Contributing factors to the empowerment of fishpond farmer of post Tsunami Aceh

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Abstract. The 2004 Indian Ocean earthquake and tsunami have significant implication to a destructive damage community fish farming in Aceh. The recovery has done during the rehabilitation and reconstruction process. This study aims to identify the degree of fishpond farmer’s empowerment of post-tsunami and its contributing factors. The study employs quantitative and qualitative approaches through a questionnaire survey and interview with 51 respondents. Data analysis used descriptive analysis to measure empowerment degree and multiple linear regression analysis to identify determinant factors. The study finds that about half of the respondents are at a moderate level of empowerment degree, more than a quarter is at a high level, and the rest is low. Statistically shows that social network, motivation, innovativeness, resources availability, and characteristics of the economy have a positive correlation and significant to empowerment degree of the fishpond farmer. Meanwhile, information tools and extension mechanism are not significant. Therefore, the role of extension and initiatives are necessary to encourage and enhance the quality of empowerment by enabling and improving the capacity of the agent of change.

1. Introduction
A devastating earthquake and tsunami in 2004 have triggered tremendous destruction and severely affected the community’s livelihood along the coastline area. Aquaculture contributed to 16% of total fish production in Aceh during the pre-disaster year, which accounted for US$ 56 million of the total US$ 164 million fish value [1]. About 17,938 households directly employ in 31,923 ha of actual areas of fishponds from total 36,575 ha of total areas and in the aquaculture supply chain [2]. The recovery process of damaged fishponds has initiated and implemented by the Ministry of Marine Affairs and Fisheries in cooperation with the international governments and organizations. The rapid progress of physical rehabilitation has done within 3 years of the reconstruction process. Moreover, the agencies also initiated a social recovery to fishpond farmers that focused on better management practices to encourage knowledge and capacity on fish farming activities.

Post tsunami reconstruction has improved community-farming infrastructures through rehabilitation of soil and water conditions, irrigation canals, machinery production systems, markets as well as logistic and transportation. However, lack of technology resources and farming system contribute to low productivity and well-being of community farming. Many of the fishpond farmers
engage in a traditional system with small-scale farming that is less than 2 ha [3]. They are also facing a lack of capital investment such as financial access, land management, ownership, high production costs, labor shortage, and management information system. Therefore, a continuous social recovery through capacity development is still challenging as a means to enhance agribusiness empowerment of fishpond farmers.

Empowerment means the ability in solving problems and making decisions, which is enabling the farmer to stimulate, to cope and to optimize potential strengths, access and control towards any material and social resources available within them [4][5][6]. It is a process that challenges the way things are and can be about power, helping, achieving, and succeeding. Thus, the core concept of the empowerment is the idea of power, which involves that the power can change and the idea that power can expand [7]. It is often related to the ability to do, regardless of wishes or interests [8] and is commonly understood as authority that recognizes complete responsibility—influence and control, and the choices made (freedom to achieve and capability to function) [9][10].

2. Methods
This study employed a quantitative and qualitative approach by using a questionnaire survey and interviews with 51 fish farmers living in Kecamatan Peukan Bada and Kecamatan Mesjid Raya, Aceh Besar. Analysis data used a descriptive evaluation and multiple linear regression method with a natural log transformation. Degree of empowerment measured by using four indicators: namely awareness and desire to change, ability to enhance capacity to gain access, ability to cope with problems, and ability to build network and solidarity [11]. The measurement used the following formula:

\[
RS = \frac{(m-n)}{b}
\]

Description:
RS : scale range
m : highest score in measurement
n : lowest score in measurement
b : formed category (low, moderate, and high)

The determinant factors to empowerment degree depended on following variables: material resources availability (X_1), social relations and interaction (X_2), economic conditions (X_3), motivation (X_4), information sources (X_5), extension and mentoring (X_6) and innovativeness (X_7) [12][13][14]. Mathematically, the empowerment equation model as follow:

\[
\ln Y = \ln a_0 + a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + a_4 \ln X_4 + a_5 \ln X_5 + a_6 \ln X_6 + a_7 \ln X_7 + e
\]

Description:
Y : degree of empowerment
a_0 : constants
a_1...a_7 : coefficient of regression
X_1-7 : independent variables
e : error

The next step conducted statistical tests, which were t-test, F test, and coefficient of determination (R^2) test.

3. Results and Discussion
3.1 Characteristics of Respondent
Table 1 shows the characteristics of the respondent. The majority of the respondent is more than 35 years old. They have experience in managing fishpond for more than 20 years. About more than half of the respondent have a moderate level of formal education background. Majority of respondents are
running a small-scale fishpond, which is less than 2 ha. They employ extensive and semi-intensive typical technology operation used. Meanwhile, the large-scale pond engages in a semi-intensive and intensive method. Practically a half of respondents run a business in private property, and nearly a half other use rent land, and very small portion work under profit-sharing mechanism.

### Table 1. Characteristics of respondent (N=51).

| Description       | Frequency | Percentage |
|-------------------|-----------|------------|
| Age (year)        |           |            |
| <35               | 6         | 12         |
| 35-55             | 35        | 69         |
| >55               | 10        | 19         |
| Education         |           |            |
| SD                | 12        | 23         |
| SMP               | 10        | 20         |
| SMA               | 23        | 45         |
| >SMA              | 6         | 12         |
| Land ownership    |           |            |
| Private property  | 24        | 47         |
| Land lease/rent   | 24        | 47         |
| Profit sharing    | 3         | 6          |
| Land size (ha)    |           |            |
| <1                | 22        | 43         |
| 1-2               | 23        | 45         |
| >2                | 6         | 12         |

#### 3.2 The Degree of Fish Farmer Empowerment

The degree of empowerment is the results and consequences of interventions arising from community endorsement supports and activities [15]. This study employs four parameters of empowerment levels. First, the power within is awareness and desire to change. Second, it is the power to enhance the capacity to gain access. Third, the power over is the ability to cope with obstacles. Fourth, it is the power with the ability to build network and solidarity. This framework arranges in a gradual and multilevel manner, which ‘the power within’ is the entry point to the next level of empowerment, and is to way to achieve the highest level of ‘the power with’ the ability to build a network and solidarity.

### Table 2. The level and degree of empowerment (N=51).

| Indicator       | Low | Moderate | High |
|-----------------|-----|----------|------|
|                 | Freq. | % | Freq. | % | Freq. | % |
| Power within    | 2    | 4 | 33    | 65 | 16    | 31 |
| Power to        | 7    | 14 | 26    | 51 | 18    | 35 |
| Power over      | 3    | 6 | 13    | 25 | 35    | 69 |
| Power with      | 3    | 6 | 40    | 78 | 8     | 16 |
| Degree of empowerment | 9    | 18 | 28    | 55 | 14    | 27 |

#### 3.3 Awareness and Desire to Change

The entry-point of the power within is a construction upon the indicators of awareness of changing knowledge, behavior, and attitude in livelihoods. The survey shows that the majority of respondent have a moderate level of awareness and desire to change by 65 percent, high attentiveness by 31 percent, and the lowest by 4 percent. From this viewpoint, knowledge practically supposed as the most desirable by the farmers that reasonably able to gain and change [16] [17]. The social recovery on community best practice management initiative has contributed to enhancing capacity and access to information system on farming. Meanwhile, the ability to changing behavior and attitude are moderately difficult to achieve due to the lack of internal resources availability and accessibility. The
expose of this application depends upon the control and access to capital and technology in upgrading and improving the farming system in terms of scale and management.

3.4 Ability to Enhance Capacity to Gain Access
The efficacious in operating and developing fishpond involves farmer’s capability to function in accessing information, financial capital and market. In terms of scale and technology, fishpond farming requires high operational costs and treatments. Therefore, knowledge and information are essential. The study finds that access to information still limited and difficult to gain. The local extension mechanisms do not intensively perform well. Most of the farmer claims using their networks as a means in procuring and dealing with specific issues, such as land and water condition, pests and diseases control and management. The availability of financial institutions – form and informal, spatially located within the community has to provide adequate resources in investment and tradable costs. So far, self-investment and small business banking credit take place as major institutions in financing. Cost establishment and profitability of fishpond farming depend upon scale, technology and ‘know-how’ method where market plays significant there [18][19][20]. Most of the farmer claims that the marketplace is wide open in selling their commodity through local and regional sphere mechanisms.

3.5 Ability to Cope with Obstacles
There are three important components in assessing farmer’s capacity to cope with obstacles in fishpond matters, which is the production process, production failures, and hazard risks. The study finds that the majority farmer has high capacity in dealing with any obstacles that might occur. The interventions that had delivered through best practice management initiative have contributing to increase knowledge, awareness, and preparedness to manage difficulties. At the operational level, most of the farmer has adequately able to access to the production resources such as external farm inputs, tools, machinery, financial institutions, and wide market. Farmer is also able to find alternatives innovation and treatment based on personal experiences and networks in dealing with cultivating, and pests and diseases. However, dealing with production failure and hazard risk is challenging enough due to low affordability to technology and protection mechanisms. Although farming insurance has been introducing, it is still limited and does not play a role in the pond management system in Aceh.

3.6 Ability to Build Network and Solidarity
Level of the power with building a network and social cohesion among the fishpond farmer is quite high. They are a motivation to cooperate with, ability to encourage and participate in the interested groups, and willingness to liaise with actors and stakeholders. The study shows that the low level in this step is the low involvement and participation of farmer in the community and interested groups. Here, membership, network and connectedness [21] are fundamental in the business. It implies that most of the farmers in this study area have a strong relationship and cohesion within the actors and stakeholder involved.

3.7 Degree of Empowerment
In sum, the degree of empowerment of fishpond farmer in the study area indicates at a moderate level, whereas modality to function in using internal socio and economic capitals and resources available within them play significantly. The improvement of soft-skills, which is knowledge, motivation, experiences, and infrastructures, during and of the post-reconstruction regime has encouraged farmer. That is substantially important in growing business and enhancing networks. However, control to system information and technology still limited. It is due to high intervention needs and costs, wherein nature perceives still considered difficult to deal. Most of the farmer is operating a small-scale pond, which depends upon high utilization of internal capitals.
3.8 Determinant Factors to the Degree of Empowerment

In this analysis, the independent variables simultaneously have significantly contributed to the degree of empowerment (Table 3). The correlation coefficient in this equation is 0.785. It implies that the correlation between independent and dependent variables is 78.5%. The value of coefficient determination is 0.617. It explains that 61.7% of the degree of empowerment can be described by those independent variables; meanwhile, 38.3% is explained by other variables outside the model. The constant value in this analysis shows negative. It implies that if the value of all independent variables is considered constant, then it can reduce the degree of empowerment. Furthermore, all regression coefficient values for independent variables show positive. This means that if there is an increase in each this variable, it will be able to increase the degree of empowerment.

| Determination coefficient | R       | R Square | Adjusted R Square | Std. Error of the Estimate |
|---------------------------|---------|----------|-------------------|---------------------------|
| R Square                  | .785a   | .617     | .555              | .09292                    |

| Sum of Squares | df | Mean Square | F       | Sig. |
|----------------|----|-------------|---------|------|
| Regression     | .598 | 7 | .085 | 9.859 | .000a |
| Residual       | .371 | 43 | .009 |       |      |
| Total          | .969 | 50 |       |       |      |

| Unstandardized Coefficients | Standardized Coefficients | t       | Sig. |
|-----------------------------|---------------------------|---------|------|
| B                           | Std. Error | Beta    |       |      |
| Constant                    | -.267 | .188 | -1.421 | .163 |
| Resources availability      | .102  | .045 | .238  | 2.259 | .029 |
| Social relations             | .349  | .130 | .273  | 2.674 | .011 |
| Economic conditions         | .213  | .096 | .277  | 2.211 | .032 |
| Motivation                  | .288  | .124 | .251  | 2.319 | .025 |
| Information sources         | .012  | .037 | .033  | .324  | .748 |
| Extension                   | .080  | .042 | .182  | 1.914 | .062 |
| Innovativeness              | .101  | .044 | .271  | 2.305 | .026 |

*aPredictors: (constant) resources availability, social relations, economic conditions, motivation, information source, extension, and innovativeness.

The result shows that the natural logarithm multiple linear regression equation is as follows:

\[ \text{Ln}Y = -0.267 + 0.102\text{Ln}X_1 + 0.349\text{Ln}X_2 + 0.213\text{Ln}X_3 + 0.288\text{Ln}X_4 + 0.012\text{Ln}X_5 + 0.080\text{Ln}X_6 + 0.101\text{Ln}X_7 \]  

(eq 2)

Partially, the following variables are respectively significant contributions to the degree of empowerment of fishpond farmer, namely social relations, farmer’s motivation, innovativeness, material internal resources availability, and household economic condition. On the other hand, the extension activity and access to the information system and technology do not significantly determine the farmer’s capability.

3.9 Resources Availability

The availability of resources is the ability to function and utilize all available material resources located within them. Those materials resources originally come from each internal space to optimize
the management of a pond business. This includes human, physical, technology and social capital. The availability of resources statistically has a positive correlation and significant relationship to the degree of empowerment of the fishpond farmers. This implies that although the majority of farmers own and run a relatively small-scale business (less than 2 ha), they have been able to optimize the function of the availability of internal material resources properly in running their business. Nearly half of the farmers run the ponds on their private land, the others use land rent and profit-sharing systems. Access and control to land assets will be able to improve the efficiency of business activities [22], particularly to the smallholder farmers [23][24].

Majority of the landowners play a role as a provider of capital resources, operator as well as workers. On average, they have had relatively more than 20 years of experience, both managing family fishpond and/or collaborate with others (joint ventures). Most of the working capital comes from their pocket, although some also take loans from micro-credit institutions. As operators, the majority of farmers use local labor resources and their relatives in the pond business. For ponds with the use of high-tech (intensive) systems, the operator will employ skilled-labor.

The active involvement and participation in the farmer groups and institutions of the pond business system have also opened up great opportunities for them to increase their access and ability in optimizing the potential of their physical, social and economic capital resources. The liberation and enablement, especially small-scale farmers, will be more optimum and can grow when the social networks around them function properly [25]. Also, a related community group has a relationship with internal capabilities such as initiative, creativity, and networking [26] [27].

3.10 Social Relations and Interaction
Social connections and interactions have a positive and significant relationship to the empowerment of farmers. The relatively strong availability of farmer social and economic institutions has a contribution to the functioning of social and physical capital of the community in building networks, norms, and trust. This implies that the more active involvement and participation in the groups, the more can increase the level of community empowerment both in running businesses and social networks [28].

In general, two institutional characteristics exist in the farmer's environment, namely the social institutions of small groups and economic institutions (markets). Almost all the farmers are incorporated and active in a small group. This container is a means for farmers to optimize the social, physical and financial capitals, especially maintaining the safety and security of the ponds, as a means of sharing and exchanging information, and lending mutual business capital. The institutional mechanism of small groups works very well, especially for small-scale farmers. Meanwhile, the relatively large-scale farmers and the high technology systems used have utilized qualified operational management systems by recruiting and employing skilled-laborers endorsing high wages to manage and maintain the safety of the pond.

The economic institutions (markets) include producers, retailers, and large traders and regional markets. All farmers have their particular agents in marketing their products. The relationship that is built between producers and agents is mutual trust and benefit, which is mostly based on contract (agreement). Each farmer has the right to determine the decision to sell the commodity to an agent who can provide the appropriate price. Information on prices is usually available through an open market mechanism that is easily accessible to all farmers. Small farmers still depend a lot on the collection agent system; meanwhile, large farmers have utilized the contract system with large agents and the wider market. It implies that the selection of market channels depends on scale of production, access to information and technology, and farmer’s expertise on know-how for coping and complying quality of products [29].

3.11 Economic Conditions
The farmer's economic conditions include the level of income, expenses, savings, assets, and loans. The characteristic of the farmer’s economy has a positive and significant relationship to the degree of empowerment. This implies that a resilient and established household economic condition will be able
to increase the degree of empowerment. The scale of the business and the application of the pond technology system will determine the efficacy of production and business revenues. The majority of farmers claim that the application of the technology system will have an impact on increasing productivity, which will have implications for business revenues and incomes. However, many of the farmers still have economic limitations to expand the scale of business and to employ high technology systems due to financial issue.

A large amount of revenue from the pond mostly uses for business capital development turnover. Only a small portion is allocated for investment in savings and purchasing gold. This strategy is carried out as a precautionary mechanism to anticipate the necessity of capital if there is a risk of business failure and the need for expanding business capital. The majority of farmers claim they do not want to lend capital from loan/financial institutions because of internal capital perceives so far sufficiently enough to run the business today according to their capacity.

3.12 Motivation
Motivation has a positive and significant relationship to the degree of empowerment. Motivation is the encouragement that arises from the internal/personal to run the business. It is upon the needs, expectations, values, and support from the environment. The need for sustainability of livelihood is driven for farmers to continue to look for innovations in operating and developing their business activities. The average farmers have been running their fishpond business for more than 20 years. The values of business continuity and household life safety contribute greatly to the efforts made by the farmers. Even though the tsunami had destroyed their fishponds, the desire to keep on trying and running the pond had embedded to the farmers. Especially support from the program to restore ponds and capacity building initiatives during the recovery process. Almost all farmers claim that the improvement of physical and institutional infrastructures contributes significantly to access and control in the effort to run a business.

3.13 Information Sources
The ability of farmers to manage information resources has a positive relationship with the degree of empowerment, but it is not significant. The majority of farmers claim to have been able to access information resources using the existing social network and institutional structures. During this time, farmers feel the availability of tools and information media such as newspapers, radio and TV are still limited. They claim both printed and electronic media have not been able to provide fast and accurate information needed by farmers immediately. Besides, the role of the agency and the extension mechanism are also not available and/or very limited. Therefore, social networks perceive as effective and efficient platforms for getting fast and accurate information needed.

Information management activities consist of seeking, obtaining, producing, utilizing and distributing it for themselves and within their networks. The ability to manage information relatively well by farmers is related to the level of knowledge, skills, and experience in running a pond business. Their involvement in the farmer's socio-economic network (group) and the level of the cosmopolitan has a major contribution to the provision, management, and dissemination of information [30] [31].

3.14 Extension and Mentoring
Extension and mentoring has a positive relationship with empowerment but not significant. The majority of farmers claim that the extension system and mechanism did not work well in the pond business. Therefore, the dependency of farmers on extension workers, especially in the provision and dissemination of information is very low. Farmers consider the capacity and quality of extension workers cannot be relied on to provide practical assistance in the management of the fishpond. Majority of the respondent claim that extension workers never existed or were present in their setting and atmosphere. For the fishpond farmers, social networks become an important indicator for them in exchanging information between fellow parties involved in the pond culture system. Such conditions indicate that the involvement of extension institutions is still very low and not optimal in the process.
of capacity building and empowerment [32], especially related to the dissemination of information, technology, and sustainable learning systems.

3.15 Innovativeness

Innovativeness is a degree in adopting new ideas that come within and from the social system. The phases of the process include the stages of knowledge, awareness, and implementation of innovation. Statistically, it shows that the level of innovation has a positive and significant relationship to the degree of empowerment. The farmer's speed in adopting innovation is greatly influenced by knowledge, experience, and network strength. The majority of farmers have a high level of sensitivity to innovation to stimulate and accelerate the adoption process. Many farmers have begun to implement technology systems in the operation of their ponds, especially changes in the structure of cultivation from traditional to traditional plus, or to semi-intensive and so on. In many cases, local wisdom and adaptation to the potential and environmental changes also contribute to the degree of innovation. The development of information systems and technology through social networks accelerates the exchange and circulation of information and creativity in pond farming business systems.

4. Conclusions

In sum, the degree of empowerment of the fishpond farmer in the study area is moderate. The ability to cope with obstacles and social networking contribute more to the power to change and the power to expand the farmer’s capability through optimizing resources embedded and available within them. Here personal characteristics are substantial in the construction of thought, ingenuity, and creativity. Statistically, social relations, motivation, innovativeness, resources availability, and economic conditions are positively related and significant to contribute to the degree of empowerment. Here, networking is a key foundation for the empowerment, which is also supported by the initiative of the best practice management during the recovery process. The improvement of the economic climate and infrastructures are also a path to the construction of enablement and creativity. Meanwhile, information source and extension do not significant due to the absence of the extension mechanism and availability the supporting agent within the fishpond farmer.

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