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Analysis of institutional paprika supply chain in Pasuruan Regency

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Abstract. Paprika is a commodity that being developed in Pasuruan Regency. Paprika supply chain activities in Pasuruan Regency have problems in supply availability and development of marketing strategies. Fixing the problem allows paprika from Pasuruan Regency to compete with another commodity producers and expanse their market products. The purpose of this study is to determine the model of the institutional structure of the supply chain of paprika, to determine the elements, sub-elements, and relationships between each element in the supply chain. This study used Interpretive Structural Modeling (ISM) for method which involves 5 experts as respondents. The results show that there are four key elements including elements of constraints, needs, goals and institutions involved. Based on the Dependence Drive-Power (DP-D) matrix, the key sub-elements of the needs element are capital, were positioned in the independent sector. The DP-D matrix for key sub-elements of the element of need is the improvement of distribution facilities and infrastructure and the enhancement of the role of farmer groups were positioned in the linkage sector. In the DP-D Matrix for objective elements, there are key sub-elements, namely increasing productivity in the Linkage sector. Actors who act as key sub-elements of the elements of the institution involved are farmers and wholesalers. The findings of this study suggest several managerial implications to be carried out in paprika supply chain activities namely increasing productivity, coordinating between actors in the supply chain, obtaining capital assistance, and assistance in facilities both in production and distribution activities by the government.

1. Introduction

Horticulture is a commodity that has the potential to be developed in Pasuruan Regency. Developing paprika cultivation has currently becoming the attention of Indonesian Government. Paprika has great potential in terms of quality and quantity, with the average production accounts for 4 tons per month. However, the commodities production potential was unsupported by the capability to compete in the market.

Paprika supply chain activities in Pasuruan Regency have problems in providing supply availability and developing the marketing strategies. Commodity competitiveness is influenced by the institutional strength of farmers. Farmers still depend on other parties in the distribution of paprika to consumers. The dominance of middlemen is an obstacle for farmers for pricing and market expansion. Middleman plays a major role in the distribution of commodities such as paprika and other vegetable commodities. The institutional roles to support those commodities bargaining position in the market are crucial.

Another obstacle in farming is according to Smith [1] that farmers can produce products that the market needs but farmers have difficulty accessing the market. Farmers cannot increase income due to lack of profitable market access and more often farmers are forced to sell their products to buyers at whatever price they specify. The implementation of a strategy that is in accordance with the needs is needed to strengthen farmer groups in an effort to improve performance [2]. The roles of institution to enhance the commodities competitiveness are necessary. Constraints in the paprika supply chain in this study were analyzed with an institutional approach, namely the interpretive structural modeling method. The purpose of this study is to determine the model of the institutional structure of the supply chain of paprika, to determine the elements, sub-elements, and relationships between each element in the supply chain.

2. Research Methods

This research was carried out in Senda farmer group, Tutur District, Pasuruan Regency. The collected data were analysed in Agroindustry Management Laboratory, Dept. of Agro-industrial Technology, Faculty of Agriculture Technology, Universitas Brawijaya, Malang. There were five expert respondents involved, include 1 farmer, 1 middleman, 1 wholesaler, 1 staff of Agricultural department in Pasuruan Regency, and 1 staff of Agricultural department in Tutur District. Data collected from these respondents are ISM scoring with VAXO questionnaire for every element. ISM uses an interpretive approach based on the experts' judgments for establishing the contextual relationship among the different and directly related elements to obtain paprika's supply chain profile and condition.

2.1. Instutional analysis

In this case, the problem limitation includes the boundary analysis of only four elements out of nine institutional program elements. Those four elements are main obstacle, program requirement, and program goals, and institution involvement. These elements were determined through interview with the expert respondents. Then, each element was divided by several sub-elements as seen in Table 1.

2.2. Data analysis

The Interpretive Structural Modelling (ISM) method was used to analyse the data of paprika supply chain in Pasuruan District. This method was used to analyse the system elements as a graphical representation, showing a direct relationship among elements and the hierarchical arrangement. Generally, ISM technique was divided into two parts: element classification and hierarchy arrangement. ISM implementation process steps are as follows: 1) variable identification, 2) contextual relationship determination, 3) structural self-interaction (SSI) matrix development using pairwise comparison, 4) matrix transformation into Reachability Matrix, 5) transitivity assessment, 6) final reachability matrix arrangement, 7) directed graph withdrawal, and 8) transitive link deletion.
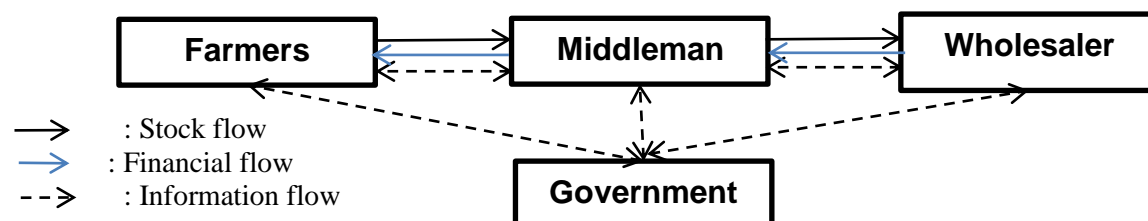
Table 1. Elements and sub-elements of supply chain organization.

Element	Sub-element
Obstacle	The amount of production has not met demand (B1)
	Lack of post-harvest handling (B2)
	Lack of facilities and infrastructure (B3)
	Lack of relationships between actors in the supply chain (B4)
	Lack of market access (B5)
	Capital (B6)
Requirement	Material handling technology (N1)
	Training assistance (N2)
	Improvement of distribution facilities and infrastructure (N3)
	Procurement of storage / warehouse (N4)
	Maximizing the role of farmer groups (N5)
	Availability of market information (N6)
	Capital assistance (N7)
Goal	Increasing supply chain revenue (G1)
	Increase productivity (G2)
	Ensure stability of supply flow (G3)
	Increase capital access (G4)
	Reducing material damage (G5)
	Improve product quality (G6)
Institution	Farmer (A1)
	Middleman (A2)
	Wholesaler (A3)
	Goverment (A4)

3. Results and Discussion

3.1. Paprika supply chain in Pasuruan Regency

The flow of goods or products is initiated by paprika farmers as suppliers and producers starting from paprika sales activities (Figure 1). Paprika is sold based on shape and color, there are various types of quality adjusted based on the market demand. Based on its quality paprika is divided into three types, namely grade A, B and C. Grade A is a super quality paprika type which is intended for export markets and for special local markets. Grade B is intended for local markets with certain contracts, such as supermarkets and fast food restaurants. Grade C is intended for independent local markets such as traditional markets. Based on interviewed with one of the farmers in the Senda farmer group, the production of paprika with grade A quality ranges from 10-15%, grade B ranges between 40-50%, and grade C ranges from 35-40% of total harvest per month. The low number of grade A and high number of grade C indicated that production in the Senda farmer group has problems, in terms of pre-harvest and post-harvest treatment that affect selling price and low income.

Figure.1 Paprika supply chain in Pasuruan Regency.

Demand and supply level is the main factor that determine of selling price in a commodity. In general, farmers have a weak bargaining position to determine the selling price.. Paprika will be purchased by middlemen who already have established partnerships with farmers. Harvesting of paprika is based on the flow of information from the farmers to the middlemen who need farmers. Brokers from the point of view of farmers can be friends or opponents. Brokers can play an important role in the distribution of paprika to consumers, but often give losses to farmers. In the sale and purchase activities, generally middlemen play prices both at the farmer level and at the distribution level. The lack of market information on actors in the supply chain is very beneficial for middlemen. Brokers can raise the selling price from 30% to 50% of the purchase price at the farmer. The domination of middlemen and wholesalers can be reduced by government participation. The government acts as a facilitator, supervisor and policy maker in economic activities. The government can provide assistance in an effort to strengthen farmers' selling positions in the market such as financial assistance, repair of facilities, training and supervision of each supply chain activity. Efforts to strengthen the position of farmers in the market are by strengthening the internal and external conditions of farmer groups.

3.2. Obstacle element analysis

The DP-D matrix in Figure 2 shows the sub-elements of the amount of production that have not met demand (B1), the lack of post-harvest handling (B2) and capital (B6) are in the IV sector Independent. This means that the these sub-elements have a strong influence on other sub-elements in the Linkage and Dependent sectors, namely the sub-elements of the lack of distribution facilities and infrastructure (B3) and the lack of relationships between actors in the supply chain (B4) and the lack of market access (B5) . The diagram in Figure 2 shows the influence between sub-elements where capital sub-elements are at level 4, which means that capital sub-elements are key elements of supply chain constraints.

The capital sub-element is in an independent quadrant which means that the sub-elements affect other sub-elements. Capital greatly influences the sustainability of both production and distribution such as availability of facilities and infrastructure, quantity and quality of products, and market access. Capital is the main driver of production activities, so maintaining the stability of funds flow in the business is critical [3]. Capital in the paprika supply chain still comes from individual actors. Capital in production activities can be in the form of land, labor, seeds, inputs, and water. Non-production capital can also be in the form of improving the quality of labor, technology transfer and improving facilities and infrastructure [2].
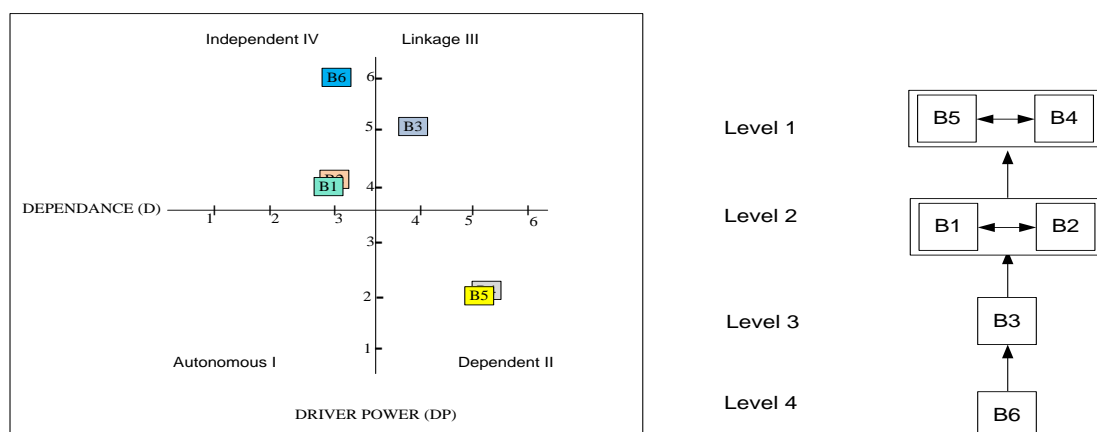

Figure 2. DP-D matrix and diagram of obstacle element structural model.

3.3. Requirement element analysis

The DP-D matrix in Figure 3 shows that almost all sub-elements are in the Linkage sector. This means that the sub-elements in the sector linkage have a relationship with each other. In the DP-D matrix it can be seen that the sub-elements of improvement of distribution facilities and infrastructure (N3) and maximizing the role of farmer groups (N5) have the highest driver power. Production facilities and supply chain infrastructure are the important factors in supply chain activities such as irrigation, road, vehicle, and cold storage to improve supply chain performance [2].
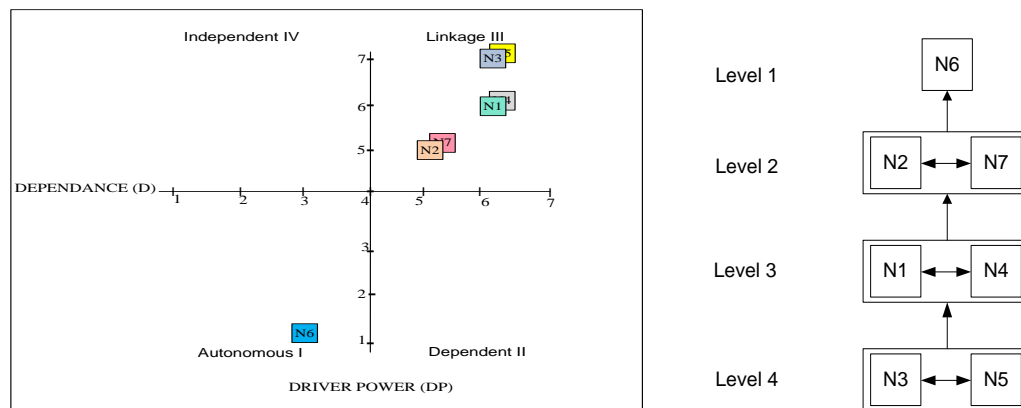

Figure 3. DP-D matrix and diagram of requirement element structural model.

The structural model diagram shows key elements of supply chain requirement, namely the sub-elements of maximizing the role of farmer groups and improving facilities and infrastructure. Maximizing the role of farmer groups as intermediaries in organizations can provide support for farmers in farmer groups in an effort to improve farmer performance. Strengthening the role of farmer groups can help improved in information management, information mediation, new technology education, and business cooperation [5]. Budiarta [6] stated that farmer groups have an important role in a farming business. Farmer groups act as activity planners, institutional relations, technology dissemination, and capital. According to Hasibuan [7], institutional relations exist between farmer groups and related institutions, for example the government, banks or cooperatives.

3.4. Goal element analysis

In Figure 4 shows the sub-elements of increasing supply chain revenue (G1), increasing supply chain productivity (G2), ensuring supply flow stability (G3), reducing material damage (G5), improving product quality (G6) located in one sector, the sector linkage. This means that the five sub-elements are interconnected with other sub-elements in the sector. The figure shows that the sub-element of productivity improvement is a key element of supply chain goal. Increased productivity can be done with land intensification and extensification. Increased production not only from the number of results produced but also in terms of stability and quality [4]. Products with good quality and stability of supply will strengthen selling prices, and provide a special attraction for investors to invest in production development [8]. According to Dass [9], in an effort to increase production income it will be easier to obtain when production flow is more stable because a stable production flow can facilitate in decision making. .
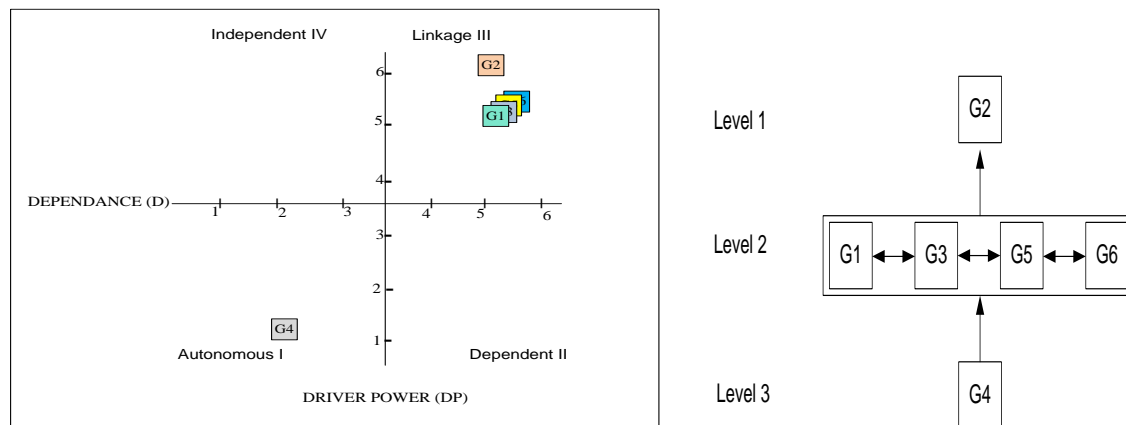
Figure 4. DP-D matrix and diagram of goal element structural model.

The goal element diagram also shows that sub-elements of productivity improvement can affect other sub-elements. Increased productivity can be done with the application of technologies in production activities such as fertilizing to enriching the soil by regulating nutrient levels [10]. Increased productivity can also be achieved through replacing traditional varieties with hybrid types and adopting better production technologies [11]. Another way to increase productivity in farming can be done by increased production capacity, product quality and maintain the stability supply [12]. The quality of vegetables that consumers want is fresh produce. Vegetable quality is assessed by color and appearance, taste and aroma, texture and nutritional value.

3.5. Institution element analysis
Institutional sub-elements that are considered as the main factor in improving the performance of paprika supply chains in Pasuruan Regency are farmers and wholesalers (Figure 5). Farmers are cast in the arrangement of both production and distribution planning. Farmers have an important role in the supply chain, where farmers are able to contribute to the high and low performance of the supply chain [13]. Wholesalers are broader trade chains. Many risks are faced by wholesalers to meet market demand, including high supply [1]. Actors in the supply chain have a relationship of interdependence both in terms of information transfer and resources. Actors in the supply chain can provide benefits, constraints or challenges between actors in the supply chain, so that partnership coordination needs to be well established [14].
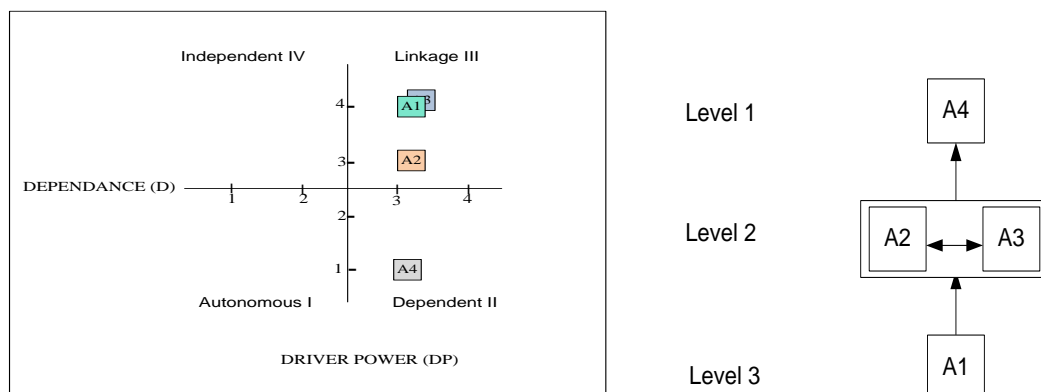

Figure 5. DP-D matrix and diagram of institution element structural model

3.6. Managerial implication

The findings from observation and ISM analysis suggested the following managerial implication include increasing productivity, coordinating between actors in the supply chain, obtaining capital assistance, and government assistance in terms of production and distribution facilities.

4. Conclusion

Actors in the paprika supply chain consist of farmers, intermediaries, wholesalers and the government. A key element in supply chain barriers is capital. To increase competitiveness, the supply chain must maximize the role of farmer groups and improve facilities and infrastructure. The goal must be done by increasing productivity to reduce the number of down grade products and improve supply stability. These key elements require the role of farmers as producers and the core of the paprika supply chain.

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