ANALYSIS OF POTATO SUPPLY CHAIN MANAGEMENT IN NGABLAK AND PAKIS DISTRICTS, MAGELANG REGENCY

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ABSTRACT

The fluctuating price of potatoes every year as well as the high costs of distribution, storage, and maintenance mean that farmers earn less profit than expected. The research aims to analyze supply chain management, marketing efficiency, and potato supply chain risks. The research was carried out in September 2023 in Pakis and Ngablak Districts, Magelang Regency. This research uses a survey method with a descriptive approach. Determining the institutional sample uses snowball sampling while the farmer sample uses Cluster Sampling or Multistage Random Sampling method. The pattern of flow of information, finances, and goods runs smoothly. In the calculation of the farmer's share of large-grade potato commodities obtained at the research location, channel I was 84.61%, channel II was 85.71% and channel III was 80.00%, including in the efficient category. The farmer's share grade value was obtained by channel I at 75.00%, channel II at 77.77%, including in the efficient category, channel III at 70%, including in the inefficient category. The small farmer's share grade value obtained by channel I was 71.42%, channel II was 75%, which was included in the efficient category and channel III was 66.66%, which was not included in the efficient category. There are 23 risk agents and 15 risk events in the potato supply chain in Ngablak and Pakis Districts, Magelang Regency. Phase 1 HoR analysis provides results based on the Pareto diagram that there are 3 priority risk agents, namely crop failure, potatoes damaged in transit, and natural factors or disasters.

Keywords: *supply chain management, marketing efficiency, supply chain risk*

BACKGROUND

Indonesia is a tropical country that is rich in vegetables. Good agroclimatological conditions and the availability of resources support the growth and development of vegetables, especially horticulture. One commodity that is in great demand is potatoes (Solanum tuberosum L). According to the Central Statistics Agency (BPS) in 2022, potato production in Indonesia will reach 1.36 million tons in 2021. Potatoes have high economic value, potatoes can be processed into various forms of processed food products which can be used as safe substitute food ingredients (Cahyadi and Firdaus, 2020). Magelang Regency is one of the potato-producing districts in Central Java. The Magelang Regency area in general is a plateau in the form of a basin surrounded by mountains (Merapi, Merbabu, Andong, Telomoyo, Sumbing) and the Menoreh mountains. The height of the area is between 153-3,065 m above sea level. Potato-producing areas in Magelang Regency are in the districts of Kajoran (578 masl), Kaliangkrik (823 masl), Pakis (841 masl), and Ngablak (1,378 masl) which are located on the slopes of Mount Merbabu and Mount Sumbing so that they are productive

areas for plant cultivation. potato. Based on data from the Central Statistics Agency (BPS) of Magelang Regency for 2020 and 2021, potato production reached 5,654.7 tonnes and 5,927 tonnes. Potato production in Magelang Regency has increased by 5% from 2020.

Potatoes are a perishable and large commodity, therefore appropriate and efficient post-harvest technology and marketing are very important for the entire consumption production system (Hossain & Miah, 2009). Potatoes are an annual horticultural plant that lasts 90-180 days, this plant is also a type of shrub with a small stem diameter and can reach a height of 50-120 cm. Potatoes are most suitable for planting in mountainous areas with an altitude above 700 meters above sea level (Utami et al., 2015). Farmers do not market or sell potatoes directly to consumers. The potato marketing chain in Magelang Regency starts with collectors and middlemen. Several problems in the potato commodity marketing system in Magelang Regency are high marketing costs, price fluctuations, and the potato marketing chain. Based on potato distribution, the satisfaction felt by farmers is different. Farmers who get capital from middlemen have an unwritten agreement that they have to sell it to the middleman because there is a fee for using the capital so they have to sell it to the middleman. Long supply chains cause marketing costs from producers to consumers to be quite high so consumers have to pay more than the price that should be offered. According to Imanullah (2017) The supply chain from producer to consumer is very long, causing damage and a decrease in product quality because agricultural products are easily damaged. The high cost of marketing horticultural commodities is a result of inefficiencies caused by the length of marketing channels (Nuramalia et al., 2020). Every supply chain activity process has the potential to face risk. Some examples of supply chain risks include raw material shortages, supplier failures, rising material prices, machine breakdowns, uncertain demand, inaccurate forecasting, order changes, and transportation failures. The potential for these risks to occur, and if they do occur, will certainly have an impact on supply chain management performance. Therefore, it is necessary to carry out studies related to potato marketing institutions, to find appropriate and efficient marketing channels and identify risks in the potato supply chain so that they can be used as a reference for farming business actors to increase the productivity of potato farming businesses. Based on the problems above, the objectives of this research are (1) to analyze potato supply chain management, (2) to analyze marketing efficiency in each marketing channel and (3) to analyze the risk of the potato supply chain in Ngablak and Pakis Districts, Magelang Regency.

RESEARCH METHODS

This research was carried out in September 2023 in Kajoran, Kaliangkrik, Pakis, and Ngablak Districts, Magelang Regency. The location was chosen purposively with the consideration that Magelang Regency is one of the potato-producing areas in Central Java. The author refers to research methods in research Hidayat et al. (2017); Nur Huda et al. (2017); Nugroho et al. (2021); and Ratna et al. (2022) namely a survey with a descriptive approach. Determining the institutional sample uses snowball sampling because the population size is unknown Nur Huda et al., (2017). The institutional sample in this study consisted of 2 middlemen, 8 collectors, 3 wholesalers, and 10 retailers. Samples were obtained from interviews with farmers followed by the order in each marketing channel. Based on the data obtained, there are similar distribution channels so there are similar institutions. The farmer sampling technique used was the Cluster Sampling or Multistage Random Sampling method. In practice, cluster sampling is used to reduce costs, because the clusters are existing administrative

areas (districts, sub-districts, RW, RT, and so on). The sampling technique in this research was carried out randomly based on data from potato farmers in Pakis and Ngablak Districts. Based on the research area in Ngablak District and Pakis District, Ngablak District consists of 16 villages, and the 2 villages with the largest population of potato farmers were taken, namely Jogonayan Village and Genikan Village. Pakis District consists of 20 villages and the 3 villages with the largest population of potato farmers were taken, namely Kaponan Village and Kenalan Village. Next, data was obtained for each village, namely from Genikan Village, Genikan Hamlet, Jogonayan Village from Jogonayan Hamlet, and Deles Hamlet. Meanwhile, in Kenalan Village it was taken from Kenalan Hamlet, Kesingan Hamlet, and Kedakan Hamlet. In Kaponan Village, Kenanggan Hamlet, Wekas Hamlet, Upper Pogalan Hamlet, and Lower Pogalan Hamlet were taken. Based on the data obtained, the sample of potato farmers was 40 people.

The data collected from this research consists of primary and secondary data. Primary data was obtained by direct interviews with respondents through a list of questions that had been prepared in advance. Secondary data was obtained from BPS data from Magelang Regency. The three data collection techniques commonly used are observation, interviews, and literature study. The analytical method used to answer the first research objective is regarding the mechanism of product flow, financial flow, and information flow in the potato supply chain in Magelang Regency using descriptive analysis methods. This analysis was carried out in a field survey with observations and interviews of sample respondents (farmers, collectors, middlemen, wholesalers, and retailers). The analytical method used to answer the second research objective is to calculate marketing margin costs and marketing efficiency in the potato supply chain in Magelang Regency using the marketing efficiency analysis method. To calculate the marketing margin, use the formula from Anindita dan Baladina (2017).

$$MP = Hj - Hb$$

Information:

MP : Marketing margin
Hj : Selling price (Rp/Kg)
Hb : Purchase price (Rp/Kg)

Farmer's share is one approach to see how much farmers get in return for the products they produce, which is measured by comparing the prices received by farmers and the prices at the consumer level (Muslim and Darwis, 2012).

$$\text{Farmer's Share} = Pf\,(PS) = Pf/Pr \; x \; 100 \%$$

Information:

Pr : Price at retail level (rupiah)
Pf : Price at farm level (rupiah)
FS or Pf (PS) : Share of price received by farmers

Criteria:

1. If %Pf (PS) > 70% then marketing is efficient. This means that supply chain performance is efficient.
2. If %Pf (PS) ≤ 70% then marketing is inefficient. This means that supply chain performance is inefficient.

Identification of risks in the supply chain is obtained from interviews with marketing institutions. Marketing agency respondents in the potato supply chain included 2 middlemen, 8 collectors, 3 wholesalers, and 10 retailers. After the risks are obtained, they are identified using a descriptive approach using the SCOR method which has been developed by Supply Chain Council (2012) based on the plan, source, make, deliver, and return. In the identification process, this research was carried out using field observations and interviews to find out the risks and risk agents that occur in the potato supply chain in Magelang Regency can be seen in Table 1 and Table 2.

Table 1. Identification of Supply Chain Risks Using the SCOR Method

SCOR Elements	Code	Identify Risk Events
Plan	E1	Increase in potato prices from major producers
	E2	Collectors/traders' profits are reduced
	E3	Incorrect type of potato ordered
Source	E4	Inconsistency in the quality of orders
	E5	Too many potatoes
Make	E6	There are damaged potatoes
	E7	Decreased quantity and quality of potatoes
	E8	Decreased potato quality due to packaging
	E9	Order cancellation
	E10	The number of collectors or traders
	E11	A lot of potatoes are wasted
Deliver	E12	Decreased quality due to the shipping process
	E13	Error in type or quantity of potatoes shipped
	E14	The vehicle was damaged
	E15	Delays in delivery

Table 2. Identification Risk Agent

Code	Identify Risk Agents
AR1	Demand is increasing
AR2	Numbers are shrinking
AR3	Crop failure
AR4	Demand does not decrease and increases
AR5	Natural factors or disasters
AR6	Travel is stuck or delayed
AR7	Lack of transportation and vehicles
AR8	Potatoes damaged in transit
AR9	Storage error
AR10	Packaging error

AR11	Delivery schedule delays
AR12	Conditions in an area that are not conducive
AR13	Management of collectors or traders is less organized
AR14	The number of farmers is increasing
AR15	Inappropriate quality of potatoes
AR16	Potato quality checking techniques
AR17	Type of transportation or vehicle
AR18	Number of unrecorded requests
AR19	Unclear buyer information
AR20	Human error
AR21	Limited resources (tools)
AR22	Order uncertainty
AR23	The technique for treating or handling potatoes is not optimal

The method used to analyze risk events and risk agents is the House of Risk (HoR) method (Irawan et al., 2019). The House of Risk method is a risk management model resulting from the development and modification of the HoR model which functions to determine risk agents and determine priorities in carrying out prevention (Pujawan and Geraldine. 2009). The Phase 1 HoR method is used to answer the third research objective (identifying and analyzing priority risk agents) by:

1. Identify risk events (Ei) that have been experienced and may occur in each production process, then determine the severity of the risk event by assessing it using a severity scale of 1–10, the scale criteria are Ulfah et al. (2016) can be seen in Table 3.

Table 3. Severity Scale

Rank	Severity Scale
10	The dangerous effects caused are very high
9	The effects are very high
8	The effects are very high
7	The effects are high
6	The effects are moderate
5	The effects are low
4	The effects are very low
3	The effect is small
2	The effect is very small
1	Has no effects arising from the cause of failure

Source: Syamsiyah et al. (2019)

Loss level criteria according to Marshall (2001):

a. 0 : No effect
b. 2 – 5 : Low
c. 6 – 9 : Moderate
d. 10 – 20 : High
e. > 20 : Very high

2. Identify risk agents (Oj) in each production process, then determine the frequency of risk agents by assessing them using an occurrence scale of 1–10, the scale criteria are using Ulfah et al. (2016) can be seen in Table 4.

Table 4. Occurrence Scale

Rank	Occurrence Scale
10	Happens more than 1 time in 1 day
9	Happens every 3 – 4 days
8	Happens every week
7	Happens every month
6	Happens every 3 months
5	Happens every 6 months
4	Happens every year
3	Occurs every 1 – 3 years
2	Occurs every 3 – 4 years
1	Happened more than 4 years

Source: Syamsiyah et al. (2019)

3. Explaining the matrix and measuring the correlation between risk events and risk agents using 0, 1, 3, 9 where 0 means no correlation, a value of 1 means a low correlation, 3 means a medium correlation and a value of 9 means a high correlation (Ulfah et al., 2016).

4. Determine the risk sequence by calculating the ARP (Aggregate Risk Potential) value based on the Phase 1 HoR matrix. The ARP value is obtained by multiplying the severity, occurrence, and correlation values between the risk agent and the risk event by Ulfah et al. (2016) can be seen in Table 5.

Table 5. Phase 1 HoR Model

Risk Events	Risk Agents					Severity
	A1	**A2**	**A3**	**A4**	**A5**	
E_1	R_{11}	R_{11}	R_{11}	R_{11}	R_{11}	S_1
E_2	R_{21}	R_{21}	R_{21}	R_{21}		S_2
E_3	R_{31}	R_{31}	R_{31}			S_3
E_4	R_{41}	R_{41}				S_4
E_5	R_{51}					S_5
Occurrence (O)	O_1	O_2	O_3	O_4	O_5	
Aggregate Risk Potential	ARP_1	ARP_2	ARP_3	ARP_4	ARP_5	

Source: Ulfah et al. (2016)

So, the Aggregate Risk Potential (ARP) according to Ulfah et al., (2016) can be calculated using the formula:

$$ARP_j = O_j \, \Sigma \, S_i \, R_{ij}$$

Information:

ARP$_j$: Aggregate Risk Potential

O$_j$: Probability of risk occurring (j)

S$_i$: Severity level of risk events (i)

R$_{ij}$: Correlation value between risk agents (j) and risk events (i)

5. Determine the priority ranking using Pareto analysis based on the highest ARP value and the results obtained are used for HoR Phase 2 (Ulfah et al., 2016).

RESULT AND DISCUSSION

Potato Supply Chain Management

1. Identify Supply Chain Members. In this research, the primary members of the potato supply chain are potato farmers, collectors, wholesalers, and potato retailers. Meanwhile, the secondary members of the potato supply chain are the Magelang Regency Agriculture and Plantation Service and the Market Manager in Magelang Regency.

2. Characteristics of Potato Supply Chain Management in Ngablak and Pakis Districts, Magelang Regency

   a. Consumenrs. Consumers in the Ngablak and Pakis Districts, Magelang Regency potato supply chain management use potatoes as a daily vegetable ingredient.

   b. Distribution of Agricultural Products. At the research location, distribution activities are carried out by collectors, middlemen, wholesalers, and retailers. Potatoes to be sent are usually sorted and graded first. Potato distribution includes:

      1) Carry out product delivery activities according to request.

      2) Transporting potatoes does not exceed the normal capacity of the vehicle to keep the potatoes in good condition.

      3) Packaging potatoes using waring to keep potatoes from rotting easily.

      4) Delivery activities are carried out by agreements between marketing institutions

      5) Store potatoes in a temporary warehouse for no more than one week and in non-humid conditions.

3. The role of marketing in supply chain solutions. Potato marketing activities in Ngablak and Pakis Districts, Magelang Regency are carried out by marketing institutions other than farmers, namely: middlemen, collectors, wholesalers, and retailers. The role of marketing in the Ngablak and Pakis Districts, Magelang Regency potato supply chain includes:

   a. Increase the value of potatoes with timely delivery, quantity, and quality according to orders.

   b. Makes it easier for farmers to sell potatoes to consumers.

   c. Expanding the potato marketing area, which initially marketed potatoes in Ngablak and Pakis Districts, Magelang Regency, can now market potatoes to consumers inside and outside Magelang Regency.

   d. Reducing marketing costs incurred by potato farmers.

4. Characteristics of potatoes. The perishable nature of potatoes increases the importance of storage, handling, and transportation. To reduce the risk of perishability of potato products, potato supply chain members carry out activities:

   a. When transporting potatoes during product distribution, the load is no more than the normal capacity of the vehicle.

   b. To avoid the nature of potatoes being easily damaged if there is too much water, waring is used for packaging so that the potatoes remain fresh and dry.

   c. Potato prices are relatively stable to reduce the risk of prices being too low. Magelang Regency potato farmers usually delay selling their potatoes by looking at market prices.

   d. Middlemen and collectors buy potatoes by looking at the availability of farmers' crops, farmers directly sell their crops to middlemen and collectors.

Potato Marketing Channels

Based on research that has been carried out, it can be seen that the potato marketing pattern in Ngablak and Pakis Districts, Magelang Regency is as follows:
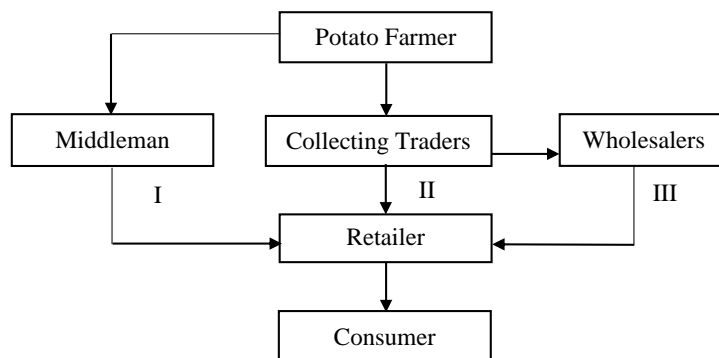

Figure 1. Potato Marketing Channel Patterns in Ngablak and Pakis Districts, Magelang Regency

Information:

⟶ : States a relationship

I   : Marketing channel one

II   : Marketing channel two

III   : Marketing channel three

Potato marketing in Ngablak and Pakis Districts, Magelang Regency has three marketing channel patterns, namely:

1. Marketing channel pattern I
   Farmers → Middlemen → Retailers → Consumers
2. Marketing channel patterns II
   Farmers → Collectors → Retailers → Consumers
3. Marketing channel patterns III
   Farmers → Collectors → Wholesalers → Retailers → Consumers

Marketing institutions grade potatoes based on the following potato grading criteria:

1. Large   > 101 gr/tuber
2. Medium   = 50 - 100 gr/tuber
3. Small   < 50 gr/tuber

There are 8 traders in the potato supply chain in Ngablak and Pakis Districts, Magelang Regency. Collectors come to the farmers' homes and buy the potatoes once a week according to orders. There are 2 middlemen traders in the potato supply chain in Ngablak and Pakis Districts, Magelang Regency. Middlemen come to the farmers' homes and buy the potatoes once a week according to orders. There are 3 wholesalers in the potato supply chain in Ngablak and Pakis Districts, Magelang Regency. Wholesalers in marketing channel III purchase potatoes from collectors once a week. There are 10 retailers. Retailers purchase potatoes from collectors, middlemen, and wholesalers with an average of 1.5 tons every 1-3 days. The number of farmers based on the potato marketing channels used in distributing potatoes can be seen in Table 6.

Table 6. Types of Marketing Channels and Number of Respondent Farmers in Ngablak and Pakis Districts, Magelang Regency

No	Marketing Channel	Number of Farmers	Percentage (%)
1	Channel I	11	27.50
2	Channel II	21	52.50
3	Channel III	8	20
	Amount	40	100

Table 6 shows that the marketing channel most widely used by farmers is marketing channel II, namely 21 farmers, 52.50%, of farmers directly sell their potatoes to wholesalers who will sell them to potato retailers. The reason farmers prefer marketing channel II is because the price is higher and the process of selling potatoes is considered easier, both in the purchasing process and payment problems, especially by farmers who produce potatoes in large quantities and collectors can absorb potatoes in greater quantities compared to other marketing agencies. The reason farmers choose marketing channel I is because middlemen provide capital and provide loans to farmers. The reason why farmers choose marketing channel III is more about the suitability of prices offered by collectors and farmers do not bear the costs of transportation, storage, or packaging.

Flow Pattern of Main Components of the Potato Supply Chain in Ngablak and Pakis Districts, Magelang Regency

1. Flow of Goods

In this flow of goods, there are problems because product distribution activities in the goods flow pattern are hampered by information regarding the number of potatoes that must be sent as well as problems with delays in the potato delivery schedule. This condition occurs due to poor conditions of road access and transportation. The pattern of goods flow in the potato supply chain in Ngablak and Pakis Districts, Magelang Regency is presented in Figure 2.
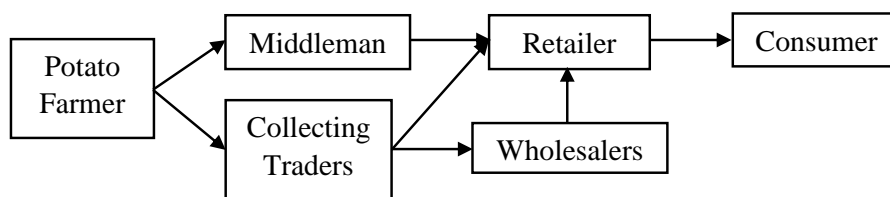

Figure 2. Goods Flow Patterns in the Potato Supply Chain in Ngablak and Pakis Districts, Magelang Regency

The flow of goods in the potato supply chain in Ngablak and Pakis Districts, Magelang Regency starts from farmers who produce potatoes. The farmers' harvest will be bought by middlemen, and the collectors will then sell the potatoes to wholesalers and retailers. The price of potatoes from farmers is Rp 11,000 and Rp 12,000/kg. Potato prices fluctuate greatly depending on consumer demand in the market and the current season. The price of potatoes in Ngablak and Pakis Districts, Magelang Regency is also influenced by the market price of potatoes in Dieng. During the harvest and rainy season, potato prices at the farmer level tend to fall. This happens because when the harvest occurs, the supply of potatoes will increase, thereby reducing the price level. Plus, rainy season conditions make potatoes rot easily, reducing the quality of the potatoes.

The mechanism for purchasing potatoes by collectors or middlemen is carried out directly. After finding out about potato prices during research from other farmers, farmers offer the potatoes they harvest to collectors or middlemen. Usually, some collectors need a supply of potatoes at a certain time because they receive orders from regular wholesalers or retailers so they need potatoes that meet the criteria and can pay more than other collectors. Farmers offer potatoes to middlemen because the middleman provides capital and must deposit the potatoes with the middleman. Potato farmers in Ngablak and Pakis Districts, Magelang Regency usually sell directly to the collector who has the highest bid. Potatoes that have been transacted will be taken by collectors or middlemen at each farmer's house and collected at home for re-weighing, sorting, and grading. The means of transportation used by collectors or middlemen to pick up potatoes from farmers' houses is by motorbike or renting a pick-up truck.

Potatoes are sorted and graded by middlemen and collectors, then the potatoes will be packed into wearing sacks. Next, the potatoes will be sent to wholesalers and retailers, usually, deliveries from middlemen and collectors in Ngablak and Pakis Districts, Magelang Regency are carried out in the afternoon or evening. This aims to ensure that the potatoes arrive immediately and can be bought and sold by retailers in traditional markets. Based on the research results, potato price data at the consumer level was obtained based on grade/quality in channel tables I, II, and III.

Table 7. Potato Prices at Consumer Level Based on Grade/Quality on Channel I

Channel/Grade	Grand Harvest Price (Rp/Kg)	Usual Harvest Price (Rp/Kg)
Channel I		
Large	11,000	13,000
Medium	6,000 – 7,000	7,000 – 8,000
Small	5,000 – 6,000	6,000 – 7,000
Channel II		
Large	12,000	14,000
Medium	7,000 – 8,000	8,000 – 9,000
Small	6,000 – 7,000	7,000 – 8,000
Channel III		
Large	12,000	15,000
Medium	8,000 – 9,000	9,000 – 10,000
Small	7,000 – 8,000	8,000 – 9,000

In channel I, large quality/grade potatoes that have been purchased by retailers will be resold to final consumers during the main harvest for Rp 11,000/kg while the regular harvest costs Rp. 13,000/kg. Medium quality/grade potatoes that have been purchased by retailers will be resold to final consumers during the main harvest for Rp 6,000-7,000/kg while the normal harvest costs Rp 7,000-8,000/kg. Small quality/grade potatoes that have been purchased by retailers will be resold to final consumers during the main harvest for Rp 5,000-6,000/kg while normal harvest costs Rp 6,000-7,000/kg. In channel II, large quality/grade potatoes that have been purchased by retailers will be resold to end consumers during the main harvest for Rp 12,000/kg while the regular harvest costs Rp 14,000/kg. Medium quality/grade potatoes that have been purchased by retailers will be resold to final consumers during the main harvest for Rp 7,000-8,000/kg while normal harvest costs Rp 8,000-9,000/kg. Small quality/grade potatoes that have been purchased by retailers will be resold to final consumers during the main harvest for Rp 6,000-7,000/kg while the normal harvest costs Rp 7,000-

8,000/kg. In channel III, large quality/grade potatoes that have been purchased by retailers will be resold to end consumers during the main harvest for Rp 12,000/kg while the regular harvest costs Rp 15,000/kg. Medium quality/grade potatoes that have been purchased by retailers will be resold to final consumers during the main harvest for Rp 8,000-9,000/kg while the normal harvest costs Rp 9,000-10,000/kg. Small quality/grade potatoes that have been purchased by retailers will be resold to final consumers during the main harvest for Rp 7,000-8,000/kg while normal harvest costs Rp 8,000-9,000/kg.

2. Financial Flow

The smooth flow of money or finances supports the achievement of an effective supply chain. Financial flows in the potato supply chain occur from final potato consumers to retailers, then wholesalers, collectors, middlemen, and finally to potato farmers in Ngablak and Pakis Districts, Magelang Regency. In the Ngablak and Pakis Districts, Magelang Regency potato supply chain channel, the money flow pattern is as follows:
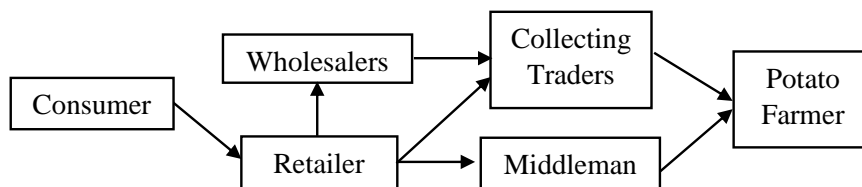

Figure 3. Financial Flow Patterns in the Potato Supply Chain in Ngablak and Pakis Districts, Magelang Regency

Based on data obtained in the field, marketing institutions do not delay payments and are paid directly. The payment mechanism for potatoes from consumers to retailers is by cash payment. The smooth flow of money supports the achievement of an effective supply chain.

3. Information Flow

The pattern of information flow in a supply chain determines the effectiveness of the supply chain in the long term, especially concerning product improvement. Information in a supply chain includes information on demand quantities, product inventory, goods delivery schedules, product prices, and information related to product criteria that consumers expect. Information is obtained via WhatsApp, telephone, and meeting in person.

a. Request Quantity Information. Based on the results of interviews and field observations of information flow patterns related to the number of consumer requests, information flows continuously from downstream marketing institutions to upstream marketing institutions.

b. Potato Inventory Information. Information on potato supplies in Ngablak and Pakis Districts, Magelang Regency has a pattern like figure 4.
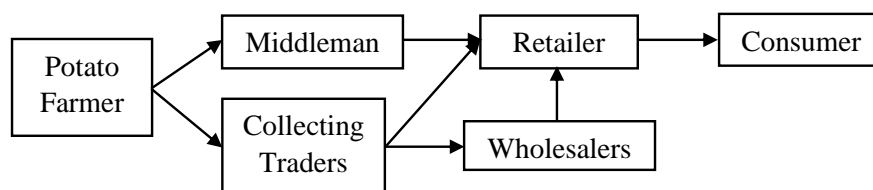

Figure 4. Information Flow Patterns on Potato Supplies in Ngablak and Pakis Districts, Magelang Regency

Based on Figure 4, product supply information starts from farmers and continues from upstream marketing institutions to downstream marketing institutions. As technology develops, the construction of facilities and infrastructure at the research location has had a positive impact on the businesses carried out by many residents of Magelang Regency. Product inventory information is provided by middlemen and collectors in Magelang Regency to further marketing institutions via telephone networks.

c. Goods Delivery Schedule. Information related to goods delivery schedules also has a pattern as above. This information is very useful to support timely delivery so that consumers get satisfaction because they can get the product they want when they need it. According to middleman and collector respondents in Ngablak and Pakis Districts, Magelang Regency, information regarding delivery schedules usually changes but is still communicated to the marketing institutions of wholesalers and retailers to whom they supply potatoes.

d. Price Information. Potato prices are formed from market mechanisms. Like agricultural products in general, the price of potatoes decreases during the harvest season and increases during the non-harvest season. This is in line with research by Rahmah and Wulandari (2021) that the marketing problem often experienced by farmers is price fluctuations, especially during the harvest season. Magelang Regency potato farmers who want to sell their products to marketing institutions must know the price of potatoes on the market. Farmers get price information from marketing agencies, middlemen, and collectors who buy their potatoes. According to respondents, potato farmers in Magelang Regency, after finding out the standard price in the market, offered their potatoes to middlemen and collectors who had the highest offers.

Marketing Efficiency

According to Wasrob and Ahmad (2015), marketing efficiency is a measure that is often used to assess market performance. High efficiency is a goal that farmers, marketing institutions, consumers, and society want to achieve, which means better market performance while decreasing efficiency indicates poor performance. Marketing efficiency has been achieved if it can increase added value, and produce profits by the costs incurred by each marketing institution, marketing margins (costs and profits) that occur are relatively by final consumer satisfaction and provide profitable income (Asmarantaka, 2014). Indicators of marketing efficiency in this research use marketing margin and farmer's share.

1. Marketing Margin

Pasaribu (2012) states that marketing margin describes the difference between prices at the consumer level and prices at the producer level. Each marketing institution carries out different marketing functions, causing differences in selling prices from one institution to another down to the final consumer level. The more marketing institutions involved, the greater the difference in prices between producers and prices at the consumer level. Potato marketing in Ngablak and Pakis Districts, Magelang Regency also involves several marketing institutions. The marketing system implemented by potato farmers in Ngablak and Pakis Districts, Magelang Regency is carried out indirectly because it involves marketing institutions in each marketing channel. Farmers very rarely use semi-direct sales or only involve one marketing agency, because the sales volume is not commensurate with marketing costs (Rahma and Wulandari, 2020). This will give rise to the emergence of various marketing channels and functions. Likewise, the difference in potato prices at the producer and consumer levels will give rise to marketing margins. The size of the marketing margin will influence whether the

marketing system can run efficiently or not (Elisa et al., 2016). The price of potatoes for each quality grade varies. The selling price for potatoes in the first channel is lower from the farmer to the middleman because the middleman gives the farmer capital in cultivating potatoes and when the harvest has to be sold to the middleman, in contrast to independent farmers, who can choose to sell potatoes to collectors at a higher bid price. Results of recapitulation of marketing margin values for potato commodities based on three grades in three marketing channel patterns in Ngablak and Pakis Districts, Magelang Regency.

Table 8. Analysis of Potato Commodity Marketing Margins in Ngablak and Pakis Districts, Magelang Regency Large Grade

Prices for Each Marketing Actor (Rp/Kg)	Marketing Channel		
	1	2	3
Farmer			
Selling price	11,000	12,000	12,000
Middleman			
Purchase price	11,000	-	-
Selling price	12,000	-	-
Margins	1,000	-	-
Collecting Traders			
Purchase price	-	12,000	12,000
Selling price	-	13,000	13,000
Margins	-	1,000	1,000
Wholesalers			
Purchase price	-	-	13,000
Selling price	-	-	14,000
Margins	-	-	1,000
Retailer			
Purchase price	12,000	13,000	14,000
Selling price	13,000	14,000	15,000
Margins	1,000	1,000	1,000
Final Consumer	13,000	14,000	15,000
Total Margin	**2,000**	**2,000**	**3,000**

In this research, the marketing chain area coverage is influenced by the length and shortness of the marketing chain. If the marketing chain is longer, the coverage area will be wider. The highest marketing chain costs are in channel 3, namely Rp 3,000/kg. This means that channel 3 is still cost-structure inefficient when compared to other channels. The lowest cost Rp 2,000/kg is in channels 1 and 2. This is normal because it is based on the coverage area of the potato commodity supply in the marketing chain. If you look at the marketing margin, the highest marketing margin is in channel 3, namely Rp 3,000/kg. Meanwhile, the lowest marketing margin is in channels 1 and 2, namely Rp 2,000. The size of the marketing margin is influenced by the size of the costs and profits earned.

Table 9. Marketing Margin Analysis of Potato Commodities in Ngablak and Pakis Districts, Magelang Regency Medium Grade

Prices for Each Marketing Actor (Rp/Kg)	Marketing Channel		
	1	2	3
Farmer			
Selling price	6,000	7,000	7,000
Middleman			
Purchase price	6,000	-	-
Selling price	7,000	-	-
Margins	1,000	-	-
Collecting Traders			
Purchase price	-	7,000	7,000
Selling price	-	8,000	8,000
Margins	-	1,000	1,000
Wholesalers			
Purchase price	-	-	8,000
Selling price	-	-	9,000
Margins	-	-	1,000
Retailer			
Purchase price	7,000	8,000	9,000
Selling price	8,000	9,000	10,000
Margins	1,000	1,000	1,000
Final Consumer	8,000	9,000	10,000
Total Margin	**2,000**	**2,000**	**3,000**

According to the agreement between potato marketers, medium-grade potatoes are medium-sized potatoes with standard fruit quality and undamaged skin. The average price of medium-grade potatoes reaches Rp 6,000 - 7,000/kg. Medium-grade marketing chain costs are the same as large-grade. The highest marketing chain costs are in channel 3 at Rp 3,000/kg. This means that the cost structure of marketing channel 3 is less efficient than other marketing channels. The lowest cost Rp 2,000/kg is found in marketing channels 1 and 2 because it is based on the coverage of the potato supply area and the fairly short channels in the marketing chain. The highest marketing margin is in channel 3, namely Rp 3,000/kg. Meanwhile, the lowest is in channels 1 and 2, namely Rp 2,000/kg. The size of the marketing margin is influenced by the size of the costs incurred and the profits earned.

Table 10. Analysis of Potato Commodity Marketing Margins in Ngablak and Pakis Districts, Magelang Regency Small Grade

Prices for Each Marketing Actor (Rp/Kg)	Marketing Channel		
	1	2	3
Farmer			
Selling price	5,000	6,000	6,000
Middleman			
Purchase price	5,000	-	-
Selling price	6,000	-	-
Margins	1,000	-	-
Collecting Traders			
Purchase price	-	6,000	6,000
Selling price	-	7,000	7,000

Margins	-	1,000	1,000
Wholesalers			
Purchase price	-	-	7,000
Selling price	-	-	8,000
Margins	-	-	1,000
Retailer			
Purchase price	6,000	7,000	8,000
Selling price	7,000	8,000	9,000
Margins	1,000	1,000	1,000
Final Consumer	7,000	8,000	9,000
Total Margin	**2,000**	**2,000**	**3,000**

Based on Table 10, when viewed in terms of marketing margin, it can be seen that the highest marketing margin is in channel 3, namely Rp 3,000/kg. Meanwhile, the lowest marketing margin is in channels 1 and 2, namely Rp 2,000. The size of the marketing margin is influenced by the size of the costs incurred and the profits obtained. In this study, the smallest costs and profits were in channels 1 and 2. The highest total profit was obtained by channel 3, namely Rp 3,000/kg and the lowest profit was obtained by channels 1 and 2, amounting to Rp 2,000/kg.

2. Farmer's Share

The research results found farmer's share as shown in table 11.

Table 11. Analysis of Marketing Margin and Farmer's Share of Large Grade Potato Commodities in Ngablak and Pakis Districts, Magelang Regency

Prices for Each Marketing Actor (Rp/Kg)	Marketing Channel		
	1	2	3
Farmer			
Selling price	11,000	12,000	12,000
Middleman			
Purchase price	11,000	-	-
Selling price	12,000	-	-
Margins	1,000	-	-
Collecting Traders			
Purchase price	-	12,000	12,000
Selling price	-	13,000	13,000
Margins	-	1,000	1,000
Wholesalers			
Purchase price	-	-	13,000
Selling price	-	-	14,000
Margins	-	-	1,000
Retailer			
Purchase price	12,000	13,000	14,000
Selling price	13,000	14,000	15,000
Margins	1,000	1,000	1,000
Final Consumer	13,000	14,000	15,000
Total Margin	**2,000**	**2,000**	**3,000**
Farmer's Share (%)	**84.61**	**85.71**	**80**

Based on calculations of the farmer's share of large marketing-grade potato commodities, it can be seen that channel I am 84.61%, channel II is 85.71% and channel III is 80.00%. Farmers sell their crops to consumers for Rp 11,000 and 12,000/Kg divided by the price at the consumer level to produce the farmer's share value. The marketing margin measurement indicator can be seen from, if the marketing margin is higher, the share received by farmers is low, and vice versa, if the marketing margin is low, the share received by farmers is high. Farmer's share $\geq 70\%$ is efficient while farmer's share $\leq 70\%$ is inefficient. So the large farmer's share grade value obtained at the research location for channel I was 84.61%, channel II was 85.71% and channel III was 80.00%, including in the efficient category.

Table 12. Analysis of Marketing Margin and Farmer's Share of Medium Grade Potato Commodities in Ngablak and Pakis Districts, Magelang Regency

Prices for Each Marketing Actor (Rp / Kg)	Marketing Channel		
	1	2	3
Farmer			
Selling price	6,000	7,000	7,000
Middleman			
Purchase price	6,000	-	-
Selling price	7,000	-	-
Margins	1,000	-	-
Collecting Traders			
Purchase price	-	7,000	7,000
Selling price	-	8,000	8,000
Margins	-	1,000	1,000
Wholesalers			
Purchase price	-	-	8,000
Selling price	-	-	9,000
Margins	-	-	1,000
Retailer			
Purchase price	7,000	8,000	9,000
Selling price	8,000	9,000	10,000
Margins	1,000	1,000	1,000
Final Consumer	8,000	9,000	10,000
Total Margin	**2,000**	**2,000**	**3,000**
Farmer's Share (%)	**75**	**77.77**	**70**

Based on calculations of farmer's share of medium-grade potato commodities for marketing, it can be seen that channel I am 75%, channel II is 77.77% and channel III is 70%. Farmers sell their crops to consumers for Rp 6,000 and 7,000/Kg divided by the price at the consumer level to produce the farmer's share value. The marketing margin measurement indicator can be seen from, if the marketing margin is higher, the share received by farmers is low, and vice versa, if the marketing margin is low, the share received by farmers is high. Farmer's share $\geq 70\%$ is efficient while farmer's share $\leq 70\%$ is inefficient. So, the moderate farmer's share grade value obtained at the research location for channel I was 75.00%, channel II was 77.77% including in the efficient category and channel III was 70.00% including in the inefficient category.

Table 13. Analysis of Marketing Margin and Farmer's Share of Small Grade Potato Commodities in Ngablak and Pakis Districts, Magelang Regency

Prices for Each Marketing Actor (Rp / Kg)	Marketing Channel		
	1	2	3
Farmer			
Selling price	5,000	6,000	6,000
Middleman			
Purchase price	5,000	-	-
Selling price	6,000	-	-
Margins	1,000	-	-
Collecting Traders			
Purchase price	-	6,000	6,000
Selling price	-	7,000	7,000
Margins	-	1,000	1,000
Wholesalers			
Purchase price	-	-	7,000
Selling price	-	-	8,000
Margins	-	-	1,000
Retailer			
Purchase price	6,000	7,000	8,000
Selling price	7,000	8,000	9,000
Margins	1,000	1,000	1,000
Final Consumer	7,000	8,000	9,000
Total Margin	**2,000**	**2,000**	**3,000**
Farmer's Share (%)	**71.42**	**75**	**66.66**

Based on calculations of farmer's share of small-grade potato commodities in marketing, it can be seen that channel I am 71.42%, channel II is 75% and channel III is 66.66%. Farmers sell their crops to consumers for Rp 5,000 and 6,000/Kg divided by the price at the consumer level to produce the farmer's share value. The marketing margin measurement indicator can be seen from, if the marketing margin is higher, the share received by farmers is low, and vice versa, if the marketing margin is low, the share received by farmers is high. Farmer's share $\geq 70\%$ is efficient while farmer's share $\leq 70\%$ is inefficient. So, the small farmer's share grade value obtained at the research location for channel I was 71.42%, channel II was 75%, which was included in the efficient category and channel III was 66.66%, which was not included in the efficient category. The longer the marketing channel, the greater the possibility that prices at the consumer level will become more expensive and make the marketing channel inefficient (Primyastanto, 2011). The length of the marketing channel can also have an impact on high marketing margins. Where the more marketing institutions involved will cause higher marketing costs. In Prayitno's (2013) research, the longer the marketing channel, the more marketing institutions are involved, so this will have an impact on the greater the marketing margin value. This situation can influence inefficient marketing activities. Farmer's share is one approach to see how much farmers receive in return for the products they produce, which is measured by comparing the prices received by farmers and the prices at the consumer level (Muslim and Darwis, 2012). If %Pf (PS) > 70% then marketing is efficient. This means that supply chain performance is efficient. If %Pf (PS) $\leq$ 70% then marketing is inefficient. This means that supply chain performance is inefficient.

Potato Supply Chain Risks

1. Metode Supply Chain Operation Reference (SCOR)

The first step in carrying out risk management is to identify risks that occur in the distribution supply chain in Ngablak and Pakis Districts, Magelang Regency. This research focuses on the distribution supply chain of middlemen, collectors, and wholesalers in Ngablak and Pakis Districts, Magelang Regency. Identification of risks in the potato supply chain was obtained from interviews with farmers, namely potato plant owners and institutions.

2. Identification Risk Events

Supply chain risk identification carried out in Ngablak and Pakis Districts, Magelang Regency is divided into risk events which will describe their severity on a scale of 1-10. Risk event identification can be seen in Table 14. Based on Table 14, it can be seen that in Ngablak and Pakis Districts, Magelang Regency 15 risk events occurred. These risk event indicators were obtained through interviews and observations during the research. This severity identification is used to find out how much disruption is caused in a company's production process. This risk event is then given a value of 1-10 for each level of severity, a scale of 10 means it has a high effect/disruption due to the risk that occurs (Ulfah et al., 2016). The risk event with the highest severity value is coded E6 and E5, namely, there are damaged potatoes and too many potatoes, while the risk event with the lowest severity value is coded E8, namely a decrease in potato quality due to packaging. Some potatoes are damaged at a high level of severity due to natural factors, delivery delays, traffic jams, and vehicle damage. Decreased potato quality due to packaging has the lowest level of severity because failures rarely occur in the field. Packaging potatoes using waring to keep the potatoes from rotting easily.

Table 14. Identification Risk Events

SCOR Element	Code	Identify Risk Event	Severity
Plan	E1	Increase in potato prices from major producers	5.78
	E2	Collectors/traders' profits are reduced	6.00
	E3	Incorrect type of potato ordered	7.04
Source	E4	Inconsistency in the quality of orders	4.74
	E5	Too many potatoes	8.17
Make	E6	There are damaged potatoes	8.35
	E7	Decreased quantity and quality of potatoes	6.00
	E8	Decreased potato quality due to packaging	2.96
	E9	Order cancellation	4.87
	E10	The number of collectors or traders	7.26
	E11	A lot of potatoes are wasted	8.04
Deliver	E12	Decreased quality due to the shipping process	5.83
	E13	Error in type or quantity of potatoes shipped	3.22
	E14	The vehicle was damaged	7.83
	E15	Delays in delivery	7.22

3. Identification Risk Agents

Potato supply chain risk identification carried out in Ngablak and Pakis Districts, Magelang Regency is divided into risk agents which will be assessed for frequency of occurrence (occurrence) on a scale of 1-10 in Table 15. Based on Table 15, it can be seen that in Ngablak and Pakis Districts, Magelang Regency, 23 risk agents are occurring. The risk agent with the highest occurrence value with code AR3 is crop failure, while the risk agent with the lowest occurrence value with code AR13 is less organized management of collectors or traders. This risk agent indicator was obtained through interviews and observations during the research. Occurrence identification is used to determine how often a risk source appears which will cause one or more risk events in the production process. This risk agent is then given a score of 1-10 for each frequency of occurrence, a scale of 1 means the risk source rarely occurs in the production process, a scale of 1 means the risk source rarely occurs in the production process, a scale of 10 means the risk source is confirmed frequently occurs in the production process (Ulfah et al., 2016).

Table 15. Identification Risk Agents

Code	Identify Risk Agents	Occurrence
AR1	Demand is increasing	5.30
AR2	Numbers are shrinking	5.48
AR3	Crop failure	6.83
AR4	Demand does not decrease and increases	3.09
AR5	Natural factors or disasters	6.22
AR6	Travel is stuck or delayed	5.61
AR7	Lack of transportation and vehicles	1.35
AR8	Potatoes damaged in transit	6.26
AR9	Storage error	3.13
AR10	Packaging error	3.22
AR11	Delivery schedule delays	1.39
AR12	Conditions in an area that are not conducive	4.30
AR13	Management of collectors or traders is less organized	1.00
AR14	The number of farmers is increasing	1.74
AR15	Inappropriate quality of potatoes	5.09
AR16	Potato quality checking techniques	3.57
AR17	Type of transportation or vehicle	1.13
AR18	Number of unrecorded requests	3.09
AR19	Unclear buyer information	2.74
AR20	Human error	4.83
AR21	Limited resources (tools)	5.35
AR22	Order uncertainty	5.39
AR23	The technique for treating or handling potatoes is not optimal	2.87

4. House of Risk (HoR) Analysis Phase 1

Event indicators and risk agents that have been identified with severity and occurrence values are continued with the stage of providing an assessment of the relationship between risk agents and risk events (correlation) to be included in the Phase 1 HoR matrix with a scale of 0, 1, 3, 9 where a value of 0 means there is no correlation, a value of 1 means low correlation, a value of 3 means medium correlation and a value of 9 means high correlation, then calculate the ARP value to find out

which risk agents need priority treatment. The calculation results of severity, occurrence, and correlation assessments using Phase 1 HoR matrix analysis can be seen in Table 16.

Table 16. HoR Phase 1 Matrix

Risk Events	Risk Agents																							Severity
---	AR1	AR2	AR3	AR4	AR5	AR6	AR7	AR8	AR9	AR10	AR11	AR12	AR13	AR14	AR15	AR16	AR17	AR18	AR19	AR20	AR21	AR22	AR23	
E1	9	3	9					9								9								5.78
E2		9	9	1	9	3		9	1	1	9	9	1		9			3		3	3	9	3	6.00
E3			9	3								1						9	1	1		9		7.04
E4			9	1	9	1		9				3			9			3	1		9	9	1	4.74
E5				3										3								3	1	8.17
E6		9	9		9	9		9	3	3		9			9					9	3	3	9	8.35
E7		3	9	3	9	1		9	3	3		9			9					3	3	3	3	6.00
E8				1					9	3					9					3	9			2.96
E9					9			3							1				9		1			4.87
E10		3		3									3	3										7.26
E11		3	9		9	3		9	1	3		9		3	9					1	3		1	8.04
E12					9	9	1	9			1										9	3		5.83
E13																		3		9		3		3.22
E14					1	9	3	3			1						3				3			7.83
E15					9	9	3				3						3				3			7.22
Occurrence	5.30	5.48	6.83	3.09	6.22	5.61	1.35	6.26	3.13	3.22	1.39	4.30	1.00	1.74	5.09	3.57	1.13	3.09	2.74	4.83	5.35	5.39	2.87	
ARP	276	288	717	99	467	316	51	714.4	83.7	82.1	89.32	277	27.8	70.41	329.7	185.7	45.15	105.2	55.61	217	222	219.2	132	
Ranking	8	6	1	15	3	5	21	2	17	18	16	7	23	19	4	12	22	14	20	11	9	10	13	

Based on Table 16, it can be seen that there is a ranking of the existing risk agents. This ranking was obtained based on the ARP (Aggregate Risk Priority) value calculation that has been carried out. A risk agent who gets top rankings means that the risk agent gets priority for risk management. Determining risk agent priorities using the Pareto diagram with the 8/20 provisions (Setyanita et al., 2017). The following is a Pareto diagram that shows the level of risk according to the calculated ARP value.
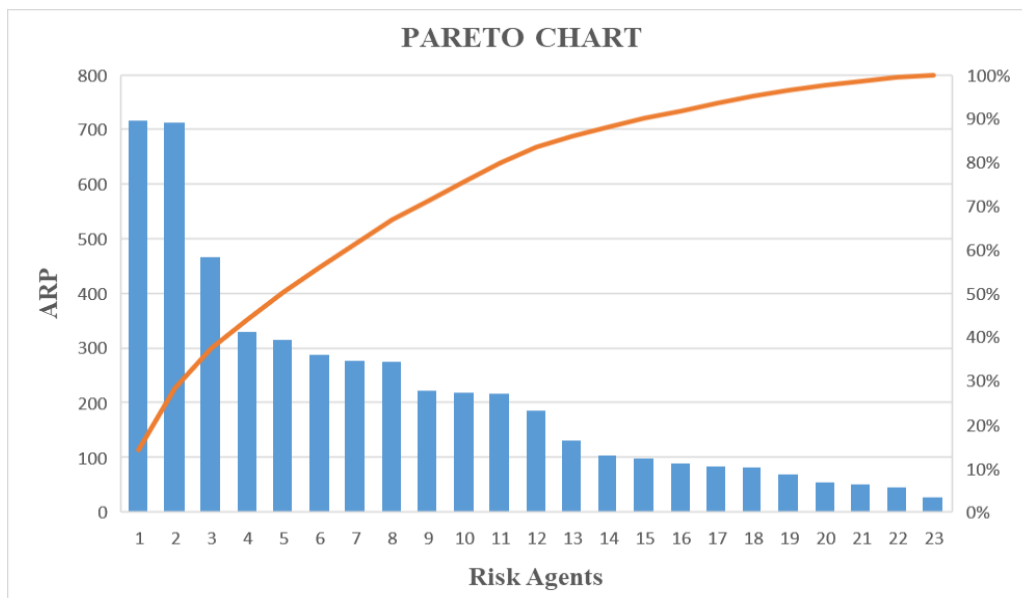

Figure 5. Pareto Chart

Based on Figure 5, it is known that 3 risk agents are considered risk priorities based on the percentage values from the Pareto diagram. Priority risk agents will receive treatment or mitigation first. The risk agents determined to be priorities are in the percentage range below 80% and are expected to represent the supply chain problems that occur. Setyanita et al (2017) support the opinion that 80% of problems occur because of 20% of the causes of existing problems and this means that

small causes of problems can have a big impact. Risk agent priorities based on the analysis results from the Pareto diagram in HoR Phase 1 can be seen in Table 17.

Table 17. Potato Supply Chain Risk Agents Priorities

Code	Risk Agents	ARP Value
AR3	Crop failure	717
AR8	Potatoes damaged in transit	714.4
AR5	Natural factors or disasters	467

Based on Table 17 risk agents with crop failure are in first place with an ARP value of 717, which is a priority risk agent that requires treatment first. The risk agent for potatoes damaged in transit ranks second with an ARP value of 714.4. Natural factor or disaster risk agents are in third place with an ARP value of 467. The risk agent with crop failure ranks first with an ARP value of 717, which is a priority risk agent that requires treatment first. Traders said that when farmers experience crop failure every month, they experience losses. Can't even get potatoes to sell. Crop failure is caused by increasingly extreme rainfall in the season, drought conditions, and increasingly unpredictable climatic conditions. Heavy rain causes planting areas to be flooded if hot weather causes drought. This causes rot disease in the tubers with symptoms of yellowing and curling leaves, then wilting and drying. The parts of the plant that are in the soil have brown spots. Infection will cause the roots and young tubers to rot. Control harvest failure by crop rotation, garden sanitation, and the use of good seeds. This situation resulted in no potatoes being sold so the number of orders could not be fulfilled.

The risk agent for potatoes damaged in transit ranks second with an ARP value of 714.4. Potatoes damaged in transit are caused by vehicles experiencing damage/getting stuck in transit, improper packaging of potatoes, and long journeys. Handling this problem can be overcome by choosing a type of vehicle that is adapted to the steep terrain, checking the condition of the vehicle, and packaging potatoes using waring. Natural factor or disaster risk agents are in third place with an ARP value of 467.0. Natural factors or disasters that occur include high rainfall, floods, and landslides during the rainy season which cause losses to traders and hinder the movement of goods. This results in delays in delivery and potatoes being damaged in transit, so that the need for potato supplies is not met and the quantity of deliveries does not match the order. Handling that can be done is well-managed inventory management, diversification of suppliers, and diversion of alternative routes.

CONCLUSION AND SUGGESTION

Farmers do not market or sell potatoes directly to consumers. The potato marketing chain in Magelang Regency starts with collectors and middlemen. Several problems in the potato commodity marketing system in Magelang Regency are high marketing costs, price fluctuations, potato marketing chains, and supply chain risks. Potato supply chain management in Ngablak and Pakis Districts, Magelang Regency consists of primary members of the potato supply chain, namely potato farmers, middlemen, collectors, wholesalers, potato retailers, and secondary members of the potato supply chain, namely the Magelang Regency Agriculture and Plantation Service and Market Managers in Magelang Regency. Marketing agencies do not delay payments and are paid directly. Information flow patterns related to the number of consumer requests and product supplies run

smoothly. Information on delivery schedules usually changes but is still communicated to the marketing agencies of wholesalers and retailers to whom they supply potatoes.

In terms of marketing margin in the potato supply chain in Ngablak and Pakis Districts, Magelang Regency, the grades are large, medium, and small, so the highest marketing margin is in channel 3, namely Rp 3,000/kg. Meanwhile, the lowest marketing margin is in channels 1 and 2, namely Rp 2,000. In the calculation of the farmer's share of large-grade potato commodities obtained at the research location, channel I was 84.61%, channel II was 85.71% and channel III was 80.00%, including in the efficient category. The farmer's share grade value was obtained by channel I at 75.00%, channel II at 77.77% including in the efficient category and channel III at 70%, including in the inefficient category. The small farmer's share grade value obtained by channel I was 71.42%, channel II was 75%, which was included in the efficient category and channel III was 66.66%, which was not included in the efficient category. There are 23 risk agents and 15 risk events in the potato supply chain in Ngablak and Pakis Districts, Magelang Regency. Phase 1 HoR analysis provides results based on the Pareto diagram that there are 3 priority risk agents, namely crop failure, potatoes damaged in transit, and natural factors or disasters.

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