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*by* Hana Catur Wahyuni

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## Identifying risk event in Indonesian fresh meat supply chain

H.C. Wahyuni<sup>1,2\*</sup>, I. Vanany<sup>1</sup>, U. Ciptomulyono<sup>1</sup>

<sup>1</sup>Department of Industrial Engineering, Institut Teknologi Sepuluh Nopember, Kampus ITS Sukolilo-Surabaya 60111, Indonesia

<sup>2</sup>Industrial Engineering Department, Universitas Muhammadiyah Sidoarjo

\*hanacatur@umsida.ac.id

**Abstract.** The aim of this paper is to identify risk issues in Indonesian fresh meat supply chain from the farm until to the “plate”. The critical points for food safety in physical fresh meat product flow are also identified. The paper employed one case study in the Indonesian fresh meat company by conducting observations and in-depth three stages of interviews. At the first interview, the players, process, and activities in the fresh meat industry were identified. In the second interview, critical points for food safety were recognized. The risk events in each player and process were identified in the last interview. The research will be conducted in three stages, but this article focuses on risk identification process (first stage) only. The second stage is measuring risk and the third stage focuses on determining the value of risk priority. The results showed that there were four players in the fresh meat supply chain: livestock (source), slaughter (make), distributor and retail (deliver). Each player has different activities and identified 16 risk events in the fresh meat supply chain. Some of the strategies that can be used to reduce the occurrence of such risks include improving the ability of laborers on food safety systems, improving cutting equipment and distribution processes

### 1. Introduction

The food supply chain is one of supply chain domain which suffers a lot of uncertainty in its functioning [1]. Structure of the supply chain relatively difference between one country to others countries [2], such as in the United Kingdom [3], Japan [4], and Australia [5]. Besides that, types of food products also have uniqueness based on types of food products such as agrifood [6] and beef products [7]. In the flow of food products in the supply chain, there is a risk that food contaminated with hazardous materials for human health, and food cannot be consumed. A risk is defined as consumer perceptions of uncertainties and events to be received as a result of purchasing a good or service [8]. Basically, there are two main components of risk, namely: (1) risk category of product, which is the perception of a person who must be accepted because of buying a certain product and (2) risk to product specification (product specific risk), which is the perception of the association to the risk that will be accepted on a product [9].

In the context of the supply chain of food products, the possible risks are the contamination of the food from the chemical, biological and physical aspects of the food security indicator or the risk that occurs due to the behavior that causes the food not to be consumed. This condition is driven by several



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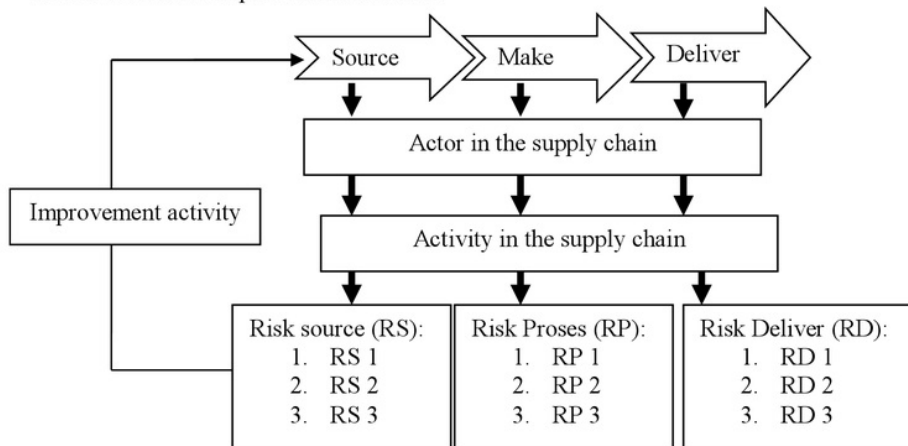
factors that influence, among others, lack of institutional support (government policy) in terms of law enforcement on food safety, lack of knowledge and awareness of farmers, as a source in the supply chain process of microbiology as a whole [10] and less optimal implementation of food safety in the process of making food [11] resulted in growth rate, improvement of quality and increase of product competitiveness of food industry product experiencing obstacles [12]. The objective of risk management in the supply chain is to increase the capability so as to reduce the probability of occurrence of risk [13]. Quantitatively, the risk can be measured so that it can be estimated its severity [1].

The contamination of hazardous substances in the supply chain is also affected by the negative manipulations perpetrated by the actors in the supply chain resulting in anxiety and inconvenience to consumers, requiring information that ensures that the products consumed to meet the quality standards and halal requirements [14]. Therefore, in the supply chain, companies should be able to identify the activities that are the source of risk so that food is unsafe to eat. Some sources of the risks if not managed properly will cause risks that have a negative impact on food products, such as contaminated *Salmonella ssp*, *S.aureus*, *E.Coli*, *Shigella spp*, *Fecal coliform* [15].

A fresh meat is one of the food sources of livestock are indispensable as a source of functional protein and growth, especially in children of an early age where at that age the rate of growth and development of brain cells is very high [16]. However, meat is also food that is at high risk of being contaminated if not managed properly. In Indonesia, several incidents due to meat poisoning occurred in Purbalingga resulting in 93 people in hospital [17], and 70 people poisoned in Nunukan District [18]. Therefore, it is necessary to identify activities at risk in the supply chain of meat. This condition indicates that fresh meat needs to be managed in order to avoid the risk of harm to health. Several preliminary studies on fresh meat supply chains are associated with improved meat quality with traceability [19]. With the knowledge of various kinds of the risk event, it is expected to be a good meat management so that the negative impact of the risk can be avoided.

**2. Research Method**

SCOR (Supply Chain Operations References) model are utilized to develop the research framework which consists of the source, process, and delivery. Figure 1 shows the proposed research framework based on the SCOR business process model. Each stage of the business process is carried out by each actor/player with different activities and different risks. Any activity that does carry risks that can be used as a basis for improvement activities



**Figure 1.** Research framework.

The research stages were conducted in three (3) stages, namely (1) risk event identification, (2) risk measurement, (3) determination of Risk Priority Value (RPV). The detail of stages is described in below.

**Stage 1. The identification of risk events**

This phase aims to: (1) identify the scope of food safety and halal integration in the supply chain, (2) identification of risk factor types at each stage of the supply chain so that information about risk activities for each Player (risk event), (3) the impact of each risk event on the risk agent (see Table 1)

**Stage 2. Risk measurement**

This phase aims to measure the various types of risks identified in phase 1. The risk assessment conducted in this phase will generate risk value for each risk event and serve to prepare risk priority and risk classification for each player in the supply chain. The measurement of risk value for each risk event is based on the Likelihood (L), Impact (I) and Detection (D) values. The technique of data retrieval is done by using questionnaire with scale 1 s / d 10 for S, I and D.

**Stage 3. Determination of RPV**

This phase aims to establish an integrated risk priority in the food supply chain. The preparation of the RPV is based on the value gained during the risk assessment. Data processing is done by ranking risk value for each risk event from the biggest value to the smallest value. The largest risk value indicates the risk level of the activity is large, meaning that the implementation of the activity is at risk of contamination of harmful substances.

**Table 1.** The identification of risk events template.

Process business	Player	Activity	Risk Event	Likelihood (L)	Impact (I)	Risk Score (LxI)	Detection (D)	RPV (LxIx D)
Source	PS	PS1	SR1	....	...	....	...	...
		PS2	SR2	...	....	...	...	...
		PS3	SR3	....	...	...	....	....
Make	PM	PM1	MR1	...	...	...	...	...
		PM2	MR2	...	...	...	...	...
		PM3	MR3	...	...	...	...	...
Deliver	PD	PD1	PD1	...	...	...	...	...
		PD2	PD2	...	...	...	...	...
		PD3	PD3	...	...	...	...	...

Indonesian food industries has experienced several accidents of risk such as SARS, bird flu, and other food contamination [20][21]. Indonesian manager believed that the implementation of supply chain risk is important to be conducted in order to reduce cost, loss of profit and others [22] **Error! Reference source not found.** and the relationships among risks should be identified to manage the risk [23].

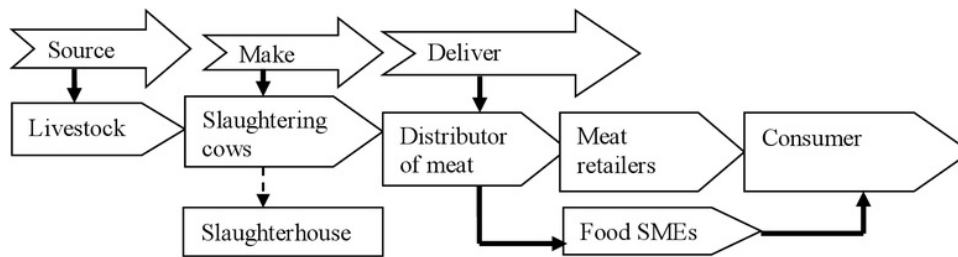
The case study in this study is a fresh beef located in Sidoarjo, East Java, Indonesia. The data collection method was carried out by using survey and interview in February 2017. The survey aims to determine the flow of processes and information flow of fresh meat supply chain management. The interviews were conducted by multiple various important information related to the management of fresh meat supply chain with the manager who understands the process and quality of the product. Three stages were implemented from this instrument: Firstly, the players, process, and activities in the fresh meat industry were identified. In the second interview, the critical points for food safety were also identified. In the third interview, the risk events of each player and processes were identified.

**3. Results and Discussions**

In general, meat is food that is easily obtained in the market. Meat supply chain shows the process of meat procurement from the beginning until the meat is received by consumers. The length of the

supply chain is strongly influenced by spatial and vertical marketing reach, where cattle sold out to the island have long supply chains than those sold in local markets [24]. The results showed that the model of fresh meat supply chain in Sidoarjo can be seen in Figure 2.

Figure 2 shows 4 actors in the fresh meat supply chain. Firstly, farmers are the beginning of the supply chain that serves as a provider of raw materials, namely cattle. Secondly, distributor of fresh meat, a part that will distribute fresh meat to retailers or small businesses such as food vendors meatballs, sausage industry, and others. Thirdly, fresh meat retailers, a part that will distribute fresh meat to the final consumer. Finally, retailers are the last part of the fresh meat supply chain process. Each stage of the supply chain poses a risk that has a negative impact on the safety of fresh meat food. The results of identification of risks in fresh meat can be seen in Table 2:



**Figure 2.** Fresh meat supply chain.

**Table 2.** Identification of risks in fresh meat supply chains.

Player of supply chain	Activity	Risk Event
Livestock	Providing cattle as the raw materials of fresh meat.	Animals are not legal (L1)
	Delivering cattle to slaughterhouses.	Depressed animals (L2)
Slaughter	Animal antemortem examination Slaughter	Animals in sickness (S1)
		Found infectious diseases (S2)
		Animals in a state of stress when cut (S3)
		Knife is not sharp (S4)
Distributor of fresh meat	Postmortem examination Maintenance of sanitation Delivery of fresh meat to distributors Meat sales to retailers	Officer is not disciplined (S5)
		Found infectious diseases in animals (S6)
		The drains are not well maintained (S7).
Fresh meat retailers	Sales of meat to end consumers	Non standard transport system (D1)
		Non standard storage system (D2)
		Meat marketed under open conditions (D3)
		Meat marketed under open conditions (Fr1)
		Meat is often held by consumers (Fr2)
		Not using plastic packaging type PE (polyethylene) and PP (polypropylene) (Fr3)
		Stored in high air temperature (Fr4)

The table 2 shows the risks occurring at each stage of the supply chain. Totally, the total of the risks events is 16 risk events in the fresh meat supply chain, consisting of 2 risk events on livestock, 7 risk

events on slaughter, 3 risk events on distribution and 4 risk events in retailers. This condition indicates that every player in the supply chain has different characteristics. In order to improve the effectiveness and efficiency of risk prevention on fresh meat, it is necessary to conduct various food safety related measures. Some strategies that can be used to mitigate risk events including improving workers' understanding of food security systems, complying with government requirements on slaughtering animals, slaughter equipment, physical environment and equipment used for cutting and distribution processes. Therefore, to prevent risks that have a negative impact on human health, it is necessary to implement the application of food safety system and the improvement of integrated infrastructure for each actor in the supply chain. A large number of actors in the fresh meat supply chain encourages inter-agency coordination. This coordination must ensure sustainability in the risk prevention process in the fresh meat supply chain.

#### 4. Conclusion

Fresh meat is a food source of the protein important for human health. Fresh meat supply chain is the process of providing raw materials to consumers. The results showed that there were found 4 actors in the fresh meat supply chain, namely: breeders, slaughterers in the slaughterhouse, distributors, and retailers. Any activity perpetrated by the offender poses a risk that has a negative impact on human health. In overall, found 16 risk events that will be a source of risk in the supply chain of fresh meat. To reduce the impact of risks to human health, it is necessary to implement an integrated food security system among actors in the fresh meat supply chain. For example, to maintain the quality of fresh meat in delivery, it is necessary to use the type of vehicle in accordance with food safety standards, in terms of temperature and packaging.

The study was limited to the risk identification process in fresh meat. This study shows the type of risk activities performed on the process of fresh meat supply chain. However the magnitude of the risks posed by these activities and other aspects that affect food security in the supply chain has not yet included. For future research, it is necessary to consider the aspects of food safety, and halal in the supply chain. The relationships among risks will be investigated in the future.

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