



CASE STUDY

Development of Food Distribution Model to Support Food Security in East Java Province

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Abstract: This study aims to analyze problems in food distribution from upstream to downstream and the efficiency of the distribution values of the food chain, and formulate an efficient food distribution system model in Pacitan Regency. A mixed method, which combines quantitative and qualitative analyses, was used. The first objective was analyzed with the fishbone diagram, the second objective with the value chain model, and the third objective with the Matrix of Alliances and Conflicts: Tactics, Objectives, and Recommendations (MACTOR). This study used primary and secondary data obtained from observations, surveys, in-depth interviews, and focus group discussions. Respondents consisted of stakeholders in agriculture and distribution channels, namely farm laborers, landowners, wholesalers, warehousing, brokers, agents, retailers, bankers / financial institutions, and information providers. The objectives associated with product flow included transportation, risk, price, distribution, profit. The results show that there are problems in the four areas of production, post-harvest, trading system, and institution. There are three food distribution systems in Pacitan East Java but the most efficient model is farmers-millers-retailers-consumers. Although farmers must allow more time to reimbursement, prices are more affordable for consumers. The results of stakeholder analysis found that the stakeholders with the highest competitiveness are retailers, agents, information and warehousing, while those with the lowest are farm laborers and landowners. The results of the convergence show that close relationship is observed between farm laborers, collectors, warehousing and landowners in Order One 1; between warehouses, landowners, and collectors in Order Two 2; and between agents and collectors in Order Three 3. This shows that collectors have the strongest potential to play the central role in the agricultural chain.

Keywords: Food security; Networking; Stakeholder analysis; Value chain

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1. Introduction

Food is a basic need and a fundamental right for everyone, which must be guaranteed by the state in collaboration with the community because food has a function in developing quality human resources to carry out daily tasks ^[1]. In 2019, the FAO estimated that around 12.5% of the world’s population were suffering from food shortages. This is due to rising food prices and the increase in the number of poor people who have no access to food. This figure represents 852 million people, with 563 million in the Asia-Pacific region, 239 million in Africa, 49 million in Latin America, and about 16 million in developed countries. This condition indicates a relatively large gap between poor, developing and developed countries (Food security requires four important aspects: availability, accessibility, security, and sustainability. These four key aspects must go hand in hand with the population growth rate. Law No. 18 of 2013 on Food defines Food security as ‘a condition for the fulfillment of food for the state to individuals, which is reflected in the availability of food that is sufficient in quantity and quality, safe, diverse, nutritious, equitable, and affordable and does not conflict with religion, belief, and culture, for the communi-

ty to be able to live healthily, actively and productively in a sustainable manner’. The law also explains and strengthens the achievement of food sovereignty, food resilience, and food safety. Specifically, food problems can be divided into four major issues including Production; Post Harvest; Trade system; Institution.

An effective and efficient distribution system is one of the requirements to ensure that all households, at all times, obtain food in sufficient quantities, of good quality, and at affordable prices. The potential for different food crop production between regions and between seasons requires careful distribution planning. An efficient food distribution mechanism is needed to achieve food security. One indicator of the efficiency of food distribution is the availability of food in the right quantity, on time, in every place according to the pattern of community needs. Food distribution problems can be caused by physical and non-physical factors. The main physical causes are related to facilities and infrastructure, transportation, and freight transport, while non-physical causes include limited market information and the behavior of distribution actors who have the power to control food supply with the aim of controlling prices.

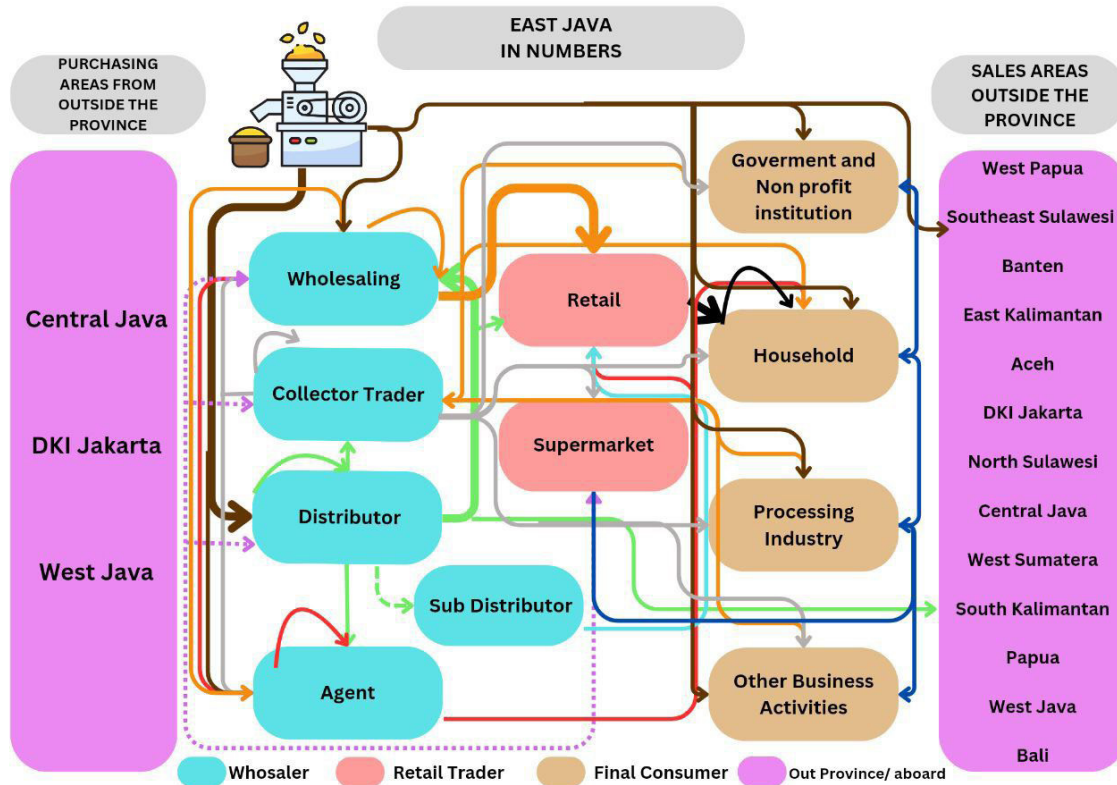


Figure 1. Food Distribution Patterns.

Source: Central Bureau of Statistics (2021) ^[2]

The number of food trade distribution chains formed from producers to final consumers is four chains involving three intermediary traders, namely distributors, wholesalers, and retail traders. However, the distribution pattern has the potential to become six chains when passing through trade channels: producers, distributors, agents, wholesalers, collectors, retail traders, and final consumers. The Central Government and/or Regional Governments can realize the efficient distribution of food by prioritizing effective and efficient transportation services in accordance with the provisions of laws and regulations. The government needs to give priority to the smooth loading and unloading of food products and is obliged to provide facilities and infrastructure for food distribution, particularly for staple food, and to develop community food distribution institutions because food distribution programs play a vital role in addressing food insecurity, promoting health and well-being, reducing food waste, and fostering community engagement. The community can participate in realizing Food Sovereignty, Food Resilience and Food Security through: (a) Implementation of food production, distribution, trade and consumption as well as implementation of community food reserves; (b) Prevention and handling of food and nutrition insecurity; (c) Delivery of information and knowledge on food and nutrition; (d) Supervision of the effective implementation of food availability, affordability, diversification, and safety; (e) Increased household food resilience.

The agricultural value-based supply chain concept, a production and marketing channel that connects farmers and ranchers with buyers while retaining producers' identities and production values has been used since the beginning of the millennium, especially in agricultural development in developing countries. This concept generally refers to all goods and services required for agricultural products to move from agricultural producers to end-consumers^[3]. The core concept of the agricultural value chain is the idea of linkages along the production chain and delivery of goods to the end-consumers through a sequence of activities^[4]. The main issue in food availability and affordability is distribution, which is the main focus of this research.

2. Materials and Methods

The location of this research is in Pacitan Regency which is located on the southern coast of the Indian Ocean, East Java Province. Pacitan Regency is an agricultural area, with the largest contribution to the economy being the agricultural and fisheries sectors. Value

chain refers to the various activities required to bring a product from the initial input-supply stage, through the various stages of production, to the final market destination. This term represents to a series of activities required to deliver a product (or service) starting from the conceptual stage, followed with several stages of production, until delivery to the end-consumers. A value chain is established when all the actors involved in the chain work in a way that maximizes the value formation along the chain. The value chain concept requires adding value as the product moves from input suppliers to producers and consumers. A value chain combines productive transformation and value addition at each stage. At each stage, the product changes hands through the chain actor, the transaction costs incurred, and generally, some form of added value. Value added results from various activities including bulking, cleaning, grading, packaging, transportation, storage, and processing^[5].

This study used the mixed method, which combines quantitative and qualitative analyses. The first objective of the study was analyzed using Atlas.ti. Atlas.ti is a software used for qualitative data analysis in social research and humanities and sciences. Researchers can manage, organize, and analyze various types of qualitative data, such as text, audio, video, images, and other documents, by using Atlas.ti. This software provides various tools to help researchers explore data, identify patterns, themes, and relationships, and build the theories or models underlying them. Furthermore, the steps involved in the qualitative analysis included a) preparing the main documents consisting of interview transcripts with the informants; b) coding, namely selecting code words that are meaningful and in accordance with the research objectives; c) formulating a network based on the results of the qualitative analysis.

The second objective of the study was tested with stakeholder analysis using the MACTOR (Matrix of Alliances and Conflicts: Tactics, Objectives and Recommendations). MACTOR is used to identify the strengths, relationships, and patterns of alliances between stakeholders. This method explains the views and preferences of each stakeholder and the level of support for the aim to be achieved. Stakeholders are groups that influence community objectives and activities^[6]. Group activities are related to the objectives to be achieved and interrelated in terms of planning, implementation, and evaluation. The objective formulation will be adjusted to the actor who is the key person in each group. Stakeholder analysis is an alternative to identify and measure the participation of each stakeholder.

The stakeholder analysis process includes: 1). identifying stakeholders; 2) differentiating and categorizing stakeholders; and 3) investigating the linkages between stakeholders. This linkage can be analyzed with Stakeholder Analysis which describes: (1) the relationship between stakeholders, the strength of the established network, their divergence and convergence, the strength of the relationship between stakeholders and (2) the relationship between stakeholders and the objective that they want to achieve ^[7].

The third objective was investigated using the triangulation method, which combines the results of the discussion of the first and second objectives. The study used nine food distribution stakeholders: farm laborer, landowner, gatherer, warehousing, middleman, agent, retailer, banking, and farmer coops. Interviews with these stakeholders were conducted to find out the relationship between the actors, as well as to conduct interviews on the problems encountered in the distribution of food to obtain responses from each of the stakeholders. The relationship between such actors was rated 0 to 4, while the responses of each actor to the questioned issue were rated between -4 to 4.

3. Literature Review

Food insecurity is extensive throughout the world and hunger and malnutrition are expected to remain serious humanitarian and political concerns, both in the short term and for the foreseeable future, particularly in low income developing countries ^[8].

Problems in managing food security start from the production aspect which includes (a) Providing agricultural production facilities; (b) Production technology; (c) harvest and post-harvest, food processing industry and distribution of harvest and processing industry results. Research conducted in Nepal shows that Nepal is unable to compete with the Indian rice milling industry due to (a) low profit margins due to high rice production costs; (b) lack of economies of scale, c) lack of long and extra long rice milling technology and lack of investment in modernization of rice milling technology, and (c) unavailability of rice throughout the year locally. The millers are willing to upgrade their rice milling technology to include high-yield parboiling, as well as long-grain and extra-long grain steamed rice. This will be a strategic decision to counter the ever-increasing rice imports in Nepal [9,10]. Farmers commonly practicing six technology-based strategies and one labour/family-based strategy with 80% adapting two or more adaptation strategies. adaptation strategies are significantly and positively

influenced by education, subsistence pressure, income from livestock and poultry, extension services, involvement in organizations and the use of ICT in farming. Adaptation probability inversely related with increasing women participation in agricultural labour force ^[11].

Research in Malaysia on food crops, especially rice, shows that another factor in determining the success of the agricultural sector is climate. Climate change is a major threat to rice production, which will ultimately affect food security because the two are interrelated. Therefore, government policies and intervention in rice production are very important in the success of the harvest ^[12,13]. The impact of climate change over the next 30 years push the global markets for food commodities, which have become increasingly important as sources of nutrition for both developing and developed countries. Food security are likely to become even most urgent in the future. Free trade policies allow countries to explore their comparative advantages in agriculture sector, increasing average per capita incomes, longer term growth rates and a country's capacity, and safety nets for the poor ^[8,14]. Climate change, which causes an increase in air temperature, has a direct influence on crop production, although the effect depends on the stage of the rice planting process. The program in the form of strengthening farmers and institutions such as socialization, training and assistance to farmers during climate change has an impact on the rice production process. Even though support for farmers is quite important, not all countries have policies and instruments that help farmers face times of crisis due to weather changes, while farmers really need information and solutions to mitigate the impact of this food crisis ^[15].

The policy consists of institutional governance, participation of farmers, agricultural sector entrepreneurs, strengthening technology and developing agricultural production facilities ^[16]. On the other hand, research in Afghanistan shows that the geographical sectors, namely mountains, limestone/coral hills and rural areas, also have an influence on harvest success. The division of zones according to location will make it easier to determine management policies and agricultural products ^[17].

Management of the agricultural sector requires strong institutions and involves all parties, including government, entrepreneurs, academics and farmers as the final target. The results of research conducted in Banten show that the criteria for the success of agricultural sector institutions are efficiency, effectiveness, communication, coordination, infrastructure and

human resources^[18]. Institutions and organizational structures within them function to open up opportunities for agricultural transformation with the aim of empowering rather than limiting farmers' choices. Through the agricultural innovation system (AIS), various stakeholders interpret innovation from the perspective of their own privilege and power in taking initiatives in the preparation of production, infrastructure and post-harvest. These power dynamics can increase agricultural risk interventions, further marginalizing already powerless groups and strengthening power hierarchies to the detriment of small farmers. A deeper understanding of the institutional context that facilitates and maintains power relationships in agricultural innovation systems, as well as the complexities associated with the promotion of transformational agricultural innovation^[19].

The problems in the agricultural sector and food security are not only in production but also in the distribution chain. Partnerships between farmers and other value chain actors, for example companies that supply or procure production facilities, companies that will process agricultural products form their value chain. The partnership model will support small farmer entrepreneurship^[20].

4. Results and Discussion

Based on the interviews with stakeholders, the outcome of the problem in food production farms involves the following four main aspects: (1) production, (2) Post-harvest, (3) Trading system, (4) Institution.

The results of interviews with agricultural food production stakeholders show the problems faced by stakeholders in terms of production, including:

- a. Access to capital is limited, as agriculture is considered a less attractive business for financial institutions due to its high uncertainty. As a result, this sector rarely obtains loans from banks. The government needs to encourage agricultural insurance, aid, and grants with particular conditions in an effort to consider the distribution aspect in the food crop sector.
 - b. Limited land due to conversion to housing and industry and a decrease in soil fertility due to continuous land use without regard to environmental aspects. Availability of production facilities in the form of superior seeds, fertilizers, pesticides and other materials that support increased production.
 - c. The decline in the quality of fertile soil occurs due to inappropriate land use, erosion, excessive use of pesticides, reduced soil nutrients, burning of crop residues, and monoculture cropping patterns.
 - d. Fluctuation, as agriculture is a fluctuating sector because its output cannot be predicted accurately (non-linear risk) because it is very vulnerable and depends on nature. Force major is often the main risk. In addition, agricultural products as raw materials have a higher risk of perishability than other sectors' products, so they need specific handling to make them more durable with their quality maintained. This requires innovation and technology in the post-harvest phase.
- The second problem is in post-harvest condition, namely the handling of agricultural products after the harvest period. The success of handling greatly affects the quality of the product and its durability. This aspect needs to consider the following three important points:
- a. Packaging. Packaging is one method that is widely used among the public to maintain the quality, freshness and shelf life of food products. Preserving agricultural products, packaging plays an important role in preventing or reducing the impact of damage, namely by protecting the food contained in it, apart from that, the role of packaging is also to protect food from the dangers of contamination and physical damage. Agricultural products are specific items and require special handling to maintain their quality and durability. Food crops will have a longer shelf life if handled properly. For example, rice will last longer if stored in dry, not humid conditions. Storage and packaging are associated with innovation and technology used in post-harvest.
 - b. Pricing and increasing added value. Prices of agricultural products are relatively volatile because they depend on the frequency of harvest and season. One of the efforts made by the government to overcome this problem is by setting the highest retail price.
 - c. Increasing the added value of agricultural products can be done with innovation in processing and marketing. Techniques such as drying, freezing and low-temperature preservation can help extend the shelf life of local agricultural products, so they can be sold and consumed for longer periods of time.
 - d. Storage of agricultural products, The function of storage is to ensure the availability of food, as industrial raw materials, to support economic activities and to supply seeds.

e. Innovation and Technology. Both are needed to increase the added value of agricultural products. Agricultural products are perishable goods, so innovation and appropriate technology will help post-harvest handling.

The third problem is regarding the trading system, which includes various aspects at the upstream, namely the trading system for agricultural supply goods such as production facilities and other supporting equipment, and downstream such as the marketing of final products. Trading system has the following main problems :

- a. Supply chain length; In traditional agriculture, farmers are very dependent on other parties from the aspects of production, technology, and marketing. Thus far, farmers have depended a lot on middlemen or brokers to meet their needs, from production facilities to sale of harvest prices, so their bargaining position has weakened.
- b. Limited access is one of the problems faced by farmers, including access to transportation, quality seeds and fertilizer, as well as access to information, education, and training.
- c. Limited facilities and infrastructure, especially limited access of farmers to transportation, quality seeds and fertilizer.
- d. Distribution is an effort to distribute agricultural products to consumers so that they can be utilized

when needed. It is hoped that the establishment of the chain will pave the way for farmers to handle of the process from upstream to downstream so that it will provide benefits and increase their bargaining position.

The final problem is regarding institution, which is one of the important aspects in the development of the distribution of the agricultural sector. The institutional aspect consists of:

- a. Farmer groups and associations of farmer groups, which are the primary or most basic organizations established and controlled by farmers.
- b. Industrial sector support, By utilizing the technologies used, the industrial sector helps the agriculture sector grow.
- c. Local government support is important in the development of farmer organizations which then will be developed into clusters, mentoring, and coaching which include trainings and soft funding assistance.
- d. Research and development support from external parties from stakeholders in the regions, including business actors, the community, government, and academic institutions, will jointly encourage the improvement of farmers' businesses towards cluster formation.

The agricultural problem is illustrated by the network below (Figure 1).

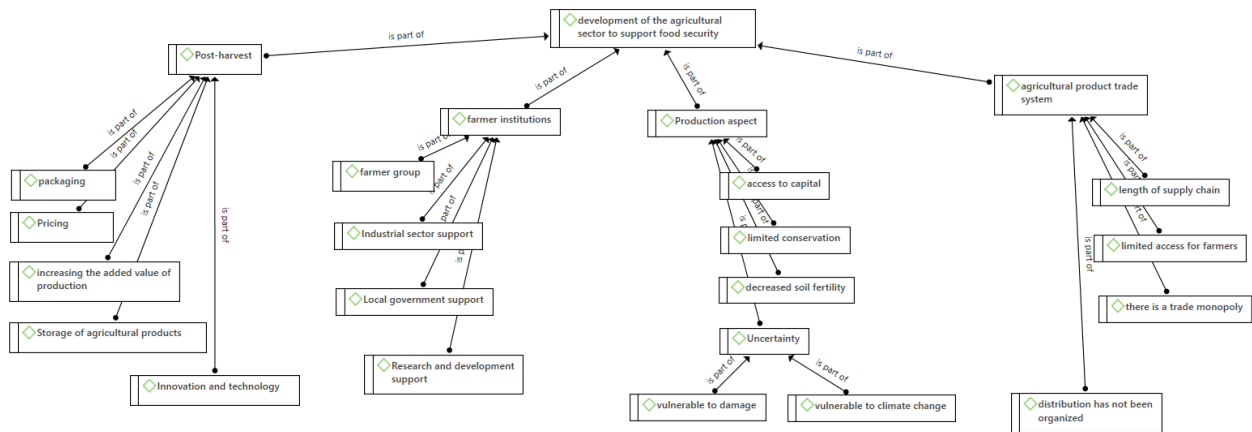


Figure 1. Network of Problems in The Agricultural Sector.

The second objective of the study was analyzed using MACTOR [21] MACTOR will explain the strength analysis of interactors or stakeholders and explore the similarities and differences of various problems in achieving the desired goal. The relationship of dependency between actors is described in four quadrants. The role of an actor is crucial in determining the

goals to be achieved in a program being carried out. The stages carried out in the analysis of stakeholders using MACTOR are: Identifying problems as well as determining actors, Filling MDI tables (Matrix of Direct Influence). This table represents the influence of interactors on other actors. Actor-objective table filling, or 2MAO, is a table that shows the relationship

between actors and objectives. This research using 9 actors, namely; (a) Farm workers; (b) land owners that large farmers who hire farm workers; (c) collectors; (d) warehousing; (e) middlemen or brokers; (f) agents; (g) retailers; (h) banking; (i) farmer coops. The objectives used in this study were (a) transportation (b) risk (c) price (d) distribution; and (e) profit. Figure 2 shows the results of Mactor's analysis on the competitiveness of each actor, especially the levels of dependence and influence.

The results show that the actors with the highest

competitiveness were collectors followed by agents and middlemen. These results indicate that the distribution channel has the strongest competitiveness in the supply chain. Land owners are ranked fourth in competitiveness, which means that although they are at the core of food security, they are not the main figures in the supply chain. The actor with the lowest competitiveness is farm labor.

Figure 3 shows the convergence relationship between actors in stakeholder analysis to identify actors who are closely related to food distribution :

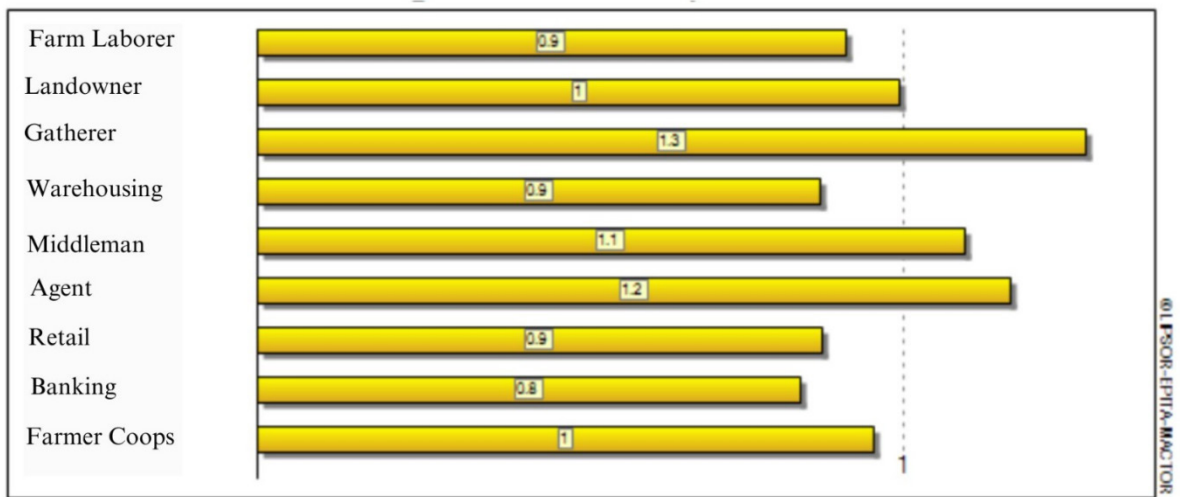


Figure 2. Competitiveness Between Actors in The Food Distribution Chain.

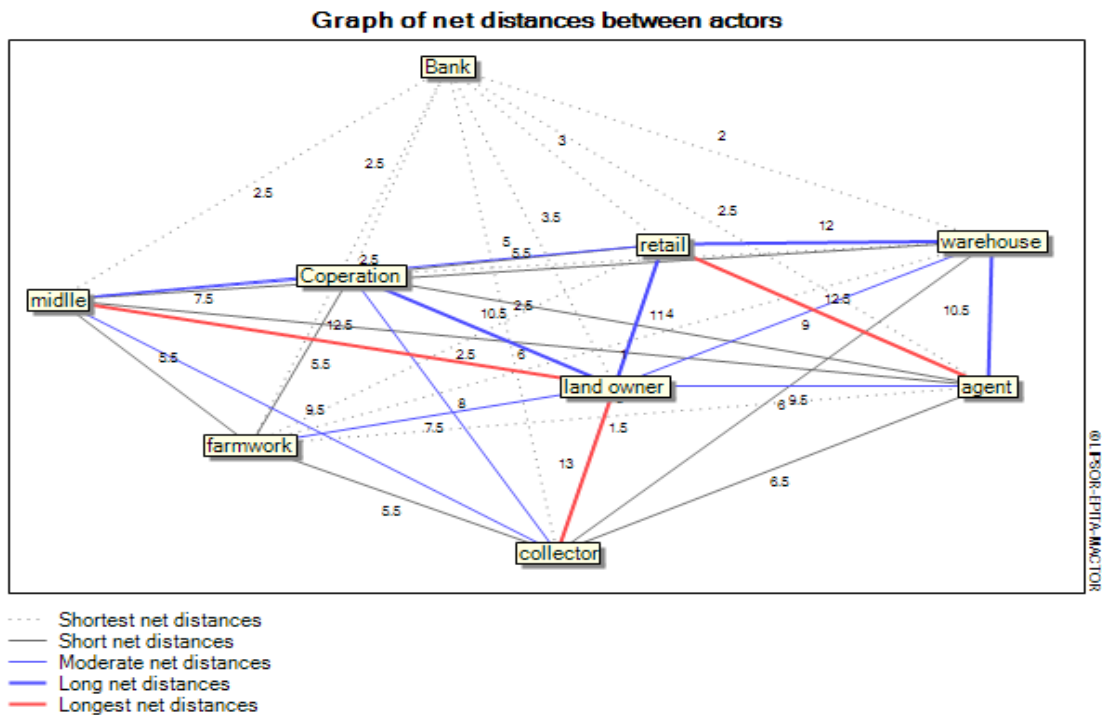


Figure 3. Net Distances of Food Distribution Supply Chain.

Figure 3 shows that the actors with the highest potential for alliances are land owners, middlemen, and collectors (red lines), while retailers have very strong alliance potential with agents. Cooperatives have strong relationships with middlemen, land owners, and retailers, while retailers have strong relationships with warehousing and land owners (blue lines). Interestingly, banks do not have a close relationship with any actor, a phenomenon that is different from the general hypothesis so far.

5. Conclusions

The results show that problems with food availability in Pacitan can be found from the upstream to the downstream, from production, provision of production needs, post-harvest management, to product distribution to end-consumers. The main actors involved in the supply chain are collectors, agents, and middlemen, while land owners, farm laborers and cooperatives have low competitiveness. This shows that the government needs to strengthen the competitiveness of landowners, farm laborers, and cooperatives through institutional development such as the Association of Farmer Groups and cooperatives thus creating good synergy and cooperation between these actors so that food security can be maintained.

Author Contributions

Study conception and design: Nurul Istiqomah, Izza Mafruhah; Data Collection: Dewi Ismoyowati; Analysis and Interpretation of results: Nurul Istiqomah, Izza Mafruhah, Dewi Ismoyowati; draft manuscript preparation: Nurul Istiqomah, Izza Mafruhah. All authors reviewed the results and approved the final version of the manuscript.

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Data Availability

The data that support the findings of this study are

available from the corresponding author upon reasonable request.

Conflict of Interest

The authors disclosed no conflict of interest.

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