From trust to collective action: Social capital and communication in community-based rat eradication (‘gropyokan tikus’) for sustainable development in Indonesia

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Abstract. The ricefield rat (*Rattus argentiventer*) is one of the main pests that threatens agricultural productivity in Indonesia. The population is increasingly concerned due to the impact of climate change, including changes in rainfall patterns that affect population dynamics, and global warming, which extends the rat activity season. Farmers traditionally apply ‘*gropyokan tikus*’ as an environmentally friendly rat control, which reflects the social capital and communication practices of collective community action. This study aims to analyze the role of social capital and communication in encouraging collective action of ‘*gropyokan tikus*’. The research was conducted in Magelang Regency from May to June 2025 using a qualitative approach. Data were collected through in-depth interviews with 12 informants. The results show that: (1) elements of social capital (trust, norms, reciprocity) enhance cooperation and solidarity among farmers, also strengthening community-based environmental management. (2) Interpersonal, group, and social media communication play a role in increasing understanding, mobilizing participation, and collective action during the planning and implementation of ‘*gropyokan tikus*’. (3) ‘Gropyokan tikus’ demonstrates the ability of local communities to adapt to climate change through more environmentally friendly pest control in a collective and coordinated manner.

1 Introduction

In recent years, environmental changes and less sustainable agricultural practices have exacerbated pest infestations on agricultural land, posing a threat to the productivity and well-being of farmers. Rice field rats are the most dominant pest species on rice crops [1], resulting in severe food shortages and contributing to food insecurity. Previous research noted that climatic conditions, including rainfall, soil properties, temperature, humidity, and organic

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matter, determine the distribution, abundance, and diversity of rice field rat species [2]. Rainfall anomalies and increased temperatures can extend the reproductive season and increase the survival of rice field rat populations [3].

On the one hand, the increase in rat pest populations is not only related to environmental and biological factors, but also to human behavior and inadequate social coordination in eradication efforts. Technical efforts often fail because they overlook social and cultural factors. Previous research in Indonesia has stated that, in efforts to address climate change, all parties, including the community, need to possess knowledge and skills and be able to support environmental conservation programs [4]. In this regard, the success of implementing sustainable agricultural practices is greatly influenced by farmers' perceptions of environmental policies and the strength of social support at the community level. Strengthened social trust and collective values increase the effectiveness of environmental policies because farmers feel a shared responsibility for the sustainability of natural resources, including in rat pest control [5].

One form of control is the 'gropyokan tikus', a community-based mutual cooperation activity aimed at eradicating rats in rice fields, which is still practiced by some farmers in Indonesia. 'Gropyokan tikus' embodies a form of collective action grounded in social capital and community communication, which is pertinent to the concepts of sustainable agriculture and social ecology. In various regions, community-based rat pest control activities, such as 'gropyokan tikus', have long been carried out as a form of adaptive, collective, and environmentally friendly response to recurring pest attacks. Previous research demonstrated that gropyokan tikus not only reduces rat populations and crop damage but also strengthens social solidarity among farmers and revitalizes local knowledge in pest management [6].

’Gropyokan tikus ’, as a more environmentally friendly pest control practice, relies not only on technical innovation but also on the strength of community-level social networks. Trust between farmers and strong social relationships foster the dissemination of information and the adoption of sustainable agricultural practices. In this context, rat-grabbing can be understood as a form of local innovation that emerges from community social capital, where trust and collaboration are the main foundations of its implementation [7].

Putnam describes social capital as networks, norms, and trust that facilitate coordination and cooperation for mutual benefit [8]. Social capital is the sum of actual and potential resources embedded in, available through, and derived from the network of relationships held by an individual or social unit. Thus, social capital encompasses both networks and the assets that can be mobilized through those networks. In rural contexts, social capital manifests itself in collective problem-solving, mutual support, and shared norms that underpin community resilience [9]. Social norms, which are shared expectations about acceptable behavior, develop within networks and support social capital, and are crucial for understanding the acceptance of policies and practices within a society [10]. Reciprocity is the tendency to exchange kindness in the form of social concern, mutual attention, and mutual assistance.

In the agricultural context, social capital strengthens collective action in natural resource management. Strengthening community social capital is widely recognized as one way to mitigate the impacts of climate change. Social capital is a crucial factor in strengthening collective action in agricultural communities, with elements such as trust, participation, and social networks playing significant roles in encouraging farmers' adaptive behavior [11].

’Gropyokan tikus’ is a community-based pest control method carried out by several individuals using simple tools, accompanied by collective solidarity among farmers. In practice, the ’gropyokan tikus’ not only physically suppresses the rat population but also strengthens the spirit of mutual cooperation and ecological awareness among farmers, serving as a manifestation of local knowledge that has developed within the community [12]. This method emphasizes community participation in implementing collective pest control strategies. Collective action occurs when effective communication reinforces the perception of shared interests, such as interpersonal and group communication that can build trust, shared meaning, and coordination. Participation and collective action are strengthened by culture and local wisdom, which foster social ties and encourage involvement in community activities, including those related to rat eradication and environmental issues in the agricultural sector.

The study of social capital elements and the role of communication in 'gropyokan tikus' offers insights into how social structures, trust, and communication processes facilitate dialogue, information exchange, and collective network formation in community-based rat eradication practices. In addition to providing an understanding of how agricultural policies must respect local values. This study aims to: (1) analyze social capital elements (trust, norms, reciprocity) in 'gropyokan tikus'; (2) analyze forms of communication in building and encouraging collective action of farmers; and (3) analyze the contribution of 'gropyokan tikus' in climate change adaptation and sustainable agriculture.

2 Material and Methods

This study was conducted from May to June 2025 in Magelang Regency, one of the major rice production centers in Central Java Province. Located in the Windusari, Secang, Bandongan, and Borobudur sub-districts, Magelang Regency, Central Java. Aspects studied include: (1) elements of social capital; (2) forms of communication, and (3) the contribution of ’gropyokan tikus’ in climate change and sustainable agriculture.

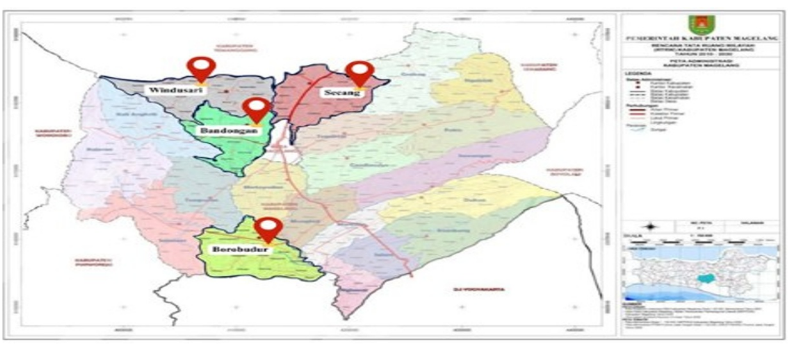

Fig. 1. Area of research

This study employs a descriptive qualitative approach to explore social interactions in the practice of ’gropyokan tikus’. Research informants were selected using purposive sampling techniques [13], which involves the deliberate selection of informants based on their wealth of information and knowledge regarding 'gropyokan tikus'. Informants included farmers, agricultural extension workers, pest and plant pest observers (POPT), as well as local leaders and community figures. Data collection techniques in this study were carried out through in-depth interviews, observation, and documentation [14]. Data analysis in this study was conducted using the interactive model developed by Miles & Huberman [13], which comprises data collection, reduction, display, and conclusion verification.

3 Results and Discussion

3.1 Elements of Social Capital in the ‘Gropyokan Tikus’

3.1.1 Trust

’Gropyokan tikus’ is a collective activity among farmers that instills trust and fosters cooperation in resolving problems related to rat eradication. Social capital strengthens social solidarity and maintains cohesion within farmer groups. Social trust forms the basis for farmer participation in this action.

> *”I believe my fellow farmers will also participate, so we can help each other”* (ARF, May 23, 2025).
> *”Gropyokan isn't just about rice fields, but also a form of mutual cooperation passed down from our ancestors. So, there's a Javanese cultural value of togetherness that makes people feel obligated to attend”* (DIN, May 24, 2025).

This trust can build the belief that collective benefits outweigh individual actions. In the face of climate change threats, trust influences how people perceive their reliance on one another to share resources, solve problems, and maintain cooperation.

3.1.2 Norms

Participation in the ’gropyokan tikus’ is considered a moral obligation and part of the culture of mutual cooperation. This activity emphasizes the importance of active community participation in designing solutions that will be implemented collectively. Farmers' participation in collective activities through the rat group demonstrates their commitment to collectively addressing the rat infestation problem.

> *"Here, it's customary to gather together during the rice planting season. If someone doesn't participate, they usually feel awkward, as they're seen as not caring enough about their neighbors' rice fields."* (AGS, June 18, 2025).
> "*If someone doesn't participate, they usually feel awkward, as they're seen as not caring enough about their neighbors' rice fields."* (YNT, May 30, 2025).

‘Gropyokan tikus’, which involves active community participation, also has a positive impact in rapidly reducing rat populations. Social norms also play a strong role. This technique not only physically suppresses rat populations but also strengthens the spirit of mutual cooperation and ecological awareness among farmers.

3.1.3 Reciprocity

In rural communities, people believe that if every citizen helps their neighbor's activities, they will receive similar assistance.

> *"If I help now, others will help me later if I need something. There's a kind of mutual trust that's ingrained in the community here."* (SFD, June 8, 2025).

Reciprocity is a form of social interaction involving the exchange of kindness between individuals within a group or between groups within a society. This reciprocal relationship has nuances of altruism, reflecting a spirit of helping and prioritizing the interests of others within the community or social group. This is reflected in high levels of social awareness, mutual assistance, and mutual concern for one another.

Fig. 2. Implementation of "*gropyokan tikus*"

Fig. 3. Implementation of "*gropyokan tikus*"

The research results show that in *"gropyokan tikus,"* social capital elements, such as trust, norms, and reciprocity, are the primary binding forces for collective work. Table 1 below is a synthesis of social capital elements and their roles in "*gropyokan tikus*"

Table 1. Elements of Social Capital in Gropyokan Tikus

Elements of Social Capital	Role in "Gropyokan Tikus"
Trust	▪ Creating a collective commitment among farmers to join "gropyokan tikus" groups ▪ Increasing participation ▪ Increasing confidence in the benefits of collective rat eradication rather than individual efforts ▪ Creating mutual trust in creating collaboration to act together
Norms	▪ As a guide for farmer behavior in the community/group ▪ Determines moral standards for mutual assistance among farmers ▪ The basis for social sanctions when individuals do not engage in collective work ▪ Creates a sense of shared benefits when rat infestations can be overcome together
Reciprocity	▪ Creating solidarity and sustainability of activities ▪ Increasing participation and mutual cooperation ▪ Strengthening cohesion in community-based pest eradication ▪ Providing a foundation for the importance of shared responsibility in eradicating rat pests

3.2 Forms and Roles of Communication in the ’Gropyokan Tikus’

Communication plays a crucial role in coordinating collective action within farming communities. The success of the ongoing "mouse group" (gropyokan tikus) program, a form of community-based pest control, relies on a complex communication process that encompasses interpersonal, group, and social media communication. These three forms of communication interact synergistically to build social trust, strengthen coordination, and foster a sense of belonging to a shared goal. Several forms of communication that play a role in the mouse group include: (1) interpersonal communication; (2) group communication; (3) organizational communication; and (4) mass communication (via social media). Interpersonal communication forms the basis for building social trust and technical coordination among rat-trapping actors. Direct interaction between farmers provides a means of exchanging information on rat hiding places, trapping strategies, and the allocation of roles in the field.

> *"If you join the' gropyokan tikus', I'm sure the results will be more noticeable than if you just set the traps yourself. I believe my fellow farmers will also participate, so we can help each other"* (ARF, May 23, 2025).

’Gropyokan tikus’ also utilizes group communication, as seen in farmer group meetings and announcements held at village halls. Strong interpersonal relationships among farmers can develop into more structured group communication patterns. Regular farmer group meetings and forums at village halls provide a dialogue space for farmers to align perceptions, exchange experiences, and agree on strategies for implementing the rat-raising program.

> *“More effective group communication, for example, through farmer group meetings, can generate new ideas, such as how to quickly block rat holes or divide up who carries tools”* (BD, June 15, 2025).

Organizational communication and mass communication (via social media) also play a role in the planning and implementation of ”gropyokan tikus”. It involves multiple parties, including government agencies represented by extension workers and local government officials, particularly at the village level. The collective rat eradication plan is communicated to farmer groups, villages, extension workers, and POPT officers, who then coordinate with the community throughout the planning and implementation stages. Communication typically uses WhatsApp.

> *"The village government also utilizes social media platforms like the village WhatsApp to announce schedules. However, face-to-face meetings remain the most effective, allowing for direct discussion and agreement on rules."* (TM, June 15, 2025).

Fig. 4. Meeting plan for *gropyokan tikus* (source: document of extension staff)

Fig. 5. Meeting plan for *gropyokan tikus* (source: document of extension staff)

The resulting forums not only strengthen technical planning but also serve as collective learning spaces that foster local innovation. The communication process that develops at the group level aligns with the social and cultural values within the farming community. Cultural communication strengthens the social and emotional dimensions of the "gropyokan tikus" implementation. The use of terms such as "war against rats," local humor, and symbols of mutual cooperation fosters a sense of community and strengthens farmers' social identity.

> *"The activity of' gropyokan tikus' isn't just about rice fields, but also a form of mutual cooperation passed down from our ancestors. So, there's a Javanese cultural value of togetherness that makes people feel obligated to attend"* (DIN, May 24, 2025).

Communication serves as a medium for instilling moral values and social norms that encourage voluntary participation among farming communities. Communication bridges individual awareness and collective goals, providing the basis for coordinated and sustainable collective action. A collaborative work culture in resource management, based on cooperation, effective communication, and equitable sharing of responsibilities, is key to increasing productivity, efficiency, and innovation. Effective communication is crucial in disaster management, especially in rural areas where traditional practices often predominate. Traditional communication mechanisms, such as cultural norms that rely on oral traditions and local leaders, foster trust and community engagement.

3.3 Contribution of 'Gropyokan Tikus' to Climate Adaptation and Sustainable Agriculture

First, 'gropyokan tikus' contributes to the implementation of sustainable agriculture by reducing the use of chemical pesticides, strengthening the resilience of agricultural ecosystems, and increasing community independence in pest management. The collective implementation of 'gropyokan tikus', based on social capital and communication coordination, makes this activity not only a technical pest control measure but also a form of community-based resource management. Farmers used chemical pesticides more frequently before the rat-grouping, but after the scheduled and massive implementation of the rat-grouping, pesticide use decreased. This reduction in pesticides has a direct impact on soil health, water quality, and food security, aligning with the principles of environmentally friendly pest management in agriculture. 'Gropyokan tikus' offers benefits such as reducing rat populations, increasing agricultural productivity, preventing the spread of disease, fostering mutual cooperation, and strengthening relationships among farmers.

Second, 'gropyokan tikus' also enhances ecological resilience against pest attacks and climate change. These activities, from the start of the planting season, can help minimize the risk of crop failure due to increased pest attacks caused by climate change. Increased rainfall and warmer temperatures certainly extend the activity and breeding season of rat pests. The type of rat control activities demonstrates that community-based measures are more adaptive than individual approaches, given the transboundary nature of the rat problem. 'Gropyokan tikus' is an effective solution for controlling rat pests because rats are fast-moving and quite difficult to eradicate, requiring regular and massive collective action.

Third, 'gropyokan tikus' practices improve local food security through natural pest control practices. Rat control activities contribute to improving local food security. Natural, collaborative pest control minimizes crop damage by relying on internal controls rather than external inputs, such as chemical pesticides. Natural pest control maintains land productivity and the balance of the agricultural ecosystem, thereby ensuring food security and safety. Rat control is not only a technical strategy for reducing pest populations but also a community mechanism for maintaining sustainable food production and food availability at the local level.

Fourth, promoting community-based sustainable agriculture management. 'Gropyokan tikus' activities are not only beneficial for pest control but also strengthen social networks, solidarity, and collective awareness of environmental sustainability. The involvement of farmer groups, community leaders, and village officials demonstrates that successful pest management relies not only on technology but also on the strength of local social institutions.

> *"We from the village help coordinate the group's schedule. Usually, the neighborhood association (RT) or farmers' group makes the proposal. With our existing social network, it's easy for us to mobilize residents because they already have a strong sense of trust,"* (JN, June 1, 2025).

This aligns with the view that sustainable agriculture requires a harmony of social, ecological, and technical aspects. 'Gropyokan tikus' activities can strengthen social cohesion and collective capacity in facing agricultural challenges. The combination of local wisdom, in the form of social and cultural values, with technical actions, such as 'gropyokan tikus', can make these activities more efficient [15].

4 Conclusion

Social capital elements, such as trust, norms, and reciprocity, form the foundation for the success of the 'gropyokan tikus'. Trust fosters consistency and a willingness among community members to participate, while reciprocity fosters a sense of moral obligation to help one another. These three elements make the ‘gropyokan tikus’ not only technically effective but also socially sustainable. Furthermore, interpersonal, group, organizational, and mass communication (via social media), as well as culture-based communication, play a crucial role in strengthening farmers' collective action. Interpersonal communication builds closeness and mutual trust between individuals. Group communication and social media facilitate coordination and efficient decision-making, while communication rooted in local culture strengthens farmers' solidarity and collective identity.

In response to climate change, which impacts fluctuations in rat infestations, ’gropyokan tikus’ contribute to collective, coordinated, and widespread community control in a more environmentally friendly manner. It also demonstrates local knowledge, showcasing the community's capacity for community-based resource management, which ultimately strengthens farmers' ability to adapt to the challenges of climate change.

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