

Capturing Profile of Halal Chicken Meat Slaughterhouse in Indonesia: A Clustering Case Study

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Abstract

Slaughterhouse is the entity with the highest halal risk in the chicken meat supply chain. Mapping of slaughterhouses is important to capture which characters of slaughterhouses could harm the halal chain. This paper segments and profiles the slaughterhouses using an extended theory of planned behavior (TPB) as clustering variables. A total of 41 slaughterhouses from Yogyakarta Province in Indonesia were investigated. Using Ward's method, two clusters of slaughterhouses were identified based on their characteristics in activities, knowledge, attitude, intention, and actual behavior. The findings show that 51% of slaughterhouses are grouped into "obedient", and 41% belong to "vulnerable". The obedient cluster consists of slaughterhouses with a very high awareness of halal behavior, while the vulnerable cluster consists of slaughterhouses with high halal behavioral risk. Pearson correlation shows that the age of slaughterhouses significantly influences intention and actual behavior, but it does not correlate substantially to knowledge and attitudes. On the other hand, the quantity of production and the number of workers was founded to have no significant correlation to halal behavior. These findings give a contribution to all stakeholders involved. The government should consider the profile and behavior of slaughterhouses in the traceability process while sellers and consumers should choose slaughterhouses with obedient profiles.

Keywords

Slaughterhouse, Behavior, Clustering, Ward's Method

1. Introduction

Chicken meat is a common source of animal protein consumed in Indonesia. With an average consumption rate of 7 kg per year per person (Junaedi 2019), chicken is the highest meat consumption, followed by beef and processed meat (sausages, corned beef, and nuggets.). It is crucial to supply halal chicken meat, considering that 82.7% of Indonesians are Muslim (www.Indonesia.go.id 2020). The large number of entities involved makes the halal chicken supply chain vulnerable to disruption. Unexpected disruptions in the supply chain are a situation that can have a significant impact on the performance of the supply chain (Aguila and ElMaraghy 2019). Disruption in the supply chain of halal chicken meat can occur in every entity involved. It is important to analyze the behavior of each entity to capture the halal risk in the supply chain. So far, behavior analysis has been mainly carried out at the consumer level, whereas the most important critical point in the supply chain for chicken is the production level. The most significant critical point in the halal chicken supply chain lies in slaughterhouses (Vanany et al. 2019). The suitability of the slaughtering process

with Islamic law is the most critical factor that must be considered in the slaughterhouse (Halaseh and Sundarakani 2012, Nugroho et al. 2018, Omar and Jaafar 2011). Halal slaughter requires procedures, tools, and officers under Islamic law (Ma'rifat, 2017). Slaughterhouse is demanded to comply with this. Mistakes in slaughtering, such as slaughtering carcasses, not saying "bismillah" when slaughtering results in chicken meat, cannot be called halal meat (Vanany et al. 2019). This mistake can impact the supply chain as a whole, especially in the downstream market where consumers will not accept and buy non-halal chicken meat (Wahyuni et al. 2019). Understanding the slaughterhouse behavior is important to know the slaughterhouse segmentation to provide halal chicken.

This study will capture the behavior of slaughterhouses and classify them into several clusters. The theory of planned behavior (TPB) was adapted as a cluster variable. TPB has been widely used to interpret behavior in consumers, sellers, and producers. In general, TPB states that actual conduct is influenced by intention, while the intention is influenced mainly by attitude. At the end of the chain, attitude is influenced by knowledge. Therefore, the behavioral variables in clustering slaughterhouses are divided into four sub-variables: actual behavior, intention, attitude, and knowledge. Clustering was chosen as a method for segmenting slaughterhouses based on their behavior. Clustering is a process for grouping data into several clusters or groups based on similarities between items (Wu 2012). The hierarchical method is applied in this paper due to the relatively small number of samples (less than 100).

Furthermore, this paper is arranged in the following order: in Section 2, relevant literature is discussed to see the map of stakeholder clustering research in the halal supply chain and emphasize the need for grouping slaughterhouses to be analyzed. The research methods and flow are presented in Section 3. Next, Section 4 discusses how data is collected to view the profile of respondents. In Section 5, the clustering results and profiles for each cluster are presented. Section 6 discusses the implications of the research results, and finally, Section 7 presents the conclusions.

2. Literature Review

Research on the behavior of halal supply chain entities is still dominated by Malaysian researchers, followed by other Muslim countries such as Pakistan, Bangladesh, and Indonesia. Several studies have appeared in countries with Muslim minority populations, such as Korea, China, the United States, and several countries in Europe. The majority of research is consumer-oriented. The output of consumer behavior studies is in the form of factors that influence consumer decisions in buying halal products and consumer segmentation (Abu-Hussin et al. 2017, Al-Banna 2019, Al-Salem and Mostafa, 2019, Mahbubi et al. 2019, Yunus et al. 2014). Two studies were found that examined the behavior of sellers of halal products. Research (Mardoni et al. 2020) examined the effect of the TPB variable on the behavior of halal food sellers in Padang, Indonesia. The linear regression method found that attitude was the only variable that significantly affected the seller's intention to provide food with halal assurance. Similar research has previously been carried out by (Shahijan et al. 2014) on halal retailers in Malaysia. The Partial Least Squares SEM method was applied to identify the factors that influence the seller's halal behavior. The results show that the retail seller's intentions and actions are significantly influenced by normative beliefs, subjective norms, retailers' behavioral beliefs, and the retailer's attitude. Several studies were found for consumer behavior in chicken meat. Research (Ismoyowati 2015) found that chicken consumers consider taste more than halal status. Research (Putri et al. 2017) identified factors that affect the willingness to pay of chicken consumers and the amount of WTP that consumers give up. The same research was conducted by (Toong et al. 2017) in Malaysia. No research has been found that has examined the behavior of chicken meat sellers.

In the supply chain of chicken meat, producers are represented by slaughterhouses. In slaughterhouses, most research that has been carried out focuses on mitigating halal risks during the process in slaughterhouses. The study by (Vanany et al. 2019) identified the risk of halal in slaughterhouses with the QFD method. Research by (Maman et al. 2018) compared the risk of halal in slaughterhouses in Indonesia and Australia with qualitative and quantitative methods. In contrast, the study by (Khan et al. 2019) arranges halal risk priorities in slaughterhouses using the AHP fuzzy method. So far, no research has been found that examines the behavior of slaughterhouses.

3. Methods

3.1 Questionnaire and Measurement

Questionnaires were delivered to 43 slaughterhouses in Yogyakarta, a province in Indonesia. It consists of four parts, including profile, production pattern, behavior pattern, and additional questions. Clustering criteria consists of production pattern and behavior. Behavioral criteria were adopted from extended TPB, composed of four variables: knowledge, attitude, intention, and actual behavior. Table 1 shows detail of the item used in each criterion.

Table 1. Clustering Criteria

Criteria	Item
Production Pattern	Length of business, Quantity Number of workers Ownership Slaughtering mechanism Source of chicken supply Division of labor
Behavior	
<i>Knowledge</i>	1. Understanding the specific terms and conditions for chicken butcher employees. 2. Availability of training on procedures for slaughtering and managing halal chicken meat 3. Understanding the terms and procedures for halal slaughter 4. Understanding of the difference between halal and non-halal chicken meat 5. Understanding the prohibition of selling chicken carcasses 6. Understanding of the verses of the Quran, hadiths, or the opinions of Ulama about the procedures for halal slaughter
<i>Attitude</i>	1. Equipment handling procedures (cleaned every day and prohibited use for non-halal goods) 2. It is a rule that all workers must be Muslim 3. Approval if the slaughterhouse must be certified halal 4. Support of punishment for a slaughterhouse that falsifies the halal label
<i>Intention</i>	1. Guarantees to sell chicken meat that is definitely halal both in the slaughtering process and in its distribution 2. Willing to take certification even at an additional cost 3. Ready to sell chicken with the halal label even though it may incur additional charges in the process 4. This slaughterhouse will only sell halal chicken meat despite environmental disturbances
<i>Actual Behaviour</i>	1. Some employees are in charge of checking the cutting and processing of chicken meat 2. "Bismillah" recites to every slaughtered chicken 3. Workers who are in charge of slaughtering are Muslims, adults, and have common sense 4. Chickens are slaughtered alive 5. The slaughter process is executed by draining the blood through the cutting of the jugular vein, carotid artery, and windpipe 6. Equipment and special equipment for cutting and processing chicken meat that is not used for other purposes

Measurement of behavioral criteria uses five Likert scales ranging from 1 to 5, where 1 strongly disagree and 5 is strongly agree. Likert scales are commonly used in clustering research (Falcão et al. 2019, Kohijoki and Marjanen, 2013, Sadiq et al. 2019).

3.2 Validity and Reliability

Validity was conducted to ensure the accuracy and consistency of the questionnaire (Taherdoost, 2018). Lawshe's CVR (content validity ratio) was conducted to verify the logical validity of each item question. Lawshe introduced Lawshe's CVR in 1975 with formula (Lawshe 1975):

$$CVR = \frac{N_e - \frac{N}{2}}{\frac{N}{2}} \dots\dots\dots (1)$$

where CVR is the content validity ratio, N_e is the number of experts who answered "important", N is the total number of experts. Since all of the CVR scores were above 0.5 for each item (with the average CVR score was 0.882), the questionnaire could be stated as valid.

4. Data Collection

there is no official data on the number of slaughterhouses in Yogyakarta, but it is estimated that there are more than 800 slaughterhouses in operation. Questionnaires were initially delivered in to 43 slaughterhouses in Yogyakarta. Only 41 data was used to further process since 2 of the questionnaires were eliminated due to outlier data. Using Slovin’s formula with error rate 5%, this sample is sufficient. The majority of slaughterhouses are private businesses, only 5% of the samples are joint ventures. All samples were categorized into the traditional slaughterhouse. A traditional slaughterhouse is a slaughterhouse that does not meet the overall standard, such as not providing a rail system and hanging equipment, no available storage (frozen room), no waste treatment facilities, and no separation of dirty and clean rooms. Most slaughterhouses have been running for more than nine years. The average slaughter capacity is 140 chickens per day, with the smallest one slaughters 30 chickens and the largest one slaughters 400 chickens per day. As traditional slaughterhouses, the majority of cutting was done manually using a knife (76%). Anyone can make this deduction because as many as 88% of the slaughterhouse do not have a division of labor even though 80% of them have more than one worker. Table 2 shows the characteristics of the samples in detail.

Table 2. Characteristics of Samples

Variable	Percentage
Age	
<i>Under 5 years</i>	10%
<i>5- under 10 years</i>	34%
<i>10- under 15 years</i>	37%
<i>> 15 years</i>	20%
Quantity per day	
<i><50 chicken</i>	5%
<i>50-under 100 chicken</i>	22%
<i>100-under 200 chicken</i>	46%
<i>>200 chicken</i>	27%
Number of employees	
<i>1 person</i>	20%
<i>2 person</i>	39%
<i>3 person</i>	27%
<i>4 person</i>	10%
<i>>4 person</i>	5%
Source of supply	
<i>From breeder</i>	88%
<i>Supplier</i>	7%
<i>Own breeder</i>	5%
Division of task	
<i>Exist</i>	22%
<i>Does not exist</i>	78%
Slaughtering process	
<i>Manually one by one</i>	76%
<i>Automatically in large quantities</i>	5%
<i>Automatically one by one</i>	20%

From the survey conducted, most slaughterhouses stated that almost all employees understand the difference between halal and non-halal chicken and know the procedures for slaughtering and handling halal chicken meat. However,

only 50% of employees know the halal literature from the Al Quran and hadiths. So, it can be said that like consumers and sellers, knowledge about halal chicken is obtained from hereditary knowledge without any unique learning process. The majority of slaughterhouses also have good attitudes and intentions towards halal chicken meat. It was proven that only 7% of the slaughterhouse did not require employees (other than slaughterers) to be Muslim. As many as 88% of slaughterhouses also agree to take part in halal certification even though they have to pay additional fees. Knowledge, attitude, and good intentions eventually manifest in daily cutting activities according to Islamic law. All slaughterhouses admitted that they had slaughtered according to the Sharia law. However, as many as 12% of slaughterhouses did not have exceptional employees to double-check the slaughter results, and there were still 13% of slaughterhouses who did not have special equipment for cutting and cleaning chicken meat. Equipment that is used occasionally is still used for other purposes outside the production process.

5. Results and Discussion

5.1 Clustering

Ward's Linkage algorithm is applied with the number of clusters 2 to 4. ANOVA test on the behavior of each cluster with $k = 4$ results Sig (p-value) of 0.005 (Sig<0.05), so it can be said that there are significant differences between the four clusters formed. However, the Post-Hoc Tukey HSD test showed no significant differences between Clusters 1, 3, and 4, and Cluster 1 is significantly different from Cluster 2. So, it can be concluded that 4 clusters cannot be used as the optimal number of clusters because there are still three clusters that are not significantly different as shown in Figure 1. The ANOVA test for $k = 3$ results in the same conclusion. Post-Hoc Tukey HSD test showed no significant difference between Clusters 2 and 3 with a Sig value of $0.946 > 0.05$ as shown in Figure 2 below.

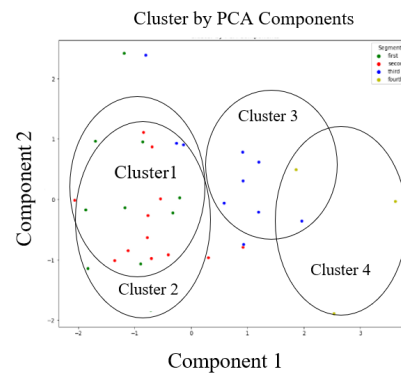


Figure 1. Segmentation in 4 Clusters

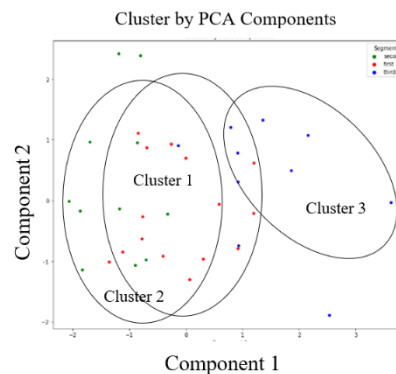


Figure 2. Segmentation in 3 Clusters

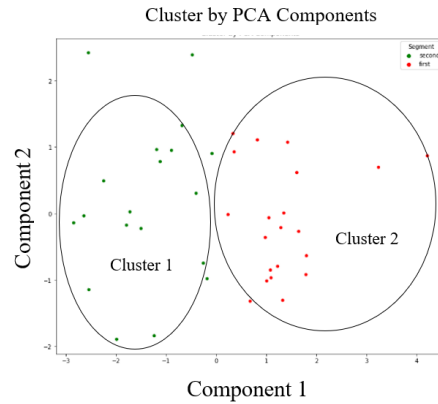


Figure 3. Segmentation in 2 clusters

Thus, the optimal cluster is obtained in the number of two clusters. T-test was conducted to confirm these results and determine whether there were differences in behavior between the two slaughterhouse clusters. The t-test results in a Sig value of 0.048 (<0.05), which means that there is a significant difference between the behavior of the two clusters as shown in Figure 3. Clustering of 41 uses Ward's algorithm with two clusters represented by a dendrogram as shown in Figure 3 below.

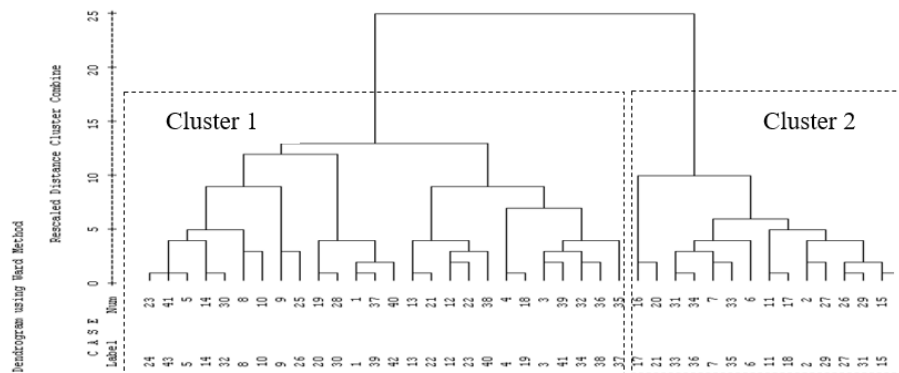


Figure 4. Ward's Algorithm in Dendrogram

5.2 Slaughterhouse Clusters

Cluster 1, with 24 slaughterhouses, performs a more significant proportion of 59%, while Cluster 2 consists of 17 slaughterhouses with a balance of 41% of the total sample. In general, the slaughterhouses in Cluster 1 shows better halal behavior than Cluster 2 (Table 3).

Table 3. Behavior Value in Each Cluster

	<i>Cluster 1</i> n=24 59%	<i>Cluster 2</i> n=17 41%
Knowledge	1,968	-2,778
Attitude	0,979	-1,382
Intension	1,092	-1,541
Actual Behavior	0,819	-1,156

Positive values in all behavioral variables indicate that the slaughterhouses in this cluster have good knowledge, attitudes, intentions, and halal behavior compared to Cluster 2. A negative value in Cluster 2 does not mean that this cluster has an insufficient concern for all halal behavior variables. However, this value only indicates that this cluster has lower regard than Cluster 1. Some slaughterhouses with inadequate levels of knowledge, attitudes, intentions, and behavior towards halal integrity may belong to this cluster, but this does not conclude that as many as 41% of the existing slaughterhouses sample does not care about providing halal chicken meat in its line of business.

5.3 Profiling

Cluster 1 consists of slaughterhouses that are older than Cluster 2. As many as 29% of the slaughterhouses in Cluster 1 have been running for more than 15 years. About 37% of the slaughterhouses only slaughter less than 100 chickens per day. This quantity is relatively less than Cluster 2. The slaughter process is generally carried out manually using knives by 2-3 workers (58%). Even though there are only 2-3 workers, 33% of the slaughterhouses in this cluster have implemented a division of labor. The existence of exceptional employees responsible for slaughtering chickens can minimize the risk of slaughter not being carried out according to sharia (Vanany et al. 2019). About 80% of the slaughterhouses admitted to conducting special terms and conditions in selecting employees responsible for slaughtering. According to the Shari'a, the example of the requirements is better understanding the procedures for slaughtering chickens and having received training in slaughtering. Implementing this rule and finding the right employees is not difficult, considering Yogyakarta is an area with most of the population being Muslim. This situation is undoubtedly different if the slaughterhouse is in a minority area. The scarcity of slaughter officers who adhere to the teachings of the Islamic religion encourages the possibility of halal risks (Maman et al. 2018). Almost all slaughterhouses in this cluster use special tools and containers while not used other than for the cutting process. However, even though no one has been certified as halal from Board for the Study of Food, Drugs, and Cosmetics of the Indonesian Ulema Council (LPPOM MUI), all slaughterhouses in Cluster 1 guarantee that chicken meat has been cut and processed according to Islamic law. The label "obedient" is appropriately assigned to the characteristics of this cluster. The below Table 4. Represents the Characteristics of each cluster.

Table 4. Characteristics of Each Cluster

Variables	<i>Cluster 1</i>	<i>Cluster 2</i>
	n=24	n=17
	59%	41%
Age		
<i>Under 5 years</i>	4%	18%
<i>5- under 10 years</i>	33%	35%
<i>10- under 15 years</i>	33%	41%
<i>> 15 years</i>	29%	6%
Quantity per day		
<i><50 chicken</i>	8%	0%
<i>50-under 100 chicken</i>	29%	12%
<i>100-under 200 chicken</i>	33%	65%
<i>>200 chicken</i>	29%	24%
Number of employees		
<i>1 person</i>	21%	18%
<i>2 person</i>	42%	35%
<i>3 person</i>	17%	41%
<i>4 person</i>	13%	6%
<i>>4 person</i>	8%	0%

Cluster 2 is dominated by slaughterhouses with ages are ten years and below (70%), but with a relatively higher quantity than Cluster 1—nearly 90% of slaughterhouses in this cluster slaughter more than 100 chickens per day. Almost 50% of Cluster 2 have 3-4 workers, but unfortunately, almost all of them do not have a clear division of work so that each worker can slaughter the chicken. Although according to (Vanany et al. 2019), the ratio of workers and the small number of chickens slaughtered reduces the risk of being halal, on the other hand, the absence of a division of labor causes the trouble of unfaithfulness to be serious. As many as 12% of the slaughterhouses also do not require all employees to be Muslim. The employees also could not distinguish between the halal and non-halal chicken. Still, just like Cluster 1, all slaughterhouses guarantee that the chicken produced has been slaughtered and processed according to Islamic law. The label “vulnerable” is following the characteristics of the slaughterhouses in this cluster. The Pearson correlation test is conducted to examine the relationship between age of business, quantity, and number of workers on the halal behavior of slaughterhouses. The findings show a significant and positive relationship between age of industry to intention and actual behavior with Sig values of 0.000 and 0.032 (<0.005). Otherwise, the age of business does not have a significant relationship to knowledge and attitudes. In contrast, the quantity and number of workers do not have a significant effect on halal behavior. These findings confirm the research conclusions by (Rhodes 1983), who reviewed 185 studies on the impact of age on work behavior. It is said that age differences have a significant effect on work behavior. Although, according to (Rafiki 2014), company age does not significantly affect the ability to produce products with halal certificates, company age significantly affects the behavior (Begley 1995).

6. Discussion

The government and MUI have a moral obligation to maintain the supply chain for halal chicken. Clustering and profiles of slaughterhouses can be utilized to build and maintain a supply chain network for halal chicken meat. The government and MUI should supervise a cluster of slaughterhouses that are vulnerable to carrying out activities that risk damaging halal meat (41%). Traceability systems should be built in Muslim-majority countries where the need for halal products is one of the government's responsibilities. Ideally, a traceability system is made to keep all essential information on product status. At the farmer level, information is presented on weight, type of feed, health, etc. At the slaughterhouse level, information records when, where, and by what means the livestock was slaughtered. In the logistics system, this system also contains the types and flows of transportation vehicles, storage warehouses, and loading and unloading processes that ensure products are not mixed with non-halal materials (Haihong et al. 2016). Several traceability systems have been researched and developed, such as the use of barcodes (Haihong et al. 2016), the Digital Business Ecosystem (DBE), and the most widely set is the use of Radio Frequency Identification (RFID) technology (Anir et al. 2008, Bahrudin et al. 2011, Haihong et al. 2016, Nasir et al. 2011). However, this ideal system is challenging to implement in Indonesia. Most of the slaughterhouses are a type of micro-business that does not master technology. Therefore, the role of the government and MUI should be focused on efforts to ensure that all upstream chicken procurement processes are under Islamic law. The government and MUI through LPPOM can appreciate the high interest of slaughterhouses in obtaining halal certification. Requirements, procedures, and costs that have been limiting so far should be minimized so that more slaughterhouses could be halal certified. Halal certificate plays an important role in convincing consumers that the product has met the requirements for halal product (Hanzaee and Ramezani, 2011). It is proven in several studies that halal logos and certification are important factors that influence consumers in choosing and consuming products (Ahmed et al. 2014, Anam et al. 2018, Fathi et al. 2016, Kurniawati and Savitri 2019, Mohamed Omar et al. 2012, Muslichah et al. 2019). Thus, although consumers cannot trace the halal process of chicken meat, the halal of the meat is guaranteed at the slaughterhouse level.

7. Conclusion

The focus of this study is to capture the profile of slaughterhouses by hierarchy clustering based on their behavior. To achieve this objective, firstly, the optimal cluster was calculated, and the slaughterhouses in Yogyakarta, Indonesia, then optimally were divided into two clusters. The obedient cluster describes slaughterhouses that are always obedient in providing halal chicken and vulnerable cluster consisting of the slaughterhouse with a high halal risk even though so far still produce halal chicken.

Like any other study, the study also has several limitations. First, bias in the respondents' answer can occur because the respondents try to show their slaughterhouses looks ideal. Second, the limited number of samples may not represent overall slaughterhouses behavior. Therefore, future research must dig deeper into the answers from respondents through other methods such as interviews. The sample size should also be expanded so that a non-hierarchical clustering method can be applied to compare the results.

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