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Application of Grey Teory Method for Halal Food Risk Assessment Based on the Traceability System in Food Supply Chain

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Abstract. The purpose of this study was to assess the risk of based halal food. The method that will be used in conducting a risk assessment using the Grey Theory method. There are three risks that need to be considered for fish meatball SME, namely the risk of adding preservative supporting ingredients to meatballs, the risk of contamination with lizard dung, rats, cockroaches. Supporting materials used are not in accordance with the list of ingredients in LPPOM MUI. Therefore fish meatball SME can communicate risk by exchanging information and opinions on food security risks by adopting important mitigation principles, namely control, coherence and coordination. By minimizing the risk of halal food in the SME, the halal guarantee law can be realized to encourage halal industry in Indonesia.

Introduction

Halal food is a very sensitive issue in Indonesia, which has the population of 255 million people 87.2 percent of whom are Muslims, representing the world's largest Muslim population [1]. Consequently, the halal food producers use the label of *halal* on their products as a symbol of quality [2], [3] and combine it with the label of *thoyyiban* - which means "safe for consumption" [4]. Therefore, halal products are consumed not only by Muslim customers but also by non-Muslim customers so that the growth of halal products is significant enough, about 18.3 percent of global food expenditures reaching US $ 1,914 billion in 2021. [5] state that Muslim consumers have a high awareness of halal products and avoid the risk of halal products. However, the risk of halal products can occur starting from the origin of raw materials, the way to obtain them, the process of handling the raw materials, the type of material or substance (material), the storage and every stage of the process from raw materials to finished products [6]. Thus, the risk potential may take place along the supply chain points such as raw material risk, production risk, food safety risk, and logistics risk [7].

In general, the risk potentials that occur on halal food products may be in the form of fraud and forgery of halal food, food safety incidents, and contamination of non halal raw ingredients [8],[9],[10] One of the potential risks occurred in 2014 on the cases of Hazelnut and Cadbury circulating in the market that were declared for containing swine DNA [11]. Additionally, in 2001, there was the case of Ajinomoto seasoning that was suspected of mixing its raw ingredients with lard in the manufacturing process. The use of raw ingredients such as pork, alcohol, carcasses, blood, forbidden (*haram*) animals and improperly slaughtered animals is forbidden even though the percentage of those ingredients is small [12] In another case, [13] mentioned the manipulation of halal labels from MUI for pork containing products which occurred in beef jerky and shredded chicken products available in the society. [13] stated that the products circulating in the society were suspected of coming from the bone and pork skin containing gelatin, shortening and lard.

A number of halal problems and scandals that have occurred in recent years on several top brands have shaken the public confidence in the ability of producers and the government to ensure the integrity of the halal labeled products starting from the source,

process and suitability with Islamic principles [14] as well as cleanliness, which is part of the Islamic religion [15]. The high number of cases of halal products indicate that the potential risks of halal products can occur throughout the supply chain from upstream to downstream whereas risk is a negative consequence of an occurrence [16], which causes loss. The greater the loss, the greater the risk [17]. Therefore, one of the ways to determine the potential risk for halal products is by conducting risk analysis for developing potential risks that occur in the food supply chain. The aim is to understand the vulnerability point along the food supply chain in order to do corrective measures against the potential risks that occur. In minimizing risk occurrence in the supply chain for halal food, however, it requires not only conducting risk analysis but also collaborating with traceability systems. [18] states that system traceability can reduce risk in the food supply chain. Similarly, [19] conducted risk identification in the food supply chain with a traceability system. A good traceability system can reduce the possibility of risks to food security and will improve the overall food security [20]

Thus, this study will conduct a risk analysis of the food supply chain by conducting a traceability system-based risk assessment on halal foods. One of the methods that will be used to assess the risk is Grey Theory method. This method is very appropriate in assessing the risk of food supply chains because Grey Theory combines the situations of obscurity [21]. In addition, many researchers apply grey theory for decision-making and evaluation [22], just as[23] applied this theory method to do the assessment of airport performance in Libya. Moreover, [24] employed grey theory on the risk of multi-attribute decision-making. This study, therefore, will use grey theory to assess the potential risk of a traceability system based on the supply chain of halal food. The purpose of this study is to assess halal food products by considering the traceability system on halal food.

Methodology

The object in this research is an SME of fish meatball production. The methods used in collecting the data include direct survey and semi-structured interview with the owner of the fish meatball SME. The first stage questionnaire was used to identify the activities of fish meatball production process from upstream to downstream. The second stage questionnaire identified the risks occurring in each activity, the causes of the risks and the impacts generated by these risks. The third questionnaire attempted to find out the frequency or the possibility of the occurrence of risks in the process of meatball production in a year besides obtaining the assessment score for each risk.

Identification of Halal-related risks. The process of identifying halal-related risks was carried out by the means of literature studies and field studies, which include literature review, brainstorming with experts, company historical data, questionnaire and interview with the stakeholders *of* fish meatball SME. The identification phase includes the data on halal-related risk events at each stage of the process of fish meatball production.

Identification of Traceability-Based Risks. The process of identifying traceability-based risks was carried out by identifying the risks that possessed not-halal potential with *traceability* starting from the incoming of raw ingredients to product distribution. The aim is to find out which non-halal risks can be handled by the *traceability* system in each risk event on halal food. The results of this identification became the basis for making the questionnaire regarding the assessment of the risks of fish meatball.

Risk Assessment. Risk identification data was the basis for making a risk assessment questionnaire. The assessment criteria used were scale 1-5 adjusted with the condition in the fish meatball SME. This questionnaire consisted of three main parts that adopted the FMEA concept *(Failure Mode and Effect Analysis)* including *severity*, *likelihood*, and *detection*. The value of *severity*, *likelihood*, and *detection* became the input for making *Comparative Series* lines in Grey Theory method. *likelihood* value that represents the probability or frequency of any potential risk events while *severity* value is the amount of impact that would be caused when this risk potential occursThe stages in the risk assessment of halal food with *grey theory* method [25] are as follows. Make a comparative line with the following formula:

1. Make a *Comparative Series* line

$$X = \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} X_1(1) & X_1(2) & \cdots X_1(k) \\ X_2(1) & X_2(2) & \cdots X_2(k) \\ \vdots & \vdots & \vdots \\ X_n(1) & X_n(2) & \cdots X_n(k) \end{bmatrix} \quad (1)$$

where $x_i^t(k)$means thek factor from x_i

2. Make standard lines

$$X_0 = X_0(1),\ X_0(2), \ldots, X_0(k)) = (1, 1, \quad (2)$$

3. Obtain the difference between comparative lines and standard lines

$$= \begin{bmatrix} \Delta_{01}(1)\ \Delta_{01}(2)\ \Delta_{01}(3) \ldots \Delta_{01}(k) \\ \Delta_{02}(1)\ \Delta_{02}(2)\ \Delta_{02}(3) \ldots \Delta_{02}(k) \\ \vdots \quad \vdots \quad \vdots \quad \cdot \quad \vdots \\ \vdots \quad \vdots \quad \vdots \quad \cdot \quad \vdots \\ \Delta_{0m}(1)\Delta_{0m}(2)\Delta_{0m}(3)\cdots\Delta_{0m}(k) \end{bmatrix} \quad (3)$$

Where $\Delta_{0j}(k) = \|X_0(k) - X_j(k)\|$

4. Calculate the relationship coefficient

$$\gamma(X_0(k), X_i(k)) = \frac{\Delta_{min} + \varsigma\Delta_{max}}{\Delta_{0j}(k) + \varsigma\Delta_{max}} \quad (4)$$

Where : j= 1,……,m ; k= 1,…..,n; $x_0(k)$ is the standard line and $x_i(k)$ is the comparative series line $\Delta_{0j} = \|X_0 - X_j(k)\|$ $\Delta_{min} = \min_{\forall j \in i} \min_{\forall k} \|X_0(k) - X_j(k)\|$ $\Delta_{max} = \max_{\forall j \in i} \max_{\forall k} \|X_0(k) - X_j(k)\|$

ς is the *identifier*, $\varsigma \in (0,1)$, only influence the valueof relative risk without changing the priorities. Generally, it is worth0.5.

5. Determine the degree of relationship

$$\Gamma(X_i, X_j) = \sum_{k=1}^{n} \beta_k \gamma(X_i(k \quad (5)$$

Where β_k is the coefficient of weight factor and $\sum_{k=1}^{n} \beta_k = 1$ If all factors are equally important.

$$\Gamma(X_i, X_j) = \frac{1}{n} \sum_{k=1}^{n} \gamma(X_i(k), X_j(k)) \quad (6)$$

6. Rank the risk priorities, In the ranking based on the degree of relationship between comparative lines and standard lines, a *relational* line could established. If $\gamma(X_0, X_i) \geq \gamma(X_0, X_j)$, which signifies the relationship level between, $X_i$and$X_0$is bigger from between$X_j$andX_0.

Result and Discussion

The identification in Table 1 carried out on the risks associated with traceability system-basedhalal refers to four fundamental questions, namely: 1) what is wrong, 2) how likely it happens, 3) what will happen if it happens, and 4) how the traceability system can

track the occurrence of such risks. According to [26] traceability system is defined as the ability to track the history, or the location of an entity through recorded identification. Halal food safety risks can occur both internally and externally. External risks take place in the activity of the fish ball grinding process which is carried out in the public grinding place, whereas internal risks are associated with the organization in the SME, which include suppliers and production process.

Identification of traceability system-based risks is aimed to establish a record of information flow within the supply chain and traceability system refers to a system that allows companies to record the history of their product information. With the traceability system, the origin of the product, processing method, safety characteristics, quality of food products and the supply chain agents are identifiable [27]. Traceability-based , there are nine risks that are suspected of influencing the halal production process. Then, the criteria included in the risk category are changed to *risk events* to facilitate the assessment process using the FMEA concept. The greater the *severity of*a risk event, the greater the impact it has on halal production. *Occurrence* assessment is carried out to measure the possibility of a risk to occur.The greater the *occurrence* value of a risk, the higher the probability of the risk to occur.The more frequent the*risk causes*occur, the greater the effect on the occurrence of*risk events*.Assessment of*detection* aims to measure the possibility of a risk to be detectable.The greater the*detection* value of a risk,the greater the possibility of a risk to beundetectable.Referring to the*current control*, the more difficult the failure detection in an assessment,the more likely the *risk event* will take place.

Grey Theory-Based Risk Assessment

Therisk assessment uses Grey methods. Grey method has the ability to overcome imperfections and vague information. Grey method is a method suitable for dealing with types of problems that include uncertain information, such as uncertainty that can be expressed by Grey Number or Grey Variable [23]. The first priority is the priority with the smallest degree of relationship. Γ7, Γ5, Γ8. Each of these risks, namely: the addition of prohibited additives, the contamination of the waste of lizards, miceand cockroaches, and the unsuitability of food additives with the list in LPPOM MUI. The complete risk levels can be observed in Table 1.

Table 1.Priority-Based Risk Levels

Risk Code	Risk Event	Degree of Relationship	Rank
R1	There are fish feed contaminated by unclean (*najis*) things.	0.619	7
R2	The fish are poisoned.	0.619	7
R3	It is mixed with non-halal meat.	0.650	6
R4	The fish meat grinder equipment is not specifically for halal products.	0.553	5
R5	It is contaminated by the waste of lizards, mice, or cockroaches.	0.499	2
R6	The ingredients are contaminated by unclean (*najis*) things.	0.515	4
R7	There is an addition of prohibited additives (Borax).	0.423	1
R8	The food additives used are not in accordance with the list of ingredients in LPPOM MUI.	0.489	3

In Table 2 *potential effect* when the risk occurs, *occurrence* or *risk cause* from the occurrence of a risk and *detection* or the level of *current control* that already exists. This is done because the risk event is an occurrence that is uncertain and can cause a loss in this case that influences the halal production process in the fish meatball SME. *Risk events* can occur due to a risk cause. Furthermore, the *risk event* also affects something called *potential effect*. A *risk event*, however, can be detected and monitored *(current control)*.

The risk of adding preservatives to meatballs is a risk with the smallest degree of 0.423, which means that this risk is classified as high and some efforts should be made to prevent this risk. The addition of food additives (BTP) is carried out to obtain the desired food and improve the foodcharacteristicsin order to increase the quality. The addition of additives to foods is allowedwhen it is in accordance with the rules of use and preservative set by the government.In contrast, the use of preservatives, if not according to the rules, for example borax or formaldehyde for meatballs, will jeopardize the safety settings of the foods that potentially affect the health.Hence, the food is not classified as *Halalan Thoyiban* because of using prohibited preservatives.

The second rank risk is the risk of contamination with the dung of lizard, mice, and cockroaches. This risk makes the safety of meatball products low.Therefore food safety management systems (FSMS) in designing control of potential food safety hazards implement Hazard Analysis Critical Control Points (HCCP). The aim of HCCP is to control general cleanliness and environmental conditions in a food processing operation. Implementation of a traceability system on fish meatball production in the SME is expected to reduce the risks associated with fish meatball products in its supply chain. By minimizing the risk of halal food in the SME, the halal guarantee law can be realized to encourage halal industry in Indonesia.

Conclusion

Traceability-based risk assessment can prevent food safety problems and can be detected if problems occur along the food supply chain. There are three risks that need to be considered for fish meatball SME, namely the risk of adding preservative supporting ingredients to meatballs, the risk of contamination with lizards, mice, cockroaches. Supporting materials used are not in accordance with the list of ingredients in LPPOM MUI. Therefore fish meatball SME can communicate risk by exchanging information and opinions on food security risks by adopting important mitigation principles, namely control, coherence and coordination. By minimizing the risk of halal food in the SME, the halal guarantee law can be realized to encourage halal industry in Indonesia.

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References

[1] Hefner, R.W. (2017), “Christians, conflict and citizenship in Muslim majority Indonesia”, The Review of Faith and International Affairs, Vol. 15 No. 1, pp. 91-101.

[2] Manzouri, M., Nizam Ab Rahman, M., Saibani, N. and Rosmawati Che Mohd Zain, C. (2013), “Lean supply chain practices in the halal food, International Journal of Lean Six Sigma,Vol. 4 No. 4

[3] Ambali, A.R. and Bakar, A.N. (2014), “People's awareness on halal foods and products: potential issues for policy-makers”, Procedia - Social and Behavioral Sciences, Vol. 121,

[4] Halim, M.A.A. and Salleh, M.M. (2012), “The possibility of uniformity on halal standards in organization of Islamic countries (OIC) country”, World Applied Sciences Journal, Vol. 17 No. 17

[5] Jonathan A.J. Wilson and Jonathan Liu (2011) "The challenges of Islamic branding: navigating emotions and halal", Journal of Islamic Marketing, Vol. 2 No. 1

[6] Nur Syarifuddin et.Al (2012), Rekayasa Sistem Kelembagaan Pasokan Bahan Baku Industri Gelatin Untuk Menjamin Mutu Produk, Jurnal Teknologi Industri Pertanian.

[7] Mohd Helmi Ali (2016), Mitigating Halal Food Integrity Risk Through Supply Chain Integration, Asia Pacific Industrial Engineering And Management System

[8] Jan Mei Soon (2014), Developing system to control food adulteration, Food policy, Vol 49 Part 1, doi.org/10.1016/j.foodpol.2014.06.005

[9] Peake, W. O., Detre, J. D. and Carlson, C. C. (2014), "One bad apple spoils the bunch? An exploration of broad consumption changes in response to food recalls", *Food Policy*, Vol. 49

[10] Pozo, V. F. and Schroeder, T. C. (2016), "Evaluating the costs of meat and poultry recalls to food firms using stock returns", Food Policy, Vol. 59, pp. 66-77.

[11] Marco Tieman, "Halal risk management: combining robustness and resilience", Journal of Islamic Marketing, https:// doi.org/10.1108/JIMA-06-2015-0041

[12] Iwan Vanany, Ghoffar Albab Maarif, Jan Mei Soon, (2018) "Application of multi-based quality function deployment (QFD) model to improve halal meat industry", Journal of Islamic Marketing, https:// doi.org/10.1108/JIMA-10-2017-0119

[13] Haryono dan Handayani DI (2018), Pemodelan Sistem Traceability Halal Supply Chain dalam menjaga Integritas Produk Makanan Halal Dengan Pendekatan Interpretive Structural Modeling (ISM), Jurnal Prozima Vol 2 Noor 2 2018, ISSN 2541-5115DOI: https://doi.org/10.21070/prozima.v2i2

[14] Samori, Z., Ishak, A.H. and Kassan, N.H. (2014), "Understanding the development of halal food standard: suggestion for future research", International Journal of Social Science and Humanity, Vol. 4 No. 6, pp. 482-486

[15] Ambali, A.R. and Bakar, A.N. (2014), "People's awareness on halal foods and products: potential issues for policy-makers", Procedia - Social and Behavioral Sciences, Vol. 121,

[16] Prakash Surya, Gunjan Soni, Ajay Pal Singh Rathore and Shubhender Singh (2017)

Risk analysis and mitigation for perishable food supply chain: a case of dairy industry, Benchmarking: An International Journal Vol. 24 No. 1, pp. 2-23.

[17] Mitchell, V.W. (1999), "Consumer perceived risk: conceptualizations and models", European Journal of Marketing, Vol. 33 Nos 1/2, pp. 163-195.

[18] Hobbs, J.E. (2004), "Information asymmetry and the role of traceability systems", *Agribusiness*, Vol. 20 No. 4, pp. 397-415.

[19] Handayani D.I (2013) , Identifikasi risiko rantai pasok berbasis sistem traceability pada minuman sari apel, Jurnal Spektrum Industri, Volume 11 Nomor 2, ISBN p-ISSN: 2302-3163 e-ISSN: 2684-9186

[20] Souza-Monteiro, D.M. and Caswell, J.A. (2010), "The economics of voluntary traceability in multi-ingredient food chains", *Agribusiness*, Vol. 26 No. 1, pp. 122-142.

[21] M. Nagai and D.Yamaguchi, The Application of Grey System Theory for Engineer and Student, Tokyo: Kyuritsu Publisher, 2004

[22] Delcea Camelia , (2015),"Grey systems theory in economics – a historical applications review", Grey Systems: Theory and Application, Vol. 5 Iss 2 pp. 263 – 276

[23] Mohamed Ibrahim Eshtaiwi, Ibrahim A Badi, Ali M Abdulshahed, Turan Erman Erkan, "Assessment of airport performance using the grey theory method: a case study in Libya", Grey Systems: Theory and Application, https://doi.org/10.1108/

[24] Lili Qian, Sifeng Liu, Zhigeng Fang, (2018) "Grey risky multi-attribute decision-making method based on regret theory and EDAS", Grey Systems: Theory and Application, https://doi.org/10.1108/ GS-05-2018-0025

[25] Chang, C.L., Liu, P.H., & Wei, C.C., (2001) *Failure mode and effects analysis using grey theory*", *Integrated Manufacturing Systems,* 12(3), 211 – 216

[26] ISO (1994), "Quality management systems e Fundamentals and vocabulary ISO". International Organization for Standardization.

[27] Peres, B., Barlet, N., Loiseau, G., and Montet, D. (2007). "Review of the current methods of analytical traceability allowing determination of the origin of foodstuffs", *Food Control*, Vol. 18 No. 3, pp. 228-235.

Appendix

Table 1. Risks Associated With Traceability-based

Activity	Risk Event	Halalness	Traceability
Provision offish foodtypes	Fish feed is contaminated by unclean (*najis*) things.	Fish feed is free from unclean (*najis*) ingredients.	Input the data on types of fish feed, know whether source of feeding is unclean (*najis*) or not
	Fish are poisoned.	Fish must be in good condition and suitable for consumption.	Input the poolcleaning schedule, code the provision on each feed
Fish Grinding	It is mixed with non-halal meat.	Meat is confirmed not to be mixed with non-halal meat by storing it separately.	code the provision on each meat
	Fish meat grinder is not specifically for halal products.	Meat grindingmachines are specifically for grinding halal meat.	Input the date and time of grinding, Input the operator identity, Input the fish condition, Identify the usedequipment, Know the halal or not halal status of equipment
Production process activities	It is contaminated bythe waste of lizards, mice, or cockroaches.	The production process area is clean and sterile so that there is no contamination of lizards, mice, or cockroaches.	Input the date and time of process, Input the employee identity Identify the usedequipment, Know the cleanliness status, Prevention from contamination
	The ingredients are contaminated by unclean (*najis*) things.	Ingredients are free from unclean (*najis*) contamination and unclean (*najis*) ingredients.	Input the date and time of process, Input the supplier code Input the composition of raw ingredients, Input the employee identity
	There is an addition of prohibited additive (Borax).	It is adjusted to the list of ingredients determined by LPPOM MUI.	Input the dataof raw ingredients, Input the data of process Employee identity
	The food additives used are not in accordance with the list of ingredients in LPPOM MUI.	It refers to the list of ingredients determined by MUI.	Input the data of used raw ingredients, Input the data of ingredients determined by MUI

Table 2. Identification of *Potential Effect, Risk Cause*, and *Current Control,* Potential Consequences

Risk	***Potential Effect***	***Risk Cause***	***Current Control***	**Potential consequences**
There are fish feed contaminated by unclean (*najis*) things.	The fish meatballs are *makruh* to consume.	Human carelessness Not too much cost of fish food	a. Providing elucidation of fish food that is unclean (*najis*) and not halal. b. Providing a guidance regarding ingredients that are halal, *makruh*, and haram.	a. Adding more cost, time, and energy for elucidation. b. Improving the employees' knowledge. c. Adding more time to study the guidance book. d. Adding more cost for doubling the guidance book.
The fish are polluted and poisoned.	The fish meatballs have bad impacts on health and they are not halal anymore.	Human carelessness Lack of knowledge by catfish farmers	a. Providing elucidation about the proper way to farm catfish. b. Keeping the cleanness of the catfish ponds.	a. Adding more cost, time, and energy for elucidation. b. Improving the employees' knowledge about catfish farming.

Risk	*Potential Effect*	*Risk Cause*	*Current Control*	Potential consequences
			c. Being more selective about the fish food.	c. Having regular duty schedule for cleaning the catfish pond. d. Adding the employees' weight to clean the pond regularly. e. Providing additional/extra cost to clean the pond. f. Having the employees feed the catfish more carefully.
It is mixed with non-halal meat.	The fish meatballs are not halal anymore.	The shared use of fish meat grinder with non halal meat	Adding more facilities special for halal food production.	a. Adding more cost to invest on the facilities. b. Adding the employees' weight to clean the catfish meat-grinding machine regularly.
The fish meat grinder equipment is not specifically for halal products.	The fish meatballs are not halal anymore.	The shared use of fish meat grinder with non halal meat	Adding more facilities special for halal food production.	a. Adding more cost to invest on the facilities. b. Adding the employees' weight to clean the catfish meat-grinding machine regularly.
It is contaminated by the waste of lizards, mice, or cockroaches.	The fish meatballs are not safe (*thoyiban*) to consume anymore.	Unclean kitchen	Having someone responsible for the cleanness of the kitchen.	a. Adding more workers special for keeping the kitchen clean. b. Adding more cost to hire new workers.
The ingredients are contaminated by unclean (*najis*) things such as the pee of mice, cockroaches, etc.	The fish meatballs are not halal to consume anymore.	Human carelessness	Keeping the kitchen clean.	a. Adding more cost to buy cleaning tools for the kitchen. b. Adding more time to keep the kitchen clean. c. Reducing the break time to clean the kitchen.
There is an addition of preservatives to the ingredients.	Overconsumption will make the fish meatballs not safe to consume anymore.	Bad impacts for human health	Providing elucidation about the danger of using preservatives for food products.	a. Adding more cost, time, and energy for elucidation. b. Improving the employees' knowledge on the danger of preservatives. c. Building the awareness to catfish food production to avoid using dangerous preservatives.
The food additives used are not in accordance with the list of ingredients in LPPOM MUI.	There is no guarantee of the halal status.	Cheaper price Lack of awareness regarding halal products set by LPPOM MUI	a. Providing activities to grow the awareness of using halal products. b. Providing specifications of ingredients included in the list set by LPPOM MUI	a. Adding more cost, time, and energy for activities to build the awareness to the use of halal products.

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