

Economic Empowerment of Rural Communities through the Development of Biofloc Fish Farming Based on Human Resource Development and Local Product Marketing Strategies

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ARTICLE INFO

Keywords: Empowerment Society, Human Capital, Biofloc, Digital Marketing, Economy Village

Received : 22, December

Revised : 24, February

Accepted: 26, April

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ABSTRACT

This community service project aims to enhance the economic capacity of rural communities through the development of biofloc-based aquaculture, supported by human capital strengthening and local product marketing strategies. The findings indicate a significant improvement in the community's technical skills in biofloc aquaculture, enhanced managerial capabilities, and the initial adoption of digital marketing practices. Furthermore, the program has generated notable social transformations, including the establishment of community-based business groups, behavioral shifts toward entrepreneurial orientation, the emergence of local leaders, and increased collective awareness of innovation and technology. From a theoretical perspective, the findings reinforce the integration of Human Capital Theory, the Resource-Based View, and Community Empowerment Theory, suggesting that effective community empowerment requires the synergy of human resource development, technological innovation, and marketing strategies.

INTRODUCTION

In context development economy local, community village own very strategic position as a driving force resilience food and development sector productive based source Power nature. One of the sectors that have potential big For developed is fishery cultivation, especially with approach technology simple like system biofloc system biofloc is innovation in aquaculture that relies on activity microorganisms For increase efficiency feed and water quality, so that capable increase productivity in a way significant (Avnimelech, 2012; De Schryver et al., 2008).

However Thus , the reality on the ground show existence gap between potential owned with capacity management . In qualitative , society village Actually own sufficient interest tall to business fish farming , will but practices carried out Still dominated by methods conventional with limitations knowledge to technology unprocessed biofloc standardized. In addition that, ability managerial society, especially in management business and marketing , still relatively low.

Institutional economy the village also has not formed in a way strong, so that management results production Not yet integrated optimally. Conditions This aggravated with Not yet existence effort creation mark plus product through branding and utilization digital marketing (Kotler & Keller, 2016).

In a way quantitative, condition the reinforced by empirical data national . Potential land For business fisheries in the village reach around 60–75%, however level its utilization Still range 30–40% (KKP, 2022; BPS, 2023). From the side productivity , methods cultivation conventional only produce around 60–100 kg per cycle , whereas system biofloc capable increase production up to 150–300 kg per cycle (Avnimelech, 2012). Although Thus, the level adoption technology biofloc Still relatively low, namely around 25–35% of perpetrators business (KKP, 2022). On the other hand , internet penetration in Indonesia has reach more from 77%, but utilization of digital marketing by actors business fishery Still is in the range of 20–30% (We Are Social & Hootsuite, 2023; Ministry of Cooperatives and SMEs, 2022). This show there is a significant gap between digital opportunities with ability its use by the community village .

Condition the reflect existence problem structural which includes low capacity source Power human, not yet optimal governance business , limited marketing strategies, and Not yet integration aspect production , management, and marketing . In perspective development economy, conditions This show there is a " capability gap " between potential source Power with capacity owned management society (Todaro & Smith, 2015).

Based on problem said, devotion to public This focused on the approach integrative that combines strengthening human capital , implementation technology biofloc, as well as marketing strategy development digital- based approach This in line with view that improvement capacity man is key main in create productivity and growth sustainable economy (Becker, 1964).

Election public village as subject devotion based on considerations that village own potential source Power great nature as well as availability power Work local that can empowered in a way productive. Besides that, society villages also face challenge in increase human resource capacity for adapt with dynamics digital economy. Therefore that, intervention based empowerment become very relevant, at the same time in line with development programs national which emphasizes strengthening economy villages and resilience food. Approach this is also appropriate with draft community development that emphasizes participation active public in the development process (Chambers, 1994).

Objective main from activity devotion This is For increase capacity public in fish farming based on biofloc, developing system business more fisheries productive and sustainable, as well as increase ability marketing through utilization digital technology. More far, activities this also aims For building an integration model between production, management and marketing that are capable increase mark plus product fisheries.

As for the changes expected social from activity This No only nature economic , but also transformational. Society is expected capable increase income through business more fisheries efficient, at the same time experience change pattern think from just subsisten become oriented entrepreneurship . Transformation This in line with draft empowerment that emphasizes improvement capacity individual and collective in control source Power economy (Chambers, 1994). In addition it is hoped that it will also be formed ecosystem economy local based collaboration and innovation, as well as increasing independence economy village in a way sustainable.

In a way theoretical, activities This based on several runway conceptual Main. Human Capital Theory confirm that investment in knowledge , skills and competencies man will increase productivity and well-being economics (Becker, 1964). Approach This reinforced by the Resource-Based View (RBV) which states that superiority competitive something entities are largely determined by sources the internal power it possesses, especially source Power valuable, rare and difficult human beings imitated (Barney, 1991).

In aspect marketing , digital marketing is an important strategy in increase Power competition product local , because allows market expansion with higher costs efficient as well as increase interaction with consumer in real-time (Kotler & Keller, 2016). Meanwhile that , technology biofloc has proven capable increase efficiency production and sustainability environment in cultivation fisheries (Avnimelech, 2012).

Integration between human capital, technology biofloc and digital marketing become foundation main in building an empowerment model public a village that is not only productive in a way economic , but also sustainable in a way social and ecological approach This at a time reflect synergy between theory and practice in effort create transformation social based community.

IMPLEMENTATION AND METHODS

Activity devotion to public This implemented with focus on empowerment public village based potential local in the sector fisheries. Subject devotion is public a village that has potential in cultivation fisheries, in particular group productive like fish farmers, village youth, and local MSME actors. Community assistance consists of from group community involved direct in activity fish farming and development business-based fisheries. Activities This implemented in the village Senggeng, District Sumberpucung , Malang Regency, with time planned implementation in the period January until March 2026.

Approach main used in activity This is Participatory Action Research (PAR), namely something methods that emphasize involvement active public in all over stages activities, start from identification problem until program evaluation. PAR places public as subject change, not just object intervention, so that capable create transformation sustainable social development (Chambers, 1994; Kemmis & McTaggart, 2005). The approach this is also seen effective in context empowerment public Because integrate reflection, action, and participation in a way simultaneous.

Besides that, activity it also integrates a number of approach strategic, namely community development, capacity building, and entrepreneurship development. The community development approach emphasizes participation active public in the development process, so creating a sense of ownership of the program being implemented (Ife & Tesoriero, 2008). Meanwhile that, capacity building focuses on increasing knowledge, skills, and competencies public as form investment in human capital that contributes to improvement productivity (Becker, 1964). The entrepreneurship approach is directed for push society so as not to only become producers, but also actors innovative and market -oriented businesses (Hisrich, Peters, & Shepherd, 2017).

Planning and organizing process community done in a way collaborative through a number of stages systematic. Stage beginning started with identification needs assessment through observation field, interview with figure society, as well as analysis potential and problems faced. Stages This important for ensure that the program is designed based on needs real public (Creswell & Creswell, 2023; Ferriswara et al., 2025). Next, it was carried out Focus Group Discussion (FGD) as participatory dialogue space for determine priority needs and compile plan action together.

Stages next is formation group assistance, which includes identification members, division participation strengthening structure organization community. This process becom important in build institutional sustainable local (Putnam, 1993). After that, it was carried out program planning which includes compilation module training (cultivation biofloc, management business, and digital marketing), scheduling activities, as well as determination indicator program success.

Program implementation is carried out through activity training and mentoring, which includes training technical fish farming based on biofloc, mentoring management business, as well as training marketing digital-based. The experiential learning approach is used in stage this, where the community Study through practice directly (Kolb, 1984). Next, monitoring and evaluation are carried out in a way periodically for measure program effectiveness and do repair continuous improvement based on bait come back public.

In activity this, society play a role as subject actively involved in the whole process, starting from identification problem until program evaluation. Form participation public covering involvement in planning, participation in training, implementation direct cultivation biofloc, as well as contribution in program evaluation. Approach participatory This aims for build independence public as well as ensure program sustainability (Chambers, 1994).

Implementation strategy devotion designed in a way integrative with combine a number of component main. First, knowledge transfer, namely through activity training and education related technology biofloc. Second, skill development, through practice direct in management pool biofloc. Third, institutional strengthening, namely strengthening institutional group business society. Fourth, digital empowerment, through training marketing digital -based for increase Power competition product. Fifth, sustainability approach, namely mentoring sustainable for ensure program sustainability in term long.

RESULTS AND DISCUSSION

Dynamics of the Community Assistance Process

Implementation devotion to public show dynamics of the developing process in a way gradual, participatory, and adaptive to condition social community. Mentoring process No only functioning as a transfer of knowledge, but also creates room learning collective (collective learning) between team devotion and community. This in line with Participatory Action Research approach which emphasizes collaboration and reflection together in the process of change social (Kemmis & McTaggart, 2005).

At the stage initiation and mapping social , society show high enthusiasm to the program, especially on the introduction technology biofloc as alternative more cultivation productive. Through discussion group (FGD), revealed that public during This Still depends on the method conventional which has risk high , such as height level fish deaths, poor water quality stable , and cost relative feed high. Awareness will limitations old method starts appears , followed by with need to innovation technology. At this stage this too, trust beginning public to team devotion start formed as foundation success of the program. Next, at the stage training technical capacity building, community get provisioning related biofloc fish farming , management business, as well as digital marketing training This No only nature theoretical, but also applicable, so that public capable understand draft biofloc in a way practical. Happens improvement skills technical in cultivation, as well as start grow awareness will importance digital marketing as a market expansion strategy. This process reflect importance investment in human capital as factor main improvement productivity (Becker, 1964).

At the stage implementation and mentoring field, community start apply technology biofloc in a way direct through activity real like manufacturing pool biofloc, spreading fish seeds, management water quality, as well as simulation marketing product. The dynamics that emerge at this stage This show the existence of a learning process based practice (learning by doing), where the community No only Study from theory, but also from experience directly. Besides that happened discussion active between member group as well as exchange knowledge between knowledge local and knowledge scientific. This is strengthen the concept of experiential learning that emphasizes experience as source main learning (Kolb, 1984).



Figure 1. Activity Dynamics of the Community Assistance Process

Monitoring and evaluation stage done in a way periodically For ensure program sustainability. Evaluation results show existence improvement participation society, ability independent in management pool biofloc, as well as increasing trust self in operate business. Findings This show that approach participatory capable push independence public in a way gradual (Chambers, 1994).

Form Program Actions in Solution Problem

Community service program This produce various action concrete which is direct answer problems faced society. Problems cultivation conventional which is not efficient overcome through training and implementation technology biofloc, which has an impact on increasing productivity. Low capacity source Power man responded to through training technical and managerial, so that increase competence public in manage business. Besides that is, the absence of a marketing strategy overcome through digital marketing training that encourages public start utilize online platforms as channel marketing. On the other hand institutional, formation group business based community become solution on weakness structure organization economy society. In general Overall, the action of this program show that approach integrative that combines aspect technical, managerial, and marketing capable produce more solutions comprehensive and sustainable (Ife & Tesoriero, 2008).



Figure 2. Form Program Action

Change Social Events that Occur

One of achievements important from devotion This is occurrence transformation social in public village. Change This No only seen in the aspect economy , but also on the structure social and patterns interaction public.

First, the emergence institutions social new in form group business fishery based community show existence strengthening institutional local. Group This No only functioning as a production unit, but also as room collaboration and learning together. The awakening network social economy local become indicator important in the empowerment process public.



Figure 3. The Empowerment Process Public

Second, it happened change behavior sufficient society significant . Society begins to switch from pattern traditional going to more patterns innovative with adopt technology biofloc. In addition that, society become more active and participatory in activity economy, as well as start develop orientation entrepreneurship (entrepreneurial mindset). Transformation This show existence change paradigm in method think and act public .

Third, the emergence of leader local (local leader) during the mentoring process become indicator important in program sustainability . Individuals This play a role as driving force group, coordinator activities, as well as connector between community and team devotion. Phenomenon This reflect formation leadership based community (grassroots leadership), which is very important in guard sustainability of empowerment programs.

Fourth, the formation of awareness new (new awareness) in public related importance technology , management business, and digital marketing becomes foundation main in the process of transformation social. Awareness This show that public No only experience changes at the practical level , but also at the cognitive and value levels (value transformation).

Impact Economic and Social

From the side economy, community service program This start show potential improvement productivity fish farming through implementation technology more biofloc efficient. Besides that , efficiency cost feed be one of profit main from system this, so that open opportunity improvement income society. Although Still in stage early, indication improvement economy Already start seen as results from program intervention.

From the side social, the impacts that arise covering increasing solidarity social between member society, the formation of community learning (learning community), as well as increasing trust self public in manage business. Condition This show that devotion No only impact on aspects economy, but also strengthens the social capital of the community, which is factor important in development sustainable (Putnam, 1993).

Integration of Findings Empirical with Perspective Theoretical

Results of service show that empowerment public through approach integrative that combines strengthening source Power human capital, innovation technology (biofloc), and marketing strategies digital- based capable push change socio-economic significant findings. This strengthens the Human Capital Theory which states that investment in knowledge and skills individual will increase productivity and value economy (Becker, 1964).

In context this, the training and mentoring process No only increase capacity technical society, but also triggers transformation pattern more mindset transformation adaptive to change. This is show that human capital in context community No only is individual, but also collective, where learning social become part important in the transformation process (Nahapiet & Ghoshal, 1998).

Strengthening Human Capital as a Driver of Transformation Social

Findings field show that improvement human resource capacity becomes factor key in the success of the empowerment program. This in line with Resource-Based View (RBV) perspective which places source Power man as asset strategic in create superiority competitive (Barney, 1991). In devotion this , society experience improvement capacity through training technical, managerial, and digital marketing. Transformation This No only impact on increasing productivity, but also on the emergence of self-efficacy, namely belief individual to his abilities in operate effort (Bandura, 1997). With Thus, human capital functions as a core driver in push transformation socio-economic public village .

Innovation Technology Biofloc as Agent Change

Implementation technology biofloc in activity devotion This functioning as agent change agent in system production society. This is in harmony with the Diffusion of Innovation Theory which explains that adoption innovation influenced by perception benefits, convenience use, and suitability with need users (Rogers, 2003). In in practice, biofloc perceived as solution on limitations method conventional, especially in matter efficiency feed and water quality. Intensive mentoring process as well as demonstration direct speed up the adoption process technology by the community. In addition that, technology biofloc also works as a learning medium social (social learning mechanism), where society Study through observation, practice, and interaction group (Bandura, 1986).

Transformation Marketing through Digital Marketing

Findings show existence shift pattern marketing public from conventional going to digital. This is in line with Marketing 4.0 concept which emphasizes integration between offline and online marketing in build connection with consumer (Anam, et al., 2025; Kotler et al., 2017). Utilization of social media as channel marketing give impact positive in expand market reach, increase visibility products , as well as create interaction direct with consumers. However Thus, the transformation This Still be at the stage early, so that required strengthening digital capacity in sustainable. In Technology Acceptance Model (TAM) perspective, level adoption technology is greatly influenced by perception benefits and convenience use (Davis, 1989).

Community Empowerment as a Transformation Process Social

From the perspective Community Empowerment Theory, empowerment public is a process that involves participation active, increase capacity, and strengthening independence (Chambers, 1994). Results of community service This show that public involved active in all over stages activities, start from planning until evaluation. The transformation that occurred covers changes in structure social (formation of group effort), change behavior (become more participatory and innovative), and change consciousness (the emergence of orientation entrepreneurship). With Thus, empowerment in context This can categorized as transformation social based community, which emphasizes change holistic in life society (Ife & Tesoriero, 2008).

CONCLUSIONS AND RECOMMENDATIONS

Based on overall series implementation devotion to society, can concluded that empowerment program economy public village through development fish farming based on technology biofloc, which is integrated with strengthening source Power man and marketing strategies product local, has give significant impact Good in a way technical, social, and economy. This program No only contribute to the improvement productivity business fisheries, but also encourages occurrence transformation social in structure and dynamics public village .

In a way empirical , strengthening capacity source Power human capital is proven become factor key in increase ability public in manage business cultivation fisheries. Through the training and mentoring process, the community experience improvement knowledge and skills that are direct impact on change behavior, from pattern business traditional going to more patterns productive, adaptive, and innovative. In addition that, the implementation technology biofloc proven capable increase efficiency production as well as productivity results cultivation . More from just innovation technical, technology this also works as a learning medium collective that drives public For more open to change and innovation.

On the other hand, the introduction of marketing strategies digital- based starting shift pattern marketing public from the previous one nature conventional going to a more modern and broader approach its reach . Although Thus, this process Still need strengthening sustainable so that the community capable optimize digital potential in maximum. Which is not lost Importantly, this program also produces change real social, marked with emergence group business based community as institutions social new, increasing participation public in activity economy, the birth of leaders local (local leader), as well as formation awareness collective going to independence economy village .

From the perspective theoretical , findings This strengthen a number of framework conceptual main in studies empowerment society . First , Human Capital Theory emphasizes that investment in form improvement knowledge and skills man will impact directly on the increase productivity and well-being economics (Becker, 1964). Second, the Resource-Based View (RBV) shows that source Power man is asset strategic that can become source superiority competitive, even at the community level (Barney, 1991). Third, Diffusion of Innovation Theory explains that adoption technology, such as biofloc , no happen in a way instant, but rather through the learning process social, communication , and ongoing mentoring (Rogers, 2003). Fourth, Community Empowerment Theory emphasizes that participation active public is key main in create sustainability of empowerment programs (Chambers, 1994).

More continue, devotion This produce something synthesis theoretical that can viewed as contribution conceptual , namely that transformation economy public village will more optimal if happen integration between strengthening human capital, adoption technology and marketing strategies digital- based in framework empowerment participatory.

Based on results mentioned, some recommendation can submitted . In practical, necessary mentoring sustainable For ensure sustainability implementation technology biofloc and development business society. Besides that, strengthening institutional economy villages, such as formation cooperative or group business together, to be important For increase scale business and market access. Optimization digital marketing is also necessary Keep going developed through training further continuation applicable, including marketplace utilization and branding strategies. In addition that, access to capital and partnership strategic with various party need facilitated so that businesses public can develop in a way more wide.

In level government policy village expected can integrating empowerment programs This to in planning development villages, such as RPJMDes, so that the program has sustainability term long. Government areas are also expected give support through provision training, assistance facilities, as well as market access. In addition that, strengthening collaboration based on the triple helix model between college high , government , and society become very important in crea te ecosystem sustainable and adaptive empowerment to change .

In a way academic, empowerment model based integrative results in devotion This own potential For developed more carry on as a theoretical model in study empowerment community. Research further research, especially longitudinal research, is required For measure impact economic and social in a way more comprehensive and quantitative. In addition that , the result devotion this can also developed become publication scientific journals national accredited and journal international reputable.

As closing reflective, devotion This show that empowerment public No not just a process of knowledge transfe, but a process of transformation social involving change method thinking, way work, and how to interact in community. Through integration between human capital, technology, and digital marketing, society village own opportunity big For transform become productive , independent and empowered communities competitive .

ACKNOWLEDGMENT

Writer conveys accept love to LPPM Widya Gama University, Chancellor and staff Rectorate of Widya Gama University, Deans Faculty within Widya Gama University, Widya Gama University students involved in activities, as well as inhabitant Village Senggreng which has been give support, participation, and work same good during implementation of community service programs to public this. And colleagues from Malang State University which has help compilation article This.

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