International Journal of the Commons

Can the Indonesian Collective Action Norm of Gotong-Royong Be Strengthened with Economic Incentives? Comparing the Implementation of an Aquaculture Irrigation Policy Program

RESEARCH ARTICLE

ADISKA OCTA PARAMITA
STEFAN PARTELOW
ACHIM SCHLÜTER
NURLIAH BUHARI

*Author affiliations can be found in the back matter of this article

ubiquity press

ABSTRACT

The Indonesian multi-level governmental program (PITAP) is a participatory pond irrigation management policy established by the Ministry of Marine Affairs and Fisheries. It aims to catalyze the rehabilitation of irrigation canals to improve water access for small-scale aquaculture farmers. In PITAP, traditional aquaculture farmers are incentivized with government funding to create community-based co-management groups (POKLINA), to maintain the self-governance of their irrigation canals. The logic of PITAP is to encourage POKLINA farmers to rehabilitate their irrigation canals through subsidized labor payments that are coupled with strengthening the strong cultural norm of mutual assistance (i.e., collective action) within Indonesian society called Gotong-Royong. PITAP aims to revitalize Gotong-Royong through subsidized labor compensation with the hope that when the subsidy program is over, Gotong-Royong will be revitalized without external support. In this study, we compare and analyze four villages on Lombok, Indonesia, that participated in PITAP program in 2020 and 2021. The study is supported with empirical data using various qualitative data collection methods, including interviews, participant observations, and the collection of policy documents. We further use the Social-Ecological System Framework (SESF) as a diagnostic tool to structure the data collection process and analysis. Findings indicate that different variables hinder and enable collective action in the four villages, leading to different PITAP program outcomes. The likely reason for this, suggested by our findings, is that each village has different social and ecological conditions that influence intrinsic motivation for collective action. PITAP program either crowds out intrinsic motivation under some conditions or crowds it in under others. This suggests the need to consider contextual adaptations in policy design and implementation to improve outcomes better.

CORRESPONDING AUTHOR:
Adiska Octa Paramita
Leibniz ZMT Bremen, Germany
adiska.paramita@leibniz-zmt.de

KEYWORDS:
social-ecological systems; collective action; co-management; aquaculture; irrigation; gotong-royong; common pool resource; environmental policy; government; Indonesia; Southeast Asia

TO CITE THIS ARTICLE:
Paramita, A. O., Partelow, S., Schlüter, A., & Buhari, N. (2023). Can the Indonesian Collective Action Norm of Gotong-Royong Be Strengthened with Economic Incentives? Comparing the Implementation of an Aquaculture Irrigation Policy Program. *International Journal of the Commons*, 17(1), pp. 462–480. DOI: https://doi.org/10.5334/ijc.1273

1. INTRODUCTION

Brackish pond aquaculture requires irrigation canals to deliver water to earthen ponds from the sea, nearby rivers, or freshwater sources. Ponds need to be filled and have regular water exchange, often daily, to ensure sufficient growing conditions (e.g., oxygen, nutrients). Pond aquaculture irrigation canals face similar challenges as those in agriculture and perhaps are even more important because they need to move higher water volumes more frequently, making them larger and more difficult to maintain (Senff et al., 2018). However, little academic or policy attention has been given to pond aquaculture irrigation management despite data showing that earthen pond aquaculture is by far the most common type of aquaculture in the world, especially in rural low and middle-income countries in Asia, Africa, and Latin America (Lebel et al., 2019; FAO, 2020; Partelow et al., 2022).

Earthen ponds are often clustered around irrigation canals, which are often the common property of the villages, although individual ponds are often private (Partelow et al., 2018). In such cases, there is mutual interest and dependency in ensuring the canals are well maintained for private benefit and mitigating shared risk (e.g., clearing debris and fixing leaks) (Partelow et al., 2022). Ponds, on average, need to be maintained and cleared of debris every six months to avoid larger structural or permanent damage. The question is who should invest, and why, in repairing the shared canals? Here arises a classic public goods provision problem, familiar to the commons governance literature, which includes a head-and-tail ender dynamic of asymmetric risks and incentives for individuals (Vermillion, 1999; Meinzen-Dick et al., 2002; Fujiie et al., 2005; Nagrah et al., 2016; Takayama et al., 2018). As such, enabling collective action for canal maintenance is an underlying governance problem in the earthen pond sector. This study analyzes the effectiveness of a policy program in Indonesia attempting to resolve these issues.

Although pond aquaculture systems face similar commons governance challenges as those in capture fisheries and agriculture systems, they lack comparative policy and research attention despite their near-equal contributions to food security, livelihoods, and environmental change. There is a need to better position pond aquaculture systems in the commons literature to benefit the field. Pond aquaculture research can benefit from the rich commons literature on collective action problems in water governance, irrigation, and fishery markets and cultures as a starting point to better understand aquaculture social-ecological system dynamics. On the other hand, the commons community can learn from a new context – pond aquaculture – to improve current theories and frameworks. In turn, commons research on pond aquaculture faces the challenge of identifying the diverse and interconnected commons unique to such systems. Here there is a strong interest to better unpack observed property rights arrangements and the types of rules and norms that are more likely to lead to sustainable outcomes in those contexts (Ostrom, 1990; Partelow et al., 2022). We build on current literature to explore the viability of common property and collective governance arrangements in pond aquaculture and if they may be optimal for achieving sustainability outcomes in coastal pond systems with high interdependencies. Furthermore, there is a strong interest in identifying the range of social and ecological factors contributing to the emergence of contextual collective action problems and the resulting institutional arrangements to deal with them (Epstein et al., 2015; Partelow et al., 2020).

1.1. POND IRRIGATION IN INDONESIA

The Ministry of Marine Affairs and Fisheries of the Republic of Indonesia (MMAF) recognizes cooperation challenges for canal maintenance because it leads to uneven and inefficient water distribution and suboptimal aquaculture production (KKP, 2020). According to Indonesian water resource law (No. 17/2019), the construction and maintenance of tertiary irrigation canals are the rights and responsibilities of water user groups. Meanwhile, the primary and secondary irrigation canals are managed by different levels of national, provincial, and local government (Sjah & Baldwin, 2014). Based on this, the government has established a participatory pond irrigation management program to foster the establishment of participatory management of irrigation canals for pond aquaculture (*Pengelolaan Irigasi Tambak Partisipatif* – PITAP). PITAP program aims to support small-scale and traditional aquaculture farmers in repairing tertiary irrigation canals by enhancing community participation with labor-intensive and simple tools (KKP, 2020). In addition, the government provides funds as labor compensation for rehabilitation work such as improving water tunnels, embankments, bridges, clearing debris, or building water dividers (i.e., release gates).

Gotong-Royong is a traditional mechanism and informal institution in Indonesia for working together and embodying a collective spirit to strengthen economic and social resilience at the local level (Suwignyo, 2019). Gotong-Royong can be understood as the Indonesian cultural practice of collective action to help each other and do collective tasks. Gotong-Royong is an ideological foundation for Indonesia's embedded social-cultural practices alongside *koperasi* (cooperative) as a foundation of economic interaction, and *musyawarah* (deliberation) associated with the cultural practice of decision-making processes (Bowen, 1986). PITAP program is designed to leverage Gotong-Royong to motivate collective action and achieve sustainable resource management within marine and fisheries communities (KKP, 2020).

PITAP program uses multiple mechanisms to increase Gotong-Royong activities among aquaculture communities. First, it provides financial incentives (i.e., paid labor) to motivate collective canal rehabilitation, hoping that intrinsic motivations are revitalized – or at least remain – once the program and its financial aid are over. Previous studies from diverse contexts have shown different effects on intrinsic motivation when interventions use economic incentives. According to motivational crowding theory, extrinsic motivations such as economic incentives can either undermine (crowd out) or strengthen (crowd in) intrinsic motivation depending on different identifiable conditions (Frey & Jegen, 2001; Frey, 2012; Rode et al., 2015). The crowding out effect has been shown to depend on the type of external intervention (controlling vs. supportive), the degree of a participant's self-determination (high vs. low), and the existing societal norms of trust (high vs. low) (Frey & Jegen, 2001; Vollan, 2008; Kerr et al., 2012).

Second, PITAP implements monitoring and sanctioning mechanisms. Monitoring may increase intrinsic motivation when perceived as supportive (Rommel et al., 2015) or decrease intrinsic motivation when perceived as hostile or unfair (Frey, 1993; Frey & Oberholzer-Gee, 1997; Dickinson & Villeval, 2008). Meanwhile, the use of punishment or sanctions may be counterproductive and crowd out the intrinsic motivations, thus backfiring on observed pro-social behavior (Fehr & Rockenbach, 2003; Holmås et al., 2010; Underhill, 2016), but it could also crowd in intrinsic motivation in a society with greater value on top-down governance (Xu et al., 2022).

PITAP program is a widespread government policy program to improve aquaculture production. It has been implemented since 2013 in 18 Indonesian provinces and 77 aquaculture districts (Technical Guidelines of PITAP Program No. 31/2021). In implementing PITAP, the aquaculture farmers are required to conduct community-based irrigation management (*Kelompok Pengelola Irigasi Perikanan* – POKLINA). A POKLINA consists of a minimum of twenty aquaculture farmers in one village to manage their irrigation canals collectively. POKLINAs should organize the following tasks:

1. decide which irrigation canals need rehabilitation
2. involve more people in the village to work together
3. coordinate with the government
4. decide the wage for the participants of the rehabilitation work according to the budget
5. report the spending to the government at the end of PITAP program
6. labor-intensive work without heavy equipment (e.g., excavator)

In PITAP, the total time to finish the rehabilitation work is thirty days. Within this period, the funds are distributed in three phases. In the first phase, the government distributes 40% of the budget before the program's implementation so that work can begin. In the second phase, the government distributes 30% of the budget, and POKLINAs are required to provide proof of rehabilitation progress amounting to 40% of the irrigation canal length. In the third phase, the government distributes the remaining 30%, after 60% of the irrigation canal length is finished. In each phase, the timeline is agreed upon in advance, and POKLINAs have to ensure that the work is completed on time.

1.2. RESEARCH QUESTIONS AND HYPOTHESES

This study's research objective is to conduct a comparative case study analysis of collective action problems across four villages in two districts involved in PITAP policy program. Findings contribute to the literature on collective action theory in community-based environmental governance, particularly pond aquaculture, and to policy recommendations for the continued implementation of PITAP program in Indonesia. The specific research questions are the following:

- What are the social and ecological variables that influence collective action problems to maintain the irrigation system for brackish pond aquaculture in the four villages?
- Did monetary incentives, monitoring, and external sanctions in PITAP program lead to crowding in or crowding out intrinsic motivation for collective action?
- How can PITAP program be revised to enable contextual adaptation and long-term collective action better when the program is completed?

In addition, we develop hypotheses that align with PITAP program based on the motivational crowding literature. PITAP program is a case example for analysis because its main mechanisms for increasing intrinsic motivation are external financial support by the government (I5) and monitoring and sanctioning rules by the government in West and East Lombok (GS8).

- Monetary incentives from the government can decrease the likelihood of collective action because it can crowd out intrinsic motivations of resource users by relying on the government to solve collective action problems.
- The existence of monitoring activities and external sanctions can decrease the likelihood of collective action because it can crowd out intrinsic motivations by overriding the prosocial motivations of Gotong-Royong.

2. METHOD

2.1. CASE STUDY LOCATIONS

The West Nusa Tenggara province is one of Indonesia's biggest aquaculture producers with potential areas of brackish pond aquaculture of around 27,927,50 Hectares (KKP, 2018). In selecting study locations, we chose four villages that participated in PITAP program, two villages in each of the two largest pond aquaculture-producing districts – West and East Lombok (Figure 1). In West Lombok, PITAP program was conducted in Lembar and Sekotong villages. In East Lombok, it was conducted in Jerowaru and Sambelia villages. There are differences in the government monitoring and sanctioning approaches between West and East Lombok. In West Lombok, daily monitoring activities were conducted by a facilitator from the Department of Fisheries and Aquaculture at the district level (*Dinas Kelautan dan Perikanan* – DKP) West Lombok according to PITAP's technical guidelines and did not reinforce sanctioning mechanisms. A government facilitator helped POKLINAS in West Lombok to create the report required by PITAP program to access funding. In East Lombok, daily monitoring activities for PITAP were absent. POKLINAs have the responsibility to create the implementation report. If the implementation of PITAP program was not completed according to the expected timeline, POKLINAs in East Lombok are penalized in the form of having to pay back the funds that they have taken for irrigation canal rehabilitation.

Lombok people or "Sasaknese" have a strong agricultural background which has been passed down over generations utilizing the abundant water and fertile soil from the volcanic Mount Rinjani. In the early 1970s, a transmigration program was reinforced in the West Nusa Tenggara province to re-distribute populations from dense inland areas to the coast for economic development (Disnakertrans NTB, 2020). In the early 1980s, community pond aquaculture began developing as an alternative livelihood for coastal communities. In Lembar, Sekotong, Jerowaru, and Sambelia, the surrounding coastal communities were allowed to clear mangrove habitats. As a reward, the village government granted property rights to pond areas to those who were involved.

In Lembar, Sekotong, and Jerowaru, community-based aquaculture farming is reliant on traditional pond systems. Meanwhile, Sambelia village has used traditional "plus" pond systems. A pond aquaculture system is considered traditional when the pond is non-fed and the fish density is less or equal to 5–10 seeds per m^2. In the traditional system, prior to cultivation, the pond is dried out and the soil in the pond is fertilized using an herbal treatment and agricultural fertilizer to grow plankton and/or algae depending on the type of cultivated species. In contrast, the traditional plus system has regular pellet feed, standardized pond densities of around 25–30 seeds per m^2, and use several aerators. Otherwise, the fed and non-fed traditional systems are similar. They both use earthen pond construction, working with simple tools such as hoes and shovels and rely on low and high tides in the irrigation canals for water exchange.

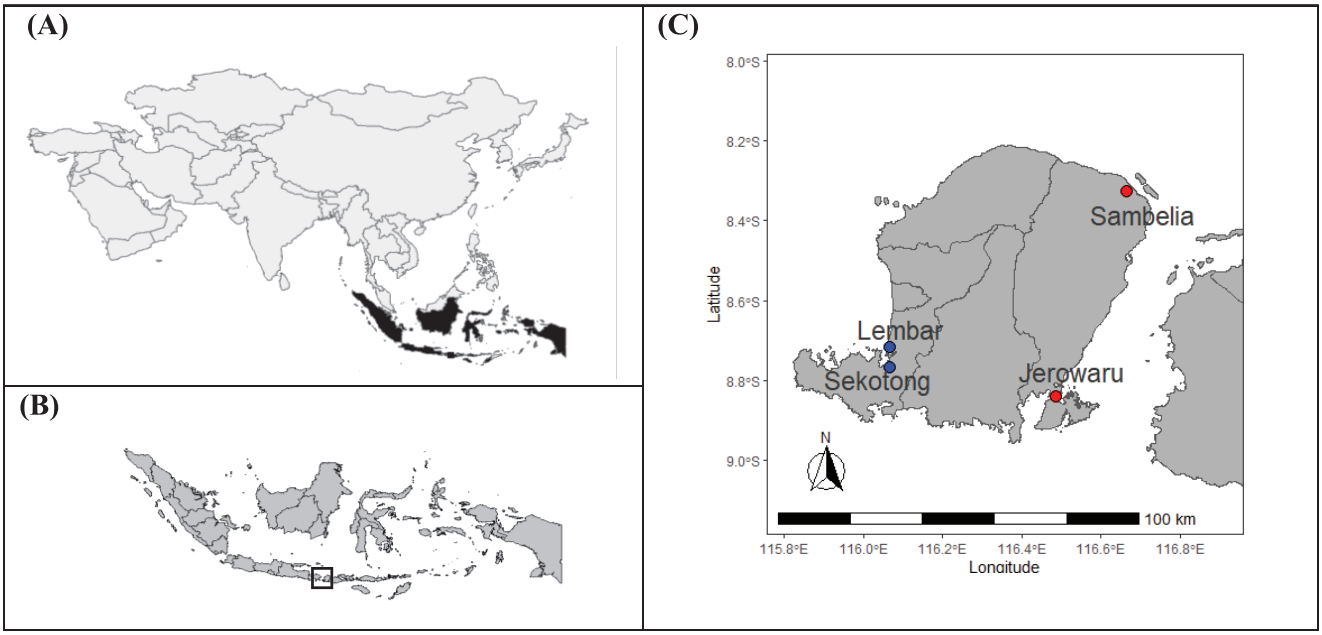

Figure 1 Map of study locations. The location of **(A)** Indonesia within the world map, **(B)** Lombok island within Indonesia, and **(C)** Lembar and Sekotong villages in West Lombok district (blue dots), Jerowaru and Sambelia villages in East Lombok district (red dots). The governance level in the fisheries and aquaculture sector consists of ministerial, provincial, district, and village governments.

2.2. PRIMARY DATA

This study used qualitative data collection methods, specifically semi-structured in-depth interviews and participant observation (Figure 2). The data was collected between August 2021 and January 2022 with a COVID-19 health and ethical protocol. Semi-structured in-depth interviews allow the researcher to explore the aquaculture system complexities, collective action problems to maintain the irrigation canals, and the implementation of PITAP program. We conducted 111 interviews (105 men, 6 women) with farmers and other key informants consisting of ministerial, provincial, and local government representatives, POKLINA leaders, PITAP participants, community leaders, and other relevant stakeholders across four villages of the case studies (Appendix 1). Lombok's fisheries and aquaculture sectors are male-dominated fields, from communities to government structures. The guidelines for semi-structured interviews are available in Appendix 2a & 2b. Our sampling approach aimed to achieve data saturation through snowballing with multiple entry points to ensure social networks do not bias data.

We used the social-ecological systems framework (SESF) (Ostrom, 2007; McGinnis & Ostrom, 2014) to construct the semi-structured in-depth interview guidelines. The SESF aims to provide a checklist of variables that enables scholars to diagnose the sets of variables that are relevant to their cases and to ultimately identify the combinations of variables potentially affecting collective action, governance, and system outcomes (Ostrom, 2007; McGinnis & Ostrom, 2014). The core of the SESF consists of first-tier variables: Resource Units (RU), Resource System (RS), Governance System (GS), Actors (A), Social, Economic, and Political Settings (SEP), and Related Ecosystems (ECO), Interaction (I), and Outcomes (O) (McGinnis & Ostrom, 2014). Within the first-tier variables, there are 56 second-tier variables (Appendix 3) (McGinnis & Ostrom, 2014).

Figure 2 Images of collective action to maintain the irrigation canals in: **(A)** Lembar in 2022 and **(B)** Sekotong in 2022. Images of **(C)** Jerowaru and **(D)** Sambelia, were taken in 2021 after collective maintenance was completed. All photos were taken by first author during fieldwork in 2022.

First, we conducted interviews with twelve key stakeholders from different study locations by examining the relevance of each SESF variable within the context of the case study. Second, we used the identified relevant variables to construct the subsequent interview guideline for different stakeholders to enable data comparisons and validation. The duration of the interviews was between 30 minutes to 2 hours and the average duration of interviews was 1 hour and 15 minutes. The information from different respondents was cross-checked until we reached data saturation and hardly any new information was obtained from additional interviews. The interviews were conducted in the local Sasak language by local research assistants that had been trained by the first author, who is a native Bahasa speaker but does not speak the local Sasak language.

In addition, we conducted participant observations to gather place-based evidence of local knowledge and practices (de Vos et al., 2019). In each village, the first author and local assistants asked for permission from the community leaders and local government representatives to conduct the research in their area and live with local communities. With permission from local stakeholders, the first author conducted participant observations in four deliberation processes between the government and POKLINA. Participant observations were also conducted to understand the dynamic in PITAP program implementation and the tendency for canal maintenance among the communities after PITAP program. The daily reflections on participant observations were recorded in field notes. The code of ethics in this study included verbal prior informed consent, the anonymity of respondents, confidentiality treatment of the data, and permission for audio recording of interviews and photos taking at the beginning. The ethical clearance has been approved by the Research Ethics Committee of the Leibniz Centre for Tropical Marine Research (ZMT) in Bremen, Germany.

2.3. SECONDARY DATA

We used secondary data which included: technical guidelines of PITAP program, PITAP contracts, the memorandum of understandings between the government and POKLINAs, the final report of each POKLINA, government regulations for irrigation canal management and aquaculture, and relevant governmental programs to support aquaculture farmers in the study areas. Some data was available on the government's official website, while others were collected by asking for a copy from the local government and POKLINAs. The summary of secondary data used to support the analysis is available in Appendix 4. The secondary data is publicly available in Bahasa Indonesia and the scanned copies are uploaded in the institutional database of the lead author. Previous studies related to PITAP in Indonesian and international journal publications could not be found for reference. Hence, according to our knowledge, this research is the first case study on PITAP by the MMAF since the establishment of the program in 2013.

2.4. DATA ANALYSIS

Content analysis was the mode of analysis for both primary and secondary data (Stemler, 2000). We used the SESF as a coding template for structuring our data into thematic areas (i.e., the variables of the SESF) (Partelow, 2018; Nagel & Partelow, 2022). Data from both primary and secondary sources were coded/attributed to variables of the SESF. Data could be coded to multiple variables, where it was then possible to analyze connectivity between statements and organize context from all sources by specific thematic relevance for synthesis within the qualitative data coding software MaxQDA Plus version 2020. Data was collated into nested thematic areas, where more specific codes could be created and assigned to data enabling a full picture to emerge from different data sources in a way that linked to the theory in the framework while remaining flexible to context. Nested coding structures enable easier aggregation and separation of themes based on similarities within qualitative text segments. When cross-linkages between coded segments are made, connections between themes can be assessed. The SESF is a useful tool for this type of coding because it provides the core concepts and relationships central to the analysis of commons, but also because it provides a nested structure for identifying social-ecological interactions which can be elucidated in coding software.

The coding process was organized into three steps. We applied the data analysis method by Carillo et al. (2019). First, the second-tier variables of the SESF were used to code the content from primary and secondary data to organize which data contributes to understanding different social and ecological features of the system, as summarized in Table 1. AOP and SP were involved in the coding process, using a consensus method based on iterative discussions and revising our joint understanding of the data. Three independent coding rounds were conducted. After each round, codes were compared and differences were discussed to reach a consensus until there was 80% similarity.

Second, we compared the coded segment from primary and secondary data to understand the interactions across SESF variables. The coded segments were further analyzed based on ordinal scaling to evaluate their associated hypothesis statements. The ordinal scales were assigned based on collective action hypotheses statements for SESF variable. We analyzed the key variables related to PITAP program: investment activities (I5) with high/moderate/low scales and monitoring and sanctioning rules (GS8) with absence/presence scales. The assigned values of the

ordinal scale are relatively compared to the qualitative data from four cases in this study. The meaning of the values of the ordinal scales are summarized in Appendix 5.

Third, we analyzed whether investment activities (I5) and monitoring and sanctioning rules (GS8) could crowd in or out collective action of farmers to maintain the irrigation canals. The level of influence is indicated by (1) an up arrow "↑" to indicate positive influence (i.e., makes collective action easier), (2) a down arrow "↓" to indicate a negative influence (i.e., makes collective action harder), (3) a horizontal line "-" to indicate no influence on collective action, and (4) an asterisk "*" to indicate contradiction with our hypothesis of collective action. The level of influence of key variables (I5, GS8) is assigned based on collective action hypotheses in connection to crowd in and crowd out effect of PITAP program on intrinsic motivation, as summarized in Table 2.

3. RESULTS

3.1. SOCIAL-ECOLOGICAL CHARACTERISTICS INFLUENCING COLLECTIVE ACTION IN THE FOUR STUDY LOCATIONS

The social and ecological characteristics of the four villages are summarized in Table 1.

3.1.1. LEMBAR AND SEKOTONG VILLAGES, WEST LOMBOK

Lembar and Sekotong share similar social and ecological characteristics, but the factors contributing to their collective action problems are different. In Lembar, all of the aquaculture farmers sold their ponds in the late 1980s to shrimp farming companies from Java, Bali or Mataram (GS4) due to the lack of knowledge of how to operate pond aquaculture systems efficiently (A7) and the lack of capital to improve production (I5). To operate the pond remotely, owners hired locals from Lembar to become caretakers in small and traditional pond systems. Meanwhile, in Sekotong, several owners of shrimp farming companies sold the ponds back to the people in the local community (GS4). The lack of leadership (A5) for coordinating owners and caretakers has led to low participation in deliberation processes (I3) to maintain the irrigation canals.

In Lembar and Sekotong, the gross profit is divided in three ways: to finance the costs of production, profits to the owner, and to finance the caretakers. The caretaker's income fluctuates depending on the cost of production and materials (e.g., seeds). The owners have full decision-making power over the ponds, leaving caretakers dependent on the owners' rules and strategies for cultivating and improving production (GS5). Besides aquaculture, coastal communities in Lembar and Sekotong rely on other livelihoods (A2), working as agricultural laborers, cattlemen, fishers, or construction workers to ensure a daily income of around Rp 50.000 – 100.000 (€3,03–€6,06). At night, they use nets in the irrigation canals to catch wild fish, shrimp, and crab from the sea with a typical income of Rp 25.000 – 50.000 (€1,51–€3,03) per day. The heterogeneity of livelihood options has caused caretakers to place little importance on aquaculture to avoid dependency (A8). In Lembar, the lack of collective choice rules for including caretakers (GS6) and lack of importance of the aquaculture resource system (A8) has led to a lack of self-organizing activities (I7). In Sekotong, low participation in deliberation processes (I3) and lack of importance of aquaculture (A8) influenced the lack of self-organizing activities as well (I7).

In Lembar, the main source of pollution is the development of the Lembar port (ECO2), which is contaminating the soil, sea, and water resources around the ponds with oil from ships. In Sekotong, gold mining (ECO2) has caused mercury contamination around the area. In addition, the ecological problems for aquaculture ponds in Lembar and Sekotong have worsened due to poor household waste management (ECO2), where trash ends up in the irrigation canals (RU1), leading to poor water quality in the ponds (RS5). In Lembar and Sekotong, the lack of self-organizing activities for canal maintenance (I7) and poor pond water quality (RS5) has led to low production (O2) and low income (O1). The key social-ecological interactions that influence collective action in Lembar and Sekotong can be found in Figures 3a and 3b.

3.1.2. JEROWARU VILLAGE, EAST LOMBOK

In Jerowaru, ponds are operated using the traditional system for salt farming during the dry season and milkfish during the rainy season. On average, a pond owner has a pond area of 100–500 acres (1 acre is 100m^2) to facilitate the solar evaporation process that uses a concentrating pond to separate the impurities from the salt water and several crystalizing ponds to produce the salt. Clear salt water from the concentration pond is pumped into several crystalizing ponds until the water is about 10 cm deep, where the sun evaporates most of the water in a couple of days. The salt pond owners need to use vast land areas to produce economically profitable amounts of salt. Every pond owner recruits 3–4 landless seasonal salt farmers to work on the salt drying process due to the labor-intensive manual processing needed. Seasonal salt farmers are new settlers from the Central Lombok district who live in the Batu Nampar hamlet, and do not own land for farming, mostly relying on seasonal jobs. Meanwhile, pond owners are local people who live in the neighboring hamlet, Batu Nampar Selatan. Salt farmers can harvest 8–10 times during the dry season, depending on days without rain. The

Table 1 The main social and ecological characteristics of the four villages, organized by the second-tier SESF variables (McGinnis and Ostrom, 2014).

1 1 acre is 100 m^2.
2 The conversion used in this study is €1 = Rp 16.500.
3 Awig-awig is the informal and unwritten rules or customary law with social sanctions of Sasaknese.

SESF VARIABLES	INDICATOR	LEMBAR, WEST LOMBOK	SEKOTONG, WEST LOMBOK	JEROWARU, EAST LOMBOK	SAMBELIA, EAST LOMBOK
RS 3 – Size of resource system	The average pond cultivation area (based on the total area of pond)	35–180 acres[1]	10–500 acres	100–500 acres	5–10 acres
RS4 – Human-constructed facilities	Irrigation canals for rehabilitation from PITAP program	Length 400 m divided into two locations Width 2,4 m and Depth 0,9 m	Length 385 m in one location Width 4,75 m and depth 0,6 m	Length 600 m in one location Width 3,5 m and depth 0,8 m In addition, a bridge construction work	Length 260 m divided in two locations Width 2 m and depth 1 m In addition, water tunnel construction work
RS9 – Location	Village location	Kebon Bongor hamlet	Sayong Baru hamlet	Batu Nampar Selatan hamlet	Sugian hamlet
RU1 – Resource unit mobility	Water sources	Fresh water source from Pengga and Gebong irrigation areas and rainfall. Saltwater from irrigation canals	Fresh water source from rainfall. Saltwater source from irrigation canals	Fresh water source from Montong Kelek dam. Saltwater source from irrigation canals	Fresh water source from Sambelia irrigation areas and rainfall. Saltwater from irrigation canals
RU4 – Economic value	Cultivated species	Milkfish *(Chanos-chanos)*, tiger shrimp *(Panaeus monodon)*, and mud crab *(Scylla serrata)*		Dry season: salt Rainy season: milkfish *(Chanos-chanos)*	Vannamei shrimp *(Litopenaeus vannamei)*, milkfish *(Chanos-chanos)*, and mud crab *(Scylla serrata)*
	Price per species – price range based on the variety of sizes	Milkfish Rp 30.000 – Rp 40.000 per kg (€1,8–€2,4)[2]			
		Tiger shrimp Rp 80.000 – Rp 150.000 per kg (€4,8–€9,1) Mud crab Rp 85.000 – Rp 130.000 per kg (€5,1–€7,8)		Salt per sack (88kg) Rp 80.000 in the dry season, Rp 300.000 in the rainy season (€4,8–€18,2)	Vannamei shrimp Rp 40.000 – Rp 70.000 per kg (€2,4–€4,2) Mud crab Rp 85.000 – Rp 130.000 per kg (€5,1–€7,8)
A1 – Number of relevant actors	Number of participants	30 participants who live in Kebon Bongor hamlet	30 participants who live in the Sayong Baru and Bertong hamlets	17 participants who live in Temayang and Temayang Indah hamlets	30 participant who live in Kokok Pedek Barat and Kokok Pedek Timur hamlets
	Other relevant actors	A facilitator from the government fisheries department (DKP) West Lombok. A technical consultant for irrigation	A facilitator from the government fisheries department (DKP) West Lombok. A technical consultant for irrigation	A technical consultant for irrigation	A technical consultant for irrigation

(Contd)

SESF VARIABLES	INDICATOR	LEMBAR, WEST LOMBOK	SEKOTONG, WEST LOMBOK	JEROWARU, EAST LOMBOK	SAMBELIA, EAST LOMBOK
GS2a – Co-management	POKLINA	POKLINA Mitra Mina Sejahtera	POKLINA Tambak Makmur	POKLINA Sumber Makmur	POKLINA Maju Bersama
GS4 – Property rights systems	Ownership of the pond	Ponds owned by people from Java, Bali, and Mataram	Majority of ponds are owned by people from Java, Bali, and Mataram. Only a few local own ponds	Ponds are owned by people from the neighboring hamlet, Batu Nampar	Aquaculture farmers own their ponds
GS8 – Monitoring and sanctioning rules	Monitoring rules in PITAP program	Monitored by DKP West Lombok with a facilitator	Monitored by DKP West Lombok with a facilitator	Lack of monitoring by DKP East Lombok, a facilitator was not existent	Lack of monitoring by DKP East Lombok, a facilitator was not existent
	Sanctioning rules if PITAP program is not implemented accordingly (e.g., timeline, budget allocation)	Not apply		Apply	
I1 – Harvesting	Harvesting cycle in one year	3–4 times a year	3–4 times a year	Dry season: salt harvest 8–10 times a year (May – October) Rainy season: milkfish harvest 2–3 times a year (November – April)	3–4 times a year
I5 – Investment	PITAP program budget	PITAP 2021 Rp79.200.000 (€4.800)	PITAP 2021 Rp79.200.000 (€4.800)	PITAP 2020 Rp102.300.000 (€6.200)	PITAP 2020 Rp170.000.000 (€10.303)
I7 – Self-organizing activities	Implementation of PITAP by POKLINAs	August-October 2021 with a duration of 30 days		March-May 2021 with a duration of 30 days	August-September 2021 with a duration of 30 days
	Wage system	Contractual wage system with Rp 60.000 (€3,6) per m^2	Contractual wage system with Rp 70.000 (€4,2) per m^2	Daily wage system with Rp 100.000 (€6,06) per day	Daily wage system with Rp 80.000 (€4,8) per day
	Equipment	Used simple tools: hoe and shovel		Used excavator	Used simple tools: hoe and shovel
I9 – Monitoring activities	Awig-awig[3]	Not present			Present
ECO2 – Pollution patterns	Waste in irrigation canals	Domestic waste in irrigation canals, pesticides from the agricultural farmers in the irrigation canals		High rates of natural sedimentation	Pesticides from the agricultural farmers in the irrigation canals

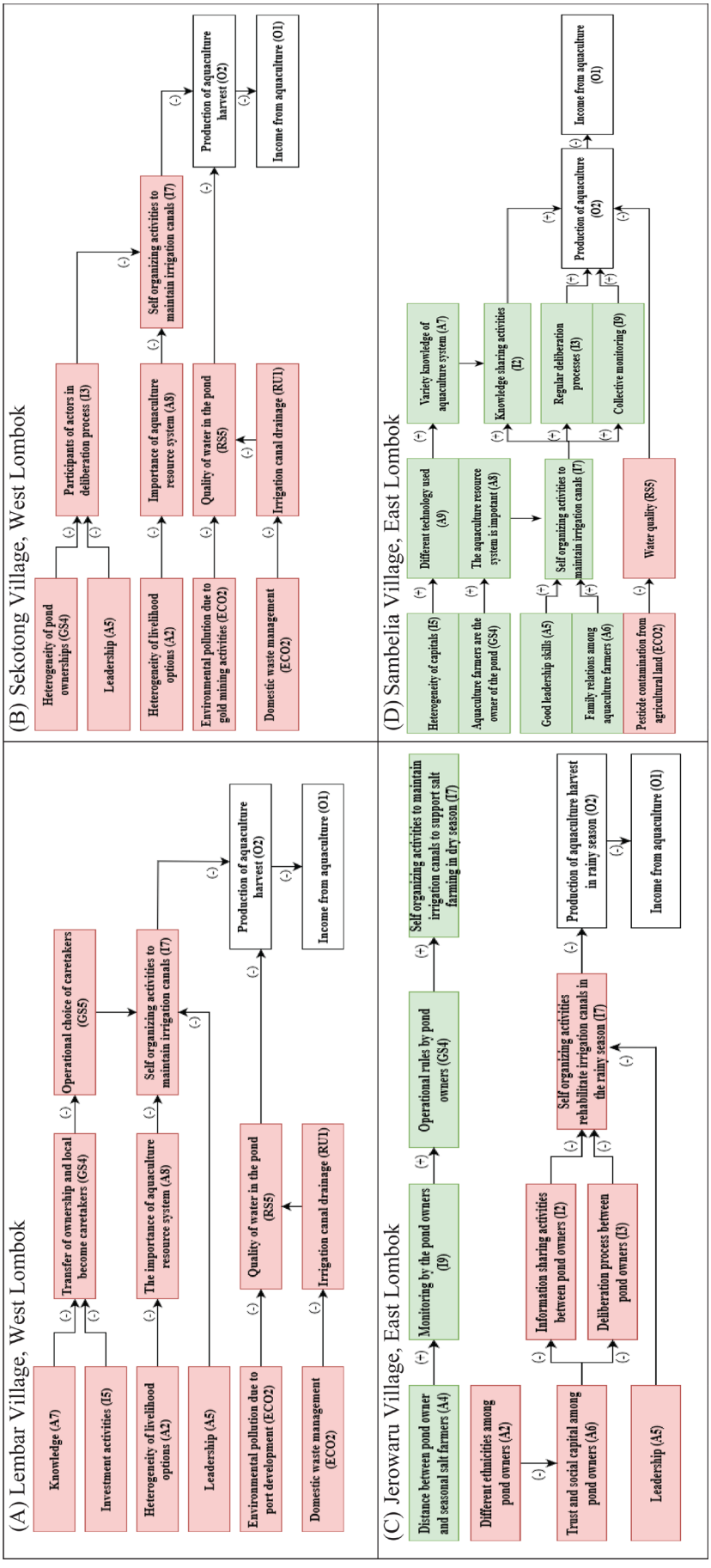

Figure 3 Key social-ecological interactions influencing collective action in **(A)** Lembar, **(B)** Sekotong, **(C)** Jerowaru, **(D)** Sambelia. The arrow indicates the interaction between SESF variables. A red box indicates a negative influence of a variable on collective action (–). A green box indicates a positive influence of a variable on collective action (+). A white box indicates the final outcome. The interactions of variables are based on researchers' interpretation of the social and ecological characteristics of each village. The descriptive analysis of this figure is available in section 3.1.1, 3.1.2, and 3.1.3.

standard price for a sack of salt (88 kg) is around Rp 70.000 – 80.000 (€4,2–€4,84). In the rainy season, the price of salt could reach up to Rp 300.000 (€18,2) per sack due to a lack of supply, while in the dry season, salt prices could reach as low as Rp 50.000 (€3,03) per sack. During the rainy season, pond owners cultivate milkfish by hiring a caretaker with a monthly salary of Rp 800.000 (€48,4). In this arrangement, the pond owner takes 100% of the profit. Meanwhile, the seasonal salt farmers depend on other livelihood activities in the rainy season, such as agriculture labor, fishing, or construction work with an average daily wage of around Rp 50.000 – 100.000 (€3,03–€6,06).

As a result of living close to their ponds (A4), the pond owners can monitor (I9) the seasonal farming practices, ensuring that operational rules are implemented by the seasonal salt farmers (GS4). Pond owners require seasonal salt farmers to conduct self-organizing activities, such as regular irrigation canal cleaning to maintain irrigation canals in the dry season (I7). Beyond individual ponds, challenges for cooperation exist among pond owners. The ethnicities of pond owners vary, such as Bajo, Bugis or Sasak. Due to differences in ethnicities (A2), the pond owners do not seem to have well-established relationships with each other (A6). This can be seen by the lack of information sharing (I2) and deliberation processes (I3) between pond owners. The lack of leadership (A5) in the salt farmer group has caused a lack of self-organizing activities to rehabilitate irrigation canals (I7) to monitor the canal condition. As a result, cultivating milkfish in the wet season is less productive (O2) than salt farming in the dry season, indicated by lower income from milkfish aquaculture (O1). The key social-ecological interactions that influence collective action in Jerowaru can be found in Figure 3c.

3.1.3. SAMBELIA VILLAGE, EAST LOMBOK

In Sambelia, the heterogeneity of capital (I5) among aquaculture farmers is reflected by the traditional and traditional plus aquaculture systems. Aquaculture farmers who focus on cultivating Vannamei shrimp operate with the traditional plus system, while aquaculture farmers who cultivate Vannamei shrimp, milkfish and mud crab use the traditional (non-fed) system. Aquaculture farmers implementing the traditional plus aquaculture system have slightly more advanced technologies, such as diesel power aerators to circulate oxygen and semi-permanent canal landslide barriers made of bamboo as a supporting infrastructure for irrigation canals (A9). Meanwhile, aquaculture farmers with the traditional system do not use them due to a lack of capital and knowledge. In other words, the knowledge differs between farmers using each system (A7) to improve aquaculture production. The aquaculture farmers with the traditional plus system conducted regular knowledge-sharing activities (I2) to build awareness regarding aquaculture-irrigation systems connectivity and to motivate aquaculture farmers in the village to take care of the irrigation canals collectively.

Unlike the other three villages, all the ponds in Sambelia are owned and managed by aquaculture farmers (GS4) without caretakers. The aquaculture farmers consider aquaculture a primary livelihood (A8), which motivates them to conduct self-organizing activities (I7). Other factors that influence the existence of self-organizing activities (I7) are the good leadership skills of the aquaculture farmer group (A5) and family relations among aquaculture farmers (A6). The self-organizing activities to improve aquaculture production and irrigation canals maintenance are reflected in regular knowledge-sharing activities (I2), deliberation process with various types of actors (I3), and collective monitoring of *Awig-awig* to mitigate the risk of thefts (I9).

However, water sources are polluted by pesticides flowing out of agricultural land (ECO2). Aquaculture and agricultural farmers in Sambelia have different irrigation canals but share an estuary to regulate water needs. During high tides, the brackish water flows into the irrigation canals, and the aquaculture farmers access the brackish water through a manual water gate. During low tides, the brackish water in the pond is released back to the estuary through the manual water gate and irrigation canal system. The agricultural farmers use the estuary as a disposal site for excess freshwater that contains pesticides. The pollution ultimately affects Vannamei shrimp production (RU5), despite social efforts to self-organize activities that avoid this (I2, I3, I9). Due to the water pollution, aquaculture farmers deal with highly fluctuating harvest levels (O2) and income (O1) which threaten collective action mechanisms. The key social-ecological interactions that influence collective action in Lembar and Sekotong can be found in Figure 3d.

3.2. PITAP PROGRAM AND ITS EFFECT ON CROWDING IN/OUT COLLECTIVE ACTION

In this section, we narrow the focus of the analysis to the outcomes of the PITAP program, focusing on whether monetary incentives (I5) crowd in or crowd out collective action across the four villages. In Lembar and Sekotong, the implementation of PITAP was accompanied by monitoring (GS8a) throughout the program, while the penalty (GS8b) was reinforced in East Lombok (Jerowaru and Sambelia). The summary of the influence of PITAP program on collective action is detailed in Table 2.

Across the four villages, the monetary incentives from the government (I5) have temporarily improved water flow in the irrigation canals (RS5) and provided wages to support the daily income of PITAP participants (O1).

Table 2 The influence of the PITAP program on collective action across the four villages. The interview data and document analysis are transformed into ordinal values by comparing every village against each other. Then, the level of influence is assigned by analyzing each case to the hypothesis of collective action. The level of influence is indicated by (1) an up arrow "↑" to indicate a positive influence enabling collective action, (2) a down arrow "↓" to indicate a negative influence hindering collective action, (3) a horizontal line "–" to indicate no influence on collective action, and (4) an asterisk "*" to indicate contradiction with a theory/hypothesis of collective action.

SESF VARIABLES	COLLECTIVE ACTION (CA) HYPOTHESIS OF VARIABLE INFLUENCE	LEMBAR, WL		SEKOTONG, WL		JEROWARU, EL		SAMBELIA, EL	
		ORDINAL VALUE	LEVEL OF INFLUENCE ON CA	ORDINAL VALUE	LEVEL OF INFLUENCE ON CA	ORDINAL VALUE	LEVEL OF INFLUENCE ON CA	ORDINAL VALUE	LEVEL OF INFLUENCE ON CA
I5 – Investment activities	Monetary incentives from the government (PITAP program) to improve the system can decrease the likelihood of collective action because it can crowd out intrinsic motivations of resource users by relying on the government to solve collective action problems	High	↓	High	↓	High	↓	High	↑*
GS8 – Monitoring and sanctioning rules	The existence of monitoring activities (monitoring by the DKP government during PITAP program) can decrease the likelihood of collective action because it can crowd out intrinsic motivations by overriding prosocial motivations	Presence	↑*	Presence	↑*	Absence	–	Absence	–
	The existence of external sanctions (penalty in PITAP program) can decrease the likelihood of collective action because it can crowd out intrinsic motivations by overriding prosocial motivations	Absence	–	Absence	–	Presence	↓	Presence	↑*

However, the monetary incentive (I5) did not manage to establish the intrinsic motivations to continue collective action among the resource users in Lembar, Sekotong, and Jerowaru after the program's completion. These findings in Lembar, Sekotong, and Jerowaru support the hypothesis that external government subsidies in the context of PITAP implementation have decreased the likelihood of post-PITAP collective action, not achieving the program's overall goal because resource users rely on the government to solve collective action problems rather than self-organizing solutions. In contrast, the aquaculture farmers in Sambelia continued to maintain their irrigation canals after PITAP program. The findings in Sambelia, therefore, contradict the hypothesis that monetary incentives are not able to crowd in intrinsic motivation after the financial support ceases to exist. Despite the high monetary incentives of the PITAP program, Sambelia sustained self-organization activities to maintain the irrigation canals (I7) after the payment had stopped due to the possibility of improving production (O2) and income (O1) from aquaculture.

Moreover, the four villages with PITAP programs differ in their monitoring and sanctioning mechanisms (GS8) to ensure that POKLINAs implement the activities according to the timeline, procedures, and contract. In Lembar and Sekotong, a representative of DKP West Lombok monitored the program implementation, and was involved in discussions about activities with the POKLINAs, and collaborated with POKLINAs to create the progress report. Meanwhile, sanctioning mechanisms were implemented by DKP East Lombok in both Jerowaru and Sambelia, to replace regular monitoring throughout the program. The findings in Lembar and Sekotong indicate that their monitoring program influenced POKLINAs to work on the PITAP program due to the supervision of the West Lombok government. POKLINAs in Lembar and Sekotong conducted the program according to the agreed contract and timeline. In Jerowaru, the implementation included using an excavator to speed up the irrigation canal rehabilitation to avoid time penalties, although the use of machinery violates the PITAP contract. Meanwhile, the POKLINA in Sambelia hired more people who live around the area to speed up rehabilitation to avoid time penalties.

Our findings indicate different outcomes across the four villages. In Lembar and Sekotong, monetary incentives have decreased the likelihood of collective action based on the principle of Gotong-Royong. However, monitoring mechanisms by the West Lombok government have led to the successful completion of the project due to following all rules. In Jerowaru, monetary incentives, the lack of continuous monitoring, and the use of a one-off sanctioning mechanism have decreased the spirit of Gotong-Royong, as reflected in the use of an excavator instead of motivating farmer participation. Meanwhile, in Sambelia, monetary incentives and sanctioning mechanisms have increased collective action and crowded in motivations after completing the program.

4. DISCUSSION

The most important finding in this study is that different social and ecological variables hinder or enable collective action in each village. The second most important finding is that PITAP program design is not achieving its long-term post-program collective action goals. Our findings indicate that the pre-existing social and ecological conditions strongly influence the success of PITAP in positive and negative ways. However, the payment and penalty mechanism does not seem to have an effect on collective action once the program and its payments end. This suggests that adapting the program to context would likely improve its likelihood of success (to leverage better enabling conditions and navigate hindering ones), but this needs to occur in tangent with designing different social mechanisms to strengthen intrinsic motivations.

4.1. A COLLECTIVE ACTION THEORY LENS ON THE SUCCESS OF PITAP

Five key variables have been important for collective action to maintain the irrigation system across the four villages. In Jerowaru, the close physical distance between pond owners and seasonal salt farmers (A4) is key for collective action in the dry season or during salt production. In Sambelia, heterogeneity of capital (I5), mixed property rights arrangements (GS4), good leadership skills (A5), and strong social capital among them due to family relations (A6), all of which increased the likelihood of collective action through intrinsic motivations. Meanwhile, in Lembar and Sekotong, no positive interactions of social-ecological variables influence collective action. Each variable is discussed further below.

First, actors located close to each other have an increased potential for collective action because physical closeness increases their interactions and lowers transactions costs for communication, which strengthens overall social capital (Ostrom, 2009; Fujiie et al., 2005; Wang et al., 2016). When farmers are located close to each other, it becomes easier to communicate, share information, and exchange ideas. These enhanced interactions provide opportunities for building relationships and fostering trust, which are essential for strengthening social capital. As a result, the likelihood of effective collaboration and cooperation is increased. In Jerowaru, we observed that the close proximity between seasonal salt farmers and pond owners improves

communication on important management activities such as the costs of production, the right to determine the crop, the method of cultivation, and to repair infrastructure. In contrast, the communications between pond owners and caretakers in Lembar and Sekotong occurred only during pre-production and post-harvest because they live further away from each other. The observed trend shows that when actors live close together, their informal daily interactions facilitate discussions about canal conditions and how to improve them more frequently than when they live further apart. This has an enabling effect on collection action.

Second, low to moderate differences in monetary investment among farmers can increase the likelihood of collective action (Ostrom, 2003; Fisher & Qaim, 2012). When there are low to moderate differences in monetary investments among farmers, it suggests a balanced distribution of costs and benefits. This balance helps to ensure that the perceived costs of participation in collective action are not overly burdensome for some while the benefits are still meaningful for all. In Sambelia, some aquaculture farmers have slightly higher capital to establish aquaculture with the traditional plus system. This is indicated by slightly more advanced technology to circulate oxygen in the pond and the use of a barrier to avoid landslides into the irrigation canals (e.g., bamboo reinforcement). Indirectly, aquaculture farmers with the traditional plus system have better knowledge of the aquaculture-irrigation system connectivity, enabling them to better minimize risks of crop failure through optimizing water flows and exchange to stabilize production conditions. The aquaculture farmers with the traditional plus system understand that the shared irrigation infrastructure influences water access and water quality for pond aquaculture. However, irrigation canals need to be maintained collectively. The aquaculture farmers with the traditional plus system seem to be more willing to self-organize knowledge sharing activities with farmers who operate the traditional system, hence collective action to maintain irrigation canals can occur and benefit everyone who is dependent on same canals and water sources.

Third, moderate heterogeneity of ownership of resource systems can increase the likelihood of collective action compared to groups with homogenous or extreme heterogeneity of assets (Vermillion, 1999; Takayama et al., 2018). In conditions where the ownership is homogeneous, farmers may perceive that their contributions are unnecessary or less consequential. Meanwhile, extreme heterogeneity can lead to inequalities and power imbalances that may discourage collective action. Moderate heterogeneity of ownership can strike a balance, minimizing free-riding tendencies, and encouraging active participation from various stakeholders. In Sambelia, all the ponds are owned by the local communities and they take care of the irrigation canals collectively and regularly. Each pond owner in Sambelia feels that they have a stake in the success of collective action and can actively contribute to its achievements. However, in the other villages, most pond owners live outside the villages and the collaboration among caretakers to maintain the irrigation canals did not occur. It is because caretakers do not have shared responsibilities that come along with ownership status. Ownership creates more intrinsic incentives to stabilize profits and lower costs by establishing stable and effective institutions for governing.

Fourth, accountable leadership increases the likelihood of collective action because a good leader can organize and motivate cooperation (Agrawal, 2001; Nagrah et al., 2016). Accountable leadership tends to include effective communication and providing clear direction to group members. A good leader communicates problem awareness, the goals of collective action and the resulting benefits to ensure that everyone understands the purpose and reason to participate. Effective leadership can reduce ambiguity while enhancing understanding and motivating individuals to work together. The strong leadership in Sambelia has helped the emergence of several self-organizing activities, such as regular meetings at the leader's house, knowledge sharing and collective monitoring for pond theft. When accountable leadership is absent, as shown in Lembar, Sekotong, and Jerowaru, self-organization activities to maintain the irrigation canals do not occur.

Fifth, high to moderate levels of confidence, trust in others, and close relationships among actors can increase the likelihood of collective action because it reduces transaction costs and increases willingness to cooperate (Agrawal, 2001; Basurto et al., 2013; Takayama et al., 2018). When farmers have high levels of confidence, trust, and close relationships, transaction costs associated with coordinating and monitoring collective action are reduced. Trust allows for a more efficient flow of information, reduces the need for costly formal mechanisms, and minimizes the risk of opportunistic behavior. Trusting relationships can create a sense of reciprocity, where individuals are more willing to contribute to collective action, believing that others will do the same. In Sambelia, successful outcomes were in part possible because the family relations among farmers make coordinating and knowledge-sharing activities easier. For instance, the appointed aquaculture group leader is the eldest in the family members. Hence, when collaborative activities or deliberation processes need to be held, the group leader can gather the aquaculture farmers and family members easily.

4.2. A MOTIVATIONAL CROWDING THEORY LENS ON PITAP PROGRAM

The government's intervention in PITAP consists of monetary incentives (I5) and monitoring and sanctioning mechanisms (GS8) to revive the cultural norms of Gotong-Royong for collective action towards canal infrastructure rehabilitation. Our findings suggest that these mechanisms do not consider the differentiated behavioral effects on existing cultural institutions (i.e., Gotong-Royong) in the short or long-term, or based on different social-ecological conditions. The lack of these considerations, according to our interpretation of the findings, decreases the likelihood of achieving the program's goal. Our results suggest that understanding context and relevant social-ecological problems as a pre-condition to program implementation are essential for understanding why the program has led to mixed and largely unsuccessful outcomes in our analysis to crowd in intrinsic motivation to maintain the irrigation canals. Previous studies have shown that monetary incentives (I5) can decrease participation if social norms favoring participation are absent or when people initially do not trust each other (Vollan, 2008; Kerr et al., 2012). In our study, Sambelia is the only village with strong social capital which enabled success not because of PITAP but despite it.

Moreover, there is a risk that when monetary incentives are introduced to groups with strong intrinsic motivation, it could influence crowding out effects that are difficult to reverse (Rode et al., 2015). A study by Maca-Millan et al. (2021) has shown that incorporating plural values via non-monetary incentives in the context of payment for ecosystem services can decrease the risk of motivational crowding out. When payments are given in the form of gifts or not mentioned, altruistic motives remain an intrinsic driver of cooperation; however, it is sensitive to the payment amount (Heyman & Ariely, 2004). Thus, we suggest shifting away from monetary incentives in PITAP program strategy.

Besides monetary incentives (GS1), monitoring and sanctioning mechanisms (GS8) are applied in PITAP program. In Lembar and Sekotong, monitoring was reinforced by the West Lombok government, while in Jerowaru and Sambelia, sanctioning was reinforced by the East Lombok government. Ostrom (1990) argues that a reliable monitoring system can encourage credible commitment to follow the rules; graduated sanctions can limit opportunistic behavior. The monitoring mechanism by the West Lombok government has encouraged the rehabilitation of irrigation canals according to the timeline, contract, and technical guidelines in PITAP program in Lembar and Sekotong. However, after the end of PITAP program, when the monitoring was no longer in place, POKLINAs in Lembar and Sekotong did not continue the rehabilitation and maintenance of irrigation canals. This finding shows that the monitoring mechanism helped the emergence of cooperation temporarily. However, once the monitoring is lifted, the intention for cooperation is diminished and intrinsic motivation is not improved. Monitoring, therefore, may have a disciplining and crowding out effect that causes differences in the outcomes (Boly, 2011).

In the case of Jerowaru and Sambelia, the penalty mechanism by the East Lombok government to ensure the implementation of PITAP program generated different results. In Jerowaru, the reinforcement of the sanctioning mechanism has caused the violation of PITAP technical guidelines to avoid a penalty. Instead of manual labor work with Gotong-Royong principle (working together), POKLINA used excavators to fasten the rehabilitation of irrigation canals with a few farmers involved. This finding confirms the motivation crowding theory related to the punishment or sanction that can cause negative impacts on altruistic cooperation (Fehr & Rockenbach, 2003; Holmås et al., 2010; Underhill, 2016). In contrast, implementing the penalty in Sambelia did not crowd out the intrinsic motivation because the good leadership skills of POKLINA in Sambelia coordinated more actors (including the local community) to fulfill the timeline of PITAP program and avoid the penalty. This finding is similar to the finding by Xu et al. (2022) that in a society with more accepting authority, mandates coupled with fines could crowd in intrinsic motivation.

4.3. POLICY RECOMMENDATIONS

Across four villages, PITAP has only managed to boost support for Gotong-Royong in Sambelia due to pre-existing factors. Meanwhile, in the other three villages, Gotong-Royong happened during the program's implementation to rehabilitate the irrigation canals but did not continue after. We argue that the current design of PITAP program was not capable of motivating collective action in the long term. Irrigation canals require regular maintenance or clearance at least once a year (best every six months) to avoid the high cost of rehabilitation and ensure pond aquaculture can access sufficient quality and quantities of water. We suggest revisions to the technical guidelines of PITAP program by investing more in capacity building, regular communication forums, and providing technical support to maintain irrigation canals. In addition, the establishment of aquaculture cooperatives should be supported by the government, especially at the MMAF, provincial, and district levels in the Marine and Fisheries Department. These alternative mechanisms, in our view, would better support the establishment of cooperatives in a way that is adaptive to contexts across different villages while still meeting the goals to support collective action. We believe this would be

more effective than providing monetary incentives in the short term.

Our first recommendation is to integrate capacity building for farmers. Capacity building is essential for effective co-management to empower people to act effectively and take social responsibility (Jentoft, 2005). The establishment of POKLINA groups needed an empowerment component to enhance leadership skills in coordinating people to maintain the irrigation canals collectively and conflict management. Leadership is one of the factors that influence successful fisheries co-management and there has been found a correlation between trust in the leader and participation in co-management (Ho et al., 2016). In addition, capacity building should also consist of training on the effective and efficient traditional small-scale aquaculture system. The lack of understanding of system connectivity between aquaculture and irrigation systems has led to a poorly irrigation canal system. Good knowledge of the resource system can increase the likelihood of collective action because resource users understand how to manage or improve the system efficiently and effectively together (Fujiie et al., 2005; North, 2005). Hence, future implementation strategies for PITAP should include these capacity-building aspects where contextual recognition for them is viewed as necessary.

Our second recommendation is to facilitate regular communication forums. Regular communication forums could lead to a better cooperation among pond owners that are characterized by highly heterogeneous ownership structures livelihood options and ethnicities. Regular communication facilitates repeated interactions in a small group, which can be a strong foundation for building trust and social capital (Agrawal, 2001; Basurto et al., 2013; Takayama et al., 2018). The participation of resource users in the regular communication forums can enable the discussion of common problems, providing fertile ground for finding common solutions with shared rules (Naziri et al., 2014). Prager (2022) argues that facilitator support may be necessary to encourage regular communication meetings and moderate the deliberation or decision-making processes between different actors (i.e., the owner of the pond, aquaculture farmers, caretakers, and local village government). A local facilitator to ensure regular communication forums by the government is essential to achieve resource users' commitment to pursue collective action goals without ongoing state funding.

Our third recommendation is to offer POKLINAs access to technical support. The rehabilitation of irrigation canals in several villages poses challenges due to the reliance on manual labor, simple equipment, and tidal flows. To address this issue, the local government's fisheries and aquaculture department should collaborate with the public works department. The government should provide training on canal maintenance techniques which are suitable for each village's irrigation system. By providing knowledge on how to maintain the resource system, POKLINAs could rehabilitate the irrigation canals regularly without depending on specific governmental programs and funds.

Our fourth policy recommendation is to support the establishment of aquaculture farmer cooperatives. Unfortunately, the aquaculture cooperatives across the four villages in this study do not exist. Farmer cooperatives can facilitate collaboration, market access, technology advancement, and capital access among members to encourage collective action (Lutz et al., 2017; Ajija et al., 2019). A case study in Uganda shows that farmer cooperatives are a promising strategy to overcome market imperfection, increase the productivity, and income of farmers through possibilities of access to credit and technical assistance or training among the members (Meier zu Selhausen, 2016). The intervention of the government to support aquaculture farmers' cooperatives might be a separate program from PITAP. However, farmers' cooperatives may play an important role in facilitating collective action and improving the welfare of traditional and small-scale aquaculture farmers in Indonesia.

5. CONCLUSION

In conclusion, this study examined the effectiveness of the PITAP program in promoting long-term collective action for maintaining irrigation canals among traditional aquaculture farmers in four villages on Lombok, Indonesia. We identified the diverse social and ecological conditions that hindered or enabled collective action in each village through a critical analysis of the program's economic incentives and using the lens of collective action theory and crowding effects. Our findings suggest that while the program successfully stimulated collective action in one village with strong pre-existing social capital, it did not sustain this motivation in the other three villages once the monetary payments ceased. To enhance the program's outcomes, we recommend policy reforms focusing on context-specific adaptations, capacity building for farmers, establishing communication forums, and providing access to technical and financial support for self-organization activities. Shifting away from monetary incentives as the sole development strategy and adopting a more comprehensive approach incorporating local leadership, trust-building, and knowledge sharing is crucial for fostering long-term collective action. Furthermore, our study highlights the effectiveness of the Social-Ecological System Framework (SESF) in diagnosing challenges and guiding

policy recommendations in aquaculture case studies. We encourage further application of the SESF to better understand the unique challenges and dynamics within the aquaculture sector. By implementing these policy reforms and employing robust diagnostic frameworks, we can strive towards more effective and sustainable programs that empower communities and revitalize cultural norms like Gotong-Royong.

ADDITIONAL FILE

The additional file for this article can be found as follows:

- **Supplementary File.** Appendices 1–5. DOI: https://doi.org/10.5334/ijc.1273.s1

ACKNOWLEDGEMENT

We thank anonymous reviewers from IJC for the comments and feedback for significantly improve the clarity and quality of the paper. We also would thank our research assistant, Septiani, N. for supporting the data collection process.

FUNDING INFORMATION

This research was supported by the German Bundesministerium für Bildung and Forschung (BMBF), Grant/Award Number 031B0785.

COMPETING INTEREST

The authors have no competing interests to declare.

AUTHOR AFFILIATIONS

Adiska Octa Paramita orcid.org/0000-0001-7164-5373
Leibniz Center for Tropical Marine Research (ZMT), Bremen, Germany; Constructor University, Bremen, Germany
Stefan Partelow orcid.org/0000-0002-7751-4005
Center for Life Ethics, University of Bonn, Bonn, Germany
Achim Schlüter orcid.org/0000-0002-0046-7263
Leibniz Center for Tropical Marine Research (ZMT), Bremen, Germany; Constructor University, Bremen, Germany
Nurliah Buhari orcid.org/0000-0003-4054-7097
Universitas Mataram, Fakultas Pertanian, Lombok, Indonesia

REFERENCES

Agrawal, A. (2001). Common Property Institutions and Sustainable Governance of Resources. *World Development*, *29*(10), 1623–1648. DOI: https://doi.org/10.1016/s0305-750x(01)00063-8

Ajija, S. R., Muryani, M., & **Rusmita, S. A.** (2019). The Cooperative Establishment Program as a Capital Solution for Fishermen in Surabaya. *Jurnal Pengabdian kepada Masyarakat (Indonesian Journal of Community Engagement)*, *8*(1), 01–06. DOI: https://doi.org/10.22146/jpkm.39773

Basurto, X., Gelcich, S., & **Ostrom, E.** (2013). The social–ecological system framework as a knowledge classificatory system for benthic small-scale fisheries. *Global environmental change*, *23*(6), 1366–1380. DOI: https://doi.org/10.1016/j.gloenvcha.2013.08.001

Boly, A. (2011). On the incentive effects of monitoring: evidence from the lab and the field. *Experimental Economics*, *14*(2), 241.

Bowen, J. R. (1986). On the political construction of tradition: Gotong Royong in Indonesia. *The Journal of Asian Studies*, *45*(3), 545–561. DOI: https://doi.org/10.2307/2056530

de Vos, A., Biggs, R., & **Preiser, R.** (2019). Methods for understanding social-ecological systems: a review of place-based studies. *Ecology and Society*, *24*(4). DOI: https://doi.org/10.5751/ES-11236-240416

Dickinson, D., & **Villeval, M. C.** (2008). Does monitoring decrease work effort?: The complementarity between agency and crowding-out theories. *Games and Economic behavior*, *63*(1), 56–76. DOI: https://doi.org/10.2139/ssrn.571705

Disnakertrans NTB. (2020). Profil Ketransmigrasian Provinsi Nusa Tenggara Barat Tahun 2020.

Epstein, G., Pittman, J., Alexander, S. M., Berdej, S., Dyck, T., Kreitmair, U., ... & **Armitage, D.** (2015). Institutional fit and the sustainability of social–ecological systems. *Current opinion in environmental sustainability*, *14*, 34–40. DOI: https://doi.org/10.1016/j.cosust.2015.03.005

FAO. (2020). *The State of World Fisheries and Aquaculture 2020*. In brief. Sustainability in action. Rome.

Fehr, E., & **Rockenbach, B.** (2003): Detrimental Effects of Sanctions on Human Altruism. *Nature*, *422*, 137–140. DOI: https://doi.org/10.1038/nature01474

Frey, B. S. (1993). Does monitoring increase work effort? The rivalry with trust and loyalty. *Economic Inquiry*, *31*(4), 663–670. DOI: https://doi.org/10.1111/j.1465-7295.1993.tb00897.x

Frey, B. S. (2012). Crowding out and crowding in of intrinsic preferences. *Reflexive governance for global public goods*, *75*, 78. DOI: https//doi.org/10.7551/mitpress/9780262017244.003.0087

Frey, B. S., & **Jegen, R.** (2001). Motivation crowding theory. *Journal of economic surveys*, *15*(5), 589–611. DOI: https://doi.org/10.1111/1467-6419.00150

Frey, B. S., & **Oberholzer-Gee, F.** (1997). The cost of price incentives: An empirical analysis of motivation crowding-out. *The American economic review*, *87*(4), 746–755.

Fujiie, M., Hayami, Y., & **Kikuchi, M.** (2005). The conditions of collective action for local commons management: the case of irrigation in the Philippines. *Agricultural economics*, *33*(2), 179–189. DOI: https://doi.org/10.1111/j.1574-0862.2005.00351.x

Heyman, J., & **Ariely, D.** (2004). Effort for payment: A tale of two markets. *Psychological science*, *15*(11), 787–793. DOI: https://doi.org/10.1111/j.0956-7976.2004.00757.x

Ho, N. T. T., Ross, H., & **Coutts, J.** (2016). The influence of leadership in fisheries co-management: the case of Tam Giang lagoon, Vietnam. *Society & natural resources*, *29*(12), 1405–1420. DOI: https://doi.org/10.1080/08941920.2016.1138562

Holmås, T. H., Kjerstad, E., Lurås, H., & **Straume, O. R.** (2010). Does monetary punishment crowd out pro-social motivation? A natural experiment on hospital length of stay. *Journal of Economic Behavior & Organization*, *75*(2), 261–267. DOI: https://doi.org/10.1016/j.jebo.2010.03.024

Jentoft, S. (2005). Fisheries co-management as empowerment. *Marine policy*, *29*(1), 1–7. DOI: https://doi.org/10.1016/j.marpol.2004.01.003

Kerr, J., Vardhan, M., & **Jindal, R.** (2012). Prosocial behavior and incentives: evidence from field experiments in rural Mexico and Tanzania. *Ecological Economics*, *73*, 220–227. DOI: https://doi.org/10.1016/j.ecolecon.2011.10.031

KKP. (2018). Potensi Usaha dan Peluang Investasi Kelautan dan Perikanan. Provinsi Nusa Tenggara Barat. Direktorat Jenderal Penguatan Daya Saing Produk Kelautan dan Perikanan Kementerian Kelautan dan Perikanan.

KKP. (2020). Laporan Tahunan Kementerian Kelautan dan Perikanan Tahun 2019. *16*, 1–168.

Lebel, L., Lebel, P., & **Chuah, C. J.** (2019). Governance of aquaculture water use. *International Journal of Water Resources Development*, *35*(4), 659–681. DOI: https://doi.org/10.1080/07900627.2018.1457513

Lutz, J., Smetschka, B., & **Grima, N.** (2017). Farmer cooperation as a means for creating local food systems—potentials and challenges. *Sustainability*, *9*(6), 925. DOI: https://doi.org/10.3390/su9060925

Maca-Millan, S., Arias-Arevalo, P., & **Restrepo-Plaza, L.** (2021). Payment for ecosystem services and motivational crowding: experimental insights regarding the integration of plural values via non-monetary incentives. *Ecosystem Services*, *52*, 101375. DOI: https://doi.org/10.1016/j.ecoser.2021.101375

McGinnis, M. D., & **Ostrom, E.** (2014). Social-ecological system framework: initial changes and continuing challenges. *Ecology and society*, *19*(2). DOI: https://doi.org/10.5751/ES-06387-190230

Meier zu Selhausen, F. (2016). What determines women's participation in collective action? Evidence from a Western Ugandan coffee cooperative. *Feminist Economics*, *22*(1), 130–157. DOI: https://doi.org/10.1080/13545701.2015.1088960

Meinzen-Dick, R., Raju, K. V., & **Gulati, A.** (2002). What affects organization and collective action for managing resources? Evidence from canal irrigation systems in India. *World development*, *30*(4), 649–666. DOI: https://doi.org/10.1016/S0305-750X(01)00130-9

Nagel, B., & **Partelow, S.** (2022). A methodological guide for applying the social-ecological system (SES) framework: a review of quantitative approaches. *Ecology and Society*, *27*(4), 39. DOI: http://doi.org/10.5751/ES-13493-270439

Nagrah, A., Chaudhry, A. M., & **Giordano, M.** (2016). Collective action in decentralized irrigation systems: Evidence from Pakistan. *World Development*, *84*, 282–298. DOI: https://doi.org/10.1016/j.worlddev.2016.02.003

Naziri, D., Aubert, M., Codron, J. M., Loc, N. T. T., & **Moustier, P.** (2014). Estimating the impact of small-scale farmer collective action on food safety: the case of vegetables in Vietnam. *Journal of Development Studies*, *50*(5), 715–730. DOI: https://doi.org/10.1080/00220388.2013.874555

North, D. C. (2005). Introduction to understanding the process of economic change. Introductory Chapters.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press. DOI: https://doi.org/10.1017/CBO9781316423936

Ostrom, E. (2003). How types of goods and property rights jointly affect collective action. *Journal of theoretical politics*, *15*(3), 239–270. DOI: https://doi.org/10.1177/0951692803015003002

Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. *Proceedings of the national Academy of sciences*, *104*(39), 15181–15187. DOI: https://doi.org/10.1073/pnas.0702288104

Ostrom, E. (2009). A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science*, *325*(5939): 419–422. DOI: https://doi.org/10.1126/science.1172133.

Partelow, S. (2018). A review of the social-ecological systems framework. *Ecology and Society*, *23*(4). DOI: https://doi.org/10.5751/ES-10594-23043

Partelow, S., Schlüter, A., Armitage, D., Bavinck, M., Carlisle, K., Gruby, R. L., ... & **Van Assche, K.** (2020). *Environmental governance theories: a review and application to coastal systems*. DOI: https://doi.org/10.5751/ES-12067-250419

Partelow, S., Schlüter, A., O Manlosa, A., Nagel, B., & **Octa Paramita, A.** (2022). Governing aquaculture commons. *Reviews in Aquaculture*, *14*(2), 729–750. DOI: https://doi.org/10.1111/raq.12622

Partelow, S., Senff, P., Buhari, N., & **Schlüter, A.** (2018). Operationalizing the social-ecological systems framework in pond aquaculture. *International Journal of the Commons*, *12*(1). DOI: http://doi.org/10.18352/ijc.834

Prager, K. (2022). Implementing policy interventions to support farmer cooperation for environmental benefits. *Land Use Policy*, *119*, 106182. DOI: https://doi.org/10.1016/j.landusepol.2022.106182

Rode, J., Gómez-Baggethun, E., & **Krause, T.** (2015). Motivation crowding by economic incentives in conservation policy: A review of the empirical evidence. *Ecological Economics*, *117*, 270–282. DOI: https://doi.org/10.1016/j.ecolecon.2014.11.019

Rommel, J., Buttmann, V., Liebig, G., Schönwetter, S., & **Svart-Gröger, V.** (2015). Motivation crowding theory and pro-environmental behavior: Experimental evidence. *Economics Letters*, *129*, 42–44. DOI: https://doi.org/10.1016/j.econlet.2015.01.025

Senff, P., Partelow, S., Indriana, L. F., Buhari, N., & **Kunzmann, A.** (2018). Improving pond aquaculture production on Lombok, Indonesia. *Aquaculture*, *497*, 64–73. DOI: https://doi.org/10.1016/j.aquaculture.2018.07.027

Sjah, T., & **Baldwin, C.** (2014). Options for future effective water management in Lombok: A multi-level nested framework. *Journal of Hydrology*, *519*, 2448–2455. DOI: https://doi.org/10.1016/j.jhydrol.2014.07.006

Stemler, S. (2000). An overview of content analysis. *Practical assessment, research, and evaluation*, *7*(1), 17. DOI: https://doi.org/10.7275/z6fm-2e34

Suwignyo, A. (2019). Gotong royong as social citizenship in Indonesia, 1940s to 1990s. *Journal of Southeast Asian Studies*, *50*(3), 387–408. DOI: https://doi.org/10.1017/S0022463419000407

Takayama, T., Matsuda, H., & **Nakatani, T.** (2018). The determinants of collective action in irrigation management systems: Evidence from rural communities in Japan. *Agricultural Water Management*, *206*, 113–123. DOI: https://doi.org/10.1016/j.agwat.2018.04.031

Underhill, K. (2016). When extrinsic incentives displace intrinsic motivation: designing legal carrots and sticks to confront the challenge of motivational crowding-out. *Yale J. on Reg.*, *33*, 213.

Vermillion, D. (1999). Property rights and collective action in the devolution of irrigation system management. In *Workshop on Collective Action, Property Rights, and Devolution of Natural Resources*, June (pp. 21–24).

Vollan, B. (2008). Socio-ecological explanations for crowding-out effects from economic field experiments in southern Africa. *Ecological Economics*, *67*(4), 560–573. DOI: https://doi.org/10.1016/j.ecolecon.2008.01.015

Wang, Y., Chen, C., & **Araral, E.** (2016). The effects of migration on collective action in the commons: Evidence from rural China. *World Development*, *88*, 79–93. DOI: https://doi.org/10.1016/j.worlddev.2016.07.014

Xu, C., Qin, B., & **Rawlings, D.** (2022). Motivational crowding effects of monetary and nonmonetary incentives: Evidence from a common pool resources experiment in China. *Ecological Economics*, *202*, 107597. DOI: https://doi.org/10.1016/j.ecolecon.2022.107597

TO CITE THIS ARTICLE:
Paramita, A. O., Partelow, S., Schlüter, A., & Buhari, N. (2023). Can the Indonesian Collective Action Norm of Gotong-Royong Be Strengthened with Economic Incentives? Comparing the Implementation of an Aquaculture Irrigation Policy Program. *International Journal of the Commons*, 17(1), pp. 462–480. DOI: https://doi.org/10.5334/ijc.1273

Submitted: 02 April 2023 **Accepted:** 05 October 2023 **Published:** 20 December 2023