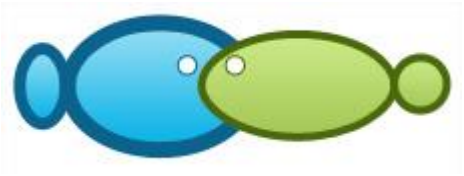

Stakeholder dynamics in mangrove tourism co-management in the mangrove ecosystem and tourism development

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Abstract. Mangrove ecotourism management is a strategic effort to maintain the sustainability of coastal ecosystems and the livelihoods of local communities, the success of which is largely determined by the relationships and dynamics between stakeholders. This study aims to analyze the influence, dependency, and potential synergy and conflict between actors in mangrove ecotourism management in Tapaktugurejo, Semarang City. The study used a mixed methods approach. 16 actors grouped into academics, businesses, government, and the community. Data were then analyzed using the Mactor method to identify stakeholders' strengths, relationships, and alliance patterns. The results of the study show that the map of influence and dependence between actors in the management of mangrove ecosystems shows diverse positions according to their respective roles and capacities. The government has high influence but low dependence as the main regulator and policymaker. Actors such as academics, Tourism Awareness Group (Pokdarwis), Fishers wives (Tirang), Semarang City Tourism Office (Dinpar), and Tapak Environmental Youth Association (Prenjak) show a strategic role in connecting various parties. The government focuses on regulatory and coordination functions, while local communities and fishermen still have limitations in influencing policy. The actors like a Prenjak and Pokdarwis are central actors with a high level of convergence in encouraging cross-party collaboration. The success of mangrove management depends on strengthening relationships between local governments, communities, and other supporting institutions. Synergy between actors is the key to the sustainability of mangrove ecosystems and the improvement of the welfare of coastal communities.
Keywords: collaborative governance, governments, local communities, mangrove ecosystems, NGO.

Introduction. Mangrove ecosystems play a crucial role in supporting coastal sustainability by providing ecological services such as biodiversity conservation, carbon sequestration, and shoreline protection, while also sustaining local livelihoods through fisheries and ecosystem-based economic activities (Yonvitner et al., 2020; Sievers et al., 2023; Rifai et al., 2023). In this context, mangrove-based ecotourism has emerged as a strategic approach that integrates environmental conservation with socio-economic development, offering opportunities to enhance community welfare while maintaining ecosystem integrity (Rastogi et al., 2021; Suhardi et al., 2024).

The governance of mangrove ecotourism is inherently complex due to the involvement of multiple stakeholders, including government agencies, local communities, non-governmental organizations, academics, and private sector actors, each with distinct interests and levels of influence (Daris et al., 2025). To address this complexity, co-management or collaborative governance frameworks have been increasingly promoted, emphasizing shared decision-making, stakeholder participation, and the integration of ecological, social, and economic objectives (Hattam et al., 2021; Lakshmisha & Thiel, 2023). Co-management is known as collaborative and participatory approach to manage resources in which stakeholders share responsibilities and decision-making authority (Hermawan & Hutagalung, 2024). Further, the involvement of local communities has been shown to help diversify local economies and strengthen the local economic resilience (Islam et al., 2018; Wahyudin & Mutamimah, 2025). However, the success of such arrangements

is strongly shaped by stakeholder dynamics, particularly power relations, trust, communication patterns, and the clarity of institutional roles (Diver 2016; Gorris & Koch, 2024).

Despite growing recognition of the ecological and economic benefits of mangrove ecotourism, existing studies often give limited attention to the processes of governance and the interactions among stakeholders that shape management outcomes (Afifah et al., 2023; Khuluq et al., 2025). Empirical evidence from different contexts highlights persistent challenges, including power imbalances, weak institutional capacity, and coordination failures, which undermine the effectiveness of formal co-management structures (Hasach et al., 2023; Siddique et al., 2024). These findings suggest that elucidating stakeholder dynamics is necessary for tackling challenges in co-management practice, yet their role within collaborative arrangements and their influence on effective governance have not been critically examined.

This study aims to address the knowledge gaps in the literature by analyzing stakeholder dynamics in mangrove tourism co-management. It particularly focuses on the influence of power, trust, communication, and institutional arrangements on decision-making processes and collaborative outcomes, rather than the assessment of environmental impacts or tourism economic outcomes.

Material and Method

Location of the study. This study was conducted at the Tapak mangrove forest, which is located in Dukuh Tapak, Tugurejo Village, Tugu District, Semarang City. Mangrove area in the Tapak area reaches ±3.00 Ha (Yaqin et al., 2022). The Tapak mangrove forest is about 20 minutes from the center of Semarang city to the west.

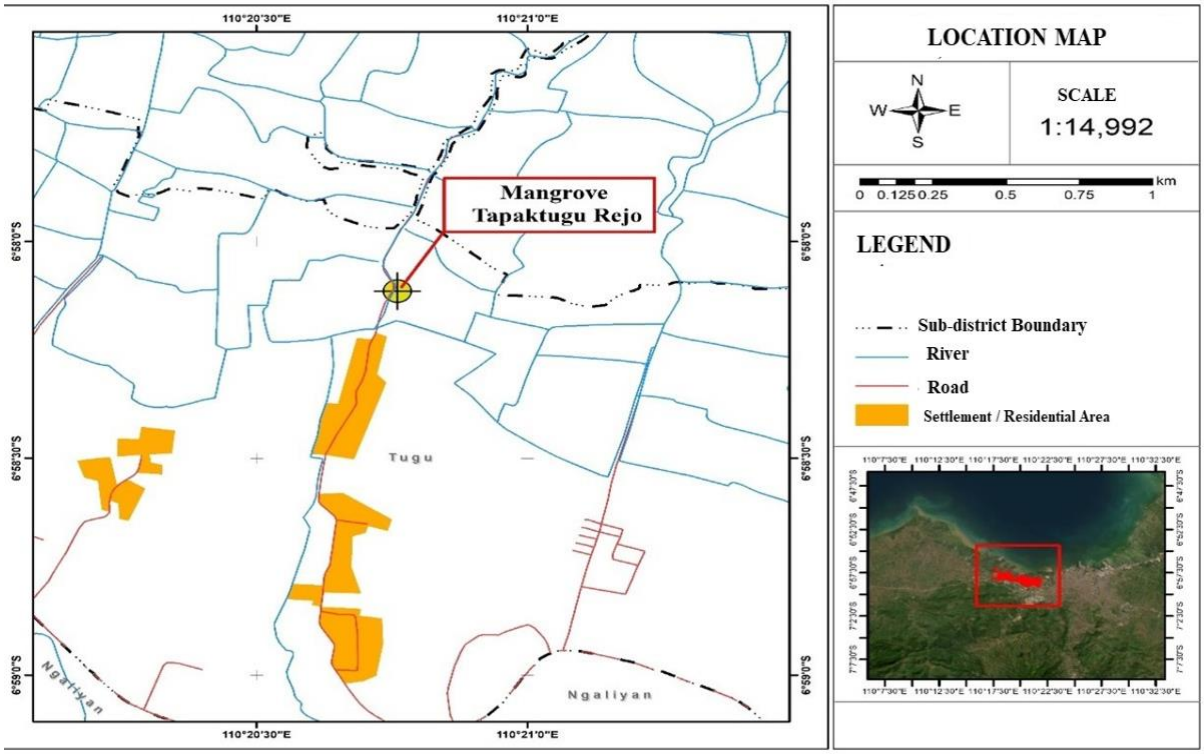

Figure 1. Map of influences and dependences between actors.

Methodology and approach. This study uses a mixed methods design by integrating qualitative and quantitative approaches to obtain an overview of the dynamics of stakeholders in the management of mangrove ecotourism in Tapaktugurejo, Semarang. Data were obtained through in-depth interviews, participatory observations, and documentation studies. Stakeholders in this study were selected purposively and limited

to key actors who have direct involvement in the management of Mangrove Sites. As such, the research findings are contextual and are not intended to be generalized broadly.

Mapping stakeholders. The subjects of the study are stakeholders who are directly or indirectly involved in the management and utilization of mangrove ecotourism. The research subjects included 16 stakeholders and mapped into four main categories, namely: Academics (A) - representatives of academic institutions and researchers; Business (B) - local business actors, MSMEs, and the tourism sector; Government (G) - relevant local government agencies (Tourism Office, Environment Office, village/sub-district government); Community (C) - community groups, ecotourism managers, and local fishermen. There are 16 main stakeholders in Tapak Mangrove, i.e Semarang City Environmental Office, Semarang City Tourism Office, Marine and Fisheries Service, Central Java Provincial Environment Office, Village and sub-district governments, Educational and research institutions, community self-help group in Tapak, Tugurejo, Semarang, which focuses on mangrove forest conservation and rehabilitation and ecotourism development that we write on mactor as a Prenjak (Tapak Environmental Youth Association) , Tourism Awareness Group, Putri Tirang as a name of fishers wives group, Fishers, fishers aquaculture, tourists; company, and NGO. An explanation of these stakeholders is provided in Table 1.

Mactor analysis. The analysis was carried out using the MACTOR (Matrix of Alliances and Conflicts: Tactics, Objectives, and Recommendations) Method to map the interests, influences, and relationships between actors (Fetoui et al., 2021; Kusumawardhani & Susilowati, 2023). The analysis stages include the identification of actors, the preparation of strategic objectives, the assessment of the influence between actors through the direct influence matrix (MID), the mapping of the position of actors towards the goals through 2MAO, and the analysis of the convergence and divergence of interests. The results of the analysis produced a map of the position of actors, the level of influence and dependence, as well as the potential for synergies and conflicts between stakeholders. The output of this research is the level of influence and dependency between actors. Convergence and divergence of interests based on the goals of each stakeholder.

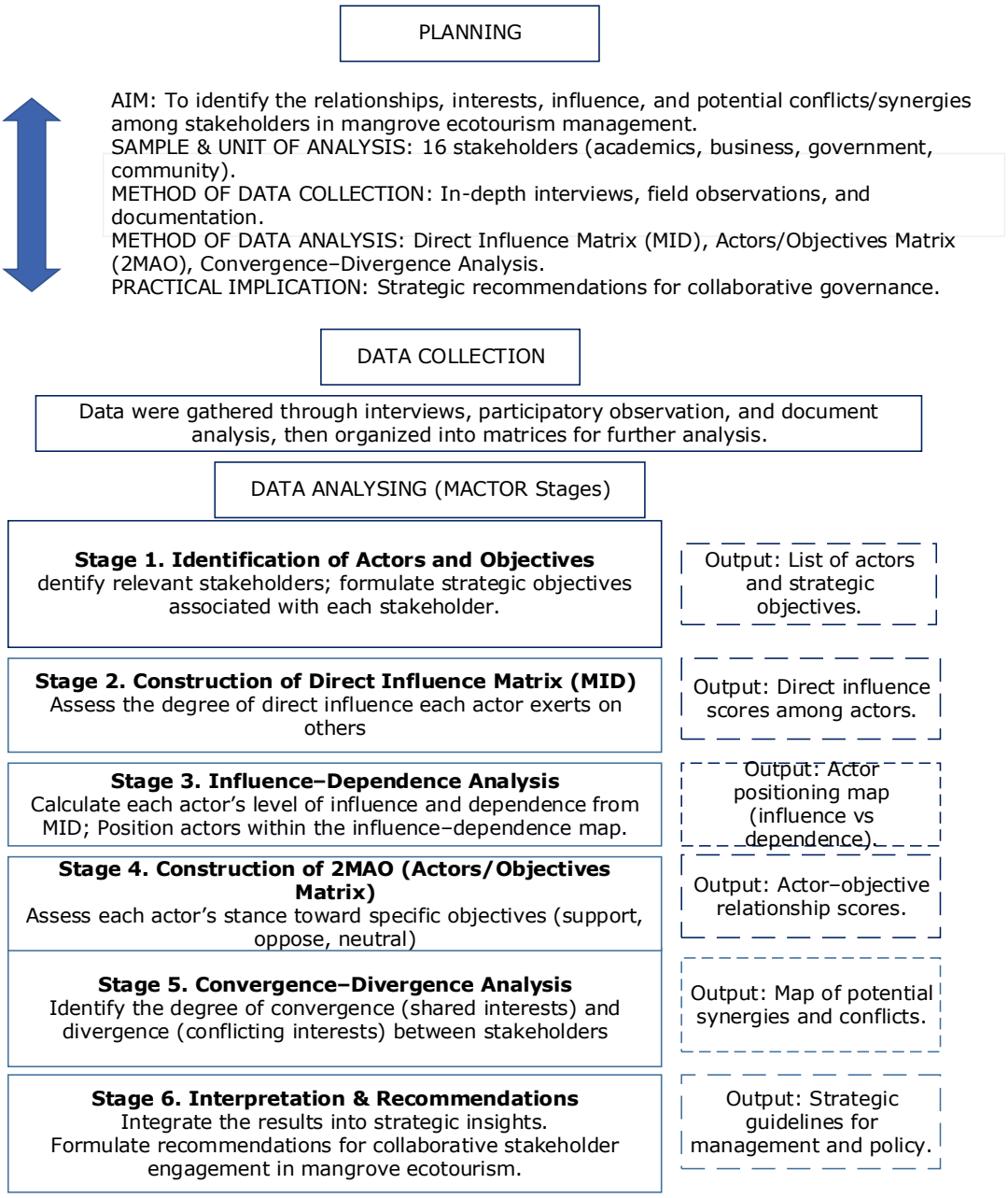

Figure 2. The stages of research analysis.

Results and Discussion. The findings and discussion are separated into five sections. The first explains the degree of influence of interdependence between actors. Second, describe the competitiveness between actors; third, describe the interaction between actors and goals; fourth, describe the potential for cooperation and conflict between actors; and fifth, explain the proximity between goals and between actors in mangrove management in Tapakrejo, Semarang.

Table 1

List of stakeholders

Actor	*Category*	*Definition*	*Role*
Prenjak Tapak Environmental Youth Association (short label in Mactor: Pjk)	Community	This community is active in the conservation and development of mangrove forest ecotourism to overcome abrasion, flooding, and pollution problems on the coast of Semarang	1). Coastal Environment Rehabilitation 2). Manufacture of Breakwater Equipment (APO) 3). Development of Eco Edu Mangrove Tourism 4). Conservation Activities
Semarang City Tourism Office (short label in mactor: Dinpar)	Government	The Tourism Office in the management of the Tapakrejo Mangrove is to develop, promote, and manage the potential of the mangrove ecotourism in order to have a positive economic impact on the surrounding community and contribute to the sustainability of the area.	Formulate tourism policies, coordinate promotional efforts, and collaborate with other stakeholders to ensure harmonious management between conservation and tourism utilization.
Pokdarwis Tourism Awareness Group (short label in Mactor: Pokdarwis)	Community	Tourism awareness group in Tugurejo Village, Tugu District, Semarang City, which manages the mangrove forest ecotourism area.	Conserving the coastal environment and developing community-based natural tourism potential.
Putri Tirang (short label in Mactor: Tirang)	Community	Founded and run in groups by local pond farmers and fishermen, Putri Tirang is a collaborative forum that combines the skills, experience, and innovation of the local community.	The Putri Tirang women's group in Tapak, Semarang, plays an important role in the management of mangrove ecotourism, especially in the aspects of creative economy and women's empowerment.
Fishers (short label in Mactor: fishers)	Community	A person (who may also be a member of a fishing group) who depends on the services of the mangrove ecosystem	1). Participation in planting 2). As a natural supervisor 3). Diversification of livelihoods: ecotourism service connoisseurs, Marine product providers, collaboration with tirang women
Petambak (short label in Mactor : fisheraq)	Community	Individuals or community groups who manage ponds for the cultivation of fish, shrimp, or other aquatic biota. Historically, their existence sometimes intersected with mangrove ecosystems, where mangrove land could be converted into ponds.	1). Conservation and rehabilitation actors 2). Natural actors 3). Economic and social contributors: livelihoods
Local Communities (short label in mactor: localcom)	Community	Households who live in the vicinity of the area, but are not formally members of the management group, They can consist of residents residing in the Site, small business actors around the area, or other individuals affected by environmental conditions there.	Passive participation: 1). Supporting the local economy 2). Becoming a social supervisor 3). Active participation (occasional)
Semarang City Environmental office	Government	The regional apparatus, led by the Head of the Service, is tasked with assisting the mayor in	Policy implementation, management and supervision

(short label in mactor: DLHCity)		carrying out government affairs in the environmental sector.	
Central Java Provincial environment office (short label in mactor: DLH)	Government	Government agencies responsible for the formulation and implementation of policies in the field of environment and forestry in the Central Java Province area.	Role as coordinator, facilitator, and educator in efforts such as mangrove planting, abrasion prevention, and climate change mitigation, capacity development and local economy
Village and sub-district governments (short label in mactor: localgov)	Government	Organizations that exist at the local level	Coordination between stakeholder
Educational and research institutions (short label in mactor: academic)	Academic	Contribution on mangrove ecosystem in Tapakrejo, Semarang, through research, community service, and education activities This research(by UNDIP)	Community service, research, education
NGO (Ngo)	Community	A non-governmental group formed voluntarily by citizens, dedicated to preserving the coastal environment and empowering the local communities living in the vicinity.	Community mobilizers and companions, Aid distributors and collaboration bridges, Implementation of conservation and rehabilitation activities, Education and environmental awareness building, Ecotourism promotion and marketing
Tourist (short label in mactor: tourist)	Community	People who visit the mangrove ecotourism area in Tapakrejo Village, Semarang.	As consumers, and as active participants who can have a positive or negative impact. (+) sources of income, increased conservation awareness, conservation supervisors and supporters, promotion of tourist destinations (-) potential environmental damage, socio-cultural change
Marine and Fisheries Service (shortlabel in mactor: DKP)	Government	Regional offices in charge of carrying out government affairs in the marine and fisheries sector in the Semarang City area, including coaching, licensing, public services, and the development of the marine and fisheries sector, including capture fisheries, aquaculture, and conservation.	Stakeholder coordination; protect coastal ecosystems; creating sustainability conservation; Coastal Policy
Company (shortlabel in mactor : Company)	Business	Companies that stand around Tapakrejo, related to positive (CSR programs) and negative things (linkages to the environment)	CSR program

Source: Observation, Literature Review, supplemented by in-depth interviews

Actor mapping. Mangrove ecosystems have a very important role in the lives of coastal communities, both from ecological, economic, and social aspects (Zamboni et al., 2022; Nuraeni & Kusuma 2023; Fadilah et al., 2025). Ecologically, mangroves function as abrasion barriers, buffers for seawater intrusion, and habitat for various types of fish, crabs, shrimp, and other marine life that are the source of livelihood for the community (Jennerjahn et al., 2017; Mitra, 2020; Sarkar et al., 2024) Meanwhile, from an economic perspective, the mangrove ecosystem supports capture fisheries, aquaculture, and nature-based ecotourism activities that can increase the income of coastal communities (Mitra, 2020). The sustainability of mangrove ecosystems is not only determined by natural conditions but also influenced by the involvement and interaction of stakeholders. Each stakeholder has a different influence, both in maintaining and in destroying the mangrove ecosystem (Kusmana et al., 2020; Nijamdeen et al., 2022).

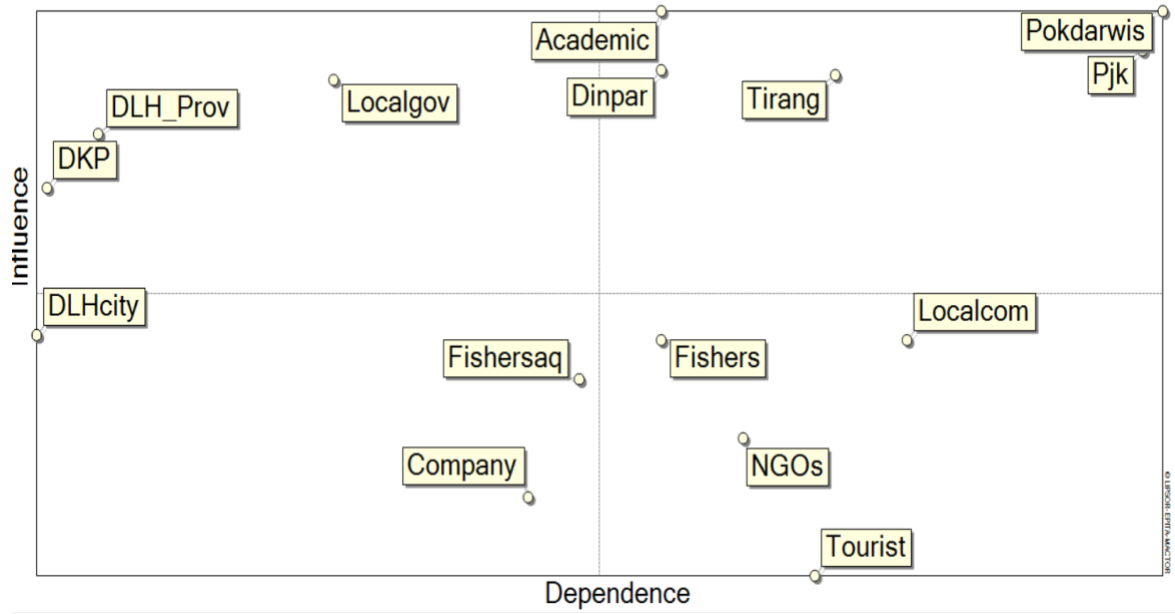

Figure 2. Map of influences and dependences between actors.

Notes:
Vertical axis (Y) - influence (The higher the player, the greater his influence on other actors)
Horizontal axis (X): Dependence
Quadrant I - key players/driving actors -> (high influence - low dependence) (upper right)
Quadrant II - driving actors / influential actors (top left)
Quadrant III - dependent actors (low influence - high dependence/ bottom right)
Quadrant IV - autonomous/marginal actors (bottom-left)

The map of influence and dependence between actors in the management of mangrove ecosystems shows diverse positions according to their respective roles and capacities. Actors with a high level of influence but low dependency, such as the DKP (Marine and Fisheries Service), Provincial DLH**,** and city governments (DLH City)**,** function as key regulators and decision-makers. They have authority in formulating policies and regulations, but are not too dependent on other actors in carrying out their roles. Furthermore, there are actors with high influence as well as high dependence, such as academics, Tourism Awareness Group (Pokdarwis), Tirang, Dinpar (Tourism Office), and Prenjak. This group is an important driving force in the implementation and empowerment of the community, but its success still requires support from other actors, both in the form of policies, funding, and community participation. Meanwhile, actors with high dependency but low influence include local communities, NGOs, companies, and tourists. They have a vested interest in the sustainability of mangroves, but the capacity to influence policy direction is relatively limited. Therefore, this group needs support and facilitation from the government and academics so that their involvement can be more meaningful.

The fishers' association is in the middle position, showing that they are direct users of mangrove resources with moderate influence and a moderate level of dependence. While

not dominant in policy, they are key actors on the ground that greatly determine the success of conservation efforts through day-to-day practice. With this map, it can be concluded that the sustainability of mangrove ecosystems is highly dependent on synergies across actors. Governments and academic institutions act as directors, local communities and fishers as key actors on the ground, while the business sector, NGOs, and tourists provide additional support both economically and socially. Collaboration between actors with different roles will ensure the preservation of mangrove ecosystems while supporting the welfare of coastal communities.

Based on the results of this study, it can be discussed that the map of influence and dependence between actors in the management of mangrove ecosystems shows complex relationship dynamics, where role balance is a key factor for success. In this study, it is related to the continuity of mangrove sustainability for the benefit of the community in the economy and ecology. The finding that the government occupies a dominant position as a regulator with low dependency underscores their role as "policy makers", but the limitations of local actors, such as local communities and fishers who tend to be more dependent, show a gap in their capacity to influence. In line with research conducted by Mariani et al. (2018), the role of the government is more focused on regulatory and coordinating functions, by emphasizing the formulation of policies, standards, and supervisory mechanisms, rather than direct involvement in implementative activities in mangrove management. On the other hand, in previous research, Brush et al. (2011) which emphasizes the importance of cross-sectoral collaboration in coastal resource management, where academics and community groups serve as a bridge between regulation and implementation. Research conducted by Uslu (2018) and Goi et al. (2022) related to the role of academics as a bridge. Thus, these results confirm that the sustainability of mangrove ecosystems cannot be achieved only with a top-down approach from the government, but requires strengthening capacity and support for more vulnerable actors to create inclusive and sustainable governance.

Actor competitiveness

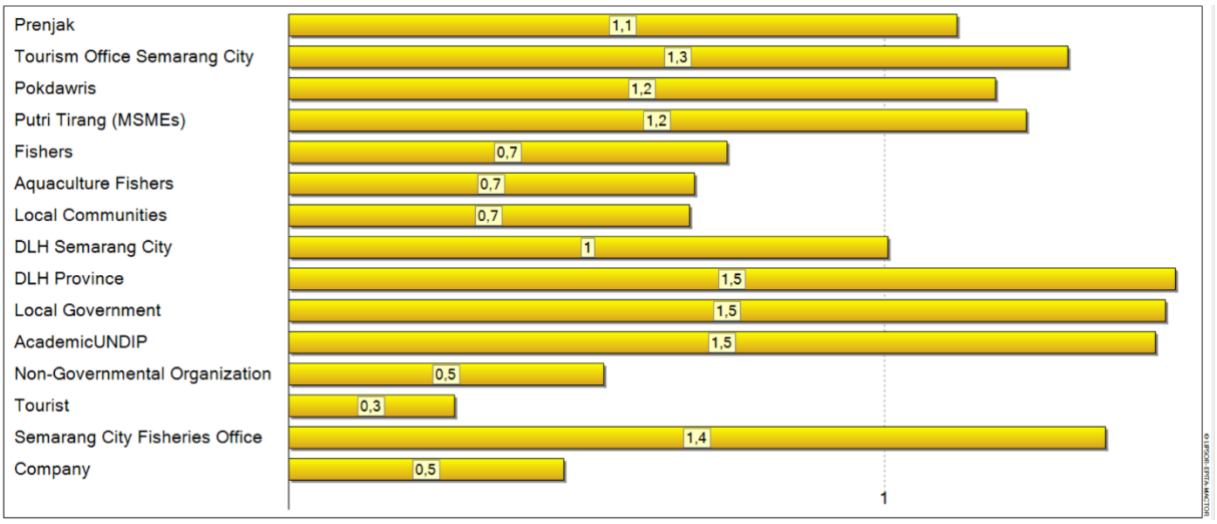

Figure 3. Histogram of competitiveness between actors.

MDI's competitiveness histogram shows that the highest level of competitiveness is owned by DLH Provincial, Regional Government, and Academics (UNDIP) with a score of 1.5, which confirms the dominance of the role of government institutions and academics in driving the initiative. The next position is occupied by the Semarang City Fisheries Office (1.4) and the Semarang City Tourism Office (1.3) which also have strong institutional capacity. Meanwhile, community-based actors such as Pokdarwis and MSMEs (1.2), Prenjak (1.1), and Semarang City Environmental Office (DLH Semarang City) (1.0) are in the medium competitiveness category. On the other hand, fishers, aquaculture fishers, and local communities (0.7), as well as NGOs and companies (0.5), showed a relatively lower level

of competitiveness, with tourists as the actors with the lowest score (0.3). In general, these findings show that the management structure is still dominated by government institutions, so it is necessary to strengthen capacity at the grassroots level and increase collaboration between actors to realize more balanced and sustainable development.

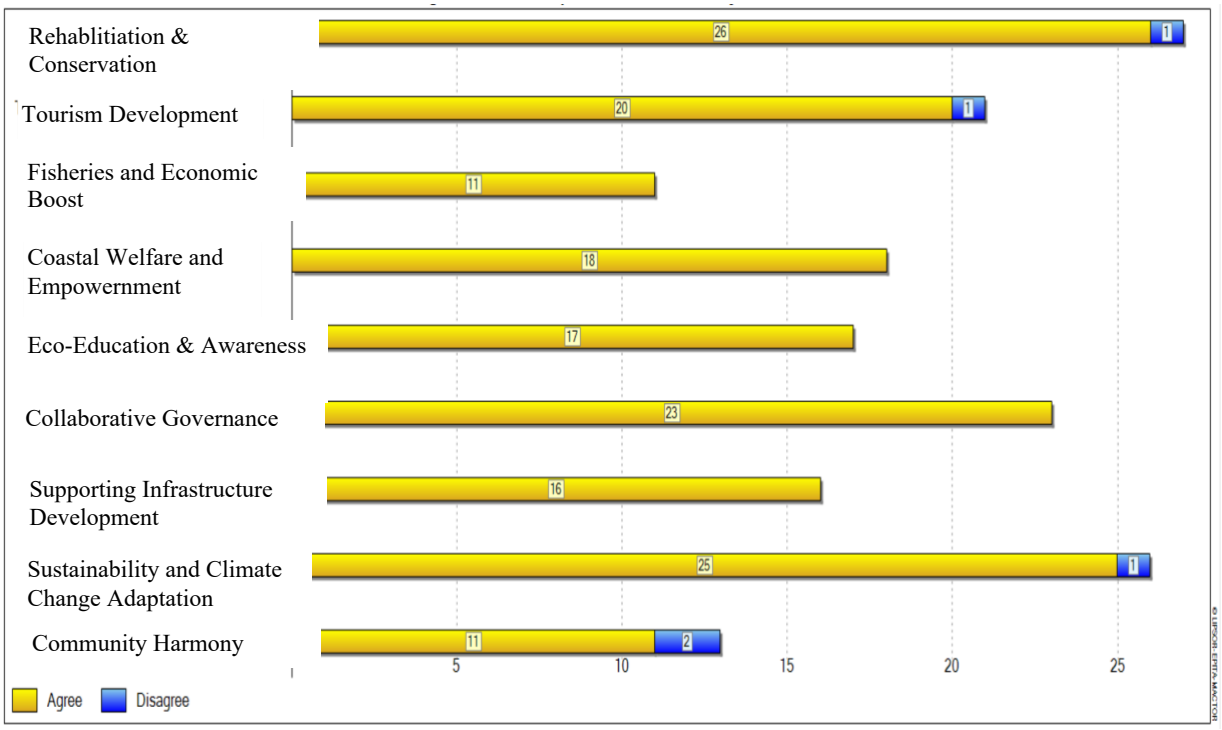

Figure 4. Actors' level of implication toward each objective in the 2MAO analysis.

Stakeholders strongly support ecological-related goals (rehabilitation, conservation, adaptation, sustainability). There is also considerable support in the aspects of institutional, empowerment, and education**.** Economic aspects such as productivity and infrastructure are supported, but relatively lower. The goal of harmonization between the parties actually received the least consensus, indicating a potential conflict of interest. This is related to the weaknesses of each actor, who sometimes do not align with each other (Ratner et al., 2013). In terms of stakeholders who focus on environmental conservation, corporate stakeholders are less effective in protecting the environment and are even violating it. This is what causes potential conflicts of objectives from stakeholders. Economic versus environmental trade-off is indeed a problem that must be overcome together (Horii & Ikefuji, 2014).

Convergence and divergence of actors. This convergence graph shows that coastal ecosystem management involves multi-stakeholder interactions with varying degrees of common interest. This is related to research by Kusumawardhani & Susilowati (2023), which shows how far the actors are in supporting the same goal. Each actor brings different backgrounds, mandates, and goals, but at some point, there is an area of convergence that allows for cooperation to be formed. Actors often unite around broad goals, such as sustainable development or food security, which can mobilize diverse stakeholders to collaborate despite differing sub-goals (Nonet et al., 2022).

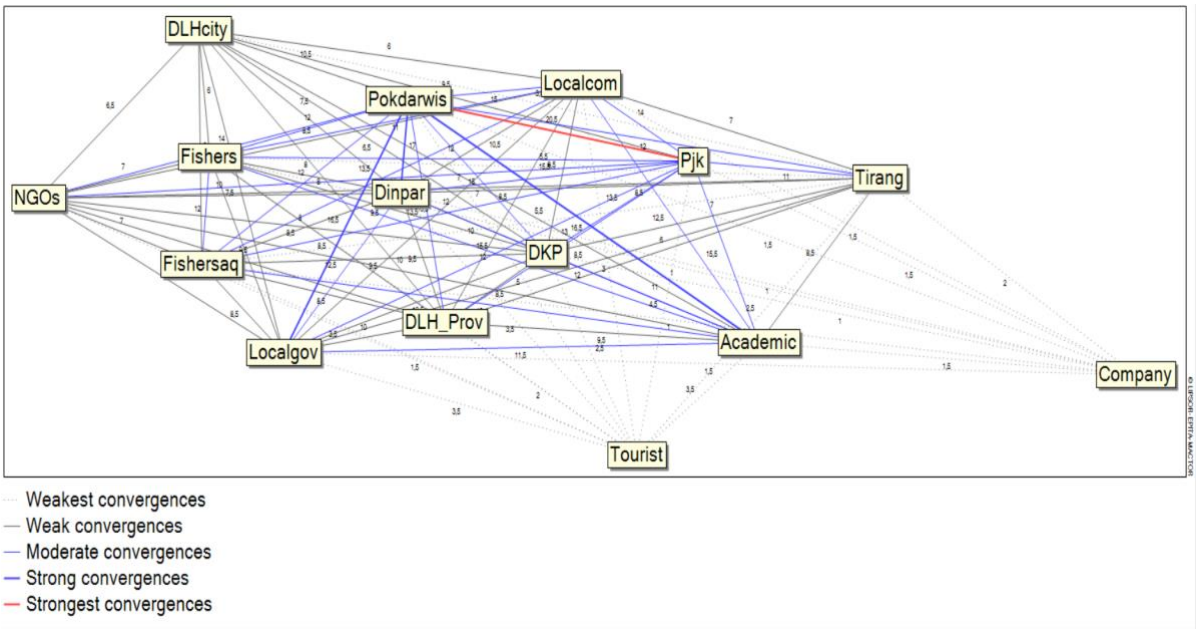

Figure 5. Order 2 Convergences between actors in mangrove ecosystem governance.

Prenjak and Pokdarwis play a vital role and have a high convergence occupy a strategic position as a central actor who has high convergence with many parties. Tapak Environmental Youth Association are involved in conservation, while Tourism Awareness Group is involved in tourism. Tourism in the Tapakrejo mangroves is educational tourism, so Pokdarwis and Prenjak collaborate and are directly involved in the management of mangrove conservation. They periodically check mangrove seedlings in tourist areas. There is a mangrove forest, and there is a boat tour along the Tapak River

Several critical challenges faced are conflicts between local governments and residents due to differing priorities and generational attitudes towards development and conservation (Lee & Son, 2016). Meanwhile, in Mangrove Tapakrejo, academics and NGOs are important links between the government and local communities, ensuring that the goals of empowerment, conservation, and education remain integrated.

Actors such as tourists and companies have limited involvement and are on the fringes of the network. Thus, the success of collaboration is highly dependent on strengthening central-community relations, especially through the local government, Tourism Office Semarang City, Prenjak, and Pokdarwis, which play a key role in the convergence of interests. The government, as one of the actors involved, provides various supports to develop the existing potential. For example, socializing tourist attractions in Tugurejo Village on every occasion of activities carried out at the city and inter-district levels. One of the things that is done is to help communication with CSRs related to the infrastructure of tourist attractions. Through programs that have been carried out in collaboration with academics, the NGO community, and the government, one of which is the mangrove forest ecotourism simulation activity

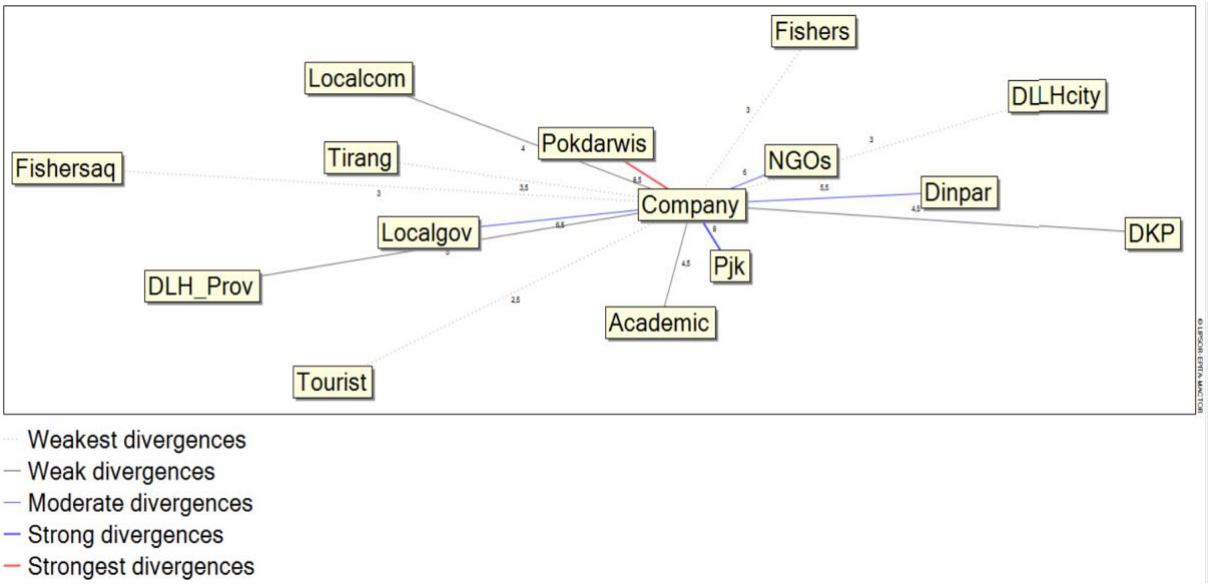

Figure 6. Order 2 divergences between actors in mangrove ecosystem governance.

Actor divergence is the difference or conflict of interests between actors in a particular system or issue (Mariani et al., 2022). The higher the divergence value, the greater the potential for conflict, friction, or difficulty in reaching a mutual agreement (Mafruhah et al., 2020). Divergence analysis is important to understand the points of disagreement so that collaboration strategies can be structured more realistically (Ariyani et al., 2020). This divergence graph shows the potential for conflict of interest between the Company and community groups such as Prenjak and Pokdarwis.

Prenjak and Pokdarwis are part of an active local community, especially in holding the principle of sustainability by emphasizing the importance of protecting mangroves as the basis of coastal ecosystems, while companies tend to be oriented towards economic exploitation that risk ignoring ecological aspects. This difference in orientation gives rise to strong divergence, so it is necessary to have a mediation mechanism or collaborative policy so that the company's economic interests can go hand in hand with the community's conservation agenda Furthermore, the analysis of convergence and divergence between actors shows that although there is a common interest in preserving mangroves, the level of difference in priorities and perspectives is still quite significant. Convergence is seen on issues such as environmental conservation and community economic empowerment, where almost all actors have a positive orientation towards sustainability. However, divergences arise in aspects of management and sectoral interests, for example between governments that focus on regulation, businesses that tend to use the economy, and communities that emphasize the immediate need for welfare. This suggests that while there is potential for collaboration, differences in orientation can create friction if not managed properly. Thus, effective mangrove governance requires a coordination mechanism that is able to balance convergence points while minimizing the impact of divergence of interests, so that joint management can run inclusively and sustainably (Raveloson, 2025). Actually, the company already has a CSR program. However, strengthening CSR strategies with a focus on environmental awareness, effective communication, and compliance with environmental regulations will be a strategic step to create better and sustainable synergies. A good governance may provides the necessary insitutional foundation for converting divergence into productive negotiation, ensuring the company’s economic interests and the community’s conservation agenda can be reconciled with a shared and enforceable management framewrok (Farmaki 2015; Roxas et al., 2020; Lawasi 2025).

MACTOR can be complemented with MICMAC to identify the most influential and most dependent variables in the system. Also, MACTOR can be added for in-depth interview results, which can be processed with NVIVO/ATLAS.ti (Mafruhah et al., 2020; Kusumawardhani & Susilowati, 2023) to make it easier to identify conflicts, opportunities,

and challenges, which will be very helpful in developing the best strategy for sustainable management in the future.

Conclusions. This study has successfully mapped stakeholder dynamics in Tapak Mangrove Forest, revealing that ecotourism success depends on synergy between regulators and community groups such as Prenjak and Pokdarwis. The findings indicate that academics and NGOs play a vital liaison role in integrating educational and empowerment objectives into government policy. Consequently, mediation mechanisms or collaborative policies, combined with effective governance, are essential to align companies' economic interests with the community's conservation agenda, preventing potential conflicts between exploitation and ecological sustainability. Finally, future research should explore shifts in stakeholder dynamics as management models adapt to different contextual pressures, including severe climate change impacts.

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Conflict of Interest. The authors declare that there is no conflict of interest.

Data Availability. The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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