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Structural Analysis for Identification of Key Actors of Sustainable Regional Development Rice Farming

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ABSTRACT

Key actors can serve as catalysts or obstacles in sustainable agriculture. This research will specifically use structural analysis to examine the role of various actor and learn about their convergence and divergence based on sustainable regional rice farming development using the Matrix of Alliances and Conflicts: Tactics, Objectives, and Recommendations (MACTOR) method. The results show that Bappenas, Kemenkeu, Setjen, Econ, and Ministry of Agrarian Affairs and Spatial Planning / National Land Agency (ATR/BPN) have a significant influence. The strategic objectives necessary for sustainable regional rice farming development include ensuring the availability of quality and safe rice in each province, improving farmers' welfare, and maintaining price stability. Most convergence occurs among actors involved in agricultural production tasks and functions, however, there is less convergence among actors responsible for rice distribution and price stability. Divergence is notably strong among actors involved in formulating technical policy guidelines at the central government level. This study can be used as input for developing a roadmap to ensure rice price stability and availability, while enhancing rice farmers' welfare.

1. INTRODUCTION

Rice, as the main food of the Indonesian population, accounts for 38.42% of the country's total food consumption [1]. Population growth and per capita consumption influence the national rice demand [2]. Indonesia's population is expected to grow by 1.2% annually, whereas the average rice consumption per household has decreased by 1.7% per year [3]. According to the National Medium-Term Development Plan (RPJMN) 2020-2024, the government forecasts rice demand to be 39.2 million tons in 2020 and 46.8 million tons in 2024, reflecting an average annual increase of 4.56% [4].

From the supply side, the national rice production in 2019 was 31.31 million tonnes. It declined by 2.63 million tons or 7.75% from 2018 [4]. The main obstacle to maintaining rice production is the shrinking of paddy fields due to land being converted to non-agricultural uses (such as commercial, industrial, and public facilities), which is estimated to include attacks by plant-disturbing organisms, limited access for farmers to innovative technology and financing, the effects of climate change, a lack of assistance from agricultural field officers, and decreasing farmer income [5].

On the demand side, efforts to meet rice needs face challenges due to rice price volatility and inaccurate data on the production, distribution, and stock levels of rice availability throughout Indonesia. This issue affects rising food inflation and reduces access to food for people living in poverty, potentially threatening the national stability. In 2020, a 10% increase in rice prices could raise inflation by 0.9% and increase the poverty rate by 1.3% [4]. According to neo-Malthusian theory, scarcity of land, clean water, and food can provoke conflicts among living beings, from the smallest organisms to large-scale wars between countries [6]. Therefore, concrete efforts are essential to enhance rice availability and stabilize prices through the sustainable regional development of rice farming [7].

The Food and Agriculture Organization (FAO) [8] defines sustainable agriculture as the management and conservation of natural resources and the direction of technological and institutional changes to ensure the sustainable achievement and fulfillment of human needs for both present and future generations. There are five principles of sustainable agriculture [9]:

(1) increasing efficiency in the use of essential resources,
(2) conserving, protecting, and improving natural resources,
(3) safeguarding livelihoods and rural well-being,
(4) boosting the resilience of humans, communities, and ecosystems
(5) practicing responsible and effective governance.

A critical aspect of sustainable development is understanding the roles and objectives of actors or stakeholders who perform specific functions within agricultural systems [10-12]. Stakeholders include farmers, government agencies, private sector entities, non-

governmental organizations, and community groups, each with distinct interests, resources, and influences. Their interactions shape policy implementation, resource allocation, and innovation adoption, ultimately affecting the sustainability. Identifying and analyzing these actors' roles and objectives is essential for designing interventions that align with diverse interests and foster collaboration. Moreover, understanding the potential conflicts or synergies among stakeholders can help mitigate challenges and enhance collective action toward sustainability goals.

The rice sector in Indonesia faces complex challenges, encompassing both supply side constraints and demand-side dynamics. On the supply side, although technological innovation has driven yield increases [13], production sustainability is threatened by significant damage to the irrigation infrastructure [14]. Meanwhile, on the demand side, pressures from population growth and market integration, influenced by government intervention, create fluctuations in market efficiency [15, 16]. However, most existing research tends to isolate production issues or market dynamics, failing to capture the complex interrelationships between technical, economic, and national food security aspects holistically.

This gap is exacerbated by regional policy and planning frameworks that often fail to integrate environmental, social, and economic issues simultaneously [17]. Existing policies tend to prioritize short-term production targets at the expense of long-term sustainability [18] and are less responsive to specific socioeconomic pressures [19] such as land conversion and the impacts of climate change [20, 21].

The fundamental problem behind the failure to implement sustainability lies in weak governance and stakeholder engagement. Inclusive governance is crucial for aligning development strategies with local realities [22]; however, this mechanism remains underexplored in Indonesia compared to its neighboring countries [23]. Although studies related to supply chains [24] and the adoption of sustainable agriculture [25] have highlighted the importance of actor coordination, a significant research gap exists in the systematic identification and evaluation of the roles, objectives, and conflicting interactions among actors.

In particular, the application of structural analysis methods to map power relations and patterns of influence in the Indonesian rice sector is scarce. This lack of approach limits the understanding of how actor configurations—including government, farmers, and market actors—collectively influence sustainability outcomes. Therefore, this study is urgently needed to address these methodological and empirical gaps by integrating supply demand analysis with structural actor analysis to formulate sustainable and adaptive regional rice agricultural development strategies.

This study aims to address these gaps by employing structural analysis to identify and evaluate the roles of stakeholders involved in rice farming and to study their convergence and divergence with sustainable regional development goals. By integrating supply and demand factors with stakeholder dynamics and governance considerations, this study seeks to provide an actor-focused, methodologically robust framework that supports sustainable rice farming development in Indonesia. Such an approach is essential for informing policymaking, improving coordination among actors, and promoting sustainable practices that ensure food security, environmental stewardship, and socioeconomic resilience.

2. METHODOLOGY

2.1 Location

The research was conducted in Jakarta, utilizing data obtained from questionnaires, in-depth interviews with stakeholders directly engaged in Indonesia's rice sector, and information sourced from government agency publications, and prior studies.

2.2 Data collection

This study used both primary and secondary data sources. Structured questionnaires were used to collect primary data from 85 participants representing 25 key stakeholder groups actively involved in the rice-farming ecosystem. Additionally, selected stakeholders were interviewed in depth to verify the results and explore the roles, responsibilities, and functions of each participant. Secondary data were sourced from official publications by government agencies and previous research.

The selection of the 25 actors was performed using a purposive sampling method. These actors were chosen to ensure a thorough representation of the rice farming structural system, encompassing macro-level policymakers (such as Ministries and Bappenas), meso-level support institutions (such as universities and logistics agencies), and micro-level implementers (including farmers and extension workers). These actors were chosen based on their legal authority, control over resources, and direct impact on the planning and execution of regional agricultural development (Table 1).

The primary research instrument was a questionnaire specifically designed to meet the requirements of structural analysis. This questionnaire employed a 5-point Likert-type scale (ranging from 0 to 4) to quantify qualitative perceptions of actor influence and issue salience. The rating criteria were clearly defined to ensure consistency among respondents: participants rated the influence one actor exerts over another on a scale from 0 to 4, where 0 indicates no influence, 1 signifies influence on operating procedures, 2 denotes influence on projects, 3 represents influence on missions, and 4 corresponds to influence on existence (critical power).

2.3 Data analysis

To examine the intricate interactions among these stakeholders, this study utilized the Matrix of Alliances and Conflicts: Tactics, Objectives, and Recommendations (MACTOR) method. MACTOR was chosen over other analytical approaches due to its capacity for conducting a structural analysis of multi-actor games. Unlike conventional statistical methods, MACTOR is distinctively adept at analyzing power dynamics (power relations), identifying convergences (alliances) and divergences (conflicts) in objectives, and simulating the strategic behavior of actors within a system characterized by an asymmetrical power distribution.

The MACTOR method measures power balance among actors and studies their convergence and divergence with several objectives described by Godet and Durance [26]. The MACTOR method has the following advantages: (1) it can describe the role of each actor, (2) it can describe how strong the relationship between actors is, (3) it can show the relationship between actors and the goals to be achieved, and (4) it can analyze actors who are reactive to a problem/issue

that arises [27]. However, MACTOR analysis also has several weaknesses: some actors may not be willing to disclose information, and actors do not have sufficient knowledge and understanding of the objectives. Therefore, in selecting actors to become sources of information, proper qualifications are needed because the results of the MACTOR analysis are highly dependent on the quality of input data obtained from the actors [28].

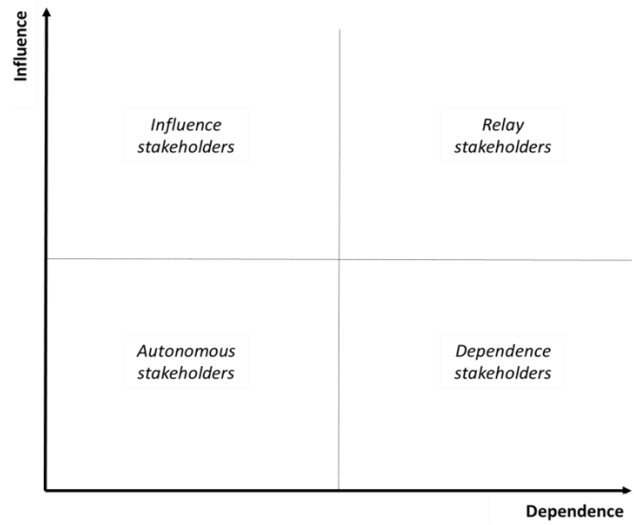

Figure 1. Grouping of actors based on the level of influence and level of dependence

All data in this study were analyzed using the MACTOR software. The initial step in the MACTOR analysis was to identify the objectives and actors involved in developing sustainable rice farming areas. The analysis utilizes two main inputs: the input Matrix of Direct Influence (MDI), which describes the direct influence between one actor and another, and the input Valued Position Matrix (2MAO), which indicates the actor's attitude toward each goal (pro, opponent, neutral, or indifferent). The MDI matrix classifies actors into four main categories: influential, relay, dependent, and autonomous stakeholders (Figure 1).

The matrix indirect-direct influence (MIDI) in Eq. (1) stores the influence data between actors.

$$MIDI_{a\to b} = MID_{a\to b} + \sum_{c}\left(min(MID_{a\to c'}MID_{c\to b})\right) \quad (1)$$

where, $MIDI_{a\to b}$ represents the total (direct and indirect) influence of actor a on actor b, and $MID_{a\to b}$ denotes the direct influence exerted by a on b. The second term captures the indirect influence of intermediary actors. Specifically, the summation Σc considers all possible intermediary actors c in the system, while c′ denotes the subset of c that effectively serves as a valid intermediary in the influence path from a to b.

The min ($MID_{a\to c'}MID_{c\to b}$) operator reflects the principle of bottleneck strength in network flows, ensuring that the weakest link between a→c′ and c→b constrains the indirect influence along the two-step paths. This approach avoids overestimating the influence by recognizing that the transmission capacity of an indirect path cannot exceed its most limited connection. Formula (1) integrates direct and indirect interactions into a single framework, with c representing the full candidate set of intermediaries and c′⊆c specifying the subset of actors that genuinely mediate influence. This distinction ensures that only feasible indirect pathways contribute to the cumulative influence of actors.

Eq. (1) allows us to determine each actor's influence (Ma) and dependence (Da), as shown in Eqs. (2) and (3).

$$M_a = \sum_{b}\left(MIDI_{a,b}\right) - MIDI_{a,a} \quad (2)$$

$$D_a = \sum_{b}\left(MIDI_{b,a}\right) - MIDI_{a,a} \quad (3)$$

We derived two key indicators for each actor from the MIDI matrix: influence (M_a), and dependence (D_a). Influence quantifies the total capacity of an actor to affect others and is computed as the row sum of the MIDI matrix for actor a, excluding self-influence (Eq. (2)), as follows: Dependence reflects the extent to which an actor is affected by others and is calculated as the column sum of the MIDI matrix for actor a, excluding self-influence (Eq. (3)).

This process produces a pair of indices (M_a, D_a) for each actor, allowing for a comparison of their roles within the influence network. High Ma values indicate actors that exert a strong influence, while high Da values indicate actors that are more dependent on others.

Eq. (4) shows how the normalization value can be calculated for each actor based on the above indicators.

$$r_a = \left(\frac{\left(M_a - MIDI_{a,a}\right)}{\sum_a(M_a)}\right).\left(\frac{M_a}{(M_a + D_a)}\right) \quad (4)$$

After determining the relationship (coefficient) between actors, as in Eq. (4), the relationship between actors and objectives is applied similarly. The 3MAO matrix in Eq. (5) shows an actor's position on an issue.

$$3MAO_{a,i} = 2MAO_{a,i}.r_a \quad (5)$$

This matrix forms the basis of most analyses, as several important values are directly derived from the 3MAO matrix. The mobilization coefficient in Eq. (6) quantifies the number of different actors involved in the "interest" system. The agreement represented by the coefficient of Eq. (7) and the disagreement in Eq. (8) show how controversial the problem is for each actor.

$$Mob_a = \sum_{i}\left|3MAO_{a,i}\right| \quad (6)$$

$$Ag_i = \sum_{a}\left(3MAO_{a,i}.\left(3MAO_{a,i} > 0\right)\right) \quad (7)$$

$$Disag_i = \sum_{a}\left(3MAO_{a,i}.\left(3MAO_{a,i} < 0\right)\right) \quad (8)$$

The 3MAO matrix is applied to obtain the convergence matrix (3CAA) in Eq. (9) and the divergence matrix (3DAA) in Eq. (10). This matrix states the extent to which each actor agrees or disagrees on different issues for each pair of actors.

$$3CAA_{a,b} = \frac{1}{2}\sum_{i}\left(\left(\left[3MAO_{a,i}\right] + \left|3MAO_{b,i}\right|\right)\left(3MAO_{a,i}.3MAO_{b,i} > 0\right)\right) \quad (9)$$

$$3CAA_{a,b} = \frac{1}{2}\sum_{i}\left(\left(\left[3MAO_{a,i}\right] + \left|3MAO_{b,i}\right|\right)\left(3MAO_{a,i}.3MAO_{b,i} < 0\right)\right) \quad (10)$$

The ambivalent coefficient in Eq. (11) indicates the stability expected of actors' potential alliances.

$$3EQ_i = 1 - \left[\frac{\left(\sum_k \left|\left|3CAA_{i,k}\right| - \left|3DAA_{i,k}\right|\right|\right)}{\left(\sum_k \left|\left|3CAA_{i,k}\right| - \left|3DAA_{i,k}\right|\right|\right)}\right] \quad (11)$$

3. RESULT AND DISCUSSION

MACTOR analysis considers actors as entities with a role in the system, utilizing their resources to directly or indirectly influence outcomes, including through other actors [10]. Factors are described as variables, ideas, topics, or elements that explicitly stimulate discussions on the future of a system [27].

3.1 Actor identification and objectives

The initial step in the MACTOR analysis was to identify the key actors and understand their goals in promoting sustainable regional development through rice farming. Table 1 outlines the main actors involved in and associated with sustainable regional development through rice farming. Table 2 presents the findings regarding the strategic objectives of these actors. These objectives are categorized into ecological, economic, social, institutional, technological, and political categories.

Ecological objectives focus on sustainability and environmental resilience, whereas economic objectives aim to enhance productivity, efficiency, and market performance. Social objectives prioritize inclusivity, community welfare, and empowerment. Institutional objectives are related to governance, regulatory structures, and organizational capacity building. Technological objectives focus on innovation, knowledge sharing, and the adoption of cutting-edge practices. Political objectives encompass policy formulation, stakeholder engagement, and government initiatives that shape agribusiness systems. This typology provides a comprehensive framework for systematically classifying strategic objectives and ensuring alignment with the broader goals of agricultural development.

Table 1 presents the main actors and institutions involved in regional rice-farming development. This network comprises different government and non-governmental organizations, each serving a specific function. Recognizing these roles is essential for evaluating the success and sustainability of rice-farming projects.

Several key government ministries play an essential role. The Deputy for Maritime Affairs and Natural Resources and the National Development Planning Agency (Bappenas) are crucial for strategic planning and policy development. The Ministry of Finance (Kemenkeu) and the Ministry of Food and Agribusiness (Ekon) oversee financial and economic policies affecting agriculture. Additionally, the Ministry of Agrarian Affairs and Spatial Planning (ATR/BPN) and the Ministry of Villages (Kemendes PDTT) handle land use and rural development, which are vital for farming.

Specialized agencies in the agricultural sector are crucial for implementing these measures. The Directorate General of Food Crops (Ditjen TP) and Directorate General of Agricultural Infrastructure and Facilities (Ditjen PSP) from the Ministry of Agriculture oversee technical cultivation and infrastructure provision. The Directorate General of Water Resources (SDA/PUPR) and its provincial and district offices are vital for managing irrigation and water distribution, which are essential for rice farming.

Table 1. Actors involved in the regional development rice farming

No.	Actors	Labels
1	Deputy For Maritime Affairs and Natural Resources, Ministry of National Development Planning/ National Development Planning Agency/Bappenas	Bappenas
2	Director General of Budget, Ministry of Finance	Kemenkeu
3	Deputy Minister for Food and Agribusiness, Coordinating Ministry for Economic Affairs	Ekon
4	Ministry of Agrarian Affairs and Spatial Planning / National Land Agency	ATR/BPN
5	Ministry of Villages, Development of Disadvantaged Regions and Transmigration	Kemdes PDT
6	Ministry of Trade	Kemendag
7	Directorate General of Water Resources, Ministry of Public Works	SDA-PUPR
8	Central Bureau of Statistics	BPS
9	Secretariat General, Ministry of Agriculture	Setjen
10	Directorate General of Food Crops, Ministry of Agriculture	DitjenTP
11	Directorate General of Agricultural Infrastructure and Facilities, Ministry of Agriculture	Ditjen PSP
12	Agency for Agricultural Extension and Human Resources Development, Ministry of Agriculture	BPPSDMP
13	Agency for Agricultural Research and Development, Ministry of Agriculture	Balitbang
14	Agency for Food Security, Ministry of Agriculture	BKP
15	Provincial Agriculture Office	DistanProv
16	District Agriculture Office	Distan Kab
17	University	PT
18	Agricultural Extension Center	BPP
19	Farmers Group	Poktan
20	Bulog Public Corporation	Bulog
21	Provincial Development Planning Agency	BappedaPro
22	District Development Planning Agency	BappedaKab
23	Field Agricultural Extension	PPL
24	Provincial Level Water Resources Office	SDA Prov
25	District Level Water Resources Office	SDA Kab

Note: SDA-PUPR = Ministry of Public Works, ATR/BPN = Ministry of Agrarian Affairs and Spatial Planning / National Land Agency, SDA Prov = Provincial Level Water Resources Office, SDA Kab = District Level Water Resources Office, Bappeda Prov = Provincial Development Planning Agency, Bappeda Kab = District Development Planning Agency, Bulog = Bulog Public Corporation, Poktan = Farmers Group

Table 1 emphasizes the vital role of research and extension services. The Agency for Agricultural Research and Development (Balitbang) and the Agency for Agricultural Extension and Human Resources Development (BPPSDMP)

focus on sharing new technologies and knowledge with farmers. At the local level, institutions such as the Provincial and District Agriculture Offices serve as the main link between central policies and farming communities. Non-governmental players, including universities (PT), Agricultural Extension Centers (BPP), and farmers (Poktan), also play key roles in research, education, and applying farming techniques. The Public Corporation (Bulog) oversees the rice supply and stabilizes prices.

This structure highlights the importance of coordination across different sectors and government levels to attain sustainable food security in the country. This shows that rice farming development depends not only on the agricultural sector but also on collaboration among policymakers, technical staff, infrastructure providers, local governments, and communities. Successful cooperation among these actors is essential for food security and sustainable growth in agriculture-driven regions.

Table 2 presents a multidimensional framework for analyzing the factors influencing a system, grouped into five main categories: ecological, economic, socio-institutional, technological, and political. This structure is vital for understanding complex issues holistically, as it allows for a more comprehensive analysis than focusing on a single factor alone.

Table 2. Strategic objectives of actors

No	Strategic Goals	Labels	Categories
1	Development of Eco-Friendly Rice Farming System	Usaha Tani	Ecological
2	Increase Paddy Field Area	LBL Sawah	Ecological
3	Increasing Water Availability and Productivity on Rice Fields	Air	Ecological
4	Mitigation of Climate Change Impacts	DPI	Ecological
5	Increase Farmers' Access to Finance	Pembiayaan	Economic
6	Increase Government Production Subsidies	Subsidi	Economic
7	Increasing the Productivity of Rice Fields per Year	ProdLahan	Economic
8	Increase Rice Farmers' Income	Pendapatan	Economic
9	Increase Rice Surplus at Provincial Level	Surplus	Economic
10	Building Rice Supply Connectivity between Regions of Surplus and Deficit	Suplai	Economic
11	Logistic Efficiency of Rice Farming System	Logistik	Economic
12	Ensuring the Availability of Quality and Safe Rice at the Provincial Level	BerasMutu	Economic
13	Rice Price Stability at the Consumer Level	StabHarga	Economic
14	Improve Farmer Welfare	Sejahtera	Social
15	Policy Regulations at the National, Provincial, and District / City Levels	Regulasi	Institutional
16	Increase the Number of Farmers who are Members of Farmer Groups	Poktan	Institutional
17	Institutional Transformation and Collaboration	Kolaborasi	Institutional
18	Development of Social and Technological Innovation	Insostek	Technology
19	Increasing the Adoption of Technological Innovations by Farmers	Adopsi	Technology
20	Increasing the Availability of Agricultural Infrastructure and Facilities on Rice Fields	PSP	Technology
21	Accelerating Agricultural Application 5.0	Agri 5.0	Technology
22	Import of Rice	Impor	Political

3.2 Direct and indirect influence of actors

This section aims to map the actors involved in the sustainable regional development of rice farming in the area. The position of an actor is assessed based on their level of influence and dependence on other actors in the network. This assessment was derived from questionnaire results and in-depth interviews with the actors, which were then quantified into scores. The higher the score, the greater the actor's influence on others. The scores were subsequently entered into the MDI using the MACTOR software, as shown in Table 3.

The MDI results (Table 3) show that several key national institutions, including Bappenas, the Coordinating Ministry for Economic Affairs (Ekon), the Secretariat General (Setjen), and the Directorate General of Agricultural Infrastructure (Ditjen PSP), have high influence scores compared to others. This highlights their central role in initiating, coordinating, and guiding the policy strategies. In contrast, groups such as farmer associations (Poktan), agricultural extension services (PPL), and regional agencies (BappedaProv, SDAKab) have lower influence scores, indicating their primary role in implementing policies rather than initiating them.

The direct influence structure in the MDI demonstrates the hierarchical governance system, with decision-making authority centralised at the national level. Local actors mainly act as implementers of strategies that are developed upstream. Recognizing these influence patterns is crucial for identifying "policy drivers" and "policy recipients," which helps pinpoint leverage points to improve coordination and collaboration within the network.

Table 4 shows the Matrix of Direct and Indirect Influence (MDII), illustrating the direct interactions among actors and their indirect connections within the sustainable development of the rice-farming system. The MDII was created by expanding the direct influence scores from the MDI (Table 4) and incorporating second-order effects based on the MACTOR approach. Each matrix entry indicates the extent of influence one actor has on another, directly or via middle stakeholders. Therefore, higher MDII values indicate a more substantial overall influence within the network of actors.

The aggregated row scores (ΣIi) indicate the total influence of each actor, whereas the aggregated column scores (ΣDi)

reflect their dependence. The MDII findings show that Bappenas (750), Ekon (752), and Setjen (594), along with Kemenkeu (534) and Ditjen PSP (521), are the most influential in shaping the policy and strategic agenda for sustainable rice farming development. Their high influence scores confirm their central role as decision-makers and policy leaders. Conversely, local actors such as Poktan (94), PPL (136), and SDA Kab (293) have much lower influence scores, emphasizing their reliance on upstream policies and their primary role as implementers.

Table 3. Matrix of Direct Influences (MDI)

MDI	Bappenas	Kemenkeu	Ekon	ATR/BPN	Kemdes PDT	Kemendag	SDA-PUPR	BPS	Setjen	Ditjen TP	Ditjen PSP	BPPSDMP	Balitbang	BKP	DistanProv	Distan Kab	PT	BPP	Poktan	Bulog	BappedaPro	BAPPEDAKAB	PPL	SDA PROF	SDA Kab
Bappenas	0	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	0	0	0	4	3	3	0	4	4
Kemenkeu	3	0	3	4	4	4	4	4	4	4	4	4	4	4	4	4	0	0	0	4	3	3	0	4	4
Ekon	3	3	0	3	3	3	3	3	3	3	3	3	3	3	0	0	0	0	0	3	0	0	0	0	0
ATR/BPN	1	1	1	0	1	0	3	1	1	2	2	2	1	1	2	2	0	2	3	0	3	3	2	1	1
Kemdes PDT	1	1	1	1	0	0	1	1	1	1	1	1	0	0	1	2	0	2	2	0	1	1	0	0	0
Kemendag	1	1	1	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	4	1	1	0	0	0
SDA-PUPR	1	1	1	1	2	0	0	1	1	2	2	2	1	0	2	2	0	1	1	0	2	2	1	4	4
BPS	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0
Setjen	1	1	1	3	1	1	3	2	0	3	3	3	3	3	4	4	0	4	3	4	1	1	3	3	3
Ditjen TP	1	1	1	3	1	1	3	2	1	0	2	2	2	2	4	4	0	3	4	4	1	1	4	3	3
Ditjen PSP	1	1	1	3	1	0	3	2	1	2	0	2	2	2	4	4	0	4	4	4	1	1	4	3	3
BPPSDMP	1	1	1	0	1	0	3	2	1	2	2	0	2	1	4	4	0	4	4	2	1	1	4	3	3
Balitbang	1	1	1	1	0	0	1	1	1	2	2	2	0	1	2	2	0	2	2	1	0	0	2	1	1
BKP	1	1	1	1	1	3	1	1	1	2	2	2	2	0	4	4	0	3	3	4	1	1	3	1	1
DistanProv	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	4	0	4	4	3	1	1	4	1	1
Distan Kab	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	4	4	3	0	1	4	1	1
PT	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
BPP	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	3	1	0	0	4	0	0
Poktan	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	4	0	1	0	0	4	1	1
Bulog	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	0	0	0
BappedaPro	1	0	0	3	0	0	0	1	0	1	3	1	0	0	4	3	0	3	4	3	0	3	0	3	1
BappedaKab	1	0	0	3	0	0	0	1	0	1	3	1	0	0	3	4	0	3	4	3	1	0	0	1	3
PPL	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1	0	1	4	0	0	0	0	0	0
SDA PROF	0	0	0	0	0	0	1	0	0	2	2	1	0	3	4	4	0	4	4	0	1	1	0	0	3
SDA Kab	0	0	0	0	0	0	1	0	0	2	2	1	0	3	4	4	0	4	4	0	1	1	0	1	0

Table 4. Matrix of Direct and Indirect Influence (MDII)

MDI	Bappenas	Kemenkeu	Ekon	ATR/BPN	Kemdes PDT	Kemendag	SDA-PUPR	BPS	Setjen	Ditjen TP	Ditjen PSP	BPPSDMP	Balitbang	BKP	DistanProv	Distan Kab	PT	BPP	Poktan	Bulog	BappedaPro	BAPPEDAKAB	PPL	SDA PROF	SDA Kab	II
Bappenas	20	18	18	30	19	16	31	29	23	37	40	34	27	31	51	55	0	47	48	46	24	27	31	33	35	750
Kemenkeu	20	18	18	30	19	16	31	29	23	37	40	34	27	31	51	55	0	47	48	46	24	27	31	33	35	752
Ekon	18	18	18	23	18	15	28	24	20	28	27	27	24	22	30	31	0	22	23	28	20	20	20	24	24	534
ATR/BPN	14	12	12	19	12	6	19	19	14	23	27	25	17	16	29	30	0	29	30	25	18	21	21	23	23	465
Kemdes PDT	12	10	10	11	10	5	10	14	12	14	14	16	12	11	15	16	0	15	15	15	12	13	13	13	13	291
Kemendag	10	8	8	9	7	7	7	10	8	10	10	10	8	8	9	9	0	5	5	13	9	9	3	7	7	189
SDA-PUPR	13	11	11	16	11	5	16	18	13	23	25	23	16	20	31	33	0	30	30	22	15	17	16	22	24	445
BPS	15	13	13	13	11	7	12	17	15	17	17	17	14	13	16	16	0	13	13	14	14	15	10	14	14	316
Setjen	16	14	14	19	12	9	24	22	16	31	30	30	21	24	39	42	0	42	44	31	20	21	35	26	28	594
Ditjen TP	16	14	14	16	12	8	20	21	16	29	28	28	19	22	34	37	0	37	41	27	20	21	31	22	24	528
Ditjen PSP	15	13	13	16	12	8	20	20	15	28	28	28	19	21	34	37	0	38	41	26	19	20	32	22	24	521
BPPSDMP	14	12	12	15	11	7	17	19	14	25	25	25	17	20	31	34	0	35	37	23	16	17	29	21	23	474
Balitbang	12	12	12	12	11	7	16	17	14	20	20	22	18	17	22	23	0	21	22	19	14	15	20	17	17	382
BKP	16	14	14	15	11	9	17	21	16	25	24	26	19	18	28	31	0	31	33	29	17	18	28	19	19	480
DistanProv	10	8	8	8	6	4	9	11	9	14	14	16	10	11	16	19	0	23	25	17	11	12	22	12	12	291
Distan Kab	9	8	8	7	6	4	9	10	9	13	13	15	10	11	15	15	0	19	21	14	11	11	19	11	11	264
PT	17	15	15	14	12	8	15	19	17	22	21	23	16	17	22	22	0	18	18	18	18	19	13	17	17	413
BPP	2	2	2	0	1	1	1	4	4	5	5	6	5	4	6	6	0	7	10	5	3	4	10	4	4	94
Poktan	2	2	2	0	1	1	3	4	4	7	7	8	5	6	8	8	0	10	12	5	5	6	11	5	5	115
Bulog	13	11	11	11	9	7	10	15	13	15	14	14	12	13	13	13	0	10	10	15	12	13	8	12	12	271
BappedaPro	8	7	7	12	6	3	12	11	9	15	18	16	10	14	24	26	0	28	29	21	13	16	21	15	17	345
BappedaKab	8	7	7	10	6	3	12	11	9	15	16	16	10	14	21	24	0	26	27	19	13	14	21	13	15	323
PPL	4	4	4	3	3	1	4	6	6	6	6	8	6	6	8	8	0	11	11	8	4	5	11	7	7	136
SDA PROF	7	5	5	8	5	4	8	11	7	14	14	15	10	13	21	24	0	30	29	18	9	10	25	13	15	307
SDA Kab	7	5	5	8	5	4	8	11	7	13	13	15	10	11	19	22	0	28	27	18	9	10	25	13	13	293
DI	278	243	243	306	226	158	343	376	297	457	468	472	344	376	577	621	0	615	637	507	337	367	495	405	425	9573

Regarding dependence (ΣDi), the findings indicate that Ditjen PSP (637), Setjen (615), and Bappenas (621) have relatively high dependence. This suggests that, although they hold significant influence, their roles are also affected by interactions with other stakeholders. These institutions serve as both initiators and mediators in governance networks. Conversely, actors like Poktan and PPL remain highly dependent, with minimal reciprocal influence, emphasizing their roles as recipients of policies set by more dominant stakeholders.

MDII analysis offers a detailed overview of stakeholder power dynamics. It emphasizes a hierarchical yet interconnected governance system, with national ministries and central agencies holding strategic roles, while provincial and district actors primarily focus on operational tasks. This influence and dependence structure highlights the need to enhance vertical coordination to achieve effective policy execution for sustainable rice farming development.

Figure 2 shows how actors are positioned on the influence–dependence plane according to the Matrix of Direct and Indirect Influence (MDII). The horizontal axis reflects the dependence levels, and the vertical axis signifies the influence levels. Dividing actors into four quadrants offers a useful framework for analyzing their roles and importance within the governance system of sustainable rice-farming development.

The upper-left quadrant (influential stakeholders) includes actors with high influence but relatively low dependence, such as Kemenkeu and Bappenas. These organizations act as primary policy drivers, wielding significant authority over other actors while remaining independent of external

pressures. Their strategic placement highlights their crucial role in shaping agendas and resource distribution at the national level.

The upper-right quadrant (relay stakeholders) includes actors with both high influence and high dependence, such as Setjen, Ekon, Ditjen PSP, and Ditjen TP. These actors serve as intermediaries who influence policies and are significantly impacted by the actions of other stakeholders. Their dual role as influencers and mediators highlights their crucial role in promoting coordination and ensuring policy integration across various levels and sectors.

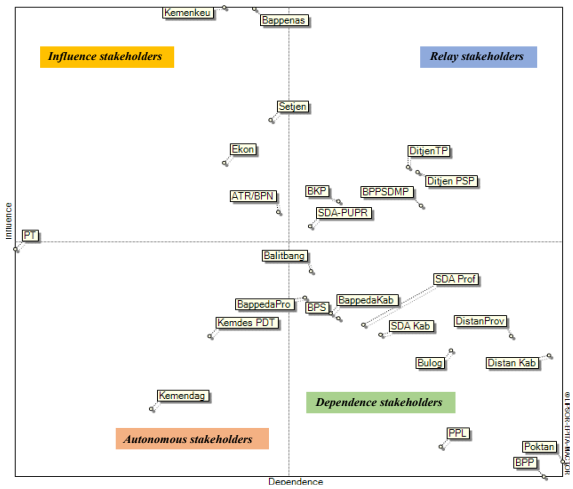

Figure 2. Map of influence and dependence between factors

The lower-right quadrant, representing dependent stakeholders, includes actors such as BappedaKab, Distankab, SDA Kab, PPL, and farmer groups (Poktan). These groups have low influence but high dependence, indicating that they primarily receive and implement policies locally. Their activities are heavily influenced by national and provincial decisions, making them reliant on external support, guidance and resources.

The lower-left quadrant, representing autonomous stakeholders, includes actors with low influence and low dependence, such as Kemendag and Kemdes PDT. These institutions have a more peripheral role in the rice farming development system because their activities are less directly linked to or affected by the larger policy network.

This influence–dependence map shows a governance structure led by a few powerful national actors, with relay stakeholders mediating decisions and local actors' high dependence. Strengthening links, especially empowering local stakeholders, is crucial for improving the effectiveness and sustainability of rice farming strategies.

Figure 3 shows the competitiveness scores of the actors based on the Matrix of Direct and Indirect Influence (MDII). The top five actors were the Kemenkeu, Bappenas, PT, Setjen, and Econ. These actors have a relatively strong influence on the rice-farming development network. Notably, although universities (PT) are classified as low-influence stakeholders on the actor map, their competitiveness score is comparatively high. This suggests that these institutions, despite being less reliant on other actors, retain the autonomy that enhances their ability to influence knowledge, innovation, and policy development.

Conversely, farmers' groups (Poktan), field agricultural extension workers (PPL), and regional agricultural offices (DistanKab) show the lowest competitiveness scores. This suggests that, although vital at the operational level, their ability to influence decision-making is limited. These results highlight that structural and institutional capacity, not just local presence, is what truly influences an actor's competitiveness within multi-stakeholder governance for sustainable rice-farming development.

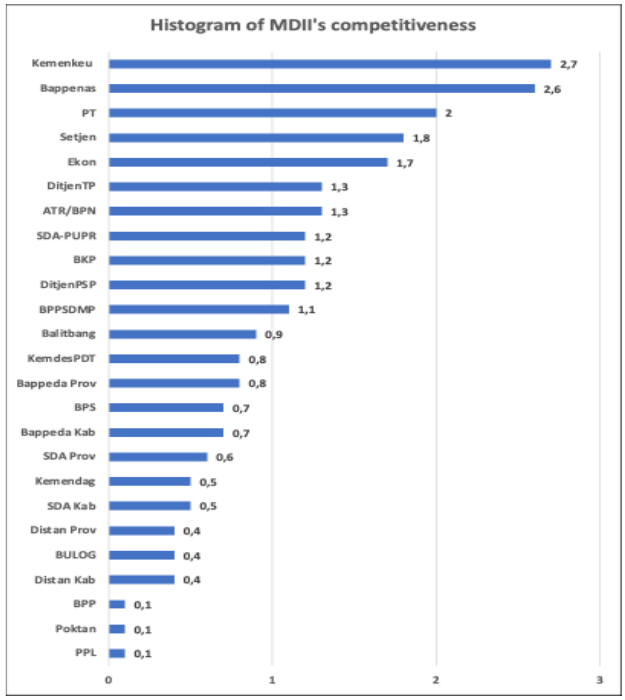

Figure 3. Histogram of actor competitiveness in MDII

3.3 Linkage of actors and goals

Table 5 shows a weighted valued position matrix (3MAO), which shows each actor's position towards each sustainable regional development rice farming goal. This matrix considers the level of competition among actors, the hierarchy of goals, and the degree to which each actor views each goal. Positive values indicate actor support for goals, while negative values indicate the opposite attitude, namely opposition or against goals- the greater the positive value, the greater the actor's support for the goal. Conversely, a more negative value indicates a higher rejection of goals.

The 3MAO matrix shows that Berasmutu objectives received the highest score. The availability of rice is a national priority program set in the RPJMN 2020-2024 [4] so that this objective can be used as a strategic target for every actor from the national to the regional level. The second goal is sejhtera and StabHarga. Increasing farmers' welfare is very important in maintaining the sustainability of rice farming because if the income from rice farming is not able to support their families, the farmers will be vulnerable to switching professions, as well as changing the function of productive agricultural land to provide for their families [29]. Therefore, maintaining price stability is part of the effort to keep the inflation rate low. Rising rice prices increase inflation and poverty, potentially disrupting national stability [13].

The analysis identified 15 contra actors, seven pro actors, and three neutral actors regarding rice imports. Notably, most pro-import actors operate at the national level, emphasizing macroeconomic stability and food security, while provincial-level actors and farmer groups mainly oppose the policy, citing

its negative impact on rural livelihoods. Although rice imports can temporarily reduce price volatility and address supply shortages, they also pose a significant risk of increasing dependence on foreign products and diminishing the competitiveness of domestic production [30]. Historical evidence from the rice trade liberalization period (1998–2003) showed that surges in rice imports had a considerable negative effect on farmers' income, highlighting the vulnerability of local producers to global market fluctuations [31]. Recent empirical studies [32], covering data from 1991 to 2022, support this conclusion by demonstrating that rice imports consistently have an adverse effect on farmers' income. This is because an increased reliance on imported rice lowers the demand for domestically produced rice, reducing the price incentives for farmers. The study also highlights the positive correlations between rice production, international trade, economic growth, population growth, and farmers' income, indicating that a balanced approach to trade policy is necessary. These findings suggest that while rice import policies may offer short-term benefits by ensuring availability, their long-term effects require careful evaluation to protect farmers' welfare and promote sustainable agricultural development.

Table 5. Matrix of 3MAO position of each actor towards each goal

3MAO	Usaha Tani	LBL Sawah	Air	DPI	Pembiayaan	Subsidi	ProdLahan	Pendapatan	Surplus	Suplai	Logistik	Berasmutu	StabHarga	Sejahtera	Regulasi	Poktan	Insostek	Kolaborasi	Adopsi	PSP	Agri 5.0	Import	Mobilisation
Bappenas	7.7	7.7	7.7	7.7	7.7	7.7	7.7	10.2	7.7	7.7	10.2	10.2	10.2	10.2	10.2	7.7	7.7	10.2	7.7	7.7	7.7	2.6	181.4
Kemenkeu	8.0	8.0	8.0	8.0	8.0	8.0	8.0	10.6	8.0	8.0	8.0	10.6	10.6	10.6	10.6	8.0	8.0	8.0	8.0	8.0	8.0	2.7	183.6
Ekon	5.1	5.1	5.1	5.1	5.1	5.1	5.1	6.8	5.1	5.1	5.1	6.8	6.8	6.8	6.8	5.1	5.1	5.1	5.1	5.1	5.1	-5.1	120.8
ATR/BPN	1.3	5.2	0.0	0.0	0.0	0.0	2.6	2.6	2.6	0.0	0.0	3.9	3.9	3.9	5.2	0.0	2.6	3.9	0.0	0.0	5.2	0.0	42.6
Kemendes PDT	2.3	2.3	2.3	2.3	2.3	1.5	3.0	3.0	2.3	1.5	1.5	3.0	2.3	3.0	2.3	1.5	2.3	2.3	2.3	3.0	2.3	-2.3	50.8
Kemendag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9	1.9	1.9	1.9	1.0	1.0	0.0	1.0	1.4	0.0	0.0	0.0	0.5	14.3
SDA-PUPR	4.6	0.0	4.6	2.3	0.0	0.0	3.5	0.0	3.5	0.0	0.0	3.5	3.5	4.6	4.6	0.0	2.3	2.3	0.0	3.5	3.5	0.0	46.5
BPS	1.3	1.3	1.3	1.3	0.0	0.0	1.3	1.3	1.3	1.3	1.3	2.0	2.0	1.3	0.0	1.3	1.3	1.3	0.7	0.7	1.3	0.7	24.2
Setjen	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	1.8	157.1
Ditjen TP	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	-3.8	111.6
Ditjen PSP	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	-3.7	108.4
BPPSDMP	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	-3.2	93.9
Balitbang	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	-2.8	79.9
BKP	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	-3.7	108.1
DistanProv	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	-1.8	38.9
Distan Kab	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	-1.4	31.4
PT	5.9	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.9	4.0	5.9	4.0	4.0	0.0	4.0	4.0	4.0	4.0	4.0	4.0	-5.9	91.1
BPP	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.1	0.2	0.0	0.2	0.2	0.2	0.2	0.2	0.2	-0.1	3.8
Poktan	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.2	0.2	0.2	0.2	0.3	0.0	0.3	0.3	0.3	0.3	0.3	0.3	-0.2	5.3
Bulog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	1.7	1.7	1.7	1.7	1.3	1.7	0.0	0.9	1.7	0.0	0.0	0.0	0.9	15.0
BappedaPro	1.6	3.2	1.6	2.4	0.8	0.8	0.8	2.4	2.4	0.0	0.0	2.4	2.4	3.2	3.2	0.8	0.8	2.4	0.8	0.8	0.8	1.6	35.4
BappedaKab	1.4	2.8	1.4	2.1	0.7	0.7	0.7	2.1	2.1	0.0	0.0	2.1	2.1	2.8	2.8	0.7	0.7	2.1	0.7	0.7	0.7	0.0	29.1
PPL	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.4	0.3	0.5	0.0	0.5	0.5	0.5	0.5	0.4	0.5	-0.5	9.4
SDA Prov	2.4	0.0	2.4	1.8	0.0	0.0	2.4	1.8	1.2	0.0	0.0	1.8	1.8	1.8	1.2	0.0	1.8	1.8	0.0	2.4	2.4	-1.2	28.6
SDA Kab	2.2	0.0	2.2	1.6	0.0	0.0	2.2	1.6	1.1	0.0	0.0	1.6	1.6	1.6	1.1	0.0	1.6	1.6	0.0	2.2	2.2	-1.1	25.8
Number of Agreements	78.6	74.0	75.3	73.3	63.1	62.4	76.0	82.0	78.1	67.4	67.9	92.0	89.0	90.8	84.4	63.7	74.6	82.8	63.9	72.5	77.7	10.7	
Number of Disagreements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-36.9	
Degree of Mobilisation	78.6	74.0	75.3	73.3	63.1	62.4	76.0	82.0	78.1	67.4	67.9	92.0	89.0	90.8	84.4	63.7	74.6	82.8	63.9	72.5	77.7	47.6	

3.4 Mapping of convergence among actors

Figure 4 illustrates the convergence relationships among the actors involved in the governance of sustainable rice farming development. The graph shows that the closer the actors are to each other, the stronger their alignment in achieving shared goals. The most significant convergence occurs between Bappenas and the Ministry of Finance (Kemenkeu), as represented by the red line. This connection emphasizes their central role in policymaking and resource allocation. Additionally, a group of actors, including the Secretariat General (Setjen), Directorate General of Food Crops (Ditjen TP), Directorate General of Agricultural Infrastructure and Facilities (Ditjen PSP), Food Security Agency (BKP), Human Resources Development and Extension Agency (BPPSDMP), Research and Development Agency (Balitbang), Coordinating Ministry for Economic Affairs (Ekon), Provincial Agricultural Offices (DistanProv), and District Agricultural Offices (DistanKab), show strong convergence, as shown by the blue lines.

These actor groups play vital roles in four strategic areas: (1) creating and establishing national agricultural policies, (2) managing and distributing financial resources, (3) developing standards, procedures, and technical criteria, and (4) executing agricultural practices at the provincial and district levels. The convergence patterns emphasize the importance of national policymaking institutions (Bappenas, Kemenkeu, Ekon) working with technical and implementation agencies to ensure that strategic goals are effectively transformed into operational actions. Meanwhile, although less converged, peripheral actors, such as farmer groups (Poktan) and extension workers (PPL), remain essential at the grassroots level but have limited influence on higher-level policy coordination.

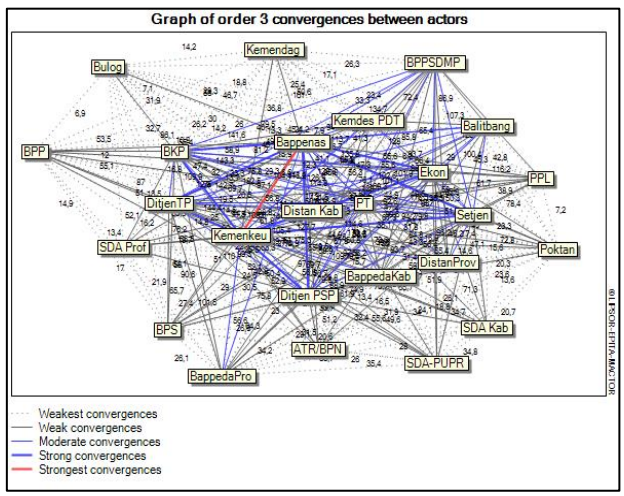

Figure 4. Convergence between actors

SDA-PUPR, ATR/BPN, SDA Prov, SDA Kab, Bappeda Prov, and Bappeda Kab actors exhibit weak alignment with other stakeholders. Nevertheless, they play a vital role in ensuring the sustainability of policies related to raw food agriculture, water security, and rice farming at both the provincial and district levels. Similarly, Kemendag and Bulog actors show weak convergence among all the system participants. Despite this, they are essential for overseeing rice distribution, trade, and price regulation policies at the farmer and consumer levels. Poktan, which is highly dependent on all actors (see Figure 3), contributes to increasing rice production and is a key target for rice farming development goals to boost income and welfare [9]. However, Poktan itself has very low convergence with other stakeholders in the region.

3.5 Mapping of divergences between actors

Figure 5 illustrates the divergence among actors; the closer the actors are to each other, the greater the divergence in sustainable regional development rice farming goals. The increasing divergence between actors also highlights their potential for conflict. PT actors show extreme divergences with Bappenas and Kemenkeu, indicated by red lines, and strong divergences with Setjen, Kemendag, BPS, Bappeda Prov, and Bulog, represented by very thick blue lines. As an independent educational institution, PT will always respond, often resulting in differing views on every policy and implementation related to sustainable regional development rice farming.

A significant divergence exists between Ditjen TP, Ditjen PSP, BKP, BPPSDMP, Balitbang, Bappenas, and Kemenkeu Setjen. In planning policies for the sustainable regional development of rice farming, there is a potential conflict among actors in defining strategic goals and choosing strategies to achieve these objectives. Proper regulation, synergistic collaboration among all actors, development of integrated data, and embracing digital transformation are essential to achieve the strategic aims of sustainable regional rice farming development.

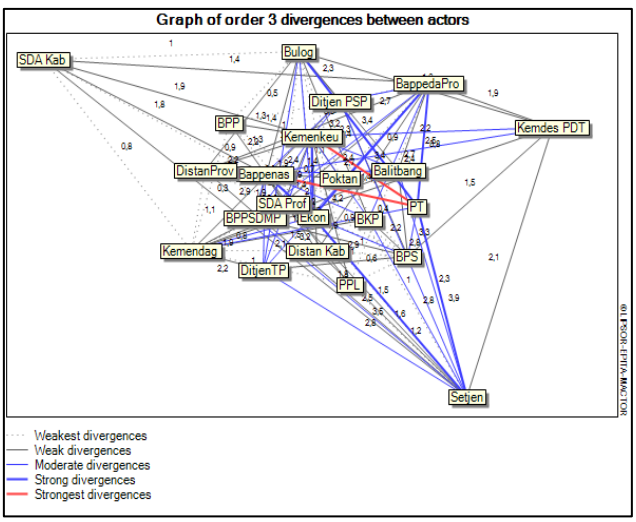

Figure 5. Divergences between actors

3.6 Ambivalence between actors

One actor can be convergent on one strategic goal and a divergent part on another strategic goal against the same actors. Actors in this position are classified as ambivalent. Therefore, to build alliances, they must cooperate on the same strategic goals and put aside other strategic objectives that place them in divergent positions.

Figure 6 shows that Bulog, Kemendag, and Bappeda Provinsi are the most ambivalent actors. Bulog and Kemendag play crucial roles in regulating trade policies, distribution, and rice prices throughout Indonesia. However, to maintain rice availability and price stability, the two actors must implement a diverging rice import policy to increase rice field productivity, farmers 'income, and farmers' welfare. Therefore, proper regulations are needed to ensure the profitability of unhulled rice prices at the farmer level. However, when production experiences a significant decline, limited rice imports are required to ensure the availability and stability of rice prices at the consumer level. They are closely monitored to avoid harming farmers.

This ambivalence underscores the dual challenge faced by these actors: they must protect farmer welfare through price support for unhulled rice at the producer level while ensuring that consumers have access to affordable rice during times of domestic production decline. Consequently, ambivalent actors should be engaged selectively, forming alliances based on shared strategic goals and setting aside areas of disagreement to prevent conflict and policy deadlocks. Establishing clear regulatory frameworks is essential for balancing these conflicting objectives. Such frameworks should allow for limited, well-monitored imports during production shortfalls and include mechanisms to ensure farmers' profitability. By doing so, the ambivalence of key actors, such as Bulog and Kemendag, can be transformed into a constructive force that aligns national food security with the sustainability of domestic rice farming.

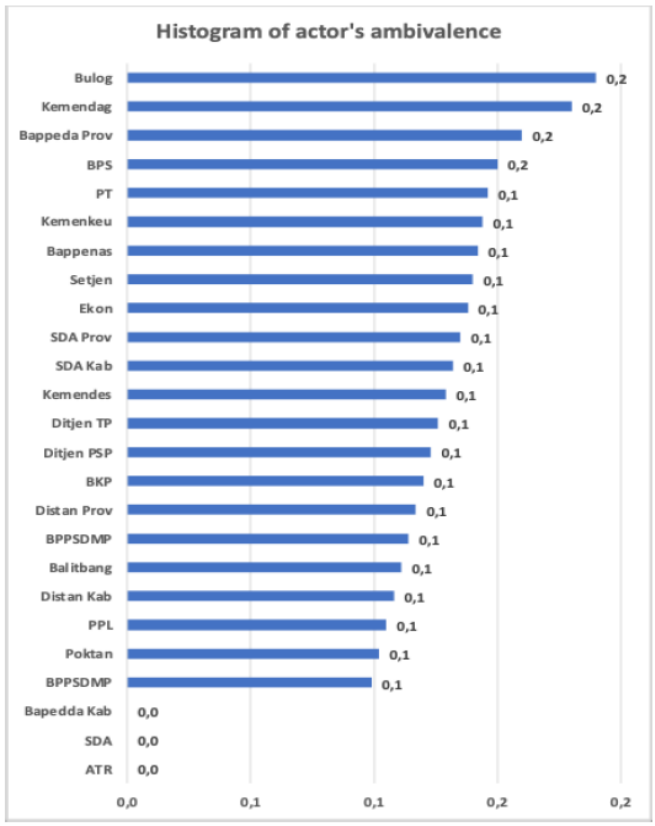

Figure 6. The histogram of the actor's ambivalence level on the goal

4. CONCLUSION

This study analyzes actors' positions in the sustainable regional development rice farming system and the role of actors in mobilizing their resources to influence strategic objectives directly or indirectly through their influence on other actors. The results show that five actors in the influence stakeholder quadrant greatly influence sustainable regional development rice farming: Bappenas, Kemenkeu, Setjen, Econ and ATR/BPN. Five actors in the relay stakeholder quadrant have powerful influence and dependence: Ditjen TP, Ditjen PSP, BPPSDMP, BKP, and Kemen PUPR. In the stakeholder dependence quadrant, twelve actors have a very high dependence on other actors, namely: Balitbang, BPS, Bulog, Bappeda Prov, Bappeda Kab, SDA Prov, SDA Kab, Distan Prov, Diskan Kab, BPP, PPL, and Poktan, and three actors in the autonomous stakeholder quadrant who have very low influence and dependence, namely: KemendesPDT, Kemendag, and PT.

Based on each stakeholder's duties and functions, actors in the influence stakeholder quadrant are influential in formulating policies and financing the sustainable regional development of rice-farming. Actors in the relay stakeholder quadrant compile implementation guidelines through norms, standards, procedures, and criteria for each policy and budget allocation, as determined by actors in the influence stakeholder quadrant. Actors will use the resulting guidelines in the stakeholder dependence quadrant for implementation in the field. Actors in the relay stakeholders quadrant are volatile, and any changes will impact all actors.

The composition of actors in the influence stakeholder quadrant and relay stakeholders are actors in the central government, while the composition of actors in the dependent stakeholder quadrant is mostly from the provincial and district governments. This explanation highlights the importance of collaboration in developing sustainable rice agricultural areas. Actors at the provincial and district levels are very dependent on all policies formulated by the central government and vice versa. The central government cannot implement policies without support from the local government, as implementers in the field.

The goals with the highest scores on the 3MAO matrix were quality, prosperity, and stability. These three objectives are strategic targets for the sustainable regional development of rice farming. Rice imports had the lowest score. Almost all provincial, district, and farmer group actors rejected the rice import policy. Farmers are greatly affected by the decline in their income from the rice import policy.

Kemendag and Bulog are autonomous stakeholders. However, these actors have a very strategic role: building connectivity of rice supply between surplus and deficit areas, improving the logistics efficiency of rice farming/farming systems, maintaining the availability of quality and safe rice at the provincial level, and maintaining rice price stability at the consumer level. The two actors need to increase their roles by strengthening regulations, adjusting institutional duties and functions, and increasing collaboration between actors.

Strong convergence occurs in actors who have the task and function of formulating policies, funding allocations, and technical production, namely Bappenas and Kemenkeu, Setjen, Econ, Ditjen PSP, Ditjen TP, BKP, BPPSDMP, Balitbang, Distan Prov, and Distan Kab. However, these actors also have strong differences. Divergences occur due to conflicts of interest in policy formulation, funding allocation, and regulation implementation. Conflicts of interest arise due to weak data and information, regulations, and the strengthening of each actor's role. Proper regulations, synergistic collaboration between actors according to their respective roles, integrated data building, and digital transformation are required.

Strong convergence only occurs in actors with duties and functions in agricultural technicalities. However, actors who play a crucial role in supporting the strategic objectives of the system have weak convergence. SDA-PUPR, ATR/BPN, Provincial SDA, District SDA, Provincial Bappeda, District Bappeda, BPP, PPL, and Poktan are actors with weak convergences.

The analysis of key actors in the sustainable regional development of rice farming can be used to develop a roadmap for achieving the national rice price availability and stability target and improving rice farmers' sustainable welfare.

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