

## INVESTIGATING STAKEHOLDERS - FARMER COMPETENCIES NEXUS: EVIDENCE FROM MACTOR ANALYSIS AND ANALYTIC HIERARCHY PROCESS IN MAGELANG AND PATI REGENCIES

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### ABSTRACT

Farmer competence is the ability of farmers to think, behave, and act in managing farming businesses. The competence can involve various stakeholders (actors) and types of farmers' competencies. Therefore, this study investigates the role of stakeholders in farmers' competencies and assesses the rank of farmers' competencies in Magelang Regency (highland) and Pati Regency (lowland). Both regions have a significant number of millennial farmers in Central Java Province. The sample for this study was 12 people (institutions) selected using purposive sampling. They provided their perceptions of farmer competencies through in-depth interviews. The interviews were conducted during July–August 2023. MACTOR and AHP methods were applied to measure the stakeholders' role and rank the types of farmer competencies. The findings reveal that all actors agreed on developing farmer competencies through collaboration and business partnerships. Some stakeholders have the strongest level of convergence, consisting of local government agricultural agencies, local government industry agencies, farmer communities, and the banking industries. In contrast, the strongest divergence occurs with sellers of agricultural products and local public figures. In addition, the ranking or priority of farmer competencies from the top is innovative, communication, and entrepreneurial competencies. Policy implications emphasize increasing the level of collaboration and partnership between agricultural business stakeholders and local governments to enhance and guarantee the quality of farmer competencies.

**Keywords:** *farmer competencies, priority factors, stakeholders, MACTOR, AHP*

### BACKGROUND

Indonesia is facing a decline in the number of young farmers over time. The condition will bring a crisis of farmer succession. The crisis of farmer succession in rural areas can be traced from the decline in the number of workers under the age group of 15-29 years, with an average decline of 3.41% per year (Saputra, et al., 2022). It is the main factor for the government to take countermeasure strategies, which include the Agriculture 4.0 policy and the millennial farmer programme. Since 2015, the Ministry of Agriculture has implemented the Agriculture 4.0 policy and the millennial farmer

programme. The Inter-Census Agricultural Survey in 2018 revealed that the most significant number of millennial farmers were in East Java and Central Java Provinces. However, the implementation of Agriculture 4.0 policy still faced challenges regarding the main actors, namely limited human resources (Shidik, 2019). Human resources can be directed to have the competences in adapting and changing the agricultural ecosystem during the disruption era.

In particular, the development of millennial farmers under Agriculture 4.0 in Central Java Province still faced various challenges because they have the low level of innovative and entrepreneurial farming. Therefore, stakeholders (actors) in the agricultural sector can contribute significantly to strengthen farmer competencies. However, the literature largely ignored the significant contribution of the stakeholders in enhancing the farmers' competencies. Septeri (2023) found limitations in the role of the village government and the Agriculture Agency in fostering millennial farmers in Gunung Kidul Regency. Furthermore, Hidayah et al. (2019) define stakeholders as individuals, groups or organizations that have interests, involvement, or are influenced (positively or negatively) by development activities or programs. There are some actors of the agricultural sector include the Regional Development Planning Agency (BAPPEDA), the Agriculture Agency, agricultural extension workers, the Tourism Agency, village governments, community leaders, and traders (Widhianthini et al., 2016 and Arham et al., 2019).

The agricultural sector has the significant contribution to the domestic economy covers the number of labour generally accounts for two-thirds of the labour force and about 40% of gross domestic product (Tabo, et al. 2021). Firdaus et al. (2023) identified that the tasks and roles of local governments to agricultural actors include: (1) increasing the ability and competitiveness of economic actors both on a large and small capital scale, (2) realising welfare for all people in the economic sector based on family principles, (3) realising synergies through partnerships with small and medium traders, cooperatives, and traditional markets whose stores are owned or managed by small and medium traders. Besides, the agricultural extension officers oversee and design agricultural extension policies and programmes (Ju & Son, 2020). Kokina & Blanchette (2019) explained that banking industry has a pivotal role as an intermediary institution. To nurture farmers' motivation and hope. Simatupang (2018) noted the importance role of farmer communities to achieve a sustainable food security. The marketing can also stimulate a sustainable food security. Agricultural marketing brings together producers and consumers through a series of activities to reach an agreement (Jeyaramya, 2022).

Competence is the ability to integrate and apply context-appropriate knowledge, skills, and psychosocial factors (e.g., beliefs, attitudes, values, and motivations) to consistently perform successfully in a specific domain (Vitello et al, 2021). There are several types of farmer competencies in the Agriculture 4.0 era, which include (Widiyanti, 2023): a) having motivation to change; b) gathering information to overcome agriculture 4.0 problems; c) open-minded, courageous, and confident; d) having emotional sensitivity and empathy; e) mastering Information and Communication Technology; and f) having the ability to elaborate messages. Faria & Mixon (2016) explained that entrepreneurial farmers are connected to the supply chain, integrated with the industry, market-orientated, forward-looking, calculated risks, created new products, adopted new technologies, and innovate. Cofre-Bravo et al. (2019) identified innovative behavior of farmers in three main components, namely generation and implementation of new ideas, networking and ability to involve workforce. Generation and implementation of new ideas are related to cognitive abilities, capacity for observation and experimentation with, and implementation of, new ideas. Networking

ability is related to farmers' motivation and drive to develop new ideas, and share knowledge. Meanwhile, the ability to involve workforce is a form of how much participation, proactivity and collaboration in the implementation and development of ideas.

Some previous studies examined farmer competencies based on technical competency and marketing competency (Yusmarni et al, 2023). Furthermore, farmer competencies were also assessed based on technical knowledge and skills (Sapar et al., 2014 and Simamora & Luik, 2019). These previous studies only emphasized on the type of farmers' competencies. However, the contribution of stakeholders in stimulating farmers' competencies is largely ignored. In particular, Rahma et al. (2014) found that stakeholders can lead farmers' competencies. The stakeholders include non-government organization, university, local government, and financial institution. They contributed to improve farmers' skill, share farmers' facility, provide training and empowering, and stimulate farmers' independence.

This study set out two research questions, namely: (a) How and to what extent do stakeholders (actors) contribute to farmers' competencies? and (b) What types of competencies are prioritised by farmers? Therefore, this study aims to assess the contribution of stakeholders (actors) to farmers' competencies and determine the types of competencies that farmers prioritise. The contributions of this study can be formulated in several ways. Firstly, studies on the stakeholders' contribution to farmer competencies and prioritisation of competency types in high and lowland areas have not been the main focus of the literature. Secondly, this study uses two methods: matrix of alliances and conflict tactics, objectives, and recommendations (MACTOR) and analytic hierarchy process (AHP). Thirdly, the findings of this study encourage stakeholders to collaborate and enhance partnerships to ensure farmers' competence in agricultural business. In addition, innovative competencies can be prioritised in realising farmers' competencies in agricultural business.

## RESEARCH METHODS

### Data and Sampling Method

This study uses primary data obtained through in-depth interviews with selected samples. The sample was selected using a purposive sampling, which resulted in 12 people (institutions) who have a strong understanding and interaction with farmer groups. The strong understanding and interaction or respondents were reflected by several indicators, namely: the respondents are the main person in decision-making process of farmer competencies in each institution and the respondents have a main program to improve farmer competencies in their institutions. Besides, the respondents are distributed in two areas equally. This condition means that there are 6 respondents in each area.

Furthermore, this study selects two area in Central Java Province cover the highland area (Magelang Regency) and lowland area (Pati Regency). These areas are the main development areas for millennial farmers in Central Java Province. Based on data from the National Farmer Network in Central Java in 2022, Magelang Regency had the most millennial farmers in Central Java, with 597 millennial farmers, followed by Pati Regency, with 300 millennial farmers engaged in food crops, horticulture, plantations, and animal husbandry. The in-depth interview period was July-August 2023. In addition, purposive sampling was used to find a sample that could answer the questions and objectives of the study (Sekaran, 2003).

The twelve respondents (institutions) were grouped into seven actor categories. The respondents are the head or manager in each institutions. They are Local Government Agricultural

Agency (LGAA), Local Government Industry Agency (LGIA), Farmer Community (FC), Agricultural Supervisor (AS), Banking Industry (BI), Seller of Agricultural Products (SA), and Local Public Figure (LPF). These seven actor groups were to show their contributions to developing farmer competencies using MACTOR. They would also reveal the highest and lowest priority types of farmer competencies using AHP. The following section, Technical Approaches, provides a detailed description of the MACTOR and AHP designs.

**Technical Approaches**

1. Matrix of alliances and conflicts tactics, objectives and recommendations (MACTOR). MACTOR is used to analyze the contribution and interaction among actors (stakeholders) of farmers’ competencies. It provides a convergence and divergence among actors using several steps include selecting actors, setting objectives, describing relationship among actors on the objectives of farmers’ competencies (Rees & MacDonell, 2017). This study proposed several objectives of farmers’ competencies include establishing the relationship among stakeholders on farmer competencies (RSFC), collaboration and partnership among stakeholders on farmer competencies (CPFC), and integrated framework and action on farmer competencies (IF AFC). Furthermore, there are twelve respondents (institutions) were grouped into seven actor categories. They are Local Government Agricultural Agency (LGAA), Local Government Industry Agency (LGIA), Farmer Community (FC), Agricultural Supervisor (AS), Banking Industry (BI), Seller of Agricultural Products (SA), and Local Public Figure (LPF). All actors (stakeholders) will choose a specific preference regarding their contribution to stimulate farmers’ competencies under a MACTOR method. The preference uses likert scales between 1-4 (1 = strongly disagree/worst, 2 = disagree/weak, 3 = agree/good, and 4 = strongly agree/best). Technically, this study employs a software of MACTOR 2.0.
2. Analytic hierarchy process (AHP). AHP is a qualitative method to rank the priority factors of farmers’ competencies. The basic concept of AHP has been introduced by Saaty (2008). It can illustrate an expert choice regarding three farmers’ competencies cover communication, innovation, and entrepreneurship. There are several steps to qualify AHP, namely: construct three factors of farmers’ competencies, arrange a questionnaire using nine scale (1 = same perception level until 9 = the most important perception level), select twelve respondents who comprehend about farmers’ competencies, and assess the priority factors of farmers’ competencies under AHP procedures. In practice, the respondents choose one of several scale following their preference. They provide the preference regarding the level of farmers’ competencies. Table 1 illustrates the priority factors of farmers’ competencies following an AHP procedure. Technically, this studi employs a Microsoft Excel 2013 (Excel 15).

**Table 1.** Farmers’ Competencies Using AHP

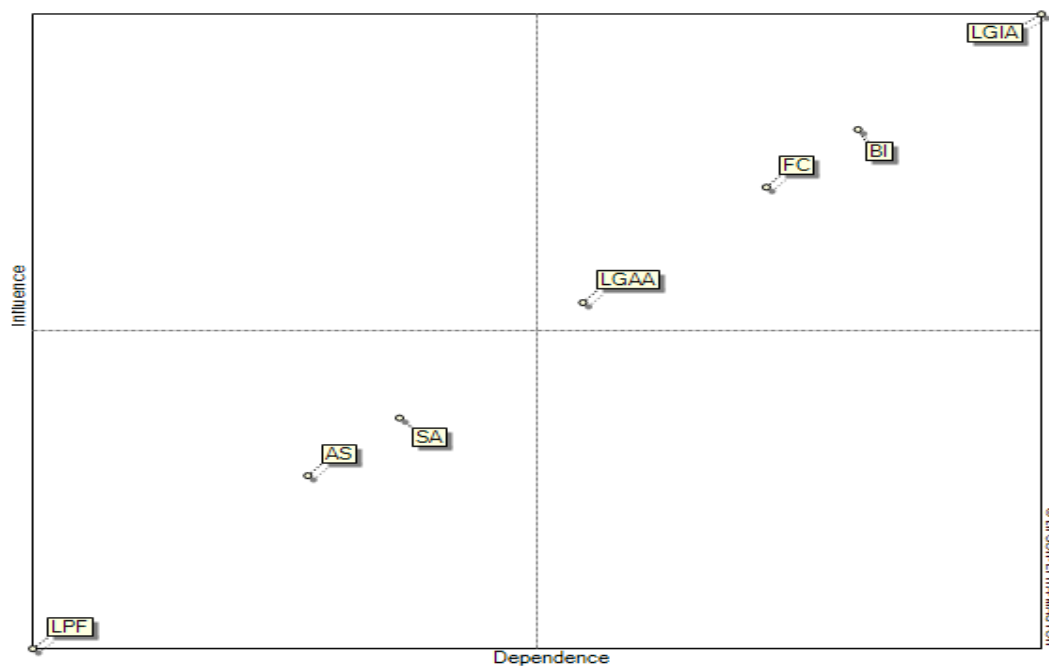
No	Criteria A	<= The most important									Same level									The most=> important									Criteria B
		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9											
1.	Communcation																			Innovation									
2.	Communcation																			Entrepreneurship									
3.	Innovation																			Entrepreneurship									

Source: Authors (2023)

**RESULT AND DISCUSSION**

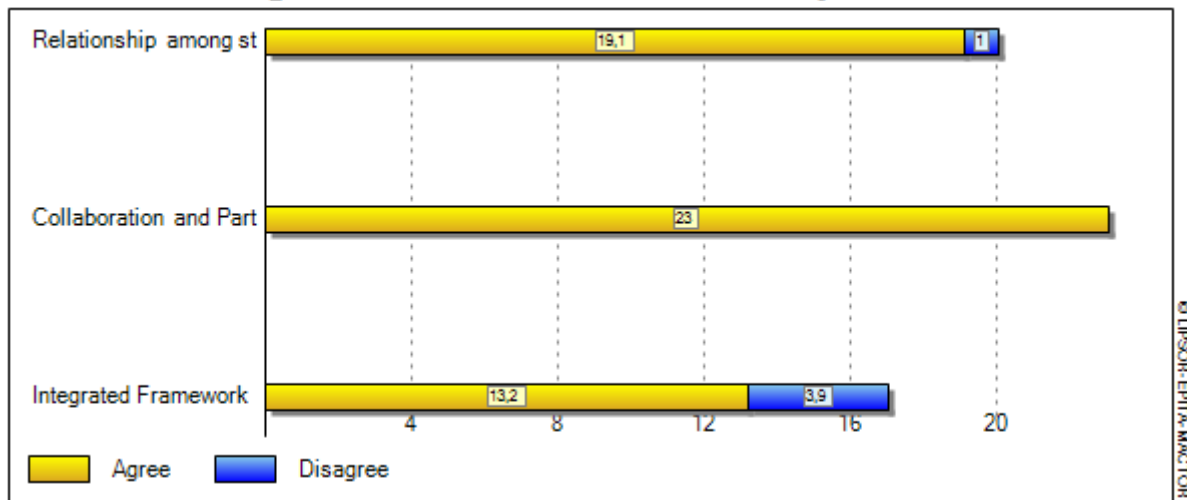
**The Role of Stakeholders on Farmer Competencies**

The stakeholders (actors) play a significant role in shaping and developing farmers' agricultural business competencies. The measurement of these roles can be traced and illustrated through a map of influence and dependence between actors (Figure 1). Figure 1 presents four quadrants: the horizontal axis shows dependence, and the vertical axis shows influence. Quadrant 2 presents four actors who have high levels of dependence and influence, which include the Local Government Agricultural Agency (LGIA), Banking Industry (BI), Farmer Community (FC), and Local Government Industry Agency (LGAA). LGIA, BI, and LGAA are government agencies that interact with farming communities. The actors are the head or manager of the institutions. This means that these three government agencies have a more significant influence and dependency on each other than on the farming communities. In contrast, the three actors with relatively low levels of dependence and influence (Quadrant 4) comprise the Seller of Agricultural Products (SA), Agricultural Supervisor (AS) and Local Public Figure (LPF). Consequently, these three actors play a lesser role in improving farmers' competencies.



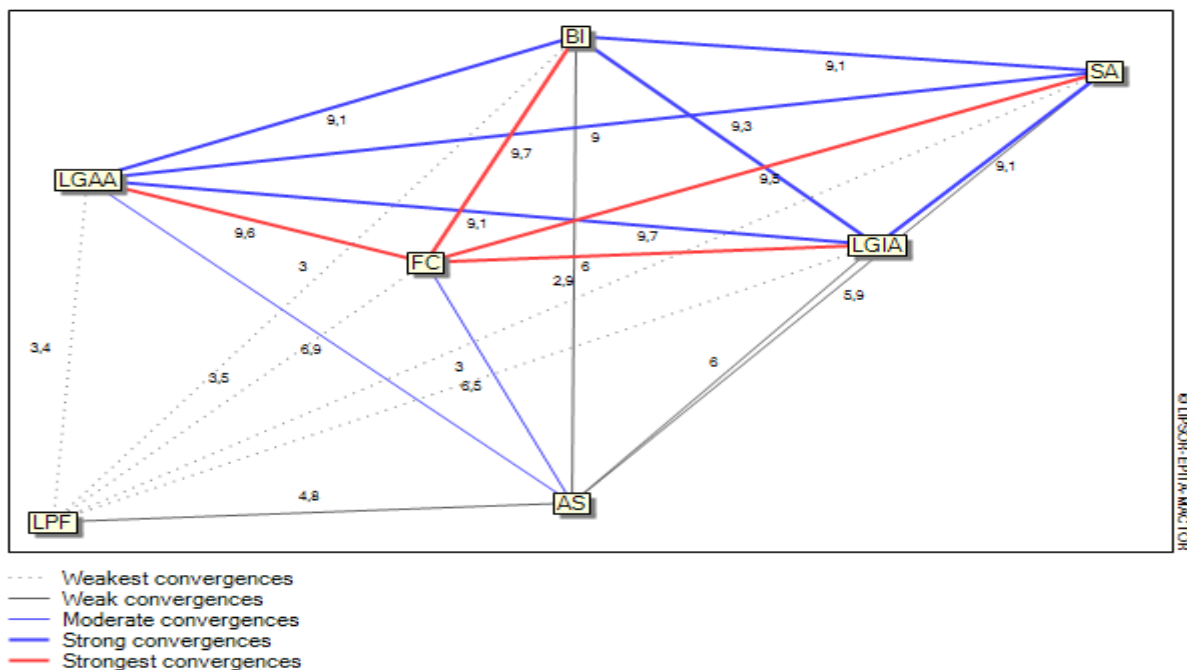
**Figure 1.** The Map of Influence and Dependence between Actors

Figure 2 presents actors' perceived agreement or disagreement levels regarding farmer competency objectives. The farmer competency objectives include establishing the relationship among stakeholders on farmer competencies (RSFC), collaboration and partnership among stakeholders on farmer competencies (CPFC), and integrated framework and action on farmer competencies (IFAFc). The findings revealed that most actors agreed with the objectives of RSFC farmer competencies. All actors agreed with the CPFC farmer competency objectives. In contrast, relatively many actors disagreed with the IFAFC farmer competency objectives. This condition means linkages and collaboration (partnerships) are the main objectives for achieving farmer competencies. Thus, actors' and farmers' competency objectives are an integrated and sustainable framework.



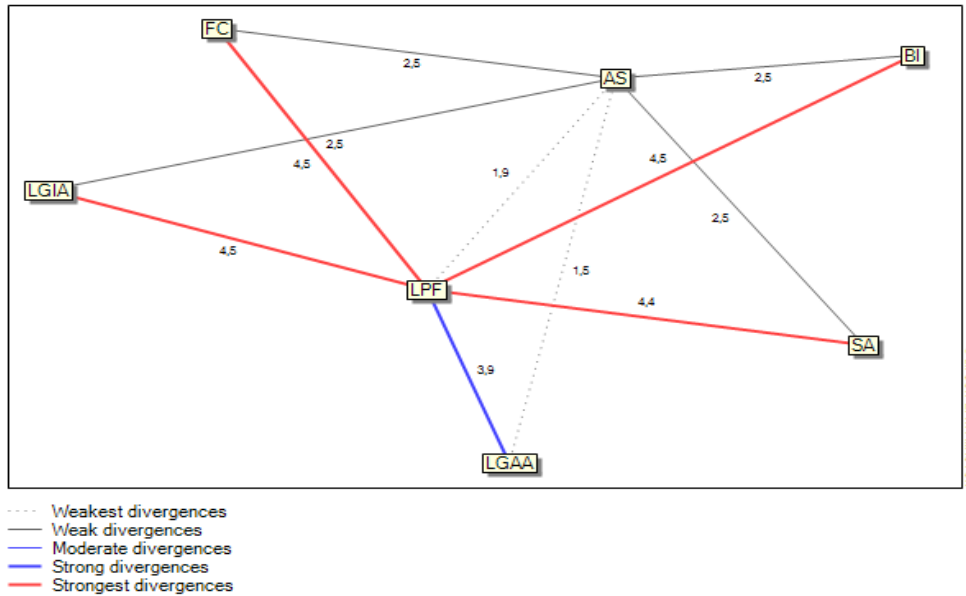
**Figure 2.** Implications of Objectives for Actors

The actors' (stakeholders') roles can also be investigated and measured based on the level of convergence towards the goal of farmer competence. Figure 3 describes that the strongest level of convergences occurs between LGAA and FC, FC and BI, and FC and LGIA. Meanwhile, the strongest level of convergences is evident for LGAA with BI, LGAA with SA, LGAA with LGIA, BI with LGIA, and BI with SA. This illustrates that agricultural supervisors have interactions and linkages with local government agricultural agencies in the implementation of farmer competencies. In addition, the local agricultural agency has significant interactions with the farmer community. Thus, these three actors can be the main motor that drives farmer competencies. In contrast, the actor pairs with a moderate level of convergence consist of AS with FC and AS with LGAA.



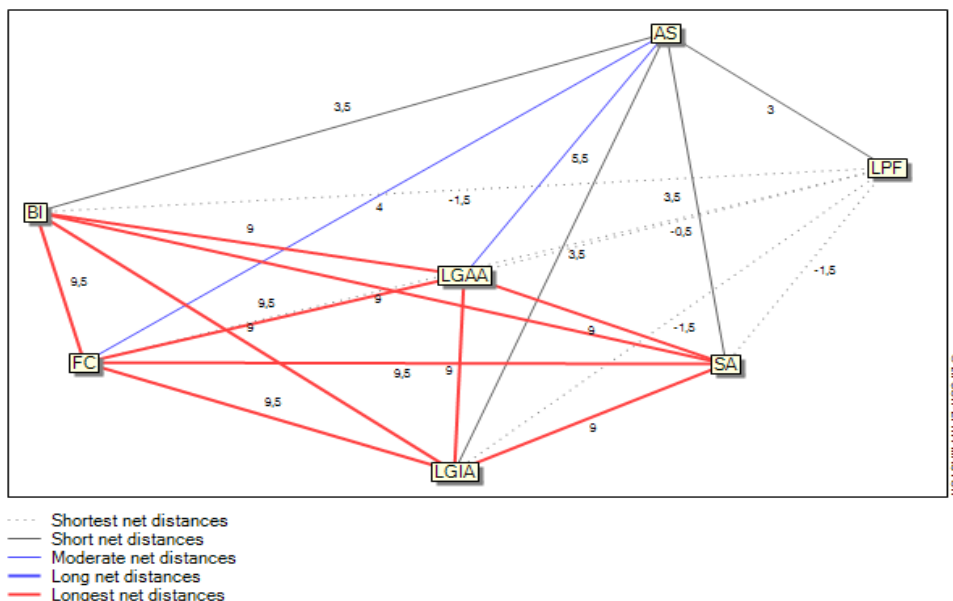
**Figure 3.** Convergence between Actors against Objectives under Order 3

Figure 4 illustrates the level of divergence among actors towards the goal of farmer competencies. The findings suggest that many actors are at the strongest level of divergence. They are LGIA with LPF, FC with LPF, BI with LPF, and SA with LPF. Meanwhile, only LGAA with LPF is at the strongest divergence level. In addition, many actor pairs are also at the weak divergence level, consisting of LGIA with AS, FC with AS, AS with SA, and AS with BI.



**Figure 4.** Divergence between Actors against Objectives under Order 3

The role of actors can also be traced from potential alliance levels (Figure 5). Potential alliance levels consider the different levels of divergences and convergences between actors of order 3. The findings describe that many actors have the longest net distances. They are FC with LGIA, FC with BI, FC with LGAA, FC with SA, BI with LGAA, BI with LGIA, BI with SA, LGAA with LGIA, LGAA with SA, and LGIA with SA. In contrast, only AS with FC and AS with LGAA have a moderate level of net distance.



**Figure 5.** Net Distances between Actors

**The Main Factors of Farmer Competencies**

The study also ranked the types of farmer competencies using the analytic hierarchy process (AHP). The ranking aims to reveal experts' preferences for farmer competency types. These preferences can shape the decision on the main types of farmer competencies. The three types of competencies inherent in agricultural business are communication, innovation, and entrepreneurship. Table 2 shows the respondents' (experts') preference level towards the three types of farmer competencies. These preference levels are displayed in a pairwise comparison matrix. In addition, the pairwise comparison matrix is the base matrix for calculating eigenvector values and prioritisation of competency types. The preference level explains that entrepreneurial competence is more important than innovative competence, entrepreneurial competence is more important than communication competence, and innovative competence is more important than communication competence.

**Table 2.** Pairwise Comparison of Farmer Competencies

Competence	Communication	Innovation	Entrepreneurship
Communication	1.00	0.25	5.00
Innovation	4.00	1.00	9.00
Entrepreneurship	0.20	0.11	1.00

Furthermore, the AHP procedure calculated the values of the eigenvector and normalised eigenvector (priority). The final calculation result is revealed in the Priority and Ranking column. These results can be broken down in several ways. First, the priority value of innovative competence is 0.709. Innovative competence is the type of competence that gets the primary and significant attention. Communication is the second competency that significantly affects farmers' competency level. Conversely, entrepreneurial competence is the type of competence that plays a less significant role in the level of competence of farmers. Thus, innovative competence is the type of farmer competence that has been and is being practised by farmers. In addition, innovative competence is the correct type of competence to shape the level of competence of farmers at this time.

**Table 3.** Eigenvectors and Priority Factors

Competence	Communication	Innovation	Entrepreneurship	Eigenvector	Priority	Ranking
Communication	2638.87	860.90	10110.94	13610.71	0.231	2
Innovation	8088.75	2638.87	30992.42	41720.04	0.709	1
Entrepreneurship	688.72	224.69	2638.87	3552.28	0.060	3

The findings presented in Table 3 require consistency testing. The two methods used to measure the consistency level were the consistency index (CI) and consistency ratio (CR). The calculation results show that the CI and CR levels are 0.036 and 0.068, respectively (Table 4). This suggests that the findings in Table 3 are consistent.

**Table 4.** Consistency Index and Consistency Ratio

Consistency Index (CI)	Consistency Ratio (CR)	Description
0.036	0.068	CR < 0.10 indicates that there is a concern of consistency in pairwise comparison.



Farmer competence can be improved through the active participation of the stakeholders (actors). Therefore, this study conducted in-depth interviews with 12 individuals (institutions) to gauge the level of stakeholders' contribution in ensuring farmers' competence in the highland area (Magelang Regency) and lowland area (Pati Regency). This study employs all sample to qualify the study's objective. This condition means that this study does not split the sample in analyzing process under MACTOR and AHP methods. The findings express that the purpose of collaboration and business partnership is a concern and agreement among the actors. In addition, local government and agricultural agencies have the strongest convergence with farmer communities. This means that there is active interaction and participation between the two actors.

Since government support means a lot to the young farmer community, the government should pay more attention to young people who are both members and not members of farmer groups. Government programmes such as the Nurturing of Young Agricultural Entrepreneurs with farming capital assistance can improve the competence of the young agricultural generation in Samarang District (Santoso et al., 2020). Furthermore, the priority types of farmer competencies consist of innovative competencies (first order), communication competencies (second order), and entrepreneurial competencies (third order). Bisseleua et al. (2017) outlined the strategic role of the stakeholders in the agricultural innovation process. They revealed that increased assets occurred more among participants of the agricultural innovation programme than non-participants. Human and social capital also contributed significantly to the agricultural innovation process.

Volschenk (2022) developed a mode of farmer competence in South Africa. His findings identified farmer competencies based on leadership, economic, and technical dimensions. In particular, Bhattacharjee and Saravana (2014) investigated the characteristics of stakeholders' roles in the North East Indian rice intensification system. They found that lower-level administrative work patterns in disseminating agricultural technology have yet to be established. In addition, collaboration and partnership between farmers and research institutions should be enhanced. Farmer interaction can also be done by establishing business partnerships through bank credit schemes to increase production (Yulia et al., 2023).

Stakeholders can apply eight strategies to develop agricultural businesses (Kuipers et al., 2017). Focus on expansion/intensification in dairy and free markets with a positive outlook on the future; expansion orientation with a perceived lack of know-how and service; and specialisation in dairy with positive opinions about locations are the main strategies expressed by the stakeholders. Another strategy is the wait-and-see (know-how and subsidy-oriented), focusing on cooperation, service, and tech with concerns on skills; diversification/organic with a focus on land, consumer and grazing/greening; trust in skills, subsidies and labour input; and wait-and-see with a pessimistic outlook on the future.

Furthermore, Paladan (2021) measured the level of farmers' and fisherfolks' entrepreneurial competence by considering gender, business experience, education level, and age. The findings were that farmers and fisherfolks have moderate entrepreneurial competence levels. Age can boost farmers' confidence, but the opposite is true for fisherfolks. Business experience can determine the level of entrepreneurial competence. In addition, the agri-food system can be supported by sustainable agricultural education. Therefore, Rastorgueva et al. (2023) investigated the skills and competencies that the stakeholders require to realise sustainable agricultural development. They found that skills for change, networking, and strategic development can stimulate stakeholders' competencies. Meanwhile, technical skills can influence sustainable agricultural development.

## CONCLUSION AND SUGGESTION

This study investigated the roles of stakeholders (actors) and ranking factors (priorities) of farmer competencies in the highlands (Magelang Regency) and lowlands (Pati Regency) during July-August 2023. The study sample was 12 people (institutions) closely related to farmer competencies. The 12 samples were grouped into seven actor categories. MACTOR analysis and the Analytic Hierarchy Process (AHP) were applied. The findings of the study can be summarised in several points. Firstly, most actors agreed with the RSFC farmer competency objective, all agreed with the CPFC farmer competency objective, and relatively many disagreed with the IFAFC farmer competency objective. Second, the strongest level of convergences occurred between LGAA and FC, FC and BI, and FC and LGIA, while the strongest level of divergence occurred between LGIA and LPF, FC and LPF, BI and LPF, and SA and LPF. Third, the priority competencies of farmers are innovative competence (first order), communication competence (second order), and entrepreneurial competence (third order).

The implications of the study can be elaborated in several ways. Firstly, local governments can maximise their role and support for farmers (farming communities) to ensure the improvement of farmers' competencies. Secondly, stakeholders related to farmer competencies can increase collaboration and partnership in farmer competency development and mentoring programmes. Third, stakeholders and farmers can place more emphasis on innovative competency practices. Furthermore, they can improve communication and entrepreneurship competencies. Thus, innovation competency becomes the basic competency required by farmers in the short term.

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