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Abstract. Abrasion in coastal area of northern Central Java is severe, with abraded area exceeding 5,000 hectares which resulted in many aquaculture ponds became submerged and dissapeared. Eventhough physically the ponds are no longer visible, however the water quality is still supporting aquaculture to be carried out in that area. This paper explores the possibility that aquaculture innovation technology using an IMTA concept is suitable for abraded area in the stakeholders' point of view so that can be introduced to local community affected by abrasion to support their livelihood. This study employed rapid appraisal for aquaculture innovation system (RAAIS) to obtain data in two location in Central Java: Demak and Brebes regency and used descriptive for analysis method. Stakeholders from different background were involved representing fish farmers, government, NGOs, private sector and academics. Systemic analysis showed that both areas uncover similar constraints due to adopting the new IMTA technology. Stakeholders believed that constraints were mostly grouped as technological and institutional issues and that most problems rooted in the national level. Issues along value chain were believed by stakeholders from Brebes region may occur mostly in production area while stakeholders from Demak believed that inability to access credit deserves the blame. The possibility of using IMTA for aquaculture activity in abraded coastal area were also dicussed based on the obtained data.

1. Introduction

Northern coast of Central Java is experiencing a serious abrasion issue which highly impact on coastal communities. Abrasion in Central Java are severe as it covers 5.235 Ha, accross 17 regions and cities and along 157,35 km of coastal line [1]. Abrasion is only one among few coastal problems encountered by northern Java, others include land subsidence, sea water rise and tidal floods. These problems occured as the impact of exploitation of coral reef and mangrove removal [2] in order to convert them into aquaculture pond [3] [1] [4] [5]. The removal of mangrove resulted in consequences that impacted the community ecologically and socioeconomically [6]. In order to regain aquaculture

function of the abraded area, an innovation in aquaculture technology should be considered and one of them is adopting Integrated Multi Trophic Aquaculture (IMTA) concept. Basic concept on IMTA includes the utilization of waste from higher trophic to be used as feed for species of the lower trophic. In order to implement new technology, stakeholder may encounter problems and challenges. These challenges needs to be identified in order to be able to address the problems and find the most suitable solutions.

2. Research Methods

This study employs Rapid Appraisal of Aquaculture Innovation System (RAAIS) as an adoption of Rapid Appraisal of Agriculture Innovation System from Schut et al [7]. This method involved stakeholders from various background related to aquaculture to carryout forum group discussion (FGD). Result of discussion were recorded using an A0 paper where the template of table were already provided in the RAAIS handbook [7]. Further interviews were carried out for some information that were unclear. Number of participants of stakeholders from 5 groups who attended the FGD in Demak and Brebes regency are shown in Table 1.

Table 1. Number of participants from different stakeholder groups

Stakeholders Group	No. of participants in Brebes Regency	No. of participants in Demak Regency
Farmers	6	6
NGO	5	4
Private sector	4	3
Government	4	6
Academics	2	1
Total	21	20

The FGD were carried out for two days involving 13 discussion sessions concerning constraints that may hinder stakeholders from implementing aquaculture innovation in coastal abraded areas. The discussions consist of two system (1) discussion within stakeholder groups and (2) plenary discussion, where all stakeholders from different groups were involved in the discussion.

3. Result

During the first part of the FGD, participants were asked to discuss and agree on 5 top constraints which stakeholders agree to be most influencing in adopting new innovation.

Table 2. Stakeholders' top five constraints

Stakeholders	Demak Regency	Brebes Regency
Farmers	Low water quality	Low quality of seeds
	Low soil quality	Low selling price
	High feed price	Lack of infrastructure
	Low quality of seed	Lack of fish disease handling skills
	Unable to find own market	Abrasion
NGO	Regional policy keeps changing	Unpredictable weather
	Farmers are reluctant to adapt new technology	Lack of aquaculture knowledge
	Lack of technology transfer capacity	Unstable market

Stakeholders	Demak Regency	Brebes Regency
Private sector	Low capacity and skills to adopt innovation	Lack of financial capital
	Limited access to capital and market	Lack of infrastructure
	Fluctuating price	Low seed quality
	Lack of disease handling knowledge	Low water and soil quality
	Lack of infrastructure	Low quality & quantity of feed ingredients
	Lack of extension service	Lack of extension services
	Limited pond management skills	High feed price
Government	Lack of motivation to adopt new technology	Market depend on collectors
	Lack of extension service.	Lack of sustainable aquaculture skills
	Unsuitable pond strucuture due to abrasion	Unpredictable weather
	Abrasion	Low quality and quantity of seed
	Lack of access to financial capital	Lack of response to adapt technology
Academics	Unable to find new market	Lack of basic research on IMTA
	Low quality and quantity of seed	Lack of coordination between stakeholders.
	High feed price	Short mindset of farmers
	Lack of infrastructure	Government regulation unsupportive
	Low selling price due to disease occurrence	Lack of village support for farmers implementing new technology

Result of discussion in Table 2 showed that there are many similarities of constraints according to stakholders' prespective in implementing innovation in abraded coastal areas. Some constraints that were mentioned few times were the high feed price, low quality of seeds, low environmental quality, lack of extension services, lack of good infrastructure, marketing and capital issues. This phenomena are inline with previous research that also found challenges encounter by small scale fish farmers were low quality of seed [8][9], lack of capital [8], low environment quality [8], market issues [8], high feed price [8][10].

Stakeholders discussed and agreed in catagorizing constraints according to different dimension of where the constraints belong. Six dimensions were provided and the result is shown in Figure 1.

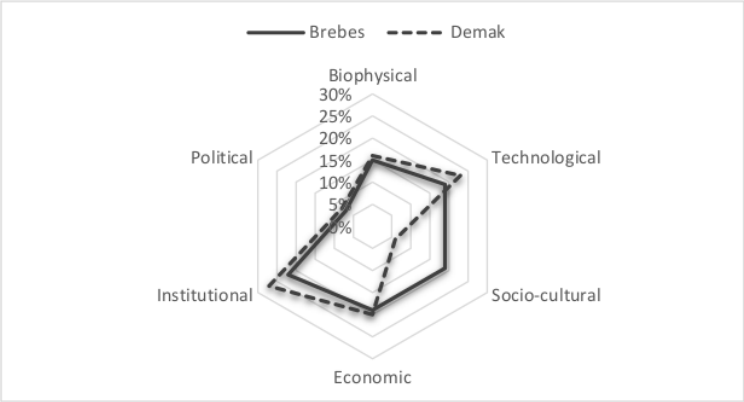

Figure 1. Groupings of aquaculture constraints according to different dimensions of complex aquculture problems

Both regions have categorized most constraints in implementing IMTA concept in abraded coastal area, are considered as institutional problems. Different opinion occured in the socio cultural dimension where stakeholders from Brebes have grouped 15% of constraints as socio-cultural, while stakeholders in Demak did not think any constraints belong to this dimension.

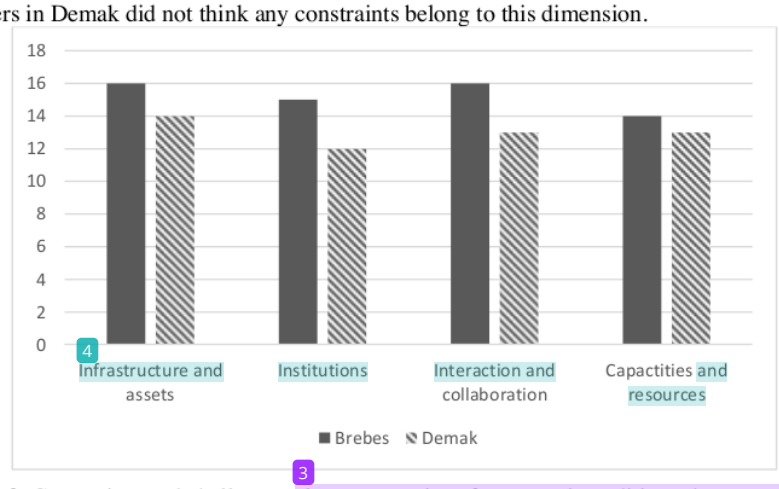

Figure 2. Constraints and challenges along categories of structural conditions that can enable or constrain innovation.

Figure 2 showed the result of stakeholders discussion regarding categorizing constraints that enable or hinder the implementation of IMTA as aquaculture innovation in abraded area. Stakeholders from Brebes region believed that most constraints are grouped into “infrastructure and assets” and “interaction and collaboration” while stakeholders in Demak regard most of the constraints as “infrastructucture and assets”.

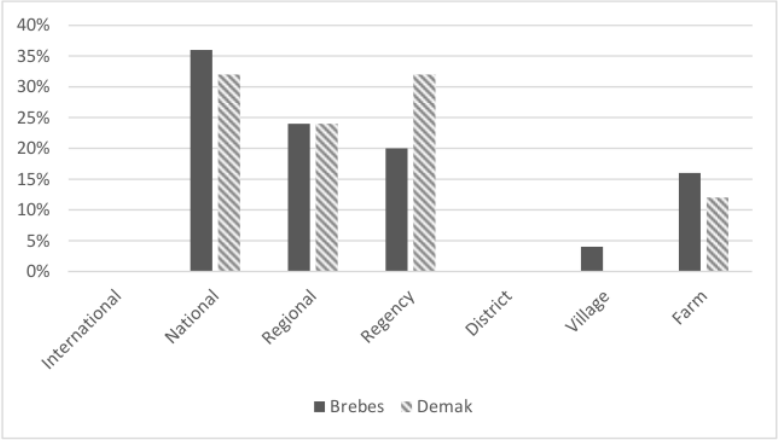

Figure 3. Percentage of constraints and challenges across different administrative levels

The administrative level of where the constraints rooted were also discussed. Result showed that stakeholders from Brebes agreed that source of most constratints were in the national level, while stakeholders from Demak believed the root problems ocuured in the national and regional level.

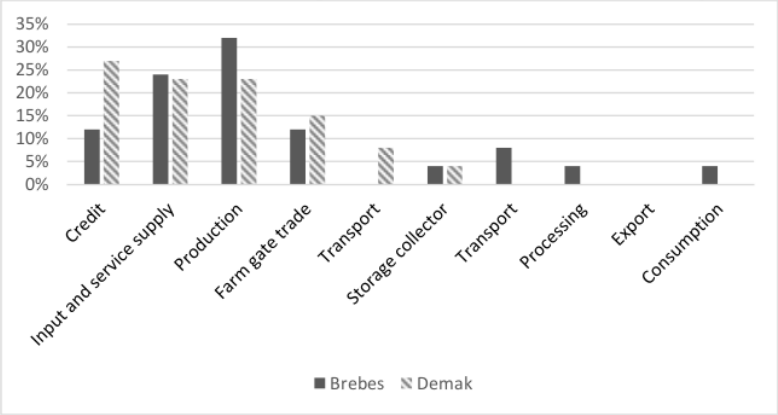

Figure 4. Percentage of constraints and challenges occur along the segments of the value chain

The highest percentage of contsraints along value change according to stakeholders in Brebes occured in the period of production, while stakeholders from Demak believed the constraints mostly happen were related to credit.

4. Discussion

The RAAIS forum group discussion focuses on the possibility to implement IMTA concept as an alternative solution for aquaculture in the abraded coastal area. Previous research from Rejeki et al [11] has analysed the ecological support for IMTA concept to be implemented in abraded area. It was found that ecologically the area is supporting IMTA concept. The waters and environmental surrounding have the required water quality and natural feed in waters are quite abundant for aquaculture. The next question was “if ecologically abraded area are feasible for aquaculture using IMTA concept, what are the constraints that may hinder the implementation?”. The RAAIS provide

answer to the questions through a series of discussion. Table 2 provide information on the top 5 constraints that may occur when implementing IMTA concept. Based on these 5 top constraints, stakeholders in both areas agreed that root problems for most contraints belonged to the institutional dimensions. This means that constraints appear as the result of institutional mistakes, such as mismanagement or the lack of enforcement or even missing of policies and regulations from government or other authorities. This is inline with previous research who also acknowledged that there are still no significant effort from the government to accomodate the needs of fish farmers in order to increase its livelihood, such as supressing the price of feed and find alternative ingredients to substitute high price of imported fish flour [12]. Further was also explained that in terms of market, government should also develop market system to guarantee fish marketing for fish farmers.

The bar chart in Figure 2 illustrate constraints that can enable or hinder the implementation of IMTA concept. Stakeholders from both region believed that most constraints were grouped into "infrastructure and assets". This relate to the fact that abraded areas in both locations have influenced the pond construction where the dikes have submerged underwater and no longer exist which was also refered by research carried out by Rejeki et al [11]. Moreover, infrastructure problems also refer to the production support such as roads and bridges which according to stakeholders are broken and urgenty need renovation. Interaction and collaboration is also in favour which can hinder implementation on IMTA. This refer to relationship between actors in aquaculture production. For example the lack of interaction between stakeholders in finding solution, or collaboration between government with private sector. Result on the discussion on where about in the administrative level does root problems occur that sparks constraints have indicate that stakeholders from both region agreed source of constraitnts rooted in the national level. Stakeholders from Demak also believed that regional level also contribute as much as the national level. It is believed by both regions that policies and regulations made in the national and regional level have impacted highly towards the occurence of constraints in the farm level. For example the high price of feed and feed ingredients, the quality of seed, market price etc. This findings was supported by previous research that government have not yet made serious act towards solving fish farming problems such as the high price of feed [12][13] [8]; problems in marketing [12][13]; quality of seed [8][13] and infrastructure [13]. These problems will also potentially hold back the implementation of IMTA in abraded area.

The discussion on where do constraints occur along the value chain resulted in a very interesting illustration as shown in Figure 4. Stakeholders in Brebes believed that constriants mostly happen in production, while stakeholders in Demak believed that constraints occured were related to credit. Production involve many variables such as inputs of seed and feed, transportation in order to obtain the inputs and also soil and water management. The problems of high feed price, low quality of seed, bad infrastructure which impacted in additional operation cost and the occurence of disease surely happen in the production period of the value chain. Stakeholders in Brebes believe this is the source of most problem. On the contrary, stakeholders in Demak believed that these constraints occur as the result of the lack in capital. If fish farmers have enough financial capital, they will be able to purchase better quality of seed and will have no problem in buying higher feed cost.

Current condition where abrasion are severe in northern coastal area of Central Java and have damaged large aquaculture areas, needed an alternative solution and innovation. Integrated multi-trophic aquaculture is an aquaculture concept where waste from species of higher trophic level are utilized as input for species of lower trophic level [11][14]. This concept were identified as a possible solution for aquaculture in severe abraded areas. The ecological condition were shown to be supporting this concept [11] and stakeholders in Brebes and Demak regency have discussed this possibility. IMTA concept were thought to be possible to be implemented in abraded areas but will come accress same challenges faced by fish farmers in non-abraded areas. There are few benefits in implementing IMTA in abraded area: (1) abraded area can regain function for aquaculture [11] and (2) obtain better financial stability through product diversivication [14] and (3) reduce waste which can potentially deteriorate environmental quality [14][15].

5. Conclusion

Based on the result of workshop and followup discussion with stakeholders, it can be concluded that constraints were mostly grouped as technological and institutional issues and that most problems rooted in the national level. Issues along value chain were believed by stakeholders from Brebes region may occur mostly in production area while stakeholders from Demak believed that inability to access credit deserves the blame. The possibility of using IMTA for aquaculture activity in abraded coastal area, although IMTA have a great potential to be developed ecologically, there are still challenges that are similar in both location. Nevertheless, these constraints were also encountered by fish farmers in general and not exclusively to implementation of IMTA. Therefore, if government develop policies and regulations supporting fish farmers, not only will support IMTA as solution to abraded areas, but also support the development of Indonesian aquaculture industry.

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