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Research

Interpretive structural modeling of tobacco farmer institutions: Pathways to strengthen economic resilience and welfare in Bojonegoro, Indonesia

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ABSTRACT

The plantation sub-sector plays a strategic role in Indonesia's economy, with tobacco being one of the most important and competitive commodities contributing to regional income and employment. Bojonegoro Regency is recognized as one of the main tobacco production centers in Indonesia, yet its farmer institutions remain weak and fragmented. This study addresses the gap in understanding the structural relationships among institutional actors involved in tobacco farming. The objective was to analyze the hierarchical structure and interaction patterns of these actors to strengthen institutional performance and sustainability. The Interpretive Structural Modeling (ISM) method was applied using data collected from experts and key stakeholders in Bojonegoro's tobacco farming sector. The ISM results revealed that tobacco farmers, PT. AOI, and the Agricultural Service possess the highest driving power and occupy the Independent sector, acting as the main driving forces of institutional development. Meanwhile, Farmer Groups and Suppliers have the lowest driving power, categorized as Dependent actors, indicating their heavy reliance on institutional and policy support. These findings highlight that improving institutional sustainability requires strengthening collaboration between independent and dependent actors, while optimizing the coordinating role of linkage actors such as the Regional Government and Agricultural Extension Workers. Overall, the study provides practical insights for policymakers to design targeted interventions that enhance the effectiveness and resilience of tobacco farmer institutions in Bojonegoro Regency.

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INTRODUCTION

The plantation subsector plays a strategic role in Indonesia's economic structure. One of the key crops in this subsector, which has significant potential for supporting economic growth, is

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tobacco (Bella et al., 2024). According to findings by (Purba et al., 2021), tobacco was not only a vital commodity for farmers, but also an important source of income for the country. Records from the Ministry of Industry 2023 indicated that the Tobacco Products Industry (*Industri Hasil Tembakau/IHT*) continues to increase its contribution to the national economy through excise taxes revenue (PRMP, 2025). In 2016, *IHT* accounted for 96.65% of the total national excise revenue. This reflected the substantial role of tobacco in driving the industrial sector and its positive impact on the economy as a whole.

Figure 1 illustrates that in 2021, Indonesia produced approximately 237.1 thousand tons of tobacco leaves, making it the fourth-largest producer in the world. This achievement not only highlights the significant potential of the tobacco industry, but also underscores its contribution to the global economy. As tobacco production continues to increase, Indonesia not only meets domestic needs, but also establishes itself as a major player in the international market. Therefore, the plantation subsector particularly tobacco can be considered a backbone of the economy, playing a key role in advancing Indonesia toward better growth and sustainability.

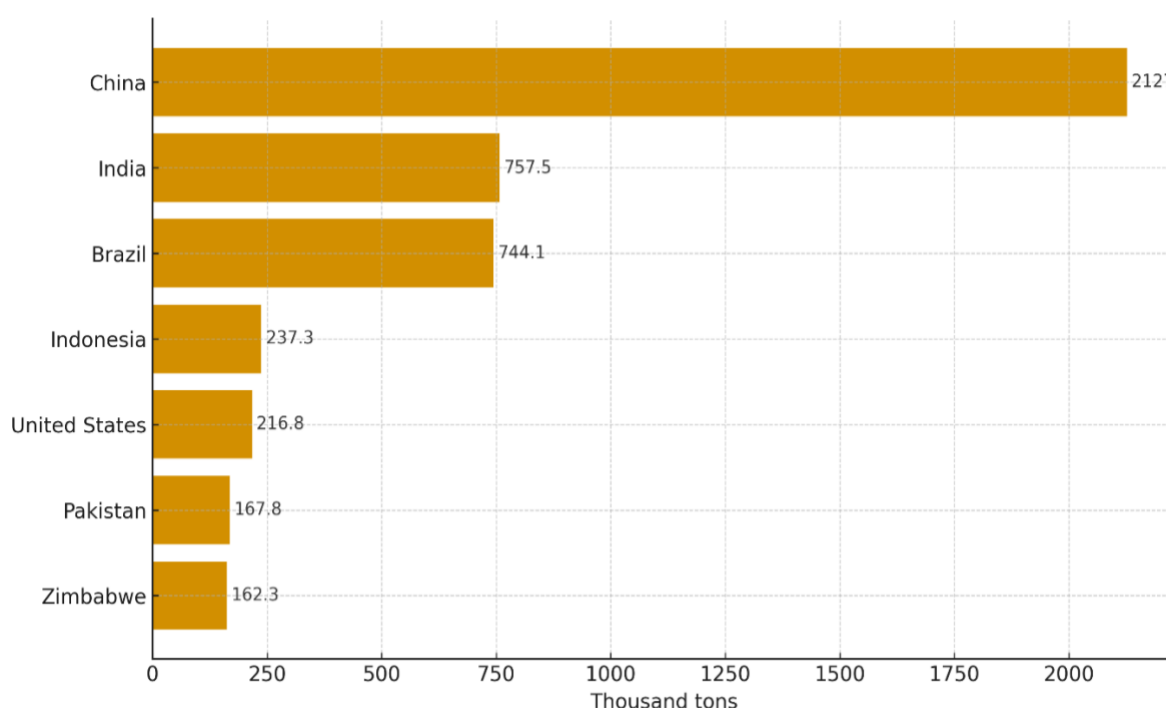


Figure 1. List of the Largest Tobacco Producers in the World

Source: (Center for Agricultural Data & Information System, 2022)

Based on the information in Table 1, Bojonegoro Regency plays a significant role as the third-largest tobacco-producing center in East Java. In 2022, Bojonegoro Regency produced 12,607 tons of tobacco across a land area of 11,484 hectares. This data underscores Bojonegoro Regency’s substantial contribution to the tobacco industry, reinforcing its position as one of the main producers in the East Java region. Additionally, approximately 70% of

Bojonegoro’s population is actively involved in the agricultural sector, including tobacco cultivation. This reflects the significant impact of the agricultural sector, particularly tobacco, on the livelihoods of the local community. The Bojonegoro area is also known for its favorable climate for tobacco growth, which is a key factor in the success of tobacco production. However, while Bojonegoro generally has a supportive climate, not all areas in the district are suitable for growing tobacco (Swarnata et al., 2024).

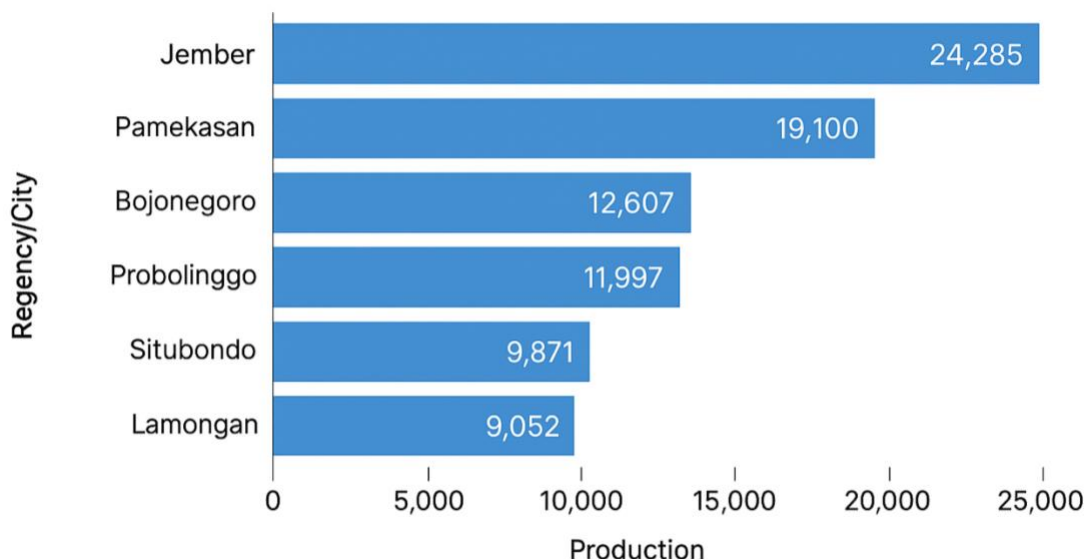


Figure 2. Tobacco Production in East Java, 2022

Source: Central Bureau of Statistics of East Java Province (2022)

Tobacco farmers in Bojonegoro are more focused on activities in certain sub-districts, such as Sugihwaras, Kedungadem, Kepohbaru, Baureno, and Sumberejo. This reflects a planned strategy to maximize harvests and efficiency in agricultural land management. With around 20 tobacco processing factories (Durroh et al., 2024). Bojonegoro has a tobacco production capacity of around 50,000 tons per year. The existence of tobacco in Bojonegoro is not only the result of current economic development, but also has long historical roots, starting from the Dutch colonial era in Indonesia. Tobacco has become an integral part of the history and economic development of the Bojonegoro community, providing a sustainable contribution today (Muafidah et al., 2024).

Table 1 shows that there are five key areas that serve as centers of tobacco production in Bojonegoro Regency, particularly in the sub-districts of Sugihwaras, Kedungadem, Kepohbaru, Baureno, and Sumberrejo, which form the economic backbone for local farmers. Tobacco farmers in Bojonegoro are involved not only in the production process but throughout the entire chain, from production to marketing. Various institutions and organizations provide essential support during these stages (Muafidah et al., 2024). This institutional system, known

as Farmer Institutions, has developed organically from within the farming community itself, with the primary goal of strengthening and advocating for their shared interests. Farmer Institutions in Bojonegoro Regency consist of various entities, such as Farmer Groups, Farmer Group Associations, Agricultural Commodity Associations, and the National Agricultural Commodity Council. The primary function of this system is to represent and advocate for the interests of tobacco farmers. This includes ensuring fair selling prices, expanding market access, and providing technical assistance to enhance the quality and productivity of tobacco farming (Durroh et al., 2024).

Table 1. Tobacco planting realization data in Bojonegoro regency, 2023

Subdistrict	Land Area (Ha)		Total Production (Ton)		Total Production (Ton)	
	Cultivated	Harvested	Rajangan	Fresh Leaves	Cultivated	Harvested
Sugihwaras	778.00	778.00	771.90	2,716.00	1,550	9,700
Kedungadem	250.00	250.00	162.00	920.00	1,200	8,000
Kepohbaru	4,027.00	4,027.00	5,637.80	-	1,400	-
Baureno	1,469.00	1,469.00	2,203.50	-	1,500	-
Sumberrejo	941.00	941.00	1,317.40	-	1,400	-

Source: Bojonegoro Regency Food Security and Agriculture Service Office, 2022

Although Farmer Institutions play a crucial role in managing the stages of tobacco production, distribution, and marketing, this system faces several obstacles. One of the main challenges is the lack of demand for tobacco, along with high explicit costs, limited use of technology, and the impact of calamities in Bojonegoro Regency. This situation indicates a tendency toward weak farmer institutions in the region and highlights the significant challenges faced in building and strengthening these institutions within the farming community. Although the Farmer Institution is expected to help farmers overcome economic inequality, it has not functioned optimally thus far. Therefore, a more in-depth analysis is needed to fully understand the institutional system for tobacco farmers in Bojonegoro and to identify the steps necessary for increasing its effectiveness. Interpretive Structural Modeling (ISM) is an analytical method that provides a deep understanding of the relationships among elements in the institutional system of tobacco farmer. This method identifies crucial factors that play a significant role in improving the welfare of tobacco farmers. By using the ISM approach, we can systematically analyze the interactions among the various institutions involved and identify the role of each in addressing the challenges faced (Thakkar et al., 2006). One of the strengths of ISM is its ability to identify the institutions that need to be actively involved in addressing problems and improving the institutional system for tobacco farmers (Jayant & Azhar, 2014). With a better understanding of the structural relationships among these institutions, strategic steps can be taken to strengthen cooperation and coordination between them (Poduval et al., 2015).

Hence, this study seeks to answer the following research questions: what key factors influence the effectiveness of farmer institutions in Bojonegoro's tobacco farming system, how the relationships among these factors are structured based on the ISM approach.

The purpose of this finding was to provide a comprehensive overview of the key actors involved in developing the institutional system for tobacco farmers in Bojonegoro. By using the ISM method, this study aimed to clearly reveal the relationships and interactions among various institutions and highlight key elements that significantly impacted the goals of institutional development (Awan et al., 2018). Thus, through the ISM approach, this finding sought to offer deeper insight into the dynamics of the institutional system of tobacco farmers in Bojonegoro, providing a strong foundation for further improvement and development. By understanding the role of each stakeholder, we hope to produce effective policy recommendations that enhance the welfare of tobacco farmers and advance the institutional system in the region. While the role of various institutions has been widely recognized, the structural relationships, interdependencies, and power dynamics among these key actors remain poorly understood. This study seeks to fill this gap by systematically mapping and analyzing these relationships through the ISM approach, thereby providing a clearer understanding of how institutional collaboration can be strengthened to improve the welfare of tobacco farmers in Bojonegoro.

METHOD

This study employed a mixed quantitative and qualitative approach focusing on five subdistricts in Bojonegoro Regency: Sugihwaras, Kedungadem, Kepohbaru, Baureno, and Sumberrejo selected purposively as the main centers of tobacco production. The research was conducted from March to April 2024, using the Purposive Sampling method to select respondents who were considered to have relevant information related to the research issue (Sugiyono, 2011). Data were collected using the purposive sampling technique to involve respondents with relevant experience and institutional knowledge related to tobacco farming. A total of 80 respondents of tobacco farmer and 5 key informant were included in the study. Data were collected through structured questionnaires, in-depth interviews, and field observations. To ensure data validity and reduce perception bias, the Interpretive Structural Modeling (ISM) process involved a heterogeneous panel of experts, including representatives of tobacco farmers, agricultural officers, the local government, agricultural extension workers, and industry actors (PT. AOI).

The analysis followed the ISM procedural stages, beginning with system identification, actor identification, and structural modeling. A Delphi-style consensus approach through focus group discussions (FGDs) was applied to refine and verify relationships among the identified

actors before constructing the Structural Self-Interaction Matrix (SSIM). The SSIM was then converted into a Reachability Matrix using defined transitivity rules to determine hierarchical levels and relational structures among the actors (Attri et al., 2013; Irianto et al., 2021). The resulting hierarchical model illustrated the distribution of driving power and dependence power across actors, providing a comprehensive understanding of the institutional dynamics that influence the sustainability and performance of tobacco farmers in Bojonegoro. The final results of this study were illustrated in a scheme that shows elements arranged both vertically and horizontally, depicting the classification of sub-elements, as shown in Figure 3.

Driver Power	IV. Independent Strong Driver – weak Dependent variables	III. Linkage Strong Driver Power– strongly Dependence
	I. Autonomous Weak Driver Power – weak Dependence	II. Dependence Weak Driver Power – strongly Dependence
	Dependence	

Figure 3. Driver Power – Dependence Matrix

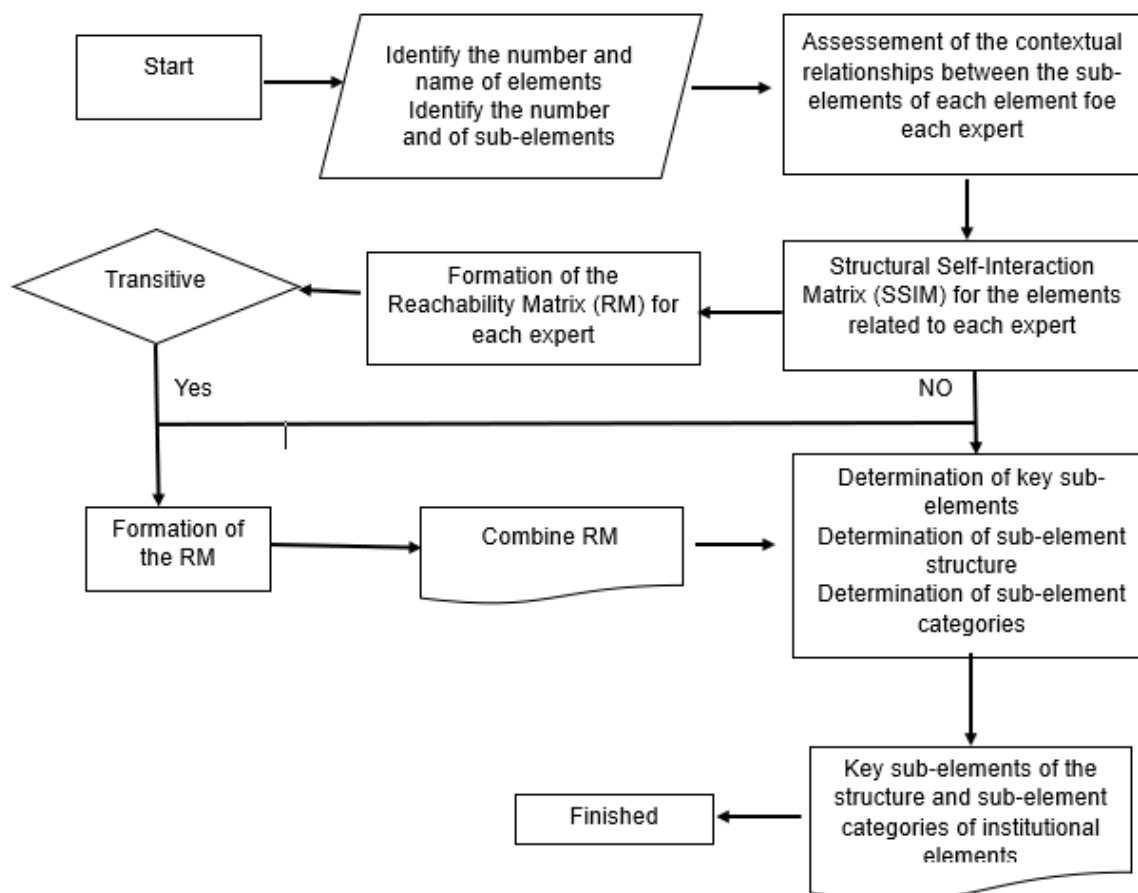


Figure 4. Stages of Intellectual Structural Modeling (ISM)

Based on the research stages (Figure 4), this study begins with the identification of key institutional elements and their corresponding sub-elements within the tobacco farming system in Bojonegoro Regency. The subsequent stage involves the assessment of contextual relationships among sub-elements through expert judgment, followed by the construction of the Structural Self-Interaction Matrix (SSIM), Reachability Matrix (RM), and transitivity analysis to derive the structural hierarchy. Through these sequential stages, the study produces a comprehensive understanding of the structural relationships, key sub-elements, and institutional categories that characterize the institutional system of tobacco farmers in Bojonegoro. The research variables included aspects, such as agricultural practices, institutional structures, government support, market conditions, and other factors relevant to the institutional system of tobacco farmers in Bojonegoro.

Interpretive Structural Modeling (ISM) Analysis

Interpretative Structural Modeling (ISM) was chosen as the primary analysis tool due to its ability to provide a deep understanding of the relationships between elements in a system. The ISM process began with the identification of key variables, followed by the development of the Structural Self-Interaction Matrix (SSIM). The SSIM was constructed based on expert opinions collected through structured discussions and questionnaires. During this stage, experts were asked to evaluate the contextual relationships between pairs of variables using four symbols V, A, X, and O, to indicate the direction and presence of influence. In this process, the symbol V indicates that element *i* influences element *j*, A indicates that element *j* influences element *i*, X represents mutual influence between elements, and O indicates no contextual relationship between the paired elements. This decision was supported by the method's relevance to the research objectives, such as identifying crucial elements in tobacco farmer institutions (Rokhani et al., 2021). Links to cited theories or methodologies, such as (Farhan et al., 2020) was explained in detail, highlighting the relevance and suitability of this approach to the research context.

A total of five experts participated in this process, representing each sub-district involved in the study. To reach consensus, multiple rounds of consultation and validation were conducted. In cases where initial responses differed, discussions were facilitated to ensure agreement on the nature and strength of the relationships among variables. The finalized SSIM was then converted into a reachability matrix, which served as the foundation for developing the hierarchical structure of the ISM model. In explaining the method, we avoided overly general explanations or information that was not directly relevant to the research objectives. Each element of the method was described clearly, focusing on its contribution to understanding the institutional system of tobacco farmers in Bojonegoro.

RESULTS AND DISCUSSION

Needs Analysis and System Identification

The respondents in this study consisted of five key experts representing each major tobacco-producing subdistrict in Bojonegoro Regency, namely Sugihwaras, Kedungadem, Kepohbaru, Baureno, and Sumberrejo. Each respondent was selected purposively based on their institutional role and expertise in the tobacco agribusiness system, including farmers, farmer group leaders, suppliers, local government officers, extension workers, and representatives from the tobacco processing industry. This composition was intended to reflect a cross-section of actors involved in both production and institutional coordination processes.

However, the limited number of expert respondents one from each subdistrict may lead to perception bias and reduce the heterogeneity required in standard ISM practices. Ideally, ISM relies on a more diverse expert panel and a consensus-based validation process such as Delphi or Focus Group Discussion (FGD). To minimize this limitation, the respondent selection emphasized those with substantial experience (10–25 years) and strategic positions in the local tobacco value chain.

The demographic and professional characteristics of respondents show that most participants were male (80%), aged between 40–60 years, and had a minimum formal education of high school level. The majority (60%) had previously been involved in partnership programs with tobacco factories, while 40% were active in farmer organizations or local cooperatives. This profile demonstrates that respondents possessed sufficient institutional knowledge and practical insight regarding the coordination, pricing, and production mechanisms of tobacco farming. In addition, supporting quantitative data were used to reinforce the credibility of expert judgments. For example, the average frequency of farmer group meetings reached 4–6 times per planting season, while the number of active extension officers in each subdistrict ranged from 8 to 12 individuals. The average partnership contract duration between farmers and tobacco factories was 6–8 months with a production absorption volume of around 2.5–3 tons per hectare. These empirical indicators support the ISM findings by confirming the functional relationships among actors within the institutional structure.

The institutional system of tobacco farmers in Bojonegoro Regency involves various actors and stakeholders who play crucial roles in the tobacco industry. The main actors include tobacco farmers, who are directly involved in the stages of tobacco production and planting, and the cigarette factory PT. AOI, which is responsible for the processing and production of tobacco products. The Regional Government and the Department of Agriculture play important roles in setting policies, providing support, and managing regulations related to the tobacco industry. Meanwhile, farmer groups and agricultural extension workers collaborate in

agricultural activities, such as training, extension, and mentoring to enhance farmers' abilities in tobacco cultivation, ultimately increasing the competitiveness and welfare of their members. Suppliers act as the link between tobacco production and local and international markets. This is consistent with the findings of (Muafidah et al., 2024) who identified the role of marketing and extension institutions as key components in the tobacco farming institutional system in Bojonegoro.

System identification was conducted to understand the organizational and institutional structures that form the tobacco industry in Bojonegoro. The analysis of external and internal factors aimed to identify the constraints faced by the institutional system of tobacco farmers (Munawaroh et al., 2017). Table 2 reflects four main constraints: lack of demand for tobacco, lack of use of technology, high explicit costs, and weather-related challenges that may hinder the development of the tobacco industry. This analysis sought to provide in-depth insights into the challenges faced by the institutional system of tobacco farmers in Bojonegoro, with the hope of identifying strategic steps to overcome these constraints.

Table 2. Obstacles to the tobacco farmers' institutional system

a. Lack of demand for tobacco	The decline in the number of tobacco farmers was caused by a lack of demand for tobacco from warehouses, which led to farmers not planting tobacco on a large scale
b. Lack of use of technology	The tobacco cultivation process in Bojonegoro Regency is still carried out manually, which makes it difficult for farmers to save costs and increase efficiency
c. High explicit costs	The explicit costs of tobacco farming in Bojonegoro Regency are relatively high due to the reliance on external labor and the use of high external inputs
d. Weather-related challenges	Prolonged wet conditions can hamper the tobacco cultivation process, making it difficult for farmers to plant tobacco

Source: primary data analysis, 2025

The subsequent Interpretive Structural Modeling (ISM) analysis was therefore designed to identify which actors hold the greatest influence in overcoming these systemic constraints. By mapping the relationships between actors, the ISM results reveal that tobacco farmers, PT. AOI, and the Agricultural Service are Independent actors with high driving power, meaning they are central to addressing the core issues identified earlier, such as low technology adoption and production inefficiency. Meanwhile, regional government and extension workers serve as Linkage actors, connecting institutional policies with field-level implementation, thus

bridging the gap between regulation and farmer practice. Farmer groups and suppliers emerge as Dependent actors, whose success relies on effective coordination and support from higher-level institutions.

In summary, the ISM results are directly aligned with the initial problem context: the institutional constraints identified in the background (limited coordination, weak support systems, and external vulnerability) are explained through the hierarchical structure of actor relationships. Strengthening collaboration between Independent and Linkage actors is thus crucial for resolving the challenges faced by the tobacco farming institutional system and for ensuring long-term sustainability and farmer welfare.

Elements of Institutional Development

In the framework of the tobacco farmer institutional system, seven key elements of the actors are identified: (1) Tobacco Farmers, (2) PT. AOI Cigarette Factory, (3) Regional Government, (4) Agricultural Service, (5) Farmer Groups, (6) Agricultural Extension Workers, and (7) Suppliers. The relationships between these elements in the institutional system were derived from the opinions of recognized experts. The initial approach used the Structural Self-Interaction Matrix (SSIM) to evaluate the relationships among these objective elements. For instance, Yusianto et al. (2019) applied ISM to analyze institutional development in the potato agroindustry in Central Java. Their study identified five key elements: main actors, needs, objectives, major constraints, and performance indicators.

The initial SSIM was then detailed based on the relationships between the actor elements in the institutional system. The Reachability Matrix was generated from the initial SSIM and subsequently revised according to the transitivity rule to obtain the revised SSIM. The final revised SSIM reflected more accurate and detailed relationships between the actor elements in the system (Irmayani, et al., 2025). The interpretation of the affordance matrix of actor elements was outlined in Table 3, providing a clear picture of the extent of interconnectedness and dependency among the actors in the institutional system. The structural model diagram, as shown in Figure 5, offers a visual representation of the relationships derived from the affordance matrix.

Table 3 presents the final reachability matrix of the actor elements involved in the institutional system of tobacco farmers. The results indicate that tobacco farmers (A1) have the highest driving power (7), followed by PT. AOI (A2) with a driving power of 6, and the Agricultural Service (A4) and Agricultural Extension Workers (A6) with a driving power of 5. This finding confirms that the institutional system is primarily driven by actors directly involved in production, market coordination, and institutional support. Tobacco farmers occupy the most

influential position because their production decisions, cultivation practices, and product quality determine the continuity of the tobacco value chain. Meanwhile, PT. AOI plays a strategic role through market access, partnership arrangements, and quality standards, while the Agricultural Service contributes through policy implementation, technical assistance, and institutional facilitation.

Table 3. The final reachability matrix and its interpretation of the actor elements

No	A1	A2	A3	A4	A5	A6	A7	Drv	R
A1	1	1	1	1	1	1	1	7	1
A2	0	1	1	1	1	1	1	6	2
A3	0	0	1	0	1	1	1	4	4
A4	0	0	1	1	1	1	1	5	3
A5	0	0	0	0	1	1	1	3	5
A6	0	1	1	1	0	1	1	5	3
A7	0	0	1	0	0	1	1	3	5
Dep	1	3	6	4	5	7	7		

Source: Primary Data Analysis, 2025

In terms of dependence power, Agricultural Extension Workers (A6) and Suppliers (A7) show the highest dependence values, indicating that their roles are strongly shaped by the actions and support of other institutional actors. This implies that extension services and supply-chain activities cannot function effectively without coordination with farmers, government institutions, and industry actors. The matrix also shows that no actor is completely isolated from the system, suggesting a high level of institutional interdependence. Therefore, the strengthening of tobacco farmer institutions requires not only empowering farmer groups and suppliers as dependent actors, but also optimizing the leadership and coordinating roles of farmers, PT. AOI, the Agricultural Service, local government, and extension workers. This interpretation is consistent with the ISM perspective, which emphasizes that actors with strong driving power should become strategic entry points for institutional strengthening and system-level intervention (Attri et al., 2013; Thakkar et al., 2006; Irmayani et al., 2025).

Next, the Driver Power – Dependence (DP-D) Matrix of the actor elements was created to evaluate the role and contribution of each actor in the system (Dang et al., 2014). This was reflected in Figure 5, which illustrates the extent to which an actor element serves as the main driver (Driver Power) or depends on other elements (Dependence) within the context of the institutional system. This approach involved a series of interrelated analytical tools, ranging from the SSIM to the DP-D Matrix, providing a comprehensive framework for understanding the dynamics and structure of the tobacco farmer institutional system. This analysis laid a solid foundation for decision-making and strategic planning in efforts to develop and improve tobacco farmer institutions in Bojonegoro Regency.

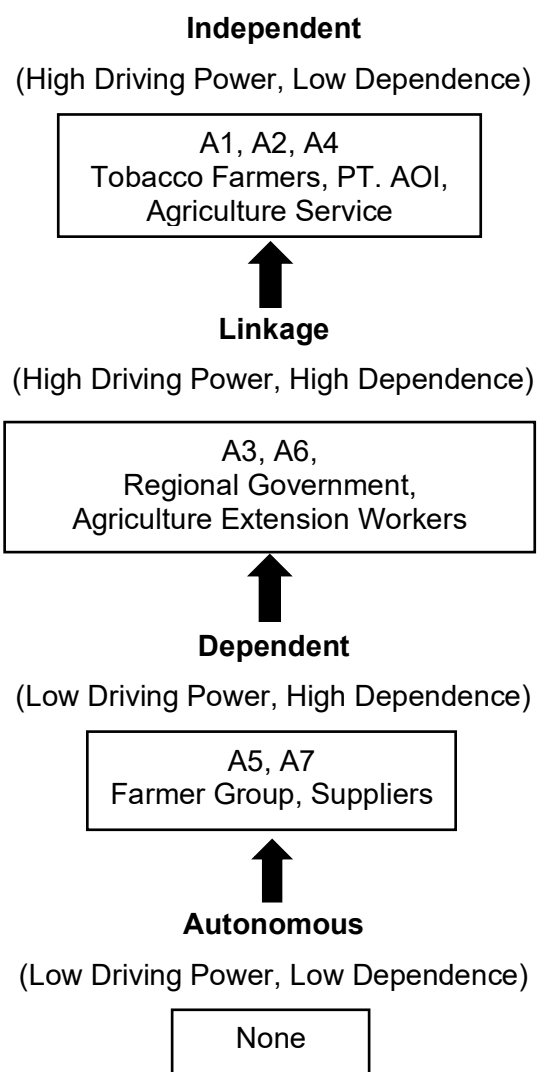


Figure 5. Structuring of Actor Elements in the Tobacco Farmer Institutional System

Actor Classification and Structural Relationship

The classification of actors based on the ISM analysis reveals the structural relationships and interdependencies within the institutional system of tobacco farmers in Bojonegoro Regency. As shown in Table 4, actors were categorized into Independent, Linkage, and Dependent groups, with no actors identified as Autonomous, indicating a tightly integrated institutional structure.

Independent actors (A1, A2, A4) namely Tobacco Farmers, PT. AOI Cigarette Factory, and the Agricultural Service hold the highest Driving Power and lowest Dependence values. These actors serve as the primary driving forces within the institutional network. Their strong influence aligns with the findings of Arfianto (2012), who emphasized that farmer organizations and leading agro-industry actors are pivotal in sustaining agricultural institutions and maintaining farmer welfare. Similarly, Yang et al. (2014) noted that the involvement of agro-industrial firms significantly contributes to both local and national economic development,

reinforcing their status as strategic institutional anchors. Moreover, agricultural service agencies play an essential role in facilitating innovation adoption and supporting sustainable agricultural management, consistent with the independent characteristics identified in this study.

Table 4. The final reachability matrix and its interpretation of the actor elements

Actor Category	Code	Actor Name	Role in the Institutional System
Independent (High Driving Power, Low Dependence)	A1, A2, A4	Tobacco Farmers, PT. AOI, Agricultural Service	The main driving forces of the institutional system. They have a strong influence on the sustainability and welfare of tobacco farmers.
Linkage (High Driving Power, High Dependence)	A3, A6	Regional Government, Agricultural Extension Workers	Connecting and facilitating actors. They provide policy direction, training, as well as technical and institutional support.
Dependent (Low Driving Power, High Dependence)	A5, A7	Farmer Groups, Suppliers	Supporting actors who depend on the policies and assistance provided by Independent and Linkage actors.
Autonomous (Low Driving Power, Low Dependence)	-	-	No actors are completely independent from the institutional system.

Source: Primary Data Analysis, 2025

Linkage actors (A3, A6) including the *Regional Government* and *Agricultural Extension Workers* are positioned as intermediary entities with both high driving power and high dependence. Their dual role of influencing and being influenced underscores their function as coordinators and facilitators. Do & Park (2009), who stated that local governments and extension institutions bridge communication between policy structures and field-level actors, ensuring system coherence. Highlighted the strategic contribution of extension workers in disseminating agricultural knowledge and enhancing farmers' managerial capacity, confirming their crucial linkage function in institutional performance.

In contrast, Dependent actors (A5, A7) *Farmer Groups* and *Suppliers* exhibit low driving power but high dependence, signifying that their performance relies heavily on institutional support and the policies implemented by Independent and Linkage actors. These findings are consistent with Danuartha et al. (2024), who found that farmer groups function mainly as operational entities facilitating collective action and resource sharing, yet remain dependent on government support and market access. Similarly, Durroh et al. (2024) observed that supplier participation in agricultural systems is often shaped by institutional and market linkages, reflecting their position as dependent stakeholders. The absence of Autonomous actors in the system indicates that all institutional components are interconnected and

participate in maintaining system functionality. This is in line with Bella et al. (2024) and Durroh et al. (2024), who argued that institutional integration is a key indicator of system sustainability, minimizing fragmentation and ensuring cohesive governance in agricultural value chains.

Overall, this ISM-based classification highlights that the sustainability of the tobacco farming institutional system is driven by the dynamic interaction between Independent and Linkage actors, supported by the operational role of Dependent actors. The hierarchical structuring of actor elements, as illustrated in Figure 5, reflects their dependency and interconnectedness. Tobacco Farmers remain at the top level, emphasizing their dominant and central role. PT. AOI and Agricultural Services are positioned just below, while Linkage actors occupy intermediary levels. Dependent actors are at the base, illustrating the flow of influence and support.

Figure 6 shows that the analysis of driving power and dependence power using the Interpretive Structural Modeling (ISM) method shows that each actor within the institutional system of tobacco farmers holds a distinct position and role based on their level of influence and dependence. Actors A1 (tobacco farmers), A2 (PT. AOI), and A4 (Agricultural Service) occupy the *High Driving–Low Dependence* quadrant, categorized as independent actors, meaning they serve as the main driving forces of the institutional system with a significant ability to influence the sustainability and welfare of farmers. Meanwhile, actors A3 (Regional Government) and A6 (Agricultural Extension Workers) fall into the *High Driving–High Dependence* quadrant or the linkage category, representing strategic actors who function as connectors between the main and supporting actors. Actors A5 (Farmer Groups) and A7 (Suppliers) belong to the dependent category, as they exhibit high levels of reliance on the policies and support provided by other actors. Interestingly, no actors fall under the autonomous category (low influence and low dependence), indicating that all actors are interrelated and interact within the tobacco institutional system.

These findings are consistent with previous studies showing that actors with high driving power function as key drivers of institutional system sustainability (Wang et al., 2015). In the agribusiness context, Fanani et al. (2015) emphasized that farmers and agribusiness institutions in independent positions play crucial roles in directing sustainable farming policies and practices. Similarly, Swarnata et al. (2024) explained that actors in the linkage category perform dual functions as policy facilitators and inter-actor coordinators to ensure institutional system synergy. Furthermore, this finding reinforces the results of Fariadi (2018), who stated that in Indonesia's agricultural institutional systems, the absence of autonomous actors reflects a strong functional interconnection among participants meaning that changes in one actor directly affect others. Therefore, this analysis highlights that the success of the tobacco

farmers' institutional system depends heavily on the synergy between the main driving actors (independent) and the facilitating actors (linkage), as well as on the the strong interdependence among institutional actors in maintaining the stability, coordination, and sustainability of the overall agribusiness system.

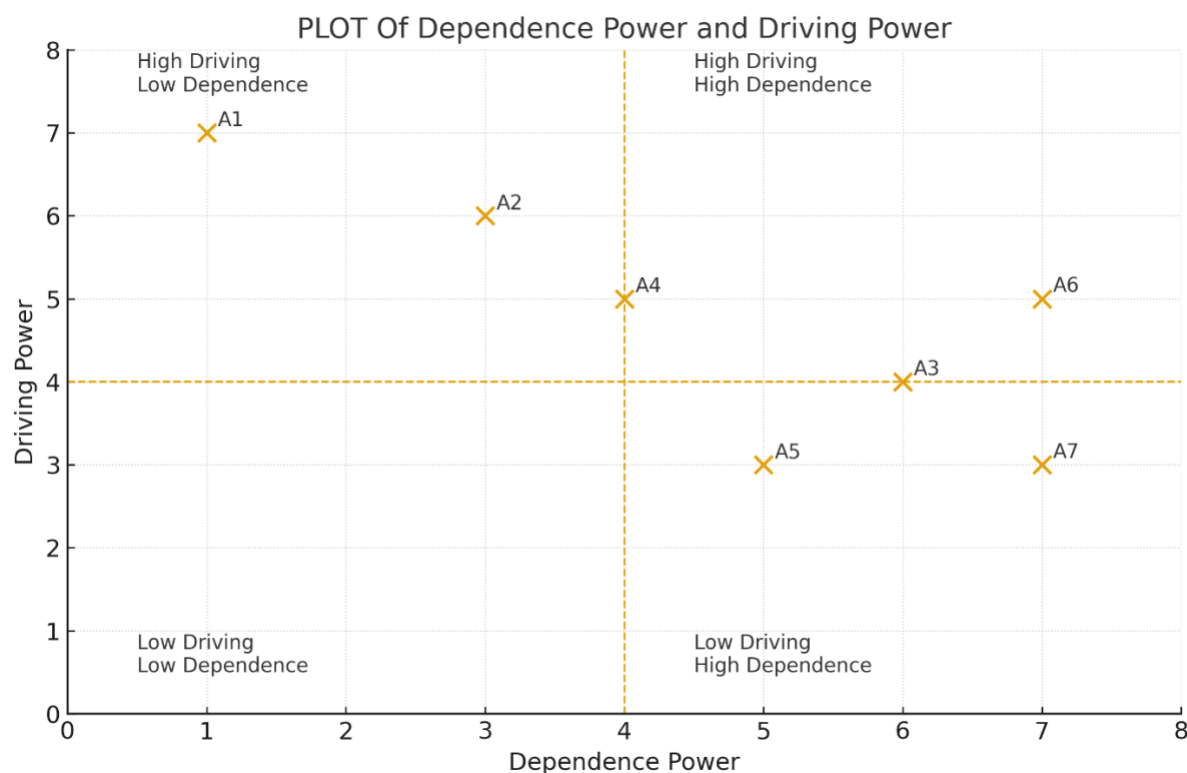


Figure 6. DP-D Matrix for Actor Elements

Source: Primary Data Analysis, 2025

However, The ISM analysis revealed distinct hierarchical roles among institutional actors based on their driving power and dependence power. Tobacco farmers (A1), PT. AOI (A2), and the Agricultural Service (A4) occupy the Independent quadrant (High Driving – Low Dependence), indicating their strong influence in directing the institutional system while maintaining relatively low reliance on external support. The high driving power of tobacco farmers can be attributed to their central role in production and resource management, which directly determines the continuity of the tobacco value chain. As primary producers, their decisions regarding planting, cultivation techniques, and product quality significantly affect downstream actors such as processing industries and suppliers. This is consistent with Yaqin & Ridho (2025), who emphasized that farmers and agribusiness institutions positioned as independent actors serve as the driving force for sustainable agricultural practices and policy formulation. Similarly, PT. AOI's influence stems from its control over market access, production contracts, and capital distribution key aspects that shape farmers' livelihoods and bargaining power. The Agricultural Service (A4) also exerts substantial influence by providing

agricultural guidance, extension programs, and regulatory oversight, thereby linking policy to practice and ensuring systemic stability.

Meanwhile, the Regional Government (A3) and Agricultural Extension Workers (A6) are positioned within the Linkage quadrant (High Driving – High Dependence), representing their dual role as both facilitators and coordinators within the institutional network. Their strong driving power arises from their capacity to shape strategic policies and channel institutional support to farmers, while their high dependence reflects reliance on cooperation with other stakeholders to implement such programs effectively. As highlighted by Wahyono et al., (2024) in the *Journal of Cleaner Production*, linkage actors play a crucial role in mediating between independent and dependent entities to maintain institutional coherence and ensure effective program execution. This interdependence ensures that while they influence the system, they also depend on collaboration from primary actors (farmers and industries) for successful policy implementation.

Conversely, Farmer Groups (A5) and Suppliers (A7) fall into the Dependent quadrant (Low Driving – High Dependence). Their limited driving power reflects structural and resource constraints farmer groups often lack autonomy in decision-making, relying heavily on institutional support, subsidies, and partnerships for production continuity. According to Fanani et al. (2015) dependent actors typically function as supporting units that operationalize programs designed by dominant actors, rather than initiating change independently. In the case of tobacco farmers, farmer groups rely on technical guidance and market linkages provided by PT. AOI and the Agricultural Service to sustain operations. Similarly, suppliers' dependence stems from their position at the end of the value chain, reliant on production outcomes and demand fluctuations determined by both farmers and processing industries.

CONCLUSION

The institutional structure of tobacco farmers in Bojonegoro Regency shows that sustainability depends on the interaction between actors with varying levels of influence and dependence. Independent actors such as farmers, cigarette factories, and agricultural services function as key drivers that initiate and sustain institutional performance. Linkage actors local government and agricultural extension workers bridge coordination and policy implementation, while dependent actors farmer groups and suppliers require continued empowerment to reduce structural dependency. This configuration confirms that institutional strength arises from the synergy between independence and interdependence among actors, emphasizing that collaborative governance and actor capacity-building are essential for sustaining farmer welfare and institutional resilience.

For independent actors (Tobacco farmers, PT. AOI, and the Agricultural Service), efforts should focus on strengthening collaboration through equitable and transparent partnership models, technology adoption, and sustainable production practices, as their strong influence can drive systemic change. For linkage actors (local government and agricultural extension workers), it is crucial to reinforce their coordinating and facilitating roles by improving extension programs, strengthening policy integration, and ensuring effective communication between farmers and industry stakeholders. Meanwhile, dependent actors (farmer groups and suppliers) require capacity-building programs to enhance managerial competence, collective bargaining power, and integration into the value chain, thereby reducing overreliance on external actors and fostering institutional resilience

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