

The Contribution of Supply Chain Risk Management Towards the Performance of the Cattle Industry in the Northern Region, Malaysia

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Abstract. The cattle livestock industry faces numerous challenges, particularly concerning the supply chain. This sector is complex and diverse, presenting positive and negative implications for the future of sustainable cattle production. This study assesses the supply chain risk factor to ensure the successful performance of cattle industry in Malaysia. Furthermore, this study provides a supply chain risk management framework model for cattle industry. This study analysed qualitatively based on in-depth interview process. The participants of this study were 14 individuals included farmer, breeders, butchers, importers, and quarantine centre provider. The findings indicated that logistic risks were comparatively less detrimental to enhancing the performance of the livestock industry. This study establishes a theoretical model for cattle supply chain risk management (CSCRM), and it suggests that cattle farmers and suppliers can successfully mitigate risks in the supply chain to achieve improved outcomes.

1 Introduction

Agriculture is a cornerstone of Malaysia's economic development. The Annual Economic Statistics (AES) reported that the gross output of the agriculture sector from RM82.2 billion in 2020 to RM100.3 billion in the coming year. The growth rate is 23.2%. What is truly impressive is that out of the RM100.3 billion, a substantial RM18.7 billion was contributed by the livestock sector. Incredibly, livestock is pivotal in advancing numerous Sustainable Development Goals (SDGs), where it is intricately linked to SDGs 1, 2, 3, 5, 8, 10, 13, and 15, showcasing the interaction between these goals. This progress is inspiring livestock providers to take advantage of opportunities in the future of agriculture in Malaysia.

Sustainable Development Goals (SDGs) comprise 17 ambitious and 169 targets. These SDGs will be a compass for international organizations, governments, civil society, and the private sector to drive human progress over the next 15 years. Based on the Global Agenda for Sustainable Livestock (GASL), 'livestock is resolving critical environmental, social, and economic challenges to ensure sustainable growth.' These challenges encompass dwindling

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natural resources, pervasive poverty, climate change, food insecurity, human health, global threats, and animal welfare.

Furthermore, this trend will persist in livestock systems. Boosting production, changing preferences, urbanized population, and rising incomes in low- and middle-income countries. This includes Asian countries [1] and populations, as in much of Africa [4]. In addition, the livestock industry is expected to grow. The demand is expected to increase by more than 70% in 2030 [5]. Furthermore, increasing demand and satisfying the changing preferences influenced the cattle supply chain in most countries. The cattle industry also needs help with problems such as feed quality, availability, disease outbreaks, labour skills, supply chain risks, environmental impacts, market access, and competition between competitors.

One of the vital issues in the cattle supply chain is managing risk. Risks in the supply chain are essential issues that cattle providers should take. These problems have increased costs, reduced productivity, delivery problems, customer complaints, reduced profits, animal welfare, and environmental issues. Cattle farmers and providers are suggested to manage risk to succeed in business properly. Therefore, this study assesses the supply chain risk factors to ensure the successful performance of the cattle industry in Malaysia and provides a supply chain risk management framework model for the cattle industry.

2 Literature Review

2.1 Livestock Industry

The livestock contributes to agricultural development, food security, employability, income, poverty reduction, and life changes. The livestock sector contributes 40% of global agricultural output and the food and nutrition security of almost 1.3 billion people. From 40% of output, 20% of output in developed and developing countries is from livestock production.

Livestock is essential in sustainable food systems. Livestock sectors consume 77 million tons of protein in feedstuff, especially for human nutrition, and 58 million tons for food products. People worldwide consume protein based on meat, almost 5 kilograms per capita.

The livestock sector refers to domesticated animals raised in farming for various purposes, including providing labour and producing products like meat, milk, eggs, leather, fur, and wool. There are two categories of livestock: ruminant and non-ruminant. Livestock, which includes ruminant and non-ruminant animals, is crucial for managing the household economy and risk. Ruminants encompass cattle, buffalo, sheep, deer, and goats, while non-ruminants include ducks, poultry, eggs, and pigs [6]. This study focuses on ruminants, especially on the cattle supply chain.

Increasing incomes, population growth, and changing diets have increased demand and are the fastest growing in agriculture. This allows agribusiness, smallholders, job creators, and producers to focus on the cattle livestock supply chain. However, the complex supply chain has encouraged them to be appropriately managed in the supply chain. The growth risks accentuate the sustainability issues that impact the environment, equity, and public health.

2.2 Malaysian government in developing the livestock industry

In 2026, livestock production in Malaysia is projected to increase to around 4.1 million, representing a 0.7% annual growth despite a 0.2% decrease since 1966. In 2021, Malaysia was ranked 72nd in livestock production, led by Cuba, followed by Brazil, India, and the United States. Regarding imports, livestock in Malaysia are expected to decrease by 0.6% annually, reaching approximately 65 million. Demand has decreased from 1994 by 4.2%

annually. Malaysia ranked 42nd in livestock imports in 2021, with Ukraine topping the list at 67.4 million.

Malaysia's Gross Domestic Product (GDP) for livestock in 2021 was estimated at RM16.52 billion from RM16 billion in the previous year [3]. Economy Minister Rafizi Ramli emphasized the need to develop modern livestock farming to boost the economy [2]. He mentioned the government's collaboration with private-sector investors to achieve this goal, highlighting the potential for expanding livestock farming due to the high demand for beef supply. He also noted the cooperation between federal and state governments in providing sites and other assistance for agriculture and livestock farming projects.

Developing the livestock industry can ensure reduced import dependence and sustain food safety. Livestock also provides employment opportunities and contributes to human society as a source of food and clothing. The demand for meat, milk, and eggs will continue rising, presenting an opportunity for livestock producers. However, to be successful in the cattle business presently, players need to understand and manage risks appropriately.

2.3 Supply Chain Risk Management (SCRM)

Risk is a complex concept and can be interpreted differently. It depends on the topic and field of study [20]. There is extensive debate on risks within organizations. In general discussions, there is a constant tension between two perspectives: (1) risk as mere danger and (2) risk as danger and for opportunity. The growing number of risks and interruptions in the supply chain can lead to unfavourable outcomes [28]. Therefore, supply chain risk management has recently emerged as a new focus for research and performance improvement.

Previous studies define supply chain risk as potential business harm, damage, loss, or unintended consequences. Supply chain risk management is still developing, and limited studies. Therefore, companies should conduct a formal risk audit to manage it. Supply Chain Risk Management (SCRM) involves (1) risk assessment, (2) risk identification, (3) risk treatment, and (4) risk analysis [17]. SCRM encompasses all risks related to the flow of information, products, materials, and disruptions. [22] explained that supply chain risk can arise from external and internal environments. Hence, producers and policymakers must examine risk factors [25]. It is challenging if unmanaged and unseen [26].

SCRM encompasses planning, operations, marketing, performance evaluation, customer delivery, diversification, import improvement, coordination, quality control, productivity optimization, and overall company performance enhancement. These activities are integral to all industries. Previous studies have applied SCRM in industries by assessing supply risk [23][8], operational risk [19], demand risk [9], [23], financial risk [11], and information risk, among others, focusing on both internal and external factors [18].

Furthermore, effectively managing risks can resolve risk issues in the supply chain. Effective risk management relies on a complete understanding of the types of risks, their sources, and the triggers for these risks [27]. However, more research needs to focus on this topic in livestock industries. Every company has a high potential to face sick cows, feed problems, delivery problems, and weight targets. Thus, identifying these SCRM helps companies manage risk effectively. Effectively managing risk encourages all players in cattle industries to reduce loss and damage [22],[10]. Hence, present research needs to be conducted on the research related to SCRM to add more academic resources.

Cattle producers have the potential to face risk in the supply chain. Managing risk helps them to succeed and solve their problems. SCRM in this study is divided into (1) supply risk, (2) operation risk, (3) demand risk, and (4) logistic risks.

2.3.1 Supply risk

Supply risk arises from "upstream" activities [23]. This type of risk pertains to issues related to suppliers, such as price fluctuations, supplier bankruptcy, quantity of inputs, and unstable quality [8]. Delivering inbound goods or services to the purchasing firm affects the downstream supply chain [21].

2.3.2 Operation risk

Operational risk is disruptions of internal problems within a firm, affecting its ability to produce and supply [19]. For instance, changes in design and technology can result in increased project costs and disrupt operational activities, ultimately leading to decreased investment returns [15].

2.3.3 Demand risk

Demand risk is activities further down the supply chain [9]. It pertains to demand fluctuations, customer bankruptcy, fragmentation, and intense market competition [24]. According to [23], changes in customer expectations can drive up product costs. Supply chain firms need help estimating and forecasting the actual market demand. Moreover, demand variability negatively impacts the inventory system [12], leading to either a shortage or a stock surplus.

2.3.4 Logistic risk

Logistics are vital components in the supply chain. In supply chains, effective logistics and infrastructure aid in delivering the right product in the correct quantity, in the proper condition, to the right place, at the right time, and at the right cost [16]. Effective logistics help deliver the right product in the proper condition, quantity, time, place, and cost. Disruptions to critical decision-making factors include reliable communications, affordable transportation, and information technology [13].

2.4 Supply chain risk and livestock performance

Supply chain risk and livestock performance are topics of much discussion in organizations. Supply chain risks can significantly impact livestock productivity, health, and welfare, ultimately affecting the quality and quantity of animal products. For instance, disease outbreaks can lead to substantial productivity and animal welfare losses. Furthermore, outbreaks can result in the death or culling of animals, reducing the available number of animals for production, which impacts the profitability, quality, and quantity of animals.

Shortages in feed supply can also affect livestock performance. Livestock requires specific diets to maintain its health and productivity. Shortages can lead to suboptimal nutrition and reduced growth rates, consequently affecting the quality of animal products and leading to lower prices and reduced profitability.

Additionally, transportation and logistics risks can also impact livestock performance. Lengthy transportation times and poor handling can result in stress and injury to animals, leading to reduced productivity and animal welfare. This can affect the quantity and quality of animal products, as stressed animals may have reduced meat or milk yield.

In conclusion, supply chain risks can significantly affect livestock performance, ultimately impacting the profitability of livestock operations. To mitigate these risks,

livestock producers and supply chain stakeholders must develop robust risk management strategies to reduce risk and improve performance.

3 Research Method

In-depth interviews were conducted in this study to understand stakeholders' perceptions in the livestock industry regarding the factors that affect supply chain risk and business performance [7]. The participants included farmers, breeders, butchers, importers, and quarantine centre providers, totalling 14 individuals. These participants are all involved in cattle livestock businesses in the northern region of Malaysia and have two years of experience in this field.

These interviews aim to comprehend their views on the factors influencing their business performance. Each interview session lasts approximately 30 to 45 minutes. Before the interviews, participants were briefed on demographics and the correlation in this study.

Demographic questions cover gender, education level, type of business, location, and years of experience. Table 1 outlines the questions of supply chain risk management and performance measurement.

Table 1. The supply chain risk management and performance measurement

Indicator	Items
Supply Risk.	Quality of The Satisfactory Supplier The Company Has a Supplier Inspection Procedure Number of Suppliers Sufficient for Business Frequent Changes Happening to Critical Resources Any Complexity to Critical Resources
Operation risk	Interruptions during the Production process The level of process variation is high Product recall processes occur frequently Inventory of products mishandled occurs Production capacity inflexible
Demand risk	Unexpected or highly uncertain demand An error occurred in giving a significant focus to the request Frequent delays in customer requests Change in the customer's preferences. The request poses a risk to the reputation of the company name.
Logistic risk	Transportation operation sufficient Bad/poor transport design on the network Transport activity has financial strength Delay during delivery
Livestock Performance	Value of The Gross Profit Margin of The Company Net Profit from The Operations Carried Out? The ratio of Profit to Sales. The company's Return on Investment The Ability to Fund Business and Growth from Profits.

4 Results and Discussion

4.1 Profile respondent

The study analyses the profile of respondents based on education level, types of business, business location, number of employees, years of experience, and available facilities. Table 2 shows the profile of respondents in this study.

Table 2. The profile of respondents.

Informants	Gender	Education level	Type business	Location	Year experiences
1	Male	Degree	Breeders	Malau, Jitra, Kedah	5
2	Male	Diploma	Quarantine Centre	Stesen Kuarantin Perlis	30
3	Male	High school	Importers / Cattle Businesses	Pdg Besar-Batu 20	30
4	Male	SPM	Breeders	Mata Ayer Perlis	18
5	Male	SPM	Breeders	Kg Sena Dalam Padang Besar Perlis	30
6	Male	Degree	Butcher	Selama Kedah	4
7	Male	SPM	Breeders	Panggas Besar, Chuping	6
8	Male	Diploma	Quarantine Centre	Padang Besar	29
9	Male	SPM	Breeders / Butcher	Selama Serdang Kedah	20
10	Male	SPM	Breeders	Kg Kubang Leret, Pokok Sena	3
11	Male	SPM	Breeders	Kg Tok Kun, Mukim Bukit Lada, Pokok Sena	5
12	Women	SPM	Butcher	Kg Bukit Tampo, Mukim Gajah Mati, Kedah	10
13	Male	SPM	Breeders	Banggol Rasyid, Selama Kedah	15
14	Male	SPM	Breeders	Batu 12, Jalan Selama Serdang Kedah	20

4.2 Supply Chain Risk Management (SCRM)

SCRM refers to any disruptions to the materials, flow of information, and products due to internal and external factors. According to this study, SCRM is categorized into four main types: (1) supply risk, (2) operational risk, (3) demand risk, and (4) logistics risk

4.2.1 Supply Risk

Based on interviews regarding supply risk, the study found that most respondents emphasized the need to address supply risk issues. Although respondents expressed satisfaction with the supply from the supplier, there are still problems related to supply risk caused by mixed sizes. The study revealed that most respondents conduct supplier inspections to ensure valid permits, and the good health of animals ordered. Furthermore, the study found that the existing suppliers can fulfil their needs. Still, there is a scarcity risk due to price fluctuations and non-standard sizes of animals, especially during festive seasons like Hari Raya. Additionally, strict border procedures lead to lengthy processes, potentially affecting the animals' health and causing fatalities. This situation poses a risk to the supply of healthy animals.

4.2.2 Operation risk

The results of an interview on operational risk showed that 50% of respondents reported no disruptions during operations. However, others mentioned that the interruptions were caused

by issues related to interstate permits, unstable market prices, and animal diseases. Most respondents also noted that there could have been more variation in carrying out activities. Furthermore, the main issue during this operation was related to livestock stock needing to meet set standards. The production capacity depended on the supplier and the current situation. The study also found that there were no product recalls during production activities. However, respondents indicated that the product would be recalled if there were a disease.

4.2.3 Demand risk

Based on the interview, the responses suggest that seasonal demand is the main risk to the demand factor. The celebration during the Hari Raya Qurban/Aidil Adha is the most critical time for all entrepreneurs. This increased demand provides an opportunity to increase profits while simultaneously offering operators the risk of meeting each customer request. However, there will rarely be a change or cancellation from the customer since they took the deposit from the customer to avoid any risk of cancellation at the last minute.

4.2.4 Logistic risk

Based on the interview results, logistics has less impact on livestock performance. Most companies have trucks for logistics and their barns. Hence, logistics risks are less risky than other risks.

Table 3. The cattle livestock performance.

Informants	The Gross Profit Margin of The Company	Net Profit from The Operations Carried Out?	The ratio of Profit to Sales?	Return on Investment	Ability to Fund Business Growth from Profits.
1	No Margin Calculation	Around 20k A Year	Not Used Because I Do not Know	No	10% Of Income
2	30k	30k Years	10%	No	No
3	150.00 Per Head	100 Per Head	1 Ratio 3	2%	No
4	500-600 Heads / 300k	150k	1 Ratio 2	7%	300k Minimum
5	400-500	300 Per Head	No	8%	15-20%
6	No	3000-6000	1 Ratio 2	1000-2500	50%
7	No	3000-5000	1 Ratio 2	1000-2500	40%
8	300k	30k Years	10%	No	No
9	70k	30k Years	500	30k	30k
10	6000	4000	6 Ratio 8	No	No
11	8000	6000	6 Ratio 8	No	No
12	4000	3000	3 Ratio 4	No	10%
13	50k Years	30k A Year	500	20%	30k
14	70k	30k	500	30k	0

4.3 Cattle livestock performance

The cattle livestock industry's performance is assessed using net profit, gross profit margin, return on investment, profit-to-sales ratio, and business funding capability. The findings

show that the profit margin is calculated per head or average. Research indicates that the profit per head ranges between RM150.00 and RM600.00, or an annual profit of RM 70 thousand to RM 300 thousand. The net profit amounts to 30 thousand per year. Studies also suggest they can allocate 10% to 50% of earnings to business funding. This study concludes that the cattle livestock industry presents significant financial opportunities and has the potential for business expansion. Table 3 shows the cattle livestock performance in the northern region of Malaysia.

4.4 Research model

The diagram below illustrates the framework resulting from this study, showing the relationship between SCRM and livestock performance. SCRM is divided into four parts: (1) supply risk, (2) operation risk, (3) demand risk, and (4) logistics risk. Some of the specific dangers falling under these categories include border procedures, varying sizes, seasonal demand, health concerns, pricing, animal diseases, specifications/standards, and ownership of trucks and barns. This relationship is depicted in the diagram below. Figure 1 shows the research model for the Cattle Supply Chain Risk Management Model (CSCRM).

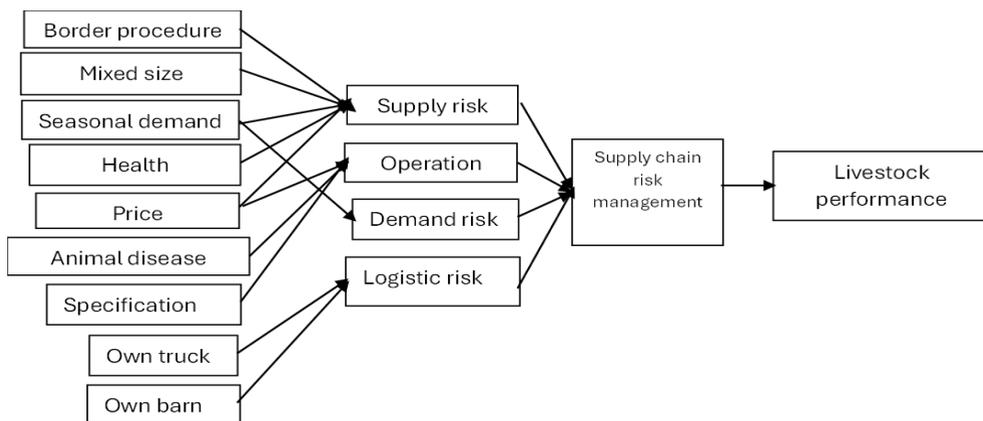


Fig. 1. The Cattle Supply Chain Risk Management Model (CSCRM).

SCRM factors (supply, operation, demand, and logistics) affect the livestock industry differently. Logistic risk was found to have less impact on livestock operators, likely because most of them have their trucks and barns. Therefore, there are more significant risks to improving the performance of the livestock industry than logistic problems. According to the interview results, supply risk is caused by border procedures, market price fluctuations, varying sizes of livestock, seasonal demand, and health inspection. Operation risk is caused by animal diseases and not following the specified standards and prices. As for the demand risk factor, seasonal demand is expected, especially during festive seasons. The unexpected demand puts constant pressure on the operators to ensure that demand can be met.

5 Conclusion and recommendation

The findings related to this model provide evidence of new conclusions in the field of the cattle livestock industry. This study also provides more details regarding the relationship between the factors in this study. It offers discoveries in finding the relationship or role of a factor, providing valuable insights for future studies.

In a practical contribution, it will guide industry players to focus on the factors that will bring success to businesses in this field. This study also guides the younger generation to

venture into this field and avoid making mistakes in running this business, as they will have focus and support based on the views and experiences of others. Therefore, the livestock business would develop more if those actively involved had guidance to build their business.

Future studies can extend this study to get the perceptions of those who do business throughout peninsular Malaysia. Furthermore, future research can explore in more detail, especially the efficiency of the other factors that impact the performance of companies involved in cattle livestock. Notably, this will offer more reading material. In addition, the study can highlight the issues and challenges encountered in other regions in order to achieve sustainable performance.

In conclusion, supply chain risk is crucial for any organization. Thus, the younger generation's involvement with management skills is necessary to solve the SCRM. Future research should increase the sample size and consider other risks. The research should be conducted empirically using quantitative methods. Furthermore, future studies should include moderator or mediator elements such as management skills, information technology, or digital marketing to improve knowledge and information.

Acknowledgment. Thanks to God, this study has been completed with His abundant grace. Our most profound appreciation and gratitude go to this study research team, respondents, and all involved.

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