Development of Potato Chip Cluster Supply Chain Institutional Model with The Integration of ISM (Interpretive Structural Modeling) and ANP (Analytic Network Process)

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ABSTRACT

Increasing the productivity of potato chip in Micro, Small, and Medium Enterprises (MSMEs) through the institutional model is significantly strengthening the economy of Batu City, especially as a tourist destination city. The institutional model ensures the smooth operation of supply chain activities due to the interactions between the actors, facilitating coordination, information sharing, and integration from upstream to downstream. This model can be used to improve the performance. To improve the performance, supply chain of potato chip MSMEs cluster faces several challenges including a limited supply of raw materials and finished products, price fluctuations, non-optimal drying processes, and inconsistent quality. Therefore, the study aimed to conduct a holistic evaluation and improvement method on the interconnected constraints to enhance supply chain's performance. The integration of Interpretive Structural Modelling (ISM) and Analytic Network Process (ANP) methods was applied to observe interactions between key elements in development of supply chain institutional potentials and to prioritize development strategies. The results showed that the key elements that influenced development of the organizations related to labor capability, diversity of raw material quality, the potential for collaboration relationships, minimizing the risk of drying during the rainy season, and participation of various actors. Based on the largest WANP weight value (0.230), the primary strategy for supply chain development in the SME cluster was the implementation of digital-based marketing. Furthermore, improving the institutional performance model of potato chip MSMEs cluster supply chain included the participation of internal and external quality assurance organizations in the product quality audit process. Ensuring product quality consistency through these audits would support digital-based marketing and help mitigate issues related to product quality and supply consistency.

Keywords: MSMEs cluster; potato chip; supply chain organizations

INTRODUCTION

The COVID-19 pandemic in Indonesia caused a global economic downturn in the second quarter of 2020 and exerted pressure on the economy, evidenced by declines in consumption levels, consumer confidence, and production activity. The decline is evidenced by the decrease in Gross Domestic Product, showing a drop in economic movement from IDR 2.7 trillion in 2019 to IDR 2.5 trillion (Ministry of Finance, 2021). In this context, Micro, Small, and Medium Enterprises (MSMEs) are still the most critical pillars of the Indonesian economy until 2021 with agro-industrial comprising 99.92% (64.13 million) of the 64.19 million MSMEs. Therefore, the ability to seize opportunities and anticipate possible threats during the pandemic and post-pandemic is essential.

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Reflecting on this evidence, economic improvement is achieved through the improvement and development of an agro-industrial supply chain based on superior regional agricultural commodities. From socio-economic, technical, and institutional perspectives, superior commodities hold strategic positions and potential for development. Using superior agricultural commodities with local natural resources to create value-added products with competitive advantages can lead to regional superior products (PUD).

In this context, PUD has a high market value and can improve the welfare as well as the economy of regional communities produced by the Cooperative-MSMEs (KUMKM) processed food in Batu City. In 2022, there are 7,396 horticultural-based food processing SMEs supporting Batu City's economy as a national tourist destination. Data from the Batu City Industry Department for 2021 shows an increase in productivity for 40 medium-small scale businesses (from 395 to 435 units), and 50 micro-scale (from 429 to 479 units). Batu City's potential as an agropolitan city includes the production of various horticultural products such as potatoes (Sofiana, 2021). According to Indonesian Statistics (2019), potato productivity reached 9,138 tons, presenting opportunities for chip business to expand. From 2016 to 2022, the number of potato chip MSMEs grows to 54, though only 9 SMEs remain operational post-pandemic (Kusumaningtyas, Mustaniroh, Astuti, et al., 2021).

Batu City has potatoes as a leading commodity, supported by the sixth largest harvested area in East Java (396 Ha) and a total production of 94,014 quintals (BPS Kota Batu, 2020). The superior processed potato product in Batu City is potato chip which is produced by SME. The average yield of slicing potatoes ranges from 74.77 to 87.82% (Thoriq et al., 2018) suggesting both technical and financial feasibility for sustaining potato chip production (Thoriq et al., 2019). In 2020-2021, 30 registered potato chip MSMEs in Batu City operated but only 9 units remained active during the pandemic. These include 5 micro and 4 small cluster units which are categorized by production capacity, monthly turnover, number of workers, length of operation, and halal certificate ownership as shown in Table 1 (Wahdania et al. 2021). The reasonably high competition between potato chip producers has led to several obstacles. Therefore, development strategy is needed including clustering SMEs based on specific criteria (Fleischmann et al. 2017).

Table 1. Results of clustering of micro and small-scale potato chip MSME

No	Indicator	MSMEs cluster	
		Micro scale	Small scale
1	Income per month (IDR)	16.800.000	42.500.000
2	Production capacity (kg)	16	53.75
3	Workers (people)	6.4	12.75
4	Operational time (years)	11.2	12.5
5	Halal Certification	1	1

The supply chain institutional model is a form of operational management perspective composed of interactions between actors, behavior among actors, and technical elements to facilitate operations. The connectedness of actors from upstream to downstream including suppliers (farmers, collectors, and cooperatives), producers, as well as distributors/ retailers through supply chain organizations helps form an ideal industrial structure and survival strategy for SMEs. This will further facilitate coordination, information sharing, and integration of upstream to downstream, as well as efforts to improve performance (Rosidi et al., 2017; Wibowo et al., 2021). The scope of this study is to enhance operational management performance through strengthening institutional structures in potato chip MSMEs, focusing on relationships including several partnership parties. Therefore, this study aims to analyze key elements and develop alternative proposals for developing an institutional model for potato chip supply chain. Increasingly dynamic market challenges and open global competition require institutional strengthening and independence for MSMEs. An appropriate supply chain institutional model will support performance and operational improvements in potato chip MSMEs in Batu City.

Existing obstacles in the institutional supply chain of potato chip MSMEs in Batu City include limited inventory of raw materials, semi-finished, and finished products, as well as inconsistent quality. Limited supply is due to the impact of the drying process not being optimal which is also constrained by the rainy season and unstable deliveries from suppliers, leading to inconsistent quantity and quality with demand. These obstacles MSMEs face are interconnected, thereby holistic evaluation and improvement are needed. Increased performance, efficiency, and profits of supply chain actors can be further achieved through appropriate integration and collaboration between parties.

The current structuring of the agribusiness and agro-industry institutional model is mostly performed manually in terms of real conditions and relationships between the engaged organizations. This can also be

performed without applying certain methods to determine the most optimal and appropriate institutional model. The upstream supply chain has a flow of relationships providing raw materials, information, finance, and products to the downstream. The relationships between organizations have interactions whose structure can be mapped to obtain a more effective institutional model. Furthermore, the Interpretive Structural Modeling (ISM) method is appropriate for supply chain institutional model because it describes the interconnections between key elements through a structure. The integration with ISM method can produce new alternative institutional structures (Rosidi et al., 2017).

Institutional structuring using ISM method is carried out without considering the weight of assessing the relationships between key elements. ISM output serves as input for Analytic Network Process (ANP) analysis to compile and determine strategic alternative priorities. This method is used to understand the interactions between criteria that will support the calculation of weights in ANP model. The integration of ANP and ISM methods can expand the static version of ISM, overcome complexity, and offer alternative and effective strategies in decision-making by considering supply chain aspects (Arsiwi & Adi, 2020). The output of the integration in this study leads to alternative and prioritized development strategies, as well as proposals for enhancing supply chain institutional model to improve the performance of potato chip micro-cluster MSMEs in Batu City.

Based on the description, supply chain actors need to evaluate and develop strategies to improve supply chain efficiency and performance. Clear relationships between actors and key supporting elements will facilitate the proposal of relevant strategies. Therefore, alternative methods can mitigate problems and produce appropriate proposals for developing an institutional model. This study expects that supply chain actors can use alternative institutional model in potato chip MSMEs cluster in Batu City to increase efficiency and productivity.

METHODS

The study was carried out on micro and small clusters of potato chip MSMEs in Batu City, including representatives from each cluster. More micro-cluster remained active during the COVID-19 pandemic than small units. The selection was based on potato chip MSMEs clustering results by Wahdania et al. (2021). There were 30 registered potato chip MSMEs in Batu City between 2020 to 2021 and 9 units were actively operating during the pandemic. These included 5 MSMEs categorized in the micro and 4 in the small cluster based on indicators of production capacity, monthly turnover, number of workers, length of operation, and ownership of a halal certificate. Furthermore, problem analysis was carried out through interviews and discussions with respondents, observations in micro-cluster SMEs, and strengthened by relevant literature.

The stages of the study implementation were presented in Figure 1. These stages included determining key elements and filling out ISM as well as ANP questionnaires with 5 expert respondents namely 1 micro-cluster SME representing 9 MSMEs with homogeneous conditions and 2 consultants from the Batu City Integrated Business Service Center who understand the potential for SME development. Additionally, this study also included 1 representative of the Batu City Industry Service who understood the regulations and business climate of MSMEs in Batu City and 1 academic who understood MSMEs' system and institutional development from an academic perspective.

Respondents and MSMEs included in the study were determined using a purposive sampling method. This implied that the samples were deliberately selected to meet the needs and requirements of the study because the population (MSMEs cluster) was infinite. Purposive sampling represented a method that originated from a deliberate selection of a population because the quality and representation of the sample were relevant to the objectives (Etikan, 2016). The data analysis method was conducted through simultaneous integration of ISM and ANP methods as explained in the input-process-output method system as shown in Figure 1.

The institutional structure was analyzed using ISM method describing the parties in supply chain. ISM analysis focused on supply chain operations of potato chip MSMEs due to the partnership's close relation to institutional strengthening. The analysis further explained 5 key elements namely main constraints, possible changes, program needs, program objectives, and organizations participated. These elements were reviewed from existing conditions and stakeholder needs, referring to the potential for developing supply chain institutional model. Identifying key elements of potato chip supply chain began with the main constraints, followed by potential changes, supply chain needs, and the objectives to be achieved. The main constraint elements, possible changes, program needs, and program objectives were detailed into 5 key sub-elements while the participating organizations included the main supply chain actors. Relationships between sub-elements in each key element were identified using

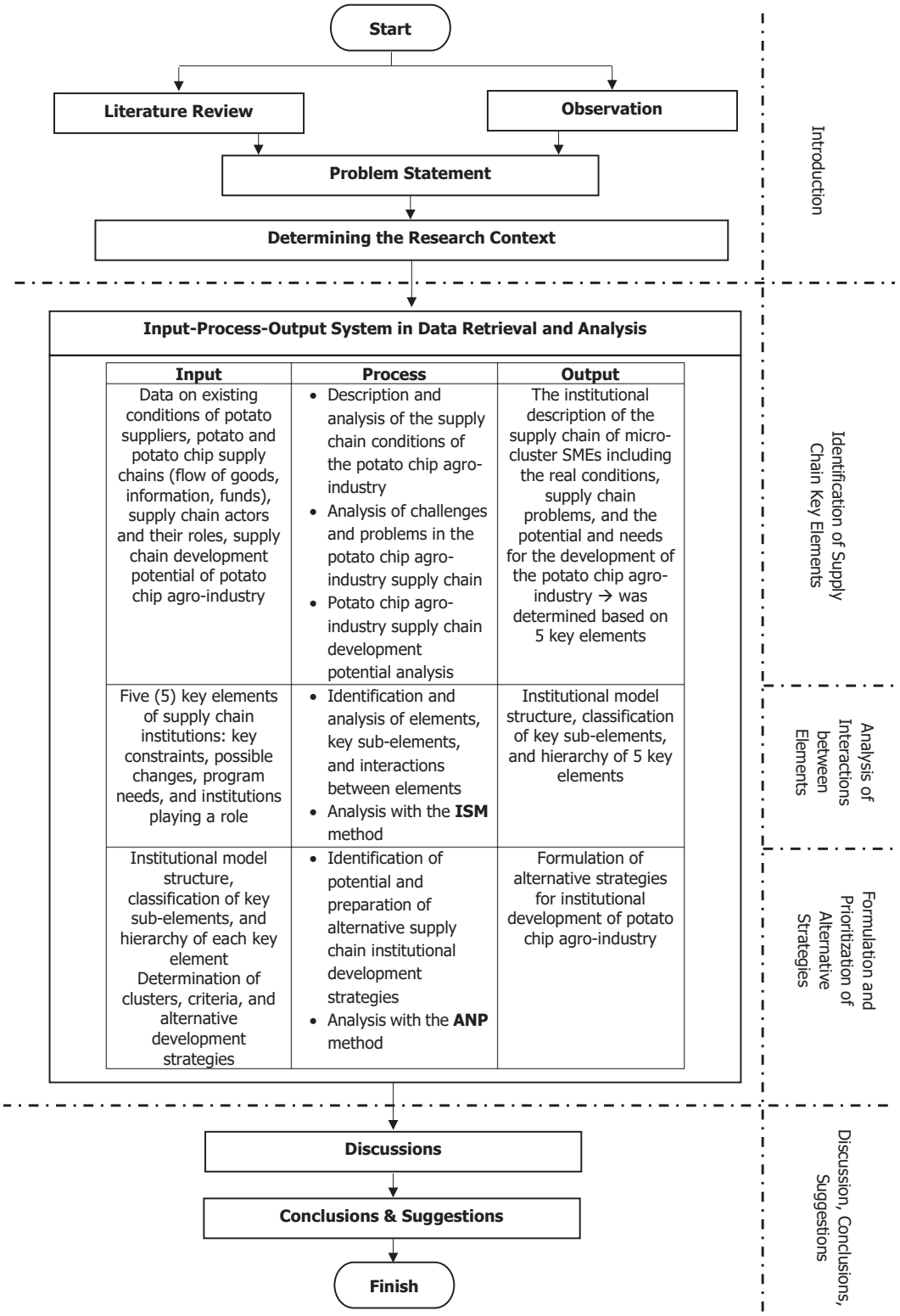


Figure 1. Study flow diagram

the structural self-interaction matrix (SSIM) as initial input for ISM method. The discussion of ISM analysis focused on directed graph output where the lowest-level sub-elements showed high independence and the top-level suggested greater dependency (Darmawan, 2017; Yang & Lin, 2020).

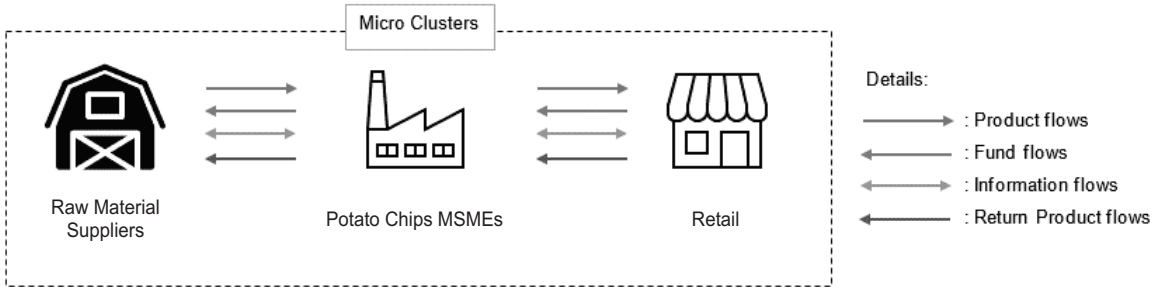


Figure 2. Micro-cluster supply chain of potato chip MSMEs

RESULTS AND DISCUSSION

The institutional structure of the micro- and small cluster potato chip supply chain in Batu City included 3 main factors namely collectors, MSMEs, and traders (retail and wholesale), as the basis for determining business development strategies. Figure 2 further showed the interactions between supply chain actors in the micro-cluster in Batu City.

Actors in the upstream micro-cluster included raw material suppliers such as potato collectors from the Vegetable Market in Batu City. Local raw material suppliers had closer distances and shorter waiting times, facilitating product creation. Geographical proximity supported cooperative trust, created better coordination between suppliers and customers, as well as facilitated the flow of raw materials (Timisela et al., 2017).

MSMEs acted as producers who processed raw materials into potato chip products. Processing potato chip from raw materials helped maintain and guarantee product quality. Collaboration between producers and suppliers was closely related to the quality of finished products. This was because the quality standards of raw materials agreed upon by both parties and supplied by suppliers directly affected product quality. Furthermore, fulfilling raw material needs improved the performance of MSMEs because production activities operated smoothly, and there was continued cooperation with suppliers in procuring raw materials. Integration between actors in supply chain could also produce higher performance, especially for food companies carrying out production from the start (Ali et al., 2021). The flow of goods and information in supply chain contributed to the smooth flow of funds/ finance because the needs of each actor were met. In this context, financial transactions between supply chain actors could add value according to the product flow. Accuracy in inventory management and use of raw materials or semi-finished products in production was part of the efforts to determine the added value customized to the partnership's capabilities.

In this study, sales of potato chip to micro-cluster MSMEs were carried out through retail as an intermediary in the form of the owned shops and social media, including in level I marketing channels before reaching customers. Currently, MSMEs have not collaborated with external parties in product sales leading to relatively lower product prices than those through external distributors, such as sales and gift shops. The advantages of the sales system of micro-cluster MSMEs included ease of selling potato chip, receiving suggestions for improvements directly from consumers, and understanding consumer needs. This further facilitated the easy adaptation to market dynamics for MSMEs. Marketing channels that were Direct and owned marketing channels provided larger margins and facilitated producers in understanding product evaluations and company value propositions from customers (Osterwalder & Pigneur, 2017). The flow of the micro-cluster supply chain was presented in Table 2.

Problems in the micro-cluster's supply chain included limited supply such as raw materials, semi-finished, and finished products, as well as inconsistencies in the quality of potatoes and chip. Raw material constraints led to unplanned production stops (downtime), affecting profit margins and overall supply chain management (Sumantika et al., 2021).

Limited supply was due to the drying process during the rainy season which took longer because of reduced sunlight intensity (more than 3 days) and increased the chance of moldy potato baskets (decreased quality). These constraints impacted the stock levels of *krecek* and potato chip, as well as caused delays in the flow of goods from MSMEs to retail. Under normal conditions, production capacity could meet market demand by an average of 100 kg per process. However, MSMEs experienced a surge in demand of up to 300% due to increased tourist activity in the Batu City Tourist Destination during the holiday season (end of year and holiday celebrations). Limited inventory further led to a restricted number of products being distributed, thereby

Table 2. Potato chip agro-industry supply chain activities in Batu City

	Micro-cluster		
	Goods flow	Information flow	Funds flow
Supplier	• Potato collector from Vegetable Market, Batu City • Deliver potatoes • Receive potato returns	• Receive orders for potatoes • Inform inventory • Inform the inventory constraints	• Receive payment for potatoes (immediate payment in full)
MSMEs	• Receive and process potatoes into potato chip (production capacity ±100 kg per production) • Deliver products • Prepare supply of *krecek* and potato chip • Return returned potatoes return	• Order potatoes (quality and quantity of potatoes, delivery time, price) • Receive a request for potato chip • Document the customer request data • Inform potato chip supply • Inform production constraints • Inform if there are potato returns	• Pay potatoes • Receive money from sales of potato chip and seasoned potato chip
Merchant (retail)	• Sell and distribute potato chip offline and online (Whatsapp) • Retail: Shops owned by MSMEs • Manage returned potato chip	• Received a request for potato chip • Inform the demand for potato chip • Inform criticism and suggestions from customers • Inform about potato chip returns	• Obtain payment for products • Send payment for potato chip (payment in full without product returns)

not all customer requests could be fulfilled due to the priority of product delivery to existing customers. The obstacle experienced during the COVID-19 pandemic was uncertainty in supply and demand. In terms of supply, MSMEs experienced a decrease in supply of raw materials. In contrast, there was a sudden decrease or increase which affected the production and operational capabilities of MSMEs (Chatterjee et al., 2022).

Analysis of Institutional Structure Using ISM Method

The key elements of supply chain were outlined in Table 3.

The main constraint elements represented the constraints and challenges potato chip MSMEs cluster faced in supply chain operations. The driving sub-elements for the main constraint elements were low workforce capability (labor discipline level) and variation in raw material quality (potato size was not uniform). Drying problems occurred during the rainy season because the process using sunlight was not optimal (exceeding the normal time), leading to limited supply of semi-finished and finished products, as well as inconsistent quality of potato chip due to improper drying. Success in mitigating the constraints of low workforce capacity and variations in raw material quality would resolve the problem of inconsistent chip quality and partnership relationships.

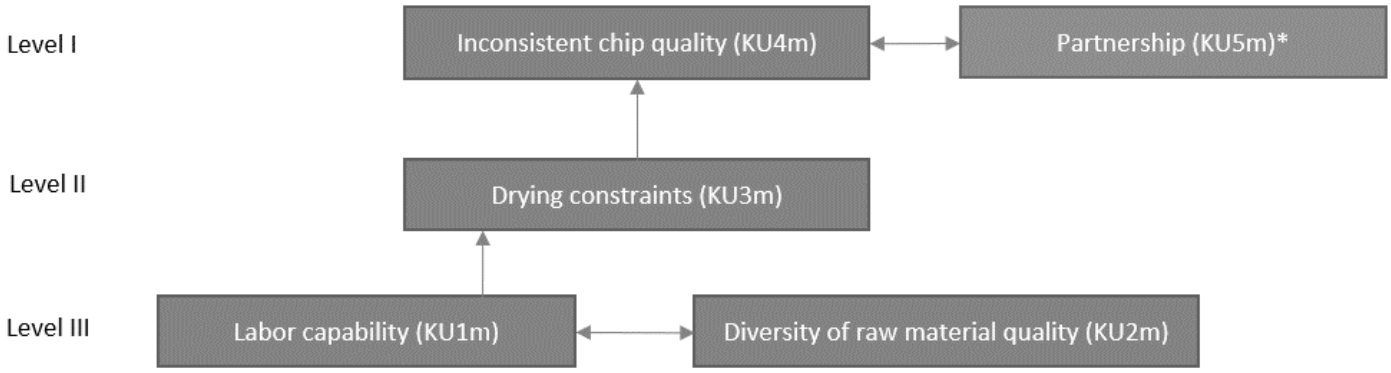
A directed graph of the main constraint elements of the micro-cluster was observed in Figure 3.

Possible change elements were potential improvements that could be made to mitigate the main constraint elements. Figure 4 showed a directed graph of micro-cluster.

Workforce training and development as those in control of supply chain activities was the most inclined change to be implemented by the micro-cluster because it had the highest independence value. This could also

Table 3. Identification of key elements of potato chip supply chain in micro-cluster MSMEs

	Main obstacle	Possible changes	Program requirements	Program objective	Participating organizations
Code	KU	PD	KP	T	L
1	Low workforce capability in carrying out production	Implementation of training and development activities (capabilities) of the workforce regularly	Workforce training and development regarding GHP, GMP, and production SOPs (basic strengthening of the quality management system)	Increasing workforce skills and SMEs' productivity	
	Primary Data, 2022	Primary Data, 2022	(Anh Do & Bui, 2022)	(Anh Do & Bui, 2022)	
2	Variability in the quality of potato raw materials supplied (low supplier institutionalism)	Standardization of potato quality before delivery	Standard agreement on potatoes delivered (between SMEs and suppliers)	Consistent quality and quantity of potato supply to be processed	
	Primary Data, 2022; (Sarinah & Djatna, 2015; Timisela et al., 2014)	Primary Data, 2022; (Sarinah & Djatna, 2015; Timisela et al., 2014)	Primary Data, 2022	(Hayuningtyas et al., 2019; Kusumaningtyas et al., 2021)	Collectors as raw material suppliers (L1)
3	Constraints on drying during the rainy season and limited supply of *krecek*	Rescheduling production by considering the risk of limited potato supply, drying problems in the rainy season, and spikes in demand	Improved production planning and guaranteed supply of *krecek* and potato chip	Consistency of quality and quantity of supply (*krecek* and potato chip)	Potato chip MSMEs as producers (L2)
	Primary Data, 2022; (Mustaniroh et al., 2021)	(Dania et al., 2012; Nemtajela & Mbohwa, 2017)	(Nemtajela & Mbohwa, 2017)	(Sarinah & Djatna, 2015; Timisela et al., 2014)	Retail/ wholesale as potato chip trader (L3)
4	Inconsistent quality of potato chip	Implementation of potato chip quality standardization system and implementation of quality audits by SMEs	Improvement of potato chip quality standards	Standardization of quality and consistency of potato chip production results	
	Primary Data, 2022; (Sarinah & Djatna, 2015; Timisela et al., 2014)	(Bai et al., 2021; Hadi et al., 2021; Hayuningtyas et al., 2019)	(Arifin et al., 2021)	(Arifin et al., 2021)	
5	Partnerships are not based on collaborative relationships (not considering the benefits for all supply chain actors)	Providing supply chain information system for each actor (facilitates interaction and synergy between actors)	Evaluate 3 flows of potato chip agro-industry supply chain periodically to support the achievement of profits for all supply chain actors	Collaborative relationships between supply chain actors in a sustainable manner (supporting the achievement of benefits for all parties)	
	Primary Data, 2022; (Bai et al., 2021; Shafi et al., 2020)	(Bai et al., 2021; Dania et al., 2018; Tamtam & Tourabi, 2021)	(Bai et al., 2021; Marimin & Safriyana, 2018; Shafi et al., 2020)	(Bai et al., 2021; Dania et al., 2018; Yang & Lin, 2020)	(Rosidi et al., 2017)



*) sub-elements that are not used in preparing alternative supply chain development strategies

Figure 3. Directed graph of the main constraint elements

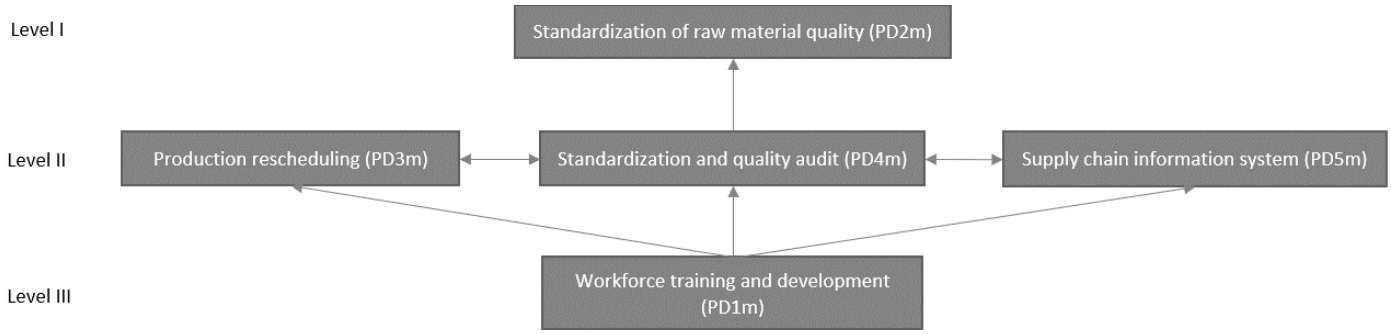


Figure 4. Directed graph of possible change elements

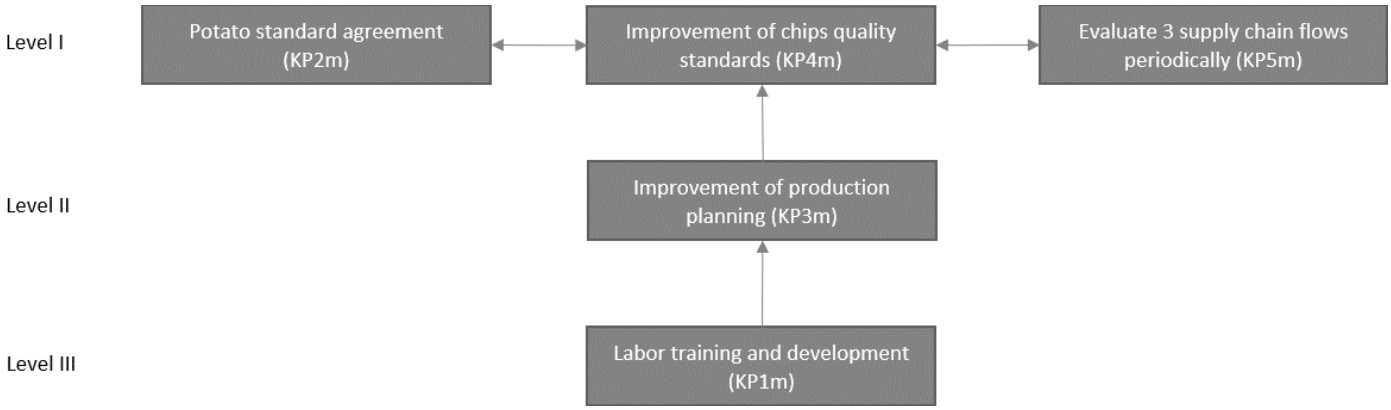


Figure 5. Directed graph of program requirements elements

be optimized to mitigate constraints on raw material quality variation and improve MSMEs' performance. Teniwut et al. (2020) stated that the training and development program would increase basic and applied knowledge of human resources including implementing production rescheduling, standardization, and quality audits, as well as implementing supply chain information system. Therefore, the program would help achieve raw material quality standardization.

The program required elements to suggest potential changes that could be implemented and considered in determining the main obstacle mitigation strategy. Figure 5 further showed the directed graph for the micro-cluster program requirement.

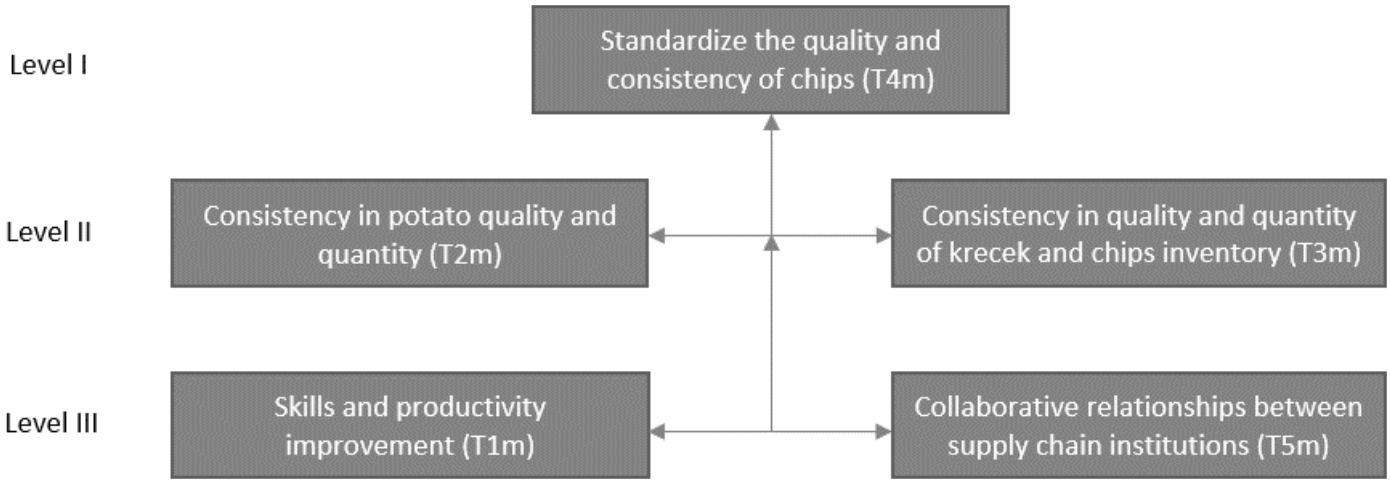


Figure 6. Directed graph of program objective elements

Workforce training and development was a driving sub-element of the program's needs and responded to possible change as well as main constraint elements for micro-cluster. Therefore, realizing the needs of the KP1m sub-elements would positively impact production planning. The workforce training and development program's success would lead to improved potato chip quality standards providing a guaranteed supply of ingredients. Furthermore, increasing workforce capabilities influenced the agreement on potato quality standards and was supported by regular evaluation of supply chain flows to achieve benefits for all actors.

The objectives of the program were prepared based on program needs, aiming to show achievement targets for managing potato chip supply chain. Figure 6 showed the directed graph of the micro-cluster MSMEs program objectives.

The sub-elements driving the objectives of the program were increasing workforce skills and productivity (T1m) as well as collaborative relationships between supply chain organizations (T5m). T1m addressed KP1m needs and mitigated KU1m constraints while T5m supported the objectives of increasing workforce skills and productivity. An effort to improve performance in management could be achieved by establishing collaborative and conducive relationships that supported employees to be more proactive in addressing out-of-control/undesirable situations (Chatterjee et al., 2022). Collaborative relationships supported easy access to information and were expected to increase trust and profits for all supply chain actors, as well as reduce price fluctuations (Teniwut et al., 2020).

In this context, the institutional element showed the actors directly engaged in the MSMEs supply chain of potato chip micro-cluster namely suppliers, MSMEs, and retail (shops owned by MSMEs). A directed graph of institutional elements included in the micro-cluster was presented in Figure 7.

In this study, the three sub-elements were at the same level driving interrelated factors that supported the success of each other. Potato supply of the micro-cluster was obtained from collectors at the Batu City Vegetable Market. Supplier relationships formed a partnership network aimed at reducing potential risks and uncertainties, obtaining external resources, and optimizing the business model (Osterwalder & Pigneur, 2017). MSMEs produced locally processed food from raw potatoes into potato chip.

The micro-cluster SMEs ensured production met standards and provided quality assurance for products because production started from raw materials. Sales of potato chip to final consumers by micro-cluster were carried out through MSMEs-owned shops. The micro-cluster had 2 retail shops located in Batu City. Selling products through individual shops allowed for greater profit margins, interaction with customers directly

Figure 7. Directed graph of the engaged organizations elements

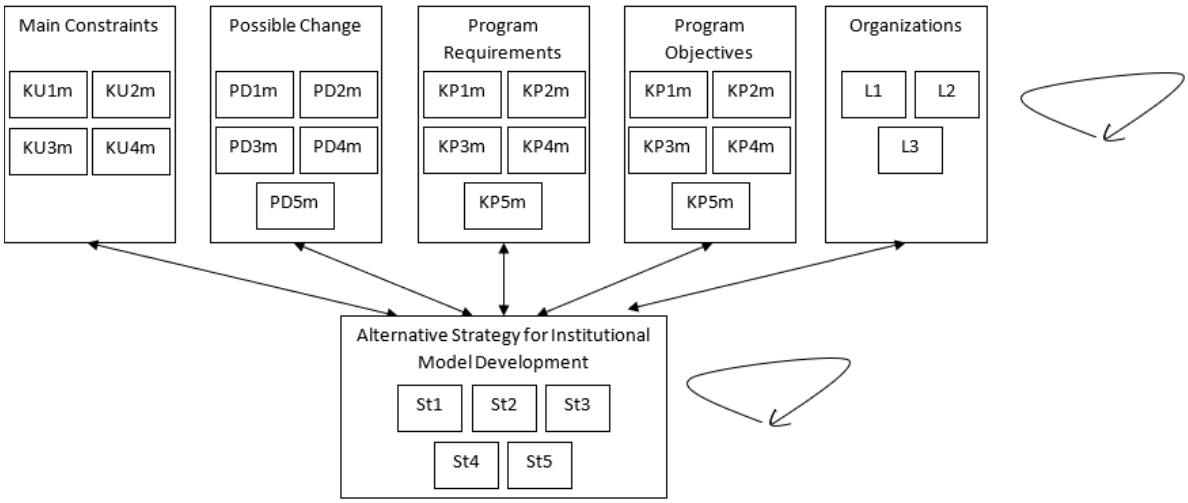


Figure 8. ANP network of micro-cluster potato chip MSMEs

Table 4. Alternative strategies

Alternative strategies	Constituent sub-elements	Strategy objectives	WANP	Priority
Implement digital-based marketing (St5)	KU1m PD1m, PD5m KP1m, KP5m T1m, T5m	• Increase sales volume • Expand marketing reach • Increase product competitiveness	0.230	1
Minimize the risk of drying out during the rainy season (St4)	KU1m, KU3m, KU4m PD1m, PD3m, PD4m KP1m, KP3m, KP4m T1m, T3m, T4m	• Manage the amount of materials and products inventory	0.221	2
Consider and document previous period consumer demand data (St3)	KU1m, KU3m PD1m, PD3m KP1m, KP3m T1m, T3m	• Makes it easier to manage inventory of materials and products • Increase the sensitivity of supply chain actors to changing patterns of consumer demand (increase/decrease in demand)	0.216	3
Carry out production planning by considering the risk of limited potato supply and consumer demand (St2)	KU1m, KU2m, KU3m PD1m, PD2m, PD3m KP1m, KP2m, KP3m T1m, T2m, T3m	• Anticipate increases/decreases in product demand • Able to meet needs appropriately and minimize losses due to predictable external risks	0.190	4
Use an integrated information system managed by all supply chain actors (St1)	All sub-elements	• Increase the effectiveness of flow performance in supply chain	0.143	5

Source: Primary data and Arsiwi & Adi (2020), Pangesti (2022)

Table 5. Combination of ISM and ANP analysis results

Method	Main obstacle	Possible changes	Program requirements	Participating organizations
ISM (Highest DP Value)	• (KU1m) • (KU2m)	• (PD1m)	• (KP1m)	• (L1) • (L2) • (L3)
ANP (Highest priority vector)	• (KU1m)	• (PD4m)	• (KP4m)	• (L1)
Combination of ISM-ANP Results	• Low workforce capability in carrying out production (KUa) • Variability in the quality of potato raw materials supplied (low supplier institution) (KUb)	• Implementation of regular workforce training and development (capacity) activities (PDa) • Implementation of potato chip quality standardization system and implementation of quality audits by SMEs (PDb)	• Workforce training and development regarding GHP, GMP, and production SOP (basic strengthening of the quality management system) (KPa) • Improvement of potato chip quality standards (KPb)	• Collector (La) • Potato chip SMEs (Lb) • Retail/ wholesaler (LC)

(more responsiveness), and ease of adaptation to changes in customer and market tastes. Manufacturers found it easier to observe product evaluations and company value propositions directly from customers and obtained more significant profit margins by implementing short, self-owned marketing channels (Osterwalder & Pigneur, 2017).

ANP Method for Analysis of Development Strategy Priorities

The 5 alternative strategies proposed were derived from ISM results, relevant literature reviews, and discussions with expert respondents. Priority analysis of strategic alternatives using ANP was carried out with Microsoft Excel including 5 key elements, 22 sub-elements, and 5 alternative strategies. Figure 8 showed the proposed ANP network for potato chip MSMEs micro-cluster. ANP method input was obtained from ISM. Proposed alternative strategies and priority results using ANP method for the micro-cluster were shown in Table 4.

Alternative strategies were proposed to be interconnected and supportive of each other's improvements. The priority alternative strategy based on ANP analysis for micro-cluster was implementing digital-based marketing (St5) with a weight ANP (WANP) of 0.230. The digital-based marketing proposal used social media platforms such as Instagram and TikTok as well as marketplaces including Shopee and Tokopedia to promote products more efficiently and sell with a wider market reach. Expanding marketing through digital media could be supported by planning and increasing production capacity. This could be achieved through the complementary implementation of the second, third, and fourth strategic priorities which included minimizing the risk of drying out during the rainy season (St4), production capacity planning (St2), and considering consumer demand data from the previous period (St3).

Institutional-Based Potato Chip Agro-Industry Supply Chain Development

ISM and ANP combination analysis results determined the proposed institutional model for improving supply chain performance of potato chip micro-cluster MSMEs in Batu City. The relationship between the results of the proposed institutional model was presented in Table 5. The proposed alternative institutional model for the Batu City potato chip micro-cluster MSMEs was developed from the current supply chain structure as shown in Figure 2. This included the results of ISM-ANP combination as observed in Table 5 as well as the review of previous publications (Hayuningtyas et al., 2019; Nuraini et al., 2016; Sembiring et al., 2018).

In this context, the proposed institutional model included internal organizations that guaranteed product quality and external organizations in the product quality audit process. Organizations in supply chain were used to maintain supply processes such as raw materials, semi-finished, and finished products. Institutional development positively impacted meeting needs and achieving objectives by supply chain actors

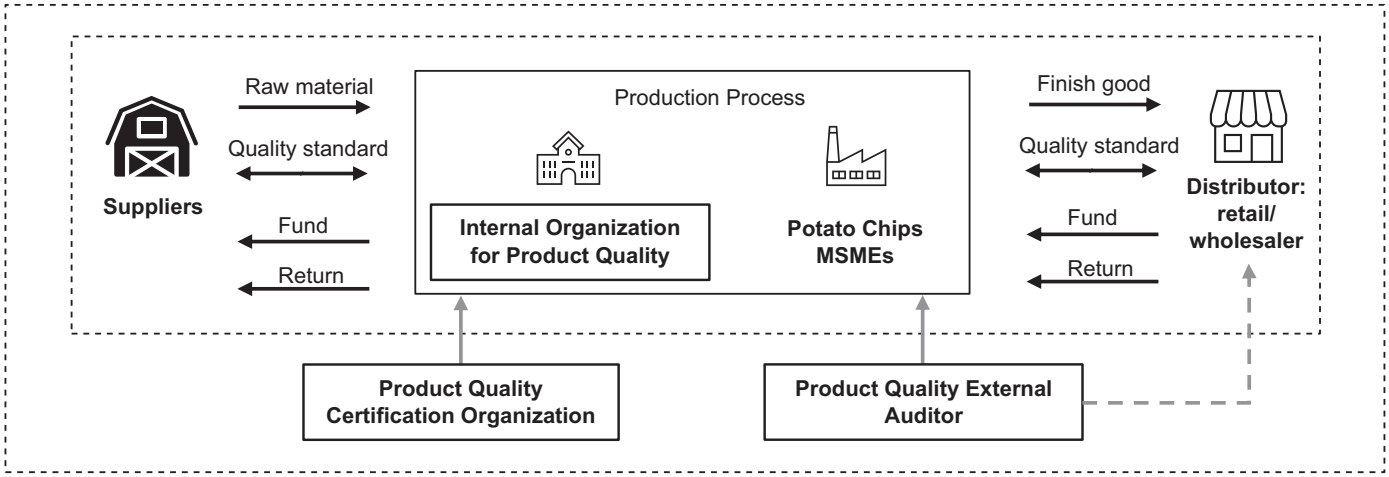


Figure 9. Proposed development of an institutional model for potato chip agro-industry supply chain

(Hayuningtyas et al., 2019). The institutional model would maximize the strategic role of organizations in agricultural and agro-industrial development in Indonesia (Nuraini et al., 2016).

The proposed institutional model included internal organizations that helped implement quality standards in the production process. This also included external auditors evaluating production operations and quality standards. The addition of internal organizations aimed to implement standards for raw materials when received and before processed, ensuring each stage of production and products produced met specified standards and consumer needs. External organizations were engaged in auditing production stages and quality standards that were implemented. The aim was to ensure the quality standards met the applicable requirements or needed improvement. Furthermore, the product quality certification body which was an external party provided evaluation and assessment results on the quality of potato chip products. Products certified by credible organizations would be more readily accepted by consumers (competitive) and enter more expansive marketing areas including digital-based marketing. The proposed institutional model was presented in Figure 9.

The expected output from the proposed institutional model was quality consistency in receiving raw materials, product quality consistency, and achieving consumer satisfaction because the product value met needs, as well as a multiplier effect for the engaged parties (Teniwut et al., 2020). External auditors needed to be engaged due to the more objective view regarding the implementation and quality standards of products in MSMEs. Consequently, all forms of evaluation and improvement efforts were right on target. The institutional structure positively impacted development of supply chain network to ensure the quantity and quality availability, supporting marketing expansion and increasing the profits of the actors (Teniwut et al., 2020). Suppliers who met raw material needs would smooth the flow of goods (Fakhrurrazi et al., 2018). The participation of many parties accompanied by clarity of the roles of each party would support agro-industry development (Sembiring et al., 2018). External parties' participation in supply chain was further categorized as a key partnership that aimed to complement resources not owned (Osterwalder & Pigneur, 2017), as well as having a positive impact on resource efficiency.

CONCLUSION

In conclusion, the study showed that the 3 main actors in the micro-cluster supply chain for potato chip in Batu City namely suppliers, MSMEs, and retailers interacted with each other in evaluating and developing an institutional model. The indicators in the micro-scale MSMEs cluster included production capacity, monthly turnover, number of workers, length of operation, and ownership of halal certificates in various quantities. Furthermore, the key elements of ISM method included the following sub-elements. The 3 engaged actors were collectors as suppliers of raw materials (potatoes) (L1), MSMEs of potato chip as producers (L2), and retailers in the form of shops owned by MSMEs as sellers (L3). ISM and ANP combination results showed 5 alternative strategies with the priority being development of micro-cluster MSMEs through implementing digital-based marketing (St5). Development of the institutional model was based on the combination of results,

including internal organizations in implementing quality standards, external auditors in evaluating production operations and standards, as well as product quality certification organizations in issuing certificates. This study emphasized the evaluation and development of supply chain that considers the roles of actors and the objectives of potato chip supply chain. ISM and ANP combination methods led to development of an institutional model for the micro-cluster MSMEs supply chain for potato chip to improve performance and productivity. Future publications should further conduct the following to have a broader understanding of the study. This included (1) carrying out dynamic simulations of the obtained institutional model, (2) analyzing canvas business and techno-economics to test the success level of supply chain framework, (3) quantifying the correlation between different driving variables, and (4) validating the results of ISM-ANP combination.

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CONFLICT OF INTEREST

The author had no conflict of interest with other parties in the implementation of this study.

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