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INTERPRETIVE STRUCTURAL MODEL OF YOUTH-BASED WASTE MANAGEMENT ENABLERS IN LABUHAN BAJO VILLAGE, INDONESIA

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ABSTRACT

Many policies, programs, and projects have been attempted to resolve waste problem in Indonesia, yet it is still one of the major environmental problems in the country. Several waste management practices exist at various levels, from the community level up to the industrial level. With increasing budget available for villages through various schemes, village-level management poses opportunities to solve waste problem in Indonesia. This empirical study uses Interpretive Structural Model (ISM) to examine variables contributing to youth-based waste management practice in Labuhan Bajo Village and the relationships among the variables. Participant observations and in-depth interviews were carried out to solicit information on important enablers for youth-based waste management. The model was developed using ten enablers. In this study, the model shows that the first driving power is facilitation, in this case, a NGO. On top of the model is the financial gain enabler. The Cross-Impact Matrix Multiplication Applied to Classification (MICMAC) analysis shows that most of the enablers are in Linkages category. Effective and efficient handling of the linkage enablers is necessary for youth-based waste management. This study offering enablers' model gained from empirical study may offer fruitful insight for enhanced body of knowledge in waste management model at village level led by the local youth particularly in Indonesian context.

Key words; *Environmental Education, Village Fund, Waste Management, Youth-Led Action.*

INTRODUCTION

Waste is becoming a global problem linked to 11 out of 17 Sustainable Development Goals (SDG)s (Wilson & Velis, 2015). Hence, waste management is becoming essential service and can be regarded as basic human needs (UNEP, 2015). According to the World Bank, current data estimates that the world generates 2.01 billion tonnes of municipal solid waste annually and it is predicted that it will increase to 3.40 billion tonnes by 2050 (World Bank, 2021).

Marine debris is one of the ubiquitous and transboundary problems related to waste(Purba et al., 2019).. Marine debris poses threats to ecosystem functioning through habitat deterioration (Hammer et al., 2012; Moore, 2008), entanglement (Reid et al., 2013), and ingestion (Lavers et al., 2019; Rochman et al., 2015), . In addition, marine debris also affect public health (Mintenig et al., 2019) tourism and maritime economies (Abalansa et al., 2020).

In Indonesia, waste remains a huge challenge as the population continues to grow. Indonesia is the second largest contributor to marine plastic debris after China (Jambeck et al., 2015). According to the National Plastic Action Partnership (NPAP), around 72% of plastic pollution in Indonesia originates from mismanagement in the rural regions and small to

medium-sized cities. The Indonesian Institute of Sciences (LIPI) estimated an average monthly plastic debris leakages in Indonesia of 113.6 ± 84 g/m^2 (Cordova et al., 2019) or equivalent to 0.40 Mt/year assuming plastic debris is most prevalent within 3 meters from Indonesia's coastlines.

The government have issued several regulations related to waste management such as Presidential Decree No.97/2017 on National Policy & Strategy on Management of Household Waste and Household-like Waste (JAKSTRANAS), and Presidential Decree No.83/2018 on Marine Debris Management (Plan of Action on Marine Plastic Debris 2017–2025). In 2020, National Plastic Waste Reduction Strategic Actions (NPWRSA) for Indonesia was issued (MoEF, 2020). Two of the strategic actions in the NPWRSA is (i) developing activities and plastic waste management pilot programs in the local government and (ii) improve the operation of collection, sorting, processing, packing and transporting of recyclable materials through the informal sector and/or community-based organizations.

Without active participations from the public, it is almost impossible to resolve waste problems as the source of waste is individual consumption. Studies on waste management planning in West Nusa Tenggara Province have called for stakeholders and publics' participation as one of the important factors for a successful implementation of waste management effort (Syaputra, 2019; Kurniawati, 2020).

With population demography of 27.94% Gen Z – born between year 1997 to 2012 and 25.87% Millennials – born between year 1981 to 1996 (together it is about 53.815% of the total population) (BPS, 2020), youth can play role in reducing waste problems in Indonesia. Considering that young people make about 30% of the world population, the importance of young people's active engagement in environmental protection is also described in Agenda 21 of Sustainable Development paragraph 25.2 as excerpted below (UNSD, 1992).

> "It is an imperative for the young people from all over the world to actively participate in all relevant levels of the decision-making process having in mind that those decisions affect not only their present lives, but their future as well. It should be added here that the intellectual contribution of young people and the possibility of giving support represent a unique perspective that should be also taken into consideration."

But how do we enable youth to be the significant actors in waste management? This empirical study in Labuhan Bajo Village, Utan Subdistrict, Sumbawa District, West Nusa Tenggara Province, aims to identify the enablers for youth-based waste management and develop the enablers model using Interpretive Structural Model (ISM). Several studies have used the ISM method to develop waste management model (Armadi et al., 2020; Chauhan et al., 2018; Thakur & Anbanandam, 2016; Kholil et al., 2008). ISM is intended for use when desired to utilise systematic and logical thinking to approach a complex issue under consideration (Ravi et al., 2005).

Labuhan Bajo village is selected because it is located in a coastal rural area with high number of population (around 2000 people). This location can provide insight into how rural areas can manage their waste so as to reduce mismanagement in the rural areas which comprised around 72% of plastic mismanagement in Indonesia as reported by the NPAP (NPAP, 2020). In addition, being a coastal village with high population, this location can represent marine debris being found most pervasive within 3 meters from coastline (Cordova & Nurhati, 2019).

METHOD

Research site

This study was carried out in Labuhan Bajo Village, Utan Subdistrict, Sumbawa District,

West Nusa Tenggara Province, Indonesia (Figure 1). The 20 km^2 coastal village is home for 1,924 people (BPS Kabupaten Sumbawa, 2019) (). There is one elementary school with eight teachers. The major source of income here is fishing. Around 20 km^2 of its marine areas was designated as Keramat, Bedil, and Temudong (Kabete) Marine Conservation Areas in 2011 where 100 ha was designated as core zone, 650 ha as limited use zone/tourism, and 1,250 ha as sustainable fishing zone (DKP Sumbawa, 2014) (). Since the enactment of Law 23/2014 about Local Government, the district government no longer has authority to manage any portion of marine areas. Article 27 of the Law regulates provincial government authority in the Sea. Under article 27, the provincial government is given authority to manage natural resources in the sea maximum 12 (twelve) nautical miles from the coastline to the open sea and/or in the direction of the archipelagic waters.

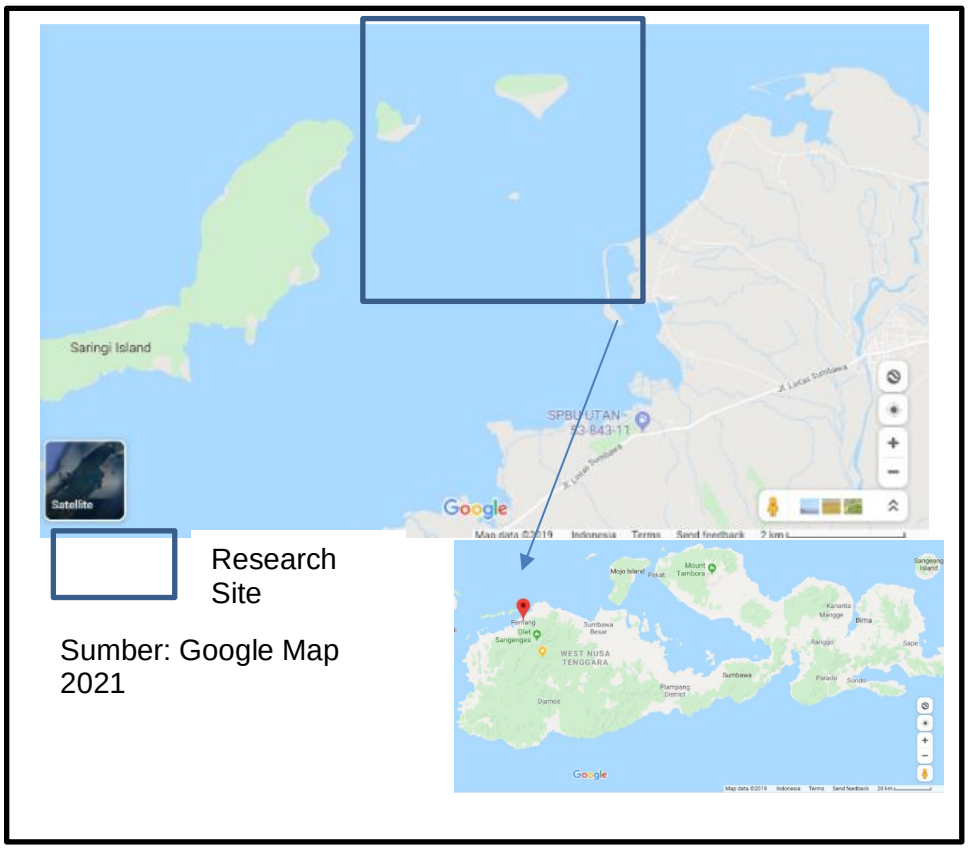

Figure 1. Research Site (Labuhan Bajo Village, Sumbawa District, West Nusa Tenggara Province, Indonesia)

Research Procedure
Data collection

To develop the interpretive structural model of youth-based waste management in Labuhan Bajo Village, we need to formulate and determine the main enablers (variables) of the model. To identify important enablers in waste management, we undertook literature reviews and solicited empirical information from key stakeholders. Most of the literature being reviewed were from the field of youth empowerment, existing waste management practices, and behavior model theories. Interview guideline was developed to identify enablers in youth-based waste management at the village level. The following literatures were used as references in interview guideline development and data analysis (Table 1).

Table 1. Literatures Used as References to Develop Semi-Structured Interview Guideline

Topic	Article Title	Key Results
Youth Activism in Waste Issues	Teen activism leads to local laws banning single-use plastics: a two-year experiential learning journey (Burke et al., 2020)	Democratic town meeting has allowed students to attend the meeting, voice their opinions, debate, and vote on local laws and budget. After two years, the students were able to influence local law on single-use plastics ban.
Youth activism in environmental politics	Perspective from a youth environmental activist: Why adults will listen to youth in politics (Hartley et al., 2021)	Adults, including local officials consider youth voices as valuable and uniquely situated to foster productive political processes for addressing marine debris.
Informal Sector in Waste Management	The Waste Experts: Enabling Conditions for Informal Sector Integration in Solid Waste Management: Lessons learned from Brazil, Egypt and India (GTZ, 2010)	Success factors influencing the integration of the informal sector in solid waste management are: 1. Internal organisation and capacities of the informal sector 2. Participation of NGO's in the integration process 3. Social acceptance of informal sector workers 4. Political will to integrate the informal sector 5. Collaboration with the formal private sector
Behavior Model	Youth and sustainable waste management: a SEM approach and extended theory of planned behavior (Heidari et al., 2018)	Motivation has the most important on intention toward waste separation. The study suggests that the authorities should encourage people, using economic incentives, to separate waste at source
Behavior Model	Factors influencing the rate of recycling: an analysis of Minnesota counties (Sidique et al., 2010)	Knowledge and environmental awareness are considered as key factors in recycling programs.

Through participant observation (April 2015 – January 2020) and in-depth interviews (March 2021), we then explored information from key stakeholders involved in the waste management practice in the study site. The key stakeholders were identified based on our observation for over five years (2015 – 2020) on who play direct roles in the initiation of the youth-based waste management at the study site. List of the key stakeholders is presented at Table 2.

Table 2. List of Interviewed Key Stakeholders

Key Stakeholder	Number of persons	Role	Demographic Information
Village Head 2015-2019	1	Major role in approving budget allocation for waste management	Male, age: 52 years old Highest education: Bachelor Degree
Village Secretary	1	Major role in putting procurement of necessary equipment such as three wheelers and bins into the village fund budget plan.	Male, age: 33 years old Highest education: Bachelor Degree
Local youth (member of Kabete Education Center	9	Communicate and negotiate waste management issue to village inhabitants, village office and village house of representatives	5 males 4 females Highest education: Senior High School age: 17 – 29 years old
Local youth (not member of Kabete Education Center)	2	Represent village inhabitants' opinion	1 male, age 22 years old 1 female, age 19 years old Highest education: Senior High School
NGO (Penjaga Pulau Community)	2	Facilitate local youth to understand their assets, develop vision, and improve their knowledge.	1 female, age 42 years old. Co-author. Highest education: Doctoral Degree 1 male, age 39 years old Highest education: Bachelor Degree

Data analysis

To better articulate the relationships of the enablers of waste management in the study site, ISM method was used. ISM is a well-established methodology for identifying relationships among specific items, which define a problem or an issue (Attri et al., 2013). Interpretive

Structural Model (ISM) was developed by adopting the steps as described in Attri et al. (2013), Talib & Faisal (2016), and Sushil (2012) as follows:

I. Identify the elements which are relevant to the problem. This could be done by a survey or group problem solving technique. In this study, facilitating conditions which allowed the youth to promote youth-based waste management at the village level are identified from the data collected from the interviews and participant observations with key stakeholders. II. Develop a structural self-interaction matrix (SSIM) of elements. This matrix indicates the pair-wise relationship among enablers of the system. This matrix is checked for transitivity. Four standardized symbols were used to denote the relationship between the two enablers under consideration. The symbols are:
   a. V: enabler i will help achieve enabler j;
   b. A: enabler j will help achieve enabler i;
   c. X: enablers i and j help each other;
   d. O: enablers i and j are unrelated.

   i represents enablers arranged in each row, while j represents enablers arranged in each column.
II. At this stage, contextual relationship is obtained from discussion with relevant key stakeholders (Village Secretary, Kabete Education Center Member, and NGO).
III. Develop a reachability matrix from the SSIM. The SSIM format is transformed into the reachability matrix format by substituting v, a, x, and o by binary numbers '1' or '0'. This transformation is carried out as per the standard ISM rules as follows:
   a. If the (i,j) entry in the SSIM is a V, the (i,j) entry inthe reachability matrix becomes 1 and the (j,i) entry becomes 0.
   b. If the (i,j) entry in the SSIM is anA, the (i,j) entry inthe reachability matrix becomes 0 and the (j,i) entry becomes 1.
   c. If the (i,j) entry in the SSIM is an X, both the (i,j) entry and the (j,i) entry of the reachability matrix become 1.
IV. If the (i,j) entry of the SSIM is a 0, then both the (i,j) and (j,i) entries of the reachability matrix become 0. Partition the reachability matrix into different levels.
V. Convert the reachability matrix into conical form.
VI. Draw digraph (directional graph) based on the relationship given in Reachability Matrix and remove transitive links.
VII. Convert the resultant digraph into an ISM based model by replacing element nodes with the statements.
VIII. Undertake MICMAC Analysis. MICMAC stands for Matrice d'Impacts croises-multiplication appliqúe an classment (cross-impact matrix multiplication applied to classification) (Godet, 1986). MICMAC analysis will classify the enablers into four categories i.e., autonomous factors, linkage factors, dependent factors and independent factors. Autonomous factors have weak drive power and weak dependence power. They are relatively disconnected from the system (Attri et al., 2013).

RESULTS AND DISCUSSION

A. Waste Management Mechanism in Labuhan Bajo Village: History and Mechanism

Environmental education in Labuhan Bajo Village, Sumbawa District, Indonesia began in 2015 when a local NGO called Penjaga Pulau Community based in Sumbawa District facilitated the establishment of a local youth organization in Labuhan Bajo Village which they called Kabete Education Center. The name "Kabete" was derived from the acronym of the three small islands surrounding the village namely Keramat Island, Bedil Island, and Temudong Island. This initiation was funded by the Van Tienhoven Foundation, a Netherland-based charity organization. In 2016, the local youth capacity and knowledge on mangrove,

seagrass, and coral reef conservation were strengthened with the financial support from the Rufford Foundation, a UK-based charity organization.

On December 2017, eight members of Kabete Education Center joined a four-day Active Citizens Training conducted by Penjaga Pulau Community in cooperation with the British Council. Active Citizens is the British Council program on social leadership training (British Council, 2021). During the training, they learned about important skills needed to be a leader in their local community. The materials covered included understanding our strengths and weaknesses, appreciation of other cultures and perceptions, community mapping, stakeholders mapping, developing problem tree and objective tree, negotiation skill, and developing action plan. During the community mapping exercise in 2017 as part of the Active Citizens Training (Figure 2), several environmental and social issues were identified by the local youth. Community mapping or sometimes called community asset mapping is a participatory tool engaging youth in exploring their assets within the physical and social environment (Ragan et al., 2010). After further discussion during the Active Citizens Training, waste issue was at their highest priority because failure to solve this issue will hinder their goal to develop the village as edutourism destination focusing on mangrove, seagrass and coral reef conservation.

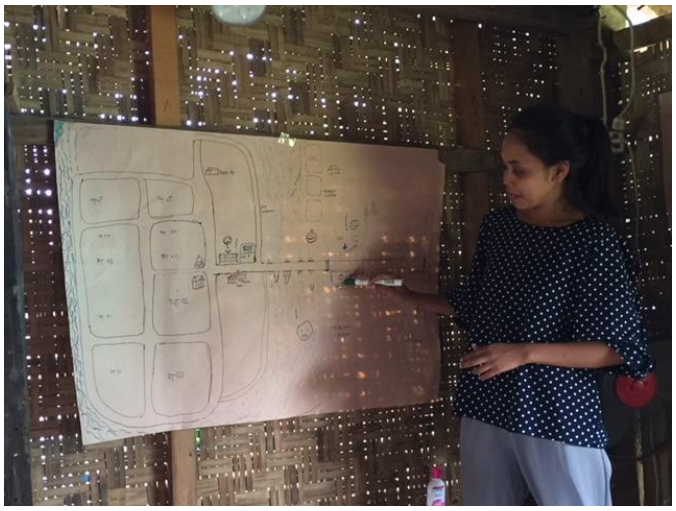

Figure 2. Community Mapping Exercise

Then during 2018, the local youth focused on tackling the waste issues in their village. They were able to pilot waste management at the village level after several discussions and negotiations with the village office and the village house of representatives to allocate village funds for waste management. Temporary landfill was established in the village. Agreement was also reached with the District Environment Agency to take the residual waste from the landfill in the village to the bigger landfill at the District Capital.

Based on the interviews to village secretary and local youth in charge of the waste management, the pilot waste management mechanism in the study site was as follows:

1. The village government provided 100 waste bins placed in several strategic locations. The village inhabitants were expected to dispose their garbage to the waste bins.
2. The local youth (i.e., Kabete Education Center) collected the bins and transported them to the village temporary landfill using three-wheeler vehicle.
3. The village inhabitants who are participating in this program paid IDR 2000 per week to the local youth. The collected money was used for operational purposes such as buying fuel for the three-wheeler.
4. The village provided incentive for the local youth amounting IDR 1,050,000 per month. In 2019, the village allocated village fund to buy 50 more waste bins and 2 more three-wheelers.

B. Waste Management Enablers in Labuhan Bajo Village

Based on the results of participant observation and in-depth interviews, the elements enabling successful waste management in the study site are:

a) Outsider facilitation. In this study, the establishment of the local youth organization was facilitated by an outsider meaning that the initiation came from outside of the village. The initiator was a local NGO called Penjaga Pulau Community. This intervention was supported by the Rufford Foundation and the Van Tienhoven Foundation. Without this intervention, it is unlikely that the local youth organization would be materialized. An attempt was made by one of the villagers to create other organization focusing on non-environmental issues in early 2018. However, the organization failed. More thorough research to understand why the other organization did not take off could provide insight on what factors may influence an organization's survival in a small village. The importance of outsider facilitation was also observed in other issue where Wildlife Conservation Society (WCS) took the initiative to gather the community for mapping of impacts of Kabete marine conservation area for fishers and its potential solutions in January 2020.

b) *Understanding assets (including pride and self-confidence).* The Active Citizens training on December 2017 allowed the local youth to reflect on their vision about their village, problems, assets, and action plan. As mentioned earlier, they focused on waste problem. They started with informal discussion with the Head of the Village but received no tangible response. In 2018, they initiated a festival in the village called "The Pride of Bajo". The festival was part of a project supported by the Conservation Leadership Programme. The festival was attended by the Head of the Village, the Head of the Subdistrict, and more than 1000 people. The local youth presented their concerns about the waste problems through parade, drama, poem, and films. According to the village officials, the festival has brought local youth's concern about waste to the village office's attention. Another important asset according to the Kabete Education Center members is to have a secretariat. They perceived that having their own secretariat would increase their profile in the village as it will become part of their identity. In the end of 2019, The Ministry of Fisheries and Marine Affairs, Republic of Indonesia built an information center which they called "*Pondok Informasi Bahari*" in the village. However, based on our interviews, the local youth is concerned about what kind of information should be provided, to whom and who would provide such information.

c) *Knowledge*. During the period of 2015 – 2016, environmental education was administered by Penjaga Pulau Community. The goal was to enhance knowledge, attitude and commitment of the local youth on marine resources conservation issues including mangroves, seagrass and coral reefs conservation through indoor and outdoor activities. Some trainings were also completed by some members such as 3R (reduce, reuse, recycle) training, diving training, and coral reef monitoring training. The local youth were also equipped with necessary equipment such as the basic diving gears, laptop, waterproof camera, and modules.

d) *Networking*. A general discussion on waste management was facilitated by Penjaga Pulau Community inviting relevant stakeholders (i.e., the Environment Agency of Sumbawa District, the Waste Bank Center – Sumbawa Techno Park, Universitas Samawa) at the beginning of 2018. Kabete Education Center was invited and at the discussion they were able to discuss their concern about waste problem in their village with the relevant stakeholders. According to the local youth, one of the factors triggering the village office to listen to their concern is the festival and the visit from the Environment Agency to the village office discussing about waste problem. The Environment Agency came to the village at the request of the local youth. This indicates that their network with Penjaga Pulau Community enabled them to have access to the Environment Agency.

e) *Recognition/Appreciation.* The local youth started to join some other trainings such as SCUBA diving training, village-budgeting planning, and more since 2016. They were given chances to manage village's activities such as Independence Day celebration. They partook in local competition such as '*Pemuda Pelopor*" for their waste management program and won the 3rd prize. With easy access to internet, they are now also actively receiving information on various opportunities. In 2021, one of them is joining the Pemuda Pelopor competition again.

f) *Availability of venue to channel their voice (i.e., through musrenbangdes*). *Musrenbangdes* stands for *Musyawarah Perencanaan Pembangunan Desa.* This is an annual discussion at the village level on the issues or problems that need to be prioritized. The local youth attended this occasion and used it as a means to share about their concern on waste problem. We also observed youth involvement in informal discussion related to fish catch, mass tourism, and village-owned enterprise facilitated by the Wildlife Conservation Society in January 2020.

g) *Village funds*. In 2015, the Indonesian Government launched its Village Funds policy. This policy enables village to manage funds provided by the state budget. The amount received for each village depend on the population of the village. The more people a village has, the more fund the village will get. With almost 2000 people, Labuhan Bajo Village receives IDR 1.3 billion per year. In 2018, around IDR 150 million was allocated for waste management. This included the establishment of a temporary landfill, the provision of waste bins, three-wheelers and incentives for the local youth managing the waste around IDR one million per month. It shows that there is an opportunity to use village funds to tackle environmental related issues. Without this fund, the village office would not have been able to put waste problem as their priority. More importantly, if there was no leadership from the local youth, even with this fund, the waste problem would not appear on the village program as infrastructure is the norm program high on the village agenda.

h) *Common goal*. The common goal was to develop education-tourism in the village. This goal, however, was difficult to take off due to waste problem. Hence, the local youth wanted to focus on overcoming the waste problem first.

i) *Other motivation.* Other motivation is very subtle. For example, they managed to get a land for their temporary land-fill from one of the villagers because he wanted to run for village head in the upcoming election. The village office, for instance, could use the three-wheelers for other purpose or even rented it to those needed.

j) *Financial gain*. As managing waste (especially other people's waste) is not an easy task, it is crucial that they are properly compensated. The current scheme provides some financial incentives, but I would argue that the current incentive scheme is underfunded.

C. Interpretive Structural Modelling

Having decided the enabler set, a structural self-interaction matrix (SSIM) is developed based on pairwise comparison of variables. The pairwise comparison was done by discussion with key stakeholders. The results are presented in Table 3.

Table 3. Structural Self-Interaction Matrix (SSIM)

ENABLERS	Enablers Description	**j**	**i**	**h**	**g**	**f**	**e**	**d**	**c**	**b**	**a**
a	Outsider facilitation	V	O	X	O	V	V	V	V	V	
b	Understanding asset	X	O	X	V	0	X	X	A		
c	Knowledge	X	X	V	V	V	V	X			
d	Network	X	X	X	V	V	V				
e	Recognition/Appreciation	X	V	V	V	X					
f	Venue to voice concerns	V	O	O	X						

g	Village funds	V	O	X							
h	Common goal	X	X								
i	Other motivation	X									
j	Financial gain										

Remarks
V: enabler i (row) will help achieve enabler j (column);
A: enabler j will help achieve enabler i;
X: enablers i and j help each other;
O: enablers i and j are unrelated.

The SSIM was converted to Reachability Matrix. The results are presented in Table 4.

Table 4. Reachability Matrix

ENABLERS	Enablers Description	**j**	**i**	**h**	**g**	**f**	**e**	**d**	**c**	**b**	**a**	**Drive Power**
a	Outsider facilitation	1	0	1	0	1	1	1	1	1	1	8
b	Understanding asset	1	0	1	1	0	1	1	0	1	0	6
c	Knowledge	1	1	0	1	1	0	1	1	1	0	7
d	Network	1	1	1	1	1	0	1	1	1	0	8
e	Recognition/Appreciation	1	1	1	1	1	1	0	0	1	0	7
f	Venue to voice concerns	1	0	0	1	1	1	0	0	0	0	4
g	Village funds	1	0	1	1	1	0	0	0	0	0	4
h	Common goal	1	1	1	1	0	0	1	0	1	1	7
i	Other motivation	1	1	1	0	0	0	1	1	0	0	5
j	Financial gain	1	1	1	0	0	1	1	1	1	0	7
	Dependency	10	6	8	7	6	5	7	5	7	2	

Remarks
a. If the (i,j) entry in the SSIM is a V, the (i,j) entry inthe reachability matrix becomes 1 and the (j,i) entry becomes 0.
b. If the (i,j) entry in the SSIM is an A, the (i,j) entry inthe reachability matrix becomes 0 and the (j,i) entry becomes 1.
c. If the (i,j) entry in the SSIM is an X, both the (i,j) entry and the (j,i) entry of the reachability matrix becomes 1.

Table 5. Enablers Level Iteration i

Enabler	**Reachability Set (R)**	**Antecedent Set (A)**	**Intersection Set**	**Level**
a	a, b, c, d, e, f, h, j	a, h	A, h	
b	B, d, e, g, h, j	a, b, c, d, e, g, h, j	b, d, e, h, j	
c	b, c, d, e, f, g, h, i, j	a, c, d, f, g, i, j	c, d, f, g, i, j	
d	B, c, d, e, f, g, h, I, j	a, b, c, d, e, h, i, j	B,c,d,e,h,I,j	
e	b, d, e, f, g, h, I, j	a, b, c, d, e, f, j	B, d, e, f, j	
f	E, f, g, j	a, c, d, e, f, g	E, f, g	
g	F, g, h, j	B, c, d, e, f, g, h	F, g, h	
h	a, b, d, g, h, i, j	a, b, c, d, e, g, h, i, j	a, b, d, g, h, i, j	
i	C, d, h, I, j	C, d, e, h, I, j	c, d, h, i, j	
j	B, c, d, e, h, I, j	A, b, c, d, e, f, g, h, i, j	B, c, d, e, h, I, j	**I**

Table 6. Enablers' Level Iteration ii

Enabler	Reachability Set (R)	Antecedent Set (A)	Intersection Set	Level
a	a, b, c, d, e, f, h,	a, h	A, h	
b	B, d, e, g, h,	a, b, c, d, e, g, h,	b, d, e, h,	
c	b, c, d, e, f, g, h, i,	a, c, d, f, g, i,	c, d, f, g, i,	
d	B, c, d, e, f, g, h, I,	a, b, c, d, e, h, i,	B,c,d,e,h,I,	
e	b, d, e, f, g, h, I,	a, b, c, d, e, f,	B, d, e, f,	
f	E, f, g,	a, c, d, e, f, g	E, f, g	**II**
g	F, g, h,	B, c, d, e, f, g, h	F, g, h	**II**
h	a, b, d, g, h, i,	a, b, c, d, e, g, h, i, j	a, b, d, g, h, i,	
i	C, d, h, I, j	C, d, e, h, I, j	c, d, h, i, j	

Table 7. Enablers' Level Iteration iii

Enabler	Reachability Set (R)	Antecedent Set (A)	Intersection Set	Level
a	a, b, c, d, e, h,	a, h	A, h	
b	B, d, e, h,	a, b, c, d, e, h,	b, d, e, h,	
c	b, c, d, e, h, i,	a, c, d, i,	c, d, i,	
d	B, c, d, e, h, I,	a, b, c, d, e, h, i,	B,c,d,e,h,I,	
e	b, d, e, h, I,	a, b, c, d, e,	B, d, e,	
h	a, b, d, h, i,	a, b, c, d, e, h, i, j	a, b, d, h, i,	**III**
i	C, d, h, I, j	C, d, e, h, I, j	c, d, h, i, j	**III**

Table 8. Enablers' Level Iteration iv

Enabler	Reachability Set (R)	Antecedent Set (A)	Intersection Set	Level
a	a, b, c, d, e,	a,	A,	
b	B, d, e,	a, b, c, d, e,	b, d, e,	**IV**
c	b, c, d, e,	a, c, d,	c, d,	
d	B, c, d, e,	a, b, c, d, e,	B,c,d,e,	**IV**
e	b, d, e,	a, b, c, d, e,	B, d, e,	**IV**

Table 9. Enablers' Level Iteration v

Enabler	Reachability Set (R)	Antecedent Set (A)	Intersection Set	Level
a	a, c	a	a	
c	c	a, c	c	**V**

Table 10. Enablers' Level Iteration vi

Enabler	Reachability Set (R)	Antecedent Set (A)	Intersection Set	Level
a	a	a	a	**VI**

ISM

The ISM was developed based on the iteration process above. Enabler a (outsider facilitation) is at the bottom of the model as this enabler has the highest driving power. Enabler j (financial gain) is at the top of the model as this has the highest dependence power. The model is presented in Figure 3.

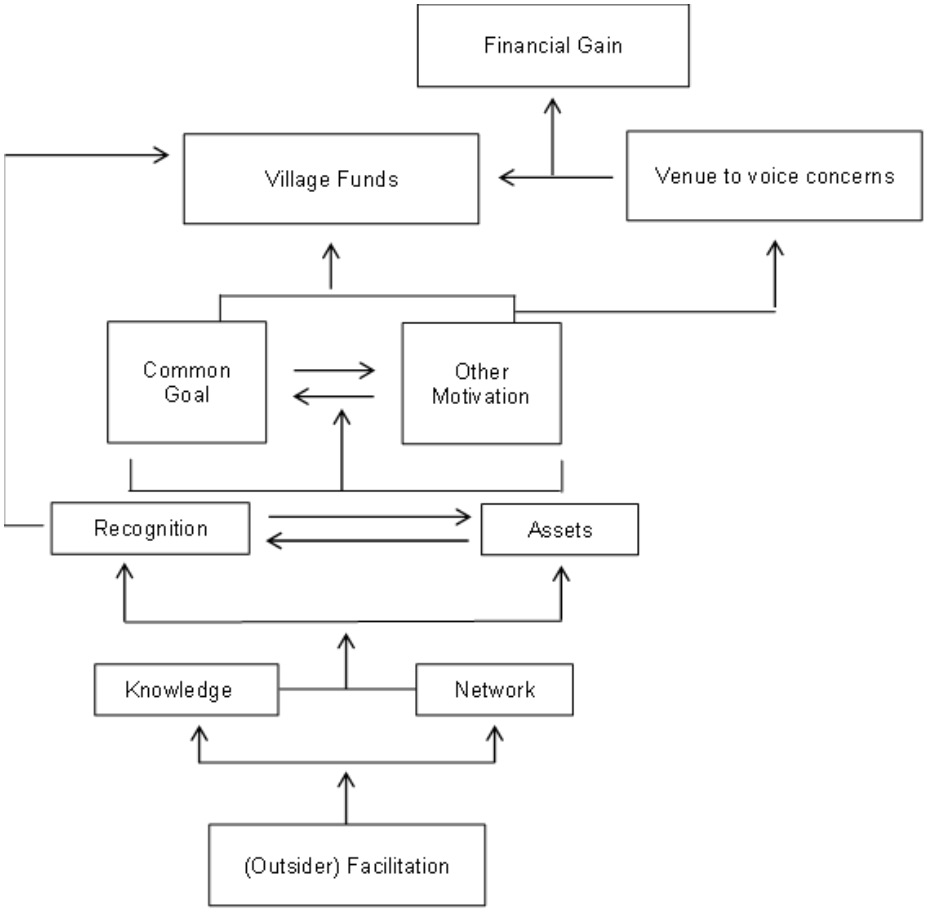

Figure 3. ISM for Youth-Based Management Enablers in Labuhan Bajo Village

Classifications of Enablers (MICMAC Analysis)

MICMAC analysis allows us to identify the key factors that drive the system based on drive power and dependence power gained from Table 3. In MICMAC analysis, the enablers are categorized into four clusters, namely, (I) autonomous, (II) dependent, (III) linkage, and (IV) independent (Figure 4).

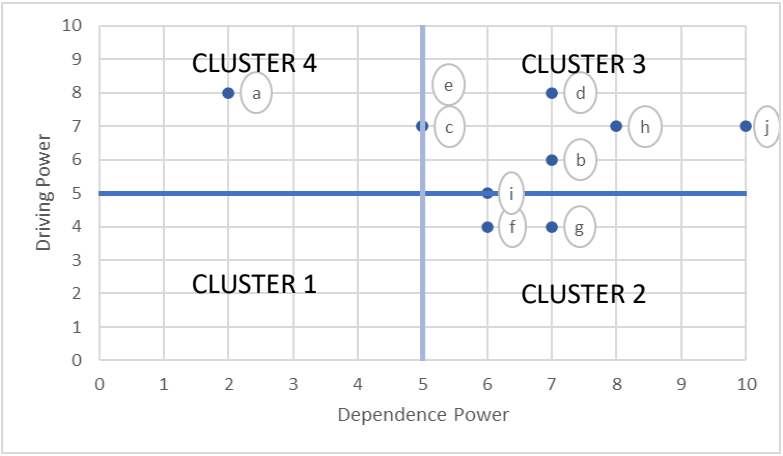

Figure 4. Driving Power and Dependence Power Diagram

Based on the MICMAC analysis, below is the classification of each enabler in this research (Table 11)

Table 11: Enablers' cluster classification

CLUSTER	Enablers	Remarks
CLUSTER I AUTONOMOUS	No enabler in this cluster	This cluster has weak drive power and weak dependence power
CLUSTER II DEPENDENT	f: Venue to voice concerns g: Village funds	This cluster has weak driving power, but strong dependence power
CLUSTER III LINKAGE	b: Understanding asset c. Knowledge d: Network e: Recognition/appreciation h: Common goal i: Other motivation j: Financial gain	This cluster has strong driving powers as well as a strong dependence.
CLUSTER IV INDEPENDENT	a: (Outsider) facilitation	This cluster has strong drive power but weak dependence power.

Cluster I – AUTONOMOUS:

The enablers in this cluster have weak drive power and weak dependence power. They are relatively disconnected from the system, with which they have few links, which may be very strong (Attri et al., 2013). In this study, there is no enabler found in this cluster.

Cluster II – DEPENDENT:
The enablers in this category have a weak driving power, but strong dependence power (Talib & Faisal, 2016). In this study, two enablers (f and g)) are in this category.

Cluster III – LINKAGE: The enablers in this cluster have strong driving powers as well as a strong dependence. They are also unstable, and so any action on them will have an effect on other and also a feedback effect on themselves. Most of the enablers are in this category (enablers b, d, e, h, i, and j).

Cluster IV – INDEPENDENT: Only one enabler (a: outsider facilitation) is in this cluster. This enabler has strong drive power but weak dependence power. In this study, this may be considered as the first enabler which allowed other enablers to materialized.

In this study, as seen from the ISM digraph (Figure 3), outsider facilitation is at the bottom of the digraph enabling the local youth to establish their local organization which was acknowledged by the village through Village Head Decree in 2015. This institutionalized local group has provided a group identity for the local youth and allowed them to voice their

concerns and undertake actions as a group. In line with the study from Afifi & Latifah (2011), this study suggests that institutional arrangement is a prerequisite for rural development. Similar finding is also reported by the GTZ where organisation is a precondition for integrating the waste informal sector in Brazil, India, and Egypt and that legal entity has to be backed up by political power (GTZ, 2010).

Many studies have suggested that facilitations after institution is established are continuous to be critical (Ariyanto et al., 2020; Ichsan et al., 2019; Larasati et al., 2021). After facilitating group identity, the NGO in this study, through various activities, facilitated the local youth to (i) enhance their knowledge, networks, and negotiation skills, (ii) understand their assets, (iv) enhance their knowledge and skills through training, and (iv) gain more recognitions. The local youth then were able to discuss their common goal and take actions.. NGO's role in waste management is also well-documented in other country such as Egypt where the local NGO piloted certain critically important projects which now represent an appropriate, efficient, culturally and locally responsive system for Cairo's waste system (GTZ, 2010). The importance of facilitator to improve youth participation in decision making in Indonesia is also documented in other issues such as in community forest management (Ilfa et al., 2021).

Attendance in meetings is one of the parameters to analyze level of participation in various programs or activities (Mando et al., 2020). In this study, the presence of venues to voice their ideas/concerns is also a very important enabler which contributed to the village agreeing to use village funds for waste management. This finding on the importance of ability to express view freely is consistent with other studies in other countries such as Lebanon (Khalil, 2017) and the United States of America (Burke et al., 2020).

The digraph and MICMAC analysis suggest that the local youth needed foremost was facilitation, in this case from an NGO, not part of their community, to develop their identity as a group, toimprove their knowledge on waste and other environmental issues, and to assist them expanding their network. With their improved knowledge and network, they collectively were able to undertook assets mapping and gained recognition or validity from the village office. Upon understanding their assets and common concerns, they were able to formulate their common goal or vision and develop their plan of actions to achieve the goal. The plan of action included tackling waste issue so they can initiate education-tourism in the village to generate funds for nature conservation. The presence of various platform to express their concerns and ideas such as through village meetings, festival, drama, talk show, etc. has contributed to local youth's concern on waste issues being taken into consideration by the village office. Study by Hartley et al., 2021 suggested that when youth are involved in local environmental politics (like through town meetings) or grassroot campaign, the adults including public officials seem prepared to respond with support, trust, and change, even if they did not immediately respond with a pledge for action. In this study, the availability of village funds has allowed village to prioritize waste issue into their budget plan. At the top of the digraph is the financial gain. It supports previous study by (Heidari et al., 2018) where they suggest that authorities should encourage people, using economic incentives, to separate waste at source We argue that to be sustainable, the local youth must have financial gain either directly or indirectly from the waste they managed.

CONCLUSION AND RECOMMENDATION

This research has documented one local youth group's embarkation into youth activism to solve waste problems. The en (10) enabling factors in youth-based waste management in Labuhan Bajo Village: facilitation, understanding asset, knowledge, network, recognition/appreciation, venue to voice their concerns, village funds, common goal, motivation, and financial gain. Eight out of ten of the enablers are classified into the Linkage Cluster. This indicates that these enablers need to be handle effectively and efficiently as any action on them will have an effect on other and also a feedback effect on themselves.

Werecommend that improving the cognitive knowledge through environmental education is important to be in place prior to taking action because the knowledge they get will improve their confidence and their critical thinking. In this case study, environmental education created pro-environment attitude and commitment of the beneficiaries. However, the positive attitude alone cannot help the youth to create changes with regards to environmental problems since environmental problems are often complex.

We also would like to point out the potentials of tapping into village funds for environmental or conservation program as exemplified by the local youth here. The leadership from the local youth is important to communicate and advocate environmental problems that should be included in the village annual program and budget.

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