and innovation policy and management written by scholars from Japan and Indonesia.

The first article, entitled *Dynamics of Organisational Capability of Japanese Construction Firm towards Open and Service Innovation through PPP/PFI arrangement* was written by **Taeko Suehiro**, **Kumiko Miyazaki**. This study examines the influence of Public-Private Partnership (PPP)—or, more specifically, Private Finance Initiative (PFI)— arrangements in relation to open and service innovation in construction firms in Japan.

Second article was composed by **Pratiwi**, entitled *The Role of Local Community Associations as Intermediaries: A Multiple Case Study in a Rural Area.* This study investigates the role, capabilities, and the outcome of the engagement of local community associations as intermediaries in different sectors such as agriculture, food processing, and tourism product. This study describes the way innovation promotes rural development.

Erman Aminullah et al., present the third article, *Policy Role in Innovation Network: Case of Indonesian Food Processing Firms.* The objective of the study is to reveal internal and external factors that affect the use of network relations for innovation, with a focus on mapping the policy role in innovation networks. The study was undertaken through case analysis in four different firms in Indonesia.

The fourth article entitled *Potentials of Research Activities in Medicines at the Indonesian Institute of Sciences (LIPI)* was by **Hadi Kardoyo et al**. This article reveals the findings of research priority setting (RPS) in the field of medicine and health at the Indonesian Institute of Sciences (LIPI) in 2017. The RPS stage had been conducted with the Delphi Method and produced five major issues.

Next article entitled *What We Learn from Innovation Failure: A Review of Clean Water Postpaid Service in Remote Island Indonesia Using Sea Water Reverse Osmosis (SWRO) Technology* was presented by **Rendi Febrianda and Nur Laili**. Final article was compiled by **Syukri Yusuf Nasution and Yovita Isnasari** with the title *Valuation IP of Nano Technology to Make a Nano Tea Based on Mangosteen Peel as a New Product Development.* This article analyses the potential of nano technology in developing new

product, such as how much the potential of the turn over if the technology is used to produce a nano tea based on mangosteen peel, how much the royalty rate, and how is the positioning of the technology in in relation with legal aspects, technological readiness, market condition and finance.

In addition to all articles presented in this volume, we also would like to thank the authors, editors, and reviewers who have worked very hard in this edition. We hope that all articles featured in this edition are useful for the readers.

Jakarta, 16 July 2020

Editor-In-Chief

JOURNAL OF STI POLICY AND MANAGEMENT

Volume 5, Number 1, July 2020

LIST OF CONTENTS

STI POLICY AND MANAGEMENT
Journal homepage: http://www.stipmjournal.org

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ABSTRACT

Every project from government should deliver a great mission, especially for undeveloped areas. But in fact, there were plenty of the projects failed to sustain then became out of order. This article uncovers the reason behind one of central government projects supplying clean water to remote area that has a big tendency to failing in sustaining its service. Using formulated factors of achieving the sustainability of clean water service as the framework, and social innovation approach as the tool of analysis, the result indicates that the service started to maintain its effective demand onerously due to dealing with the sociocultural of the users. What was missing from the system of the project in delivering the service and what solution must be taken will be discussed in this article.

I. INTRODUCTION

One of the most serious shortcomings of innovation study is the pro innovation bias. This is the implication of most research that an innovation should be diffused then adopted quickly by a social system. This pro innovation bias occurrs frequently as successful innovation leaves a trace of adoption that can be observed and investigated, while the unsuccessful innovation leaves invisible marks to be studied (Rogers, 2003).

There is no blame with this regard, especially as successful innovation is more interesting and more likely to have practical policy implications. However, knowing too much about successful innovations becomes a problem for our intellectual sense (Rogers, 2003). While a failure seems to lead to frustration only, in fact this can provide a significant insight about why it happened and how to prevent. The proverb on our society still believes that "*you will learn more from your failures than from your successes*". Many series of projects provided an opportunity to explore how weaknesses in the innovation system relate to innovation failure (Jenson, Leith, Doyle, West, & Miles, 2016)

We have learned a case of Indonesian government project providing such a postpaid service of

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public basic need as clean water to the residents of Mandangin island of East Java Province. This was a project derived from central government program to achieve the Milennium Development Goals (MDGs) in 2015. Our government made a breakthrough by means of introducing and implementing a technology of SWRO to remote area as a feasible preference that is worthy being selected because of its potential for seawater.

Initial assessment has been carried out and the service has been running since 2012. The project was not planned vaguely as it implicated the role of involvement by central government, local government, service provider, and private sector. The unit of SWRO was able to deliver 5 liters/second of capacity and can operate for many years under standard maintenance. However, the evidence has shown that the service does not operate as planned and it creates an effect in which the unit of SWRO will not function over a prolonged period of a time according to the designed life cycle of the equipment. For the record in 2015, the unit functioned in less than half of its optimum capacity. Currently it declines more than before, as predicted. This is claimed to be able to breakdown the core machine of SWRO technology. Therefore, the service is in danger of discontinuance. Whereas a service is sustainable when it functions, is used, and provides the services for which it was planned (Brikké & Bredero, 2003). The previous paper has presented that financing tool like a government policy granting a direct financial incentive to cut the selling price down seems has no effect to intensify the demand as the nature demeanor of Mandangin residents against the service (Laili, Febrianda, & Surminah, 2016).

Based on the reports from Chapagain and Hoekstra (2004) as well as Narayan (1995), a sustainable service of clean water technology relied mainly on technical, social, environmental, and institutional factors. In this paper, we attempt to reveal whether this is an inevitable fact or there was a missing puzzle or weakness from the system of this project thus causing it to fail to operate properly. The insight was gained from its procurement to the implementation. We use combined influential factors of sustainable clean water service to assess the project system then use social innovation approach to analyze the findings. The output will be a practical feedback for the system.

Mandangin Island is a part of administrative area of Sampang District, East Java Province, and geographically located in southern of Madura island. It takes about 1.5 hours to reach Mandangin Island using regular boats. This island is spanning 1.65 km^2 and inhabited approximately by 19,550 of total population in which 79% of them are conservative fisherman (Laili, Febrianda, Kusbiantono, & Surminah, 2015).

II. ANALYTICAL FRAMEWORK

This project was expected to be a pilot project from Indonesian government in order to fulfill the commitment of MDGs. One of the goals was clean water access development especially for remote areas. Mandangin Island as a remote area is occupied by the people who mainly rely on rainfall for clean water. The only abundant resource of water in this island that is available for all year is seawater. Clean water postpaid service based on SWRO technology is a something new for them.

We consider this project as a social innovation concept and take the definitional knowledge of innovation as follow.

> "*Innovation is an idea, practice, or project that is perceived as new by an individual or other unit of adoption. An innovation may have been invented a long time ago, but if individuals perceive it as new, then it may still be an innovation for them*" (Rogers, 2003)

And,

> *"Social innovations as new solutions (products, services, models, markets, processes etc.) that simultaneously meet a social need (more effectively than existing solutions) and lead to new or improved capabilities and relationships and/or better use of assets and resources"* (Davies, Caulier-Grice, & Norman, 2012)

These previous studies proposed several factors for achieving the sustainability of clean water service in rural or remote areas (Chapagain & Hoekstra, 2004; Narayan, 1995; Saniti, 2012). The same elements from each study were taken to be the principle or standard that must stand

for supporting the implementation of the service, while the rests are entered onto additional terms (*see Table 1*).

In accordance with its purpose, social innovation is seen as a response to overcoming and resolving the problem inside community by giving them a societal benefit and development (European Commission, 2009), therefore, in analyzing the findings, social innovation approach is applied.

Table 1.
Factors Affecting the Sustainablity of Clean Water Service for Rural and Remote Community

Factors	Elements
Technical factor	Parts
	Technology reliability
	Selection of appropriate technology
	Service and Infrastructure
	Selling price
	Workers/Operators
Social factor	Demand
	Ability to pay
	Sociocultural
	Level of education
Environmental factor	Source type of water
	Quality/Quantity/Continuity of water source
	Rainfall
Institutional factor	Subsidy policy
	Institutional support
	Government regulation and support
Supplementary factor	Political and economical condition
	Knowledge transfer
	Energy
	Total population
	Collaboration with society

III. METHODOLOGY

This article is designed as a qualitative reviewing study. Data and information were collected by interview and through observation. They were originated from research project report of Research Center for Science Technology and Innovation Policy and Management–P2KMI LIPI on System Transition Model of Clean Water Technology in Littoral Areas of Indonesia in 2015 (Laili et al., 2015).

The respondents on this study comprised of 5 representatives of:

1) Ministry of Public Works–Directorate of Drinking Water Development from central government as the tender holder and central regulator,
2) Public Works Departement of East Java local government office as the local regulator,
3) The champ of the project tender from private firm (PT Juhdi Sakti Engineering/PT JSE) as the constructor of SWRO technology,
4) The clean water service operator of Sampang district (PDAM Trunojoyo) as the operator of this service, and
5) Mandangin residents as the users.

The analysis is peformed qualitatively by classifying data/information, describing their phenomena then explaining the phenomena occurred from social innovation perspective. Therefore, the level of knowledge offered is descriptive and explanatory knowledge.

The plots are divided into two parts as follow:

1) Evaluation by assessment matrix
2) Main discussion

IV. RESULTS AND DISCUSSION

1. Assessment Matrix

Table 2 is used to classify and to explain the phenomena that are observed to exist or occur on each factor and element towards the sustainable model of clean water service.

2. Main Discussion

No one can ensure that the newly noble and brilliant ideas will break a certain social regime then become successful innovations. Otherwise, most of those ideas were failed on their way. Failure may lead to trauma or an inability to commit to new innovations because of severe disappointment from previous failures (Välikangas, Hoegl, & Gibbert, 2009). This may affect the further development projects. Conceptually the probability to failure can be minimized if a system of innovation is supported properly by the entire needed factors. Financial support like incentive and subsidy, and the presence of infrastructure in

Table 2.
Assessment Matrix of SWRO Postpaid Service in Mandangin Island

Factors	Elements	Phenomena	Has the phenomena occured properly toward achieving the sustainability?	Follow-up
Technical factor	Parts	SWRO technology was designed and developed by PT JSE. Some key parts of the technology such as membrane are still imported products, yet the stocks are sufficient in local market. Afterall, PT JSE will help provide them for 6 years.	Yes	-
	Technology reliability	Ministry of Public Works cooperating with consultants from University of Indonesia has set the standard specification of technology. PT JSE as the constructor has provided warranty for 6 years.	Yes	-
	Selection of appropriate technology	SWRO unit technology is the best feasible option and might be not too appropriate for all people. However, the operators were in charge for the operation and maintenance of the SWRO technology.	Yes	-
	Service and Infrastructure	In addition to SWRO technology, additional infrastructure and service system needed were provided by the operator. Clean water was distributed through direct pipeline system from the unit to the resident houses. Bills could be paid for as well by home service directly to each user.	Yes	-
	Selling price	The selling price is subsidized jointly based on the agreement between PT JSE and PDAM Trunojoyo for IDR 12,500/m^3 plus administration fee IDR 11,000/ month in exchange of Total Dissolved Solid (TDS) water.	Yes	-
	Workers/ Operators	This service was operated by 3 operators consisting of 2 technical personnels (1 personnel from PT JSE who is responsible for transferring knowledge and 1 personnel from PDAM Trunojoyo as the unit operator), and 1 administrative personnel.	Yes	-
Social factor	Demand	56% of Mandangin residents were the users of the service, however after confirmation period, the demand declined significantly. The residents often delay the payment and neglect the bill under bunch of alibis. This happened mainly when rainy season is coming.	No	Corrective action
	Ability to pay	The unit operators affirmed that the residents can afford to pay the average usage by their general economical condition.	Yes	-
	Sociocultural	Most of the residents eventually perceived that clean water is social item that could be gained for free. Furthermore, the behavior pattern (*habbit*) of them is less aware of general healthy life standard. For drinking water, they collect rainfall. For other purposes, as bathing need, they still use sea water. This is the reality allegedly affected by their general profession of conservative fisherman.	No	Corrective action
	Level of education	79% of residents were conservative fisherman, 6% shopman, 1% government employees, and 14% not working. Most of the residents still have low level of education. This may affect the living standard as well.	No	Corrective action

Factors	Elements	Phenomena	Has the phenomena occured properly toward achieving the sustainability?	Follow-up
Environmental factor	Source type of water	As a remote island, the substantial source of water is seawater.	Yes	-
	Quality/ Quantity/ Continuity of water source	Mandangin island, as a remote and coastal area, possesses proper source of seawater as the main raw source of SWRO technology that is available for all year.	Yes	-
	Rainfall	Mandangin island possesses normal chance of precipitation like most other lowland areas of Indonesia. There will be rainy and dry season. During the dry season, they need to find the other water source over collecting the rainfall.	Yes	-
Institutional factor	Subsidy policy	This project was fully funded by central government, and the selling price has been schemed to be subsidized likewise which was adjusted to the financial capability of the residents.	Yes	-
	Institutional support	For day-to-day operational support of the institution, from the procurement to the technical and administrative service, as well as the legal aspect, were supported by Ministry of Public Works – Directorate of Drinking Water Development from central government, Public Works Departement of East Java local government, private firm (PT Juhdi Sakti Engineering/PT JSE) and PDAM Trunojoyo. Nevertheless, there was no support or voluntary service providing basic social services or executing community development activities.	No	Corrective action
	Government regulation and support	Indonesia Master Plan for the Acceleration and Expansion of Indonesia Economic Development (MP3EI) based on regional economic strength, especially by extending clean water access. One of MDGs commitment from 2000 to 2015 to improve clean water access to many areas by 68.87%. SDGs target renews the MDGs target of expanding clean water access. Both are national and international commitment of government to support the development of clean water access in Indonesia.	Yes	-

Factors	Elements	Phenomena	Has the phenomena occured properly toward achieving the sustainability?	Follow-up
Supplementary factor	Political and economical condition	Indonesia's political condition after crisis in 1998 has continued to improve and become more stable. Economic growth has strengthened also for a decade and half after the crisis, but has slowed over the past few years. Indonesia has had strong fiscal position, but with small government budget (Petar Vujanovic, Dutu, & Jarrett, 2015). Indonesia's economic growth rate from 2000 to 2014 still ranged positively from 4.92 % to 6.35 % (Katadata.co.id, 2018). Nevertheless, government has sought to increase public expenditure in infrastructures including clean water treatment and sanitation.	Yes	-
	Knowledge transfer	Ministry of Public Works has made an agreement with PT JSE that it must undertake the technical assistance for 6 years. This agreement is intended not only for the need of knowledge transfer, but also as a form of accountability for the unit quality in accordance to offered technical specifications.	Yes	-
	Energy	The unit has possessed autonomous power plant. Reverse osmosis technology gives such advantages as compact construction and small energy consumption.	Yes	-
	Total population	It relates to the amount of demand. The total of Mandangin residents has surpassed the minimum ratio of cost and profit.	Yes	-
	Collaboration with society	It relates to the sharing of responsibilities. Nonetheless, this case is public project involving the application that requires a particular skill, knowledge and experience. In the future, sharing responsibility could be in the form of human capital development through recruiting local residents and providing them skills through trainings for achieving sustainable social implementation.	Yes	-

many cases are crucial for success to innovation projects (de Jong, Gillert, & Stock, 2018; García, Segarra, & Teruel, 2018; Oeiji, van der Torre, Vaas, & Dhondt, 2019).

The assessment matrix from Table 2 has shown that the elements of principle have not been fully attained for supporting the service system. The missing puzzles are situated on both social and institutional factor. Institutional factor was expected to adjust the social factor from improper to preferable ones.

Drawing on research from The Young Foundation (2012), the process of social innovation consists of six phases in which many of these overlap and the feedbacks exist between every phase which makes the process iterative like a spiral rather than linear. The six phases include:

1) Prompts–which highlight the need for social innovation,
2) Proposals–where ideas are developed,
3) Prototyping–where ideas get applied in practice,
4) Sustaining–when the idea becomes everyday practice,
5) Scaling–growing and spreading social innovations,
6) Systemic change–changing the way of things are done.

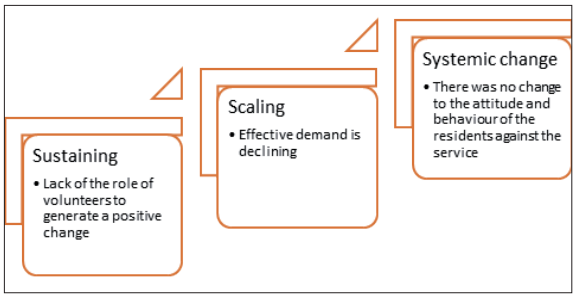
To understand the sequence of this review, let's start from the first phase of the social innovation process. In the phase of prompts, any social innovation involves prompts that highlight the need for innovation. As mentioned before, this project was expected to be a pilot project of Indonesian central government in order to fulfill the commitment of MDGs. One of its goals was clean water access development particularly for remote areas. Therefore, the need for innovation is that how to expand a clean water service to the population in remote areas.

The second phase of proposals involves the generating of a new idea that provides a solution to be developed. PDAM Trunojoyo as a local service provider initially planned to design a construction of undersea water pipeline distribution from the main island of Madura to Mandangin island. However, PDAM Trunojoyo canceled the plan as the risk of crack is highly severe plus the difficulty to search the experts for repair. Then, in the island, Ministry of Public Works offered a project of providing clean water service by constructing an embedded installation of technology turning seawater into water for daily use. This initiative eventually became one of national pilot projects from central government to overcome the scarcity of clean water in remote areas. The point is that this project was a supply push or target oriented project.

In the third phase, usually, ideas are introduced and then adjusted in experimentation or prototyping for testing the idea and refining it. In this case, target push inevitably occured and skipped over the beta prototyping or pilot scale of the project. Survey was carried out by PDAM Trunojoyo to obtain an initial image of what Mandangin residents' response to the project. The results of the survey indicated that 56% residents claimed to agree and accept either this project or its operational costs. Based on this survey and the urge from central government to concretize this pilot project, one year later, the construction of SWRO in Mandangin Island was then accomplished in 2011 and began operating in 2012. The MoU was signed in April 1st, 2011 by three representatives (Regent of Sampang District East Java province, Director of Drinking Water Development of Directorate General of Cipta Karya–Ministry of Public Works, and Head of Public Works Department of East Java Province). The first phase of the unit was serving 5 liters/second of the capacity or equivalent to 432,000 liters/day.

The next is the sustaining phase. The data from Table 2 shows that after taking the idea that has shown promise as a pilot project and turning it into an established initiative that should be sustained over time, the problem began to be harvested in the sustaining phase then continue to cause a deterioration to the next both phase of scaling and systemic change (see Figure 2). The goal of the fourth phase is making the idea become the practice of day to day life. Therefore, sustaining is not only involving service model, governance model and financing tools, but also staffing model including the role of volunteers (The Young Foundation, 2012). Generally, people working in the service sector are active volunteers themselves, and the main role of volunteering is contributing to sustainable positive change (Institute of Development Studies, 2015). Even grassroot projects as a bottom up solution responding to local stituations needs social approach for effective deployment (Dana, Gurau, Hoy, Ramadani, & Alexander, 2019). Sustaining is the phase where much of tough work should be done properly.

In the scaling phase, social innovation is strived to grow. Growing an innovation depends on effective supply and demand. Effective supply refers to the evidence to show that the innovation really works, while effective demand refers to willingness to pay (The Young Foundation, 2012). The result of the demand and sociocultural elements on Table 2 shows that the effective demand has ended up decreasing. After several months of operating in the first year, the residents have exposed inconsistant commitment to use the service by often delaying the payment and neglecting the basic bill under bunch of alibis.



Source: Construct by Authors

Figure 1. The Three Failures During the Process of the Innovation (*based on data analysis result*)

The last phase, the systemic change, is the ultimate goal of social innovations. Systemic is the result of a complex interaction of culture and user behavior. Moreover, it always involves a change to the attitudes and behaviors, and it requires people to see and think in new ways. A change in systemic change indicated that there were moderate action and incentives for residents to change their practice and behavior. In this case, the deterioration of behavior can not be avoided by which most of the residents eventually perceived that water is social item that could be accessed for free like their previous practice. Furthermore, the ignorance of general healthy life standard is the thing that should be changed even though there is no problem with their physical condition at the moment.

We consider this project as a social innovation. Social innovation has emerged as a response to the challenges of complex including social, environmental, demographic challenges and so on where conventional solution was not possible (Nicholls, Simon, & Gabriel, 2015). According to the Forum on Social Innovations (The Young Foundation, 2012), social innovation deals with improving the wellbeing of individuals or community, and local development can be considered as intertwined with it. Social innovation delivers new solution that improves the quality of life (Ville & Pol, 2008). However, in any case, it requires the sociocultural change as well during the process of the implementation (The Young Foundation, 2012). Furthermore, social innovation can construct societal transformation (Wittmayer, Backhaus, Avelino, Pel, Strasser, Kunze, & Zuijderwijk, 2019). Things like incentive or subsidy from government institutions, existence of operators and technical associates are important with their respective roles. However, nearly in every case of rural and remote areas, social aspect of rural development is equally crucial.

For achieving a sustainable rural development, transformative social innovation is required. This transformative can be initiated by developing and fostering collaboration of actors with interest in development (Castro-Arce & Vanclay, 2020). Within most social innovations, the non-profit sector or NGOs, historically has played a vital role not only in identifying and articulating social needs and suggesting ways of addressing them, but also encouraging various forms of engagement. NGOs will fill the space by playing a role in supporting and reducing barriers to adoption of innovation and pilot projects (Malena, 1995). They have a changing role over time. However, they lack to spread and grow because of financial limitation, and they usually need a support from government (TEPSIE, 2014).

Engagement during the innovation process helps secure adoption (de Jong et al., 2018). Engagement in social innovation as the many ways in which diverse actors can be brought into the process (TEPSIE, 2014). NGOs could be oriented towards empowerment or become the role model to improve and develop the sociocultural of Mandangin residents. In short way, collaboration between the state and such non-profit sector as NGOs could be alternative way in developing the sociocultural of Mandangin residents by providing the basic development activities. These activities are intended solely to build the public awareness of clean water for daily life in order to escalate the effective demand.

IV. CONCLUSION

Neglected important problems often lead to missed opportunities of corrective learning. Every innovation depends on its demand. Social innovation demand requires sociocultural change, while sociocultural change requires intensive and repeated effort. Planning for sociocultural development of Mandangin residents was skipped and forgotten that eventually led to the disturbance of scaling phase and the error of systemic change

during the innovation process. Corrective action is required by providing basic or standard development activities to revise residents' awareness to clean water in order to strengthen the effective demand. Similar issue, under the same sociocultural condition, it may reappear if the attention to the basic development is weak.

Input for social innovation approach lies on the third phase in which usually the ideas are introduced in beta testing or pilot unit. Supply push from central government becomes the cause of this overlooked beta step.

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