

FINAL PROJECT

# **MAPPING BARRIERS, SOLUTIONS, AND STRATEGIES TO IMPLEMENTATION OF HALAL SUPPLY CHAIN MANAGEMENT IN SMALL AND MEDIUM ENTERPRISES (SMEs)**

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SURABAYA  
2022**



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## VALIDITY SHEET

### MAPPING BARRIERS, SOLUTIONS, AND STRATEGIES TO IMPLEMENTATION OF HALAL SUPPLY CHAIN MANAGEMENT IN SMALL AND MEDIUM ENTERPRISES (SMEs)

#### FINAL PROJECT

Submitted to fulfill one of the requirements for obtaining a Bachelor's  
degree in Business Management

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## **FOREWORD**

This thesis was prepared as part of my coursework for a Bachelor degree in Business Management at Sepuluh Nopember Institute of Technology in Indonesia. This thesis examines barriers, solutions, and strategies from SMEs to conduct halal supply chain management. After expressing gratitude to Allah Almighty, Netty Lisdiantini, S.Sos. M.AB., as my mother, Ir. Ketut Astika, M.T, IPM, as my father, and my other family member for their unending support, I would like to express gratitude to a few individuals here. I am very appreciative of the advice, reviews, and suggestions provided by my supervisor (Dewie Saktia Ardiantono, S.T., M.T) and co-supervisor (Mushonnifun Faiz Sugihartanto, S.T., M.Sc.). Special thanks to the family of meme10nopember, MERCHUNI, Giddy Esports, Giddy Apps, Giddy Talents, and TWG Class who always has been by my side along my undergraduate journey and without whom this would not have been feasible. These individuals were always there to assist me with my research whenever I needed assistance. Working with these individuals was a massive learning curve for me, as they not only strengthened my research abilities but also provided me with context for real-world problems.

Surabaya, 8 January 2022

Gde Dharma Ardyansyah

## ABSTRACT

The halal industry has attracted a lot of attention from both the public and private sectors all around the world. The halal industry has attracted a lot of attention from both the public and private sectors all around the world. Muslims will stand for 2,761 billion of the world's 9,322 billion population, or more than 25% of the worldwide population. Many SMEs aim to implement the concept of halal logistics, but they do not have the basic knowledge and infrastructure to help them. This research used the analytic network process (ANP) method with three groups of relevant experts that comprised representatives from the government, academia, and experts. Seven dimensions collected to be discussed: process, package, storage, transport, fundamental, policy, and technology. The highlights of the discussion are about traceability and transparency, widely accepted label and audit method, and contamination prevention. Blockchain manufacturing is expensive, especially for SMEs, was the most dominant problem at the problem level. At the solution level, initiating a global halal label that is acceptable to various types of Muslim groups was determined to be the optimum solution. Finally, providing space in containers to separate halal products from non-halal products was the most dominant strategy.

**Keywords:** Analytic Network Process (ANP). Halal supply chain management (Halal SCM), Small and Medium-Sized Enterprises (SME)

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# CHAPTER I

## INTRODUCTION

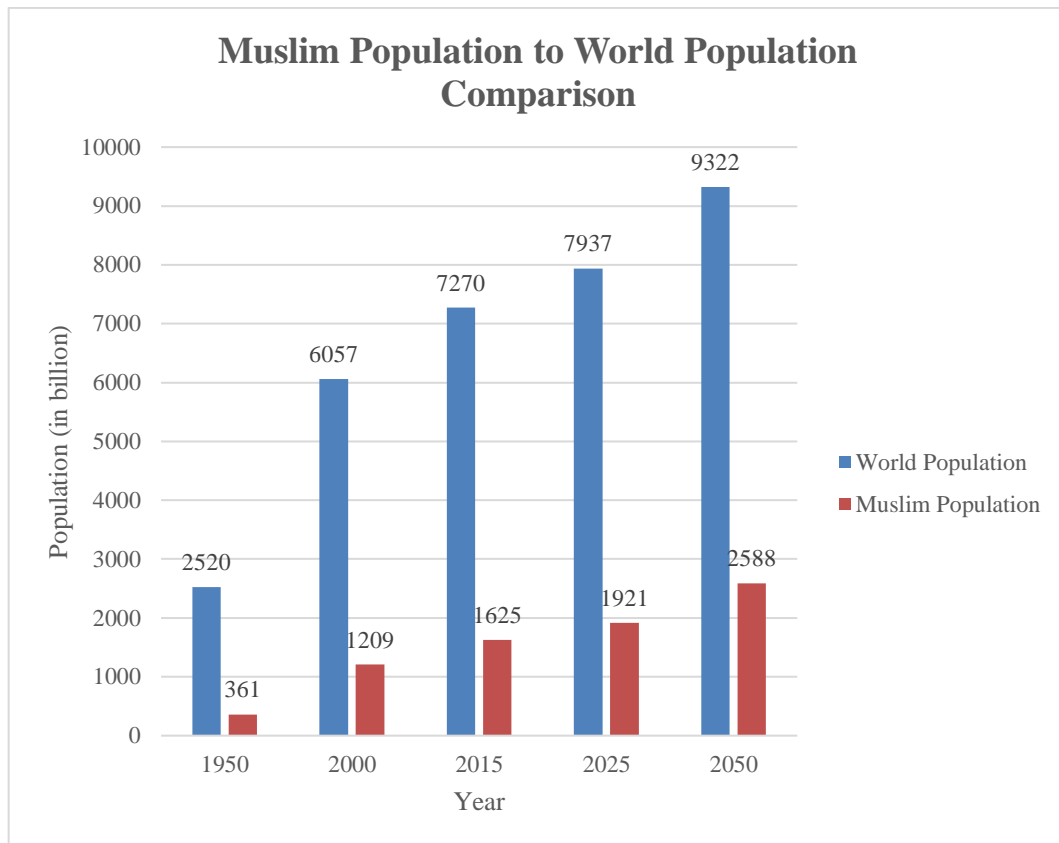
### 1.1 Background

The halal industry has attracted a lot of attention from both the public and private sectors all around the world (Yuli & Wojtyla, 2020). Industry Halal is required in Muslim countries, as well as by the majority of non-Muslim inhabitants in such countries (Mohd Nawawi, et al., 2019). The global community's rising desire to consume high-quality halal products, not only because of religious beliefs, but also because halal products ensure good product quality by taking religious ethics, health, safety, and environmental concerns into mind. Halal is a brand for Muslims, as well as a part of their religious system and moral code (Aziz & Chok, 2013). Halal is defined as anything that is allowed to ingest, whereas haram is defined as everything that is prohibited by Islamic law. The concept of halal and haram applies to all activities, including cosmetics choices. Many international corporations have adopted halal branding as a corporate strategy (Wilson & Liu, 2010). As the Muslim population grows, so does awareness of the need to consume and prioritize Halal items. From time to time, the Muslim community experiences a positive trend. Recall that Muslims are expected to account for a quarter of the world's population by 2050. The research conducted by Pew Research Center in 2015 predicts that by 2050, Muslims will stand for 2,761 billion of the world's 9,322 billion population, or more than 25% of the worldwide population (see Table 1).

**Tabel 1** World population and muslim population

Year	1950	2000	2015	2025	2050
Approximate World Population (in billion)	2.520	6.057	7.270	7.937	9.322
Approximate Muslim population (in billion)	361	1.209	1.625	1.921	2.761

Source: Pew Research Center, 2015



**Figure 1** Muslim Population to World Population Comparison  
(Pew Research Center, 2015)

Muslims spent an aggregate of \$1.9 trillion in 2020 on lifestyle items (food, clothes, travel, media/recreation, pharmaceuticals/cosmetics), down 6% from the pre-COVID-19 year of \$2 trillion. However, Muslim spending in these sectors is expected to regain momentum and grow by 7.81% CAGR reaching US\$2.76 trillion in 2025 (DinarStandard, 2021). Islamic finance assets, now valued at \$3 trillion in 2020, are also predicted to grow gradually over the following five years at a 7.9% compound annual growth rate (CAGR), reaching \$4.9 trillion by 2025 (DinarStandard, 2021). Numerous countries had an increase in Islamic finance assets during the COVID-19 year, including Indonesia, where Islamic finance banking assets increased by 10.97 percent in 2020, above the conventional banks' 7.7% growth (DinarStandard, 2021). The halal industrial sector in Indonesia has enormous development potential. Indonesia has the world's highest Muslim population at 88%, or 250 million Muslims, out of a total population of 261 million (Peristiwo, 2019). With such a group, Indonesian Muslims have enormous needs for halal food, beverages, pharmaceuticals, and cosmetics. As a result, it is necessary to establish halal logistics or supply chain. Moreover, it was stated by Drs. H. Moch. Amin Mahfud M.Pd.L as Head of the Division of Islamic Religious Affairs that the importance of halal certification has started to be socialized with big targets starting from 2019, nevertheless the effect given was not satisfying enough. The program targeted 15 million SMEs to get halal validation by 2024. However, it turned about 2400 new SMEs added to the list. It means that only 0.08% of the target reached. With the existing target, 3 million new SMEs supposed to get halal certification per year. Hence, mapping barriers to implement halal supply chain for SME will be a very interesting topic to be discussed with three major point of views, which are government, academia, and practitioner. Halal Supply Chain is a process-oriented approach to manage the flow of materials, information, and capital through strategic

coordination and collaboration of stakeholders in order to create value that improves the supply chain's performance while adhering to Halal and Thoyyib values throughout the supply chain's processes from production to consumption.

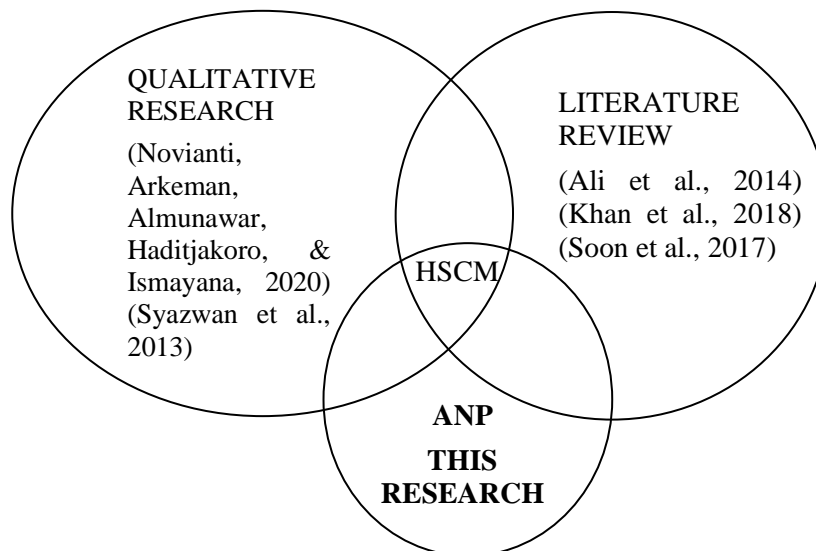
Literature study has been conducted by the author to reveal implementation failures of halal supply chain management. The study found some failures in several factors which are process, package, storage, transport, policy, fundamental, and technology. There is an increase in halal logistics research from a scientific standpoint. One of the emerging halal study themes is the logistics supply chain criteria (Haleem, Khan, & Khan, 2020). Consumer perception (Tieman, van der Vorst, & Che Ghazali, Principles in halal supply chain management, 2012), awareness (Alqudsi, 2014), intention to purchase (Mohd Yusoff, Raja Yusof, & Hussin, 2015), and readiness to pay are all factors considered while studying halal logistics from the consumer's perspective (Kamaruddin, Iberahim, & Shabudin, 2012) (Fathi, Zailani, Mohammad, & Kanapathy, 2016). Additionally, since the focus of logistics research turns from consumers to businesses (Karia & Asaari, 2016), the number of halal logistics studies examining organizational perspectives is surely expanding. For example, (Ngah, Zainuddin, & Thurasamy, 2015), (Ngah, Thurasamy, Aziz, Ali, & Khan, 2019) conducted study on halal warehouses and the push for their implementation in Malaysian food, cosmetics, and pharmaceutical firms. (Zailani, Iranmanesh, Aziz, & Kanapathy, 2017) conducted another study in which they examined the opportunities and problems associated with halal logistics among logistics service providers (LSPs). Similarly, (Zailani, Jafarzadeh, Iranmanesh, Nikbin, & Selim, 2018) evaluated the quality of logistics services provided by halal LSPs, while (Selim, Zailani, Aziz, & Rahman, 2019) evaluated halal product producers' satisfaction with halal LSP services. The findings of this study reveal that research and literature on halal logistics address both the upstream and downstream aspects of the halal supply chain. Despite this growing body of research, prior scientists and publications have paid less attention to halal logistics governance issues.

The government's participation in logistics halal research is sometimes overlooked. A little disappointing from the government's perspective, given the government's critical involvement in the logistics industry. Existing research has recognized the critical role of government in a variety of logistics fields, including sustainable logistics (Chhabra, Garg, & Singh, 2017) (Pang, Ab Talib, & Ngah, 2020), humanitarian logistics (Kunz & Reiner, 2012) (Dube, Van der Vaart, Teunter, & Van Wassenhove, 2016), urban logistics (Witkowski & Kiba-Janiak, 2014) (Kiba-Janiak, 2016), and logistics reversed (Ye, Zhao, Prahinski, & Li, 2013) (Heidari, Entezaminia, & Rahmani, 2016). It is vital to analyze the government's role in building the necessary infrastructure and facilities for Halal SCM in SMEs. Numerous SMEs desire to integrate halal logistics, but lack the necessary knowledge and infrastructure. Research gap analysis was also conducted to identify the position of this research towards other related research. The list of some related previous studies is shown in the table below.

**Table 1** Previous studies

<b>Author</b>	<b>Title</b>	<b>Methodology</b>	<b>Object</b>
(Syazwan et al., 2013)	Qualitative Research on Critical Issues In Halal Logistics	<ul style="list-style-type: none"> <li>- Qualitative research</li> <li>- Explanatory</li> <li>- Purposive sampling</li> </ul>	Uncover the issues faced among logistics service providers in implementing Halal logistics
(Soon et al., 2017)	Halal integrity in the food supply chain	Literature Review	Halal Integrity
(Ali et al., 2014)	Extenuating food integrity risk through supply chain integration: The case of halal food	<ul style="list-style-type: none"> <li>- Literature review</li> <li>- Case Study</li> </ul>	Supply Chain Integration
(Khan et al., 2018)	Defining Halal Supply Chain Management	Literature Review	Halal Supply Chain Management
(Novianti, Arkeman, Almunawar, Haditjakoro, & Ismayana, 2020)	Designing a Transparent Distributed Systems for Halal Supply Chains Using Blockchain Technology	Qualitative approach with descriptive method	<ul style="list-style-type: none"> <li>- Halal food</li> <li>- Transparency in the supply chain</li> </ul>

According to the table above, it will be best to show the research gap as the figure as follows.

**Figure 2** Research gap

The purpose of this study is to identify the problems, solutions, and strategies to developing a Halal supply chain in Indonesian small, and medium-sized businesses (SMEs). Using ANP as a method to solve the problems, the existence of this paper is expected to accelerate the development of halal industry in Indonesia.

## **1.2 Research Question**

The following is the formulation of the study's problem based on the background information.

1. What are the barriers to the implementation of the halal supply chain in SMEs?
2. What are the solutions to the barriers to implementing halal supply chain on SMEs?
3. What are the strategies to implement the solutions found?

## **1.3 Objectives**

The following is the formulation of the study's problem based on the background information:

1. Identifying the barriers of the implementation of the halal supply chain in SMEs.
2. Identifying the solutions to the barriers to implementing halal supply chain on SMEs.
3. Developing strategies for putting the solutions discovered into action.

## **1.4 Benefits**

Based on the research questions and research objectives that have been described, the values that can be obtained from this research are as follows.

1. The government can formulate policies that can be used to break down halal supply chain management obstacles for small, and medium enterprises. Furthermore, it is expected that micro, small, and medium enterprises will not find any struggle to conduct halal supply chain management practice.
2. Business owners can formulate strategies to avoid the risk of halal supply chain obstacles. This way, it is expected that business owners can grow their business creatively and support the economy.
3. Researchers can apply the solution to problems that exist in the surrounding environment with the Analytic Network Process method. Additionally, researchers can find obstacles in the halal supply chain, so that researchers can conduct deeper research in the future.

## **1.5 Scope**

The scope of the research includes limitation and assumption as a guide in determining the focus of the research. Here is the further explanation.

### **1.5.1 Limitation**

This research will cover small, and medium enterprises located in East Java and be conducted from October to December 2021.

### **1.5.2 Assumption**

Experts are considered to represent the status quo of halal supply chain in small, and medium enterprises in East Java.

## **1.6 Research Structure**

This section will discuss the style of writing utilized in this study report. The writing is structured as follows.

### **CHAPTER I INTRODUCTION**

Explaining the research's context, explaining why the research is necessary and doable, formulating the research's problems, objectives, advantages, scope, and research structure.

### **CHAPTER II THEORY LITERATURE**

Explanation of the theoretical foundations for research conducted, such as the definition of halal supply chain management Small, and Medium-Sized Enterprises (SME), Analytical Network Process (ANP), Triple Helix theory. Additionally, this chapter offers references to past studies that are relevant to the research being conducted and the research's conceptual framework.



### **CHAPTER III RESEARCH METHOD**

This chapter discusses the methods and processes for conducting research, including the subject and object of the research, the research design, measurement techniques, research variables, and the data processing techniques employed.

### **CHAPTER IV ANALYSIS**

This chapter will discuss the stages of data collection and data processing techniques, using Analytical Network Process (ANP) as well as managerial implications.

### **CHAPTER V CONCLUSIONS AND SUGGESTIONS**

This chapter summarizes the research findings in relation to the research objectives and makes recommendations to businesses based on the study's findings, as well as recommendations for future studies.

## **CHAPTER II**

### **THEORY LITERATURE**

#### **2.1 Supply Chain Management**

Supply chain management is a concept or mechanism to increase the total productivity of companies in the supply chain through optimizing the time, location and flow of material quantities (Anwar, 2011). In implementing supply chain management (SCM), companies are required to be able to meet customer satisfaction, develop products on time, incur low costs in the field of inventory and product delivery, manage the industry carefully and flexibly (Anwar, 2011). Supply chain can be defined as a set of activities (in the form of entities/facilities) involved in the process of transformation and distribution of goods from the earliest raw materials from nature to finished products to the final consumer (Patriana, 2016). Based on this definition, a supply chain consists of companies that transport raw materials from the earth/nature, companies that transform raw materials into semi-finished materials or components, suppliers of product support materials, assembly companies, distributors, and retailers who sell goods to the final consumer.

There are three kinds of things that must be managed in the supply chain (Anwar, 2011). First, the flow of goods from upstream to downstream, for example, finished products after production are sent to distributors, retailers, then to end users. Second, the flow of money that flows from downstream to upstream. Third is the flow of information that can occur from upstream to downstream or vice versa. The type of supply chain management consist of upstream supply chain that places companies as distributors and connections or liaisons to consumers or resellers who market their products, internal supply chain management which is defined as the process of inputting raw materials to the warehouse which is then transformed into basic materials for distribution carried out by the company, and downstream supply chain management which includes include setting the direction of distribution, warehousing systematics, transportation and the final activity of product delivery services.

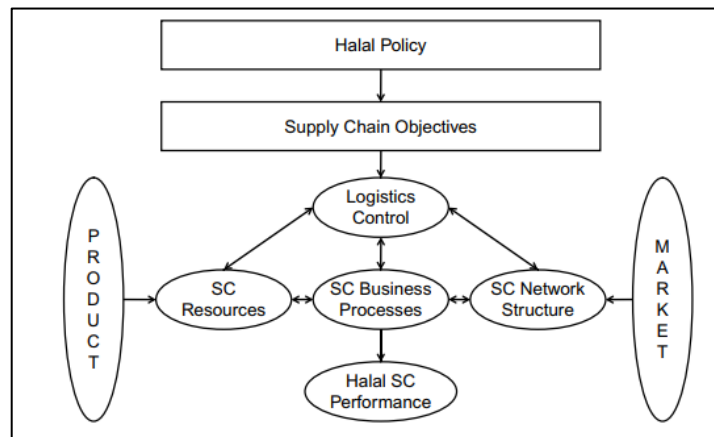
#### **2.2 Halal Supply Chain Management**

The global halal business has grown at a rather quick pace in recent years. Halal concept is now a primary purpose of modern business and has developed into a new paradigm for ensuring product quality and influencing human life, capable of altering human behavior, tastes, and values (Lada, Tanakinjal, & Amin, 2009); (Khan & Haleem, 2016). Halal Supply Chain Management is a process-oriented approach to managing the flow of materials, information, and capital through strategic coordination and collaboration of stakeholders in order to create value that improves the supply chain's performance while adhering to Halal and Thoyyib values throughout the supply chain's processes from production to consumption (Khan, Haleem, & Khan, 2018).

Numerous critical factors are addressed in that definition (Khan, Haleem, & Khan, 2018). The first is halal, a term that pertains to Islamic law (Khan, Haleem, & Khan, 2018). Thoyyib is the second (Khan, Haleem, & Khan, 2018). This term refers to food that is safe, hygienic, and veterinary, as well as a processed slaughter that must adhere to Islamic law, is protected from dirt in the environment, and promotes sustainable consumption (Khan, Haleem, & Khan, 2018). The third is to place an emphasis on fluidity (Khan, Haleem, & Khan, 2018). This demonstrates the need of ensuring the halal procedure across the supply chain (Khan, Haleem, & Khan, 2018). Fourth is coordination and collaboration, which means that suppliers, manufacturers, and consumers must all work together to assure the halal status of the product (Khan, Haleem, & Khan, 2018). Fifth is performance, which emphasizes the critical nature of supply chain performance in ensuring the legality of products (Khan, Haleem, & Khan, 2018). The sixth is a value-oriented approach; with halal products, profitability and market share are

predicted to increase (Khan, Haleem, & Khan, 2018). Seventh is manufacturing to consumption, which demonstrates the need of adhering to the high halal principle throughout the product's lifecycle (Khan, Haleem, & Khan, 2018).

Another definition is managed by a halal network with the goal of expanding the integrity of halal products from producers to consumers (Tieman, van der Vorst, & Ghazali, 2012). The greatest basis for determining the supply chain network is Halal Law, as illustrated in Figure 1 (Tieman M. , 2011).



**Figure 3** Halal SC Model

(Tieman, van der Vorst, & Ghazali, Principles in halal supply chain management, 2012)

Additionally, the supply chain's objectives/goals are set in accordance with halal guidelines. According to the framework, the halal idea must be comprehensive in nature, encompassing the product, supply chain procedures, and markets.

### 2.3 Small, and Medium-Sized Enterprises

Small, and Medium-Sized Enterprises or SME is a type of business characterized as one that is operated by an individual, household, or small company entity. SMEs are one of the economic pillar of Indonesia (Kementrian Keuangan Republik Indonesia, 2020). According to the BPS research, only a small percentage of Indonesia's 57 million Small and Medium-Sized Enterprises (SMEs) already hold halal certification (Al-Bara & Nasution, 2018). To participate in the global halal sector, the primary requirement is halal certification. Thus, mapping is necessary to identify impediments to halal certification implementation, with a particular emphasis on impediments to halal logistics and supply chain management in SMEs in this study. SMEs are regulated in the Law of the Republic of Indonesia (UUD) No. 20 of 2008 concerning MSMEs. In the Law, the criteria used to define SMEs as stated in Article 6 (*Pasal 6*) are net worth or asset value excluding land and buildings for business premises, or annual sales proceeds.

Small Enterprise is defined as a self-contained productive economic activity carried out by people or company entities that are not subsidiaries or branches of larger businesses but are owned, controlled, or become a part of a medium or big business either directly or indirectly.

1. Have a net worth greater than Rp50,000,000.00 (fifty million rupiah) but less than Rp500,000,000.00 (five hundred million rupiah), exclusive of land and buildings used for business; or
2. Have annual sales greater than Rp300,000,000.00 (three hundred million rupiah) but less than Rp2,500,000,000.00 (two billion five hundred million rupiah).

Medium Enterprises, defined as productive economic businesses that operate independently, are operated by individuals or business entities that are not subsidiaries or branches of larger companies and are owned, controlled, or become affiliated with small or

large businesses directly or indirectly, and meet the following criteria.

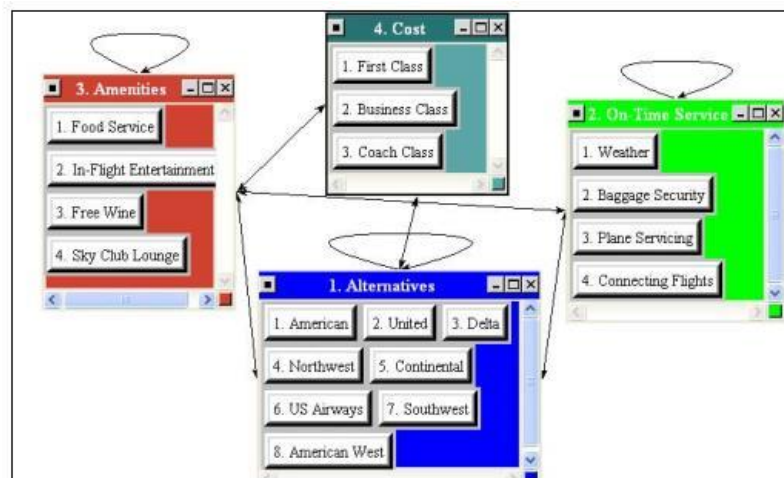
1. Has a net worth greater than Rp500,000,000.00 (five hundred million rupiah) but less than Rp10,000,000.00 (ten billion rupiah), excluding land and buildings used for business; or
2. Has annual sales greater than Rp2,500,000,000.00 (two billion five hundred million rupiah) but less than Rp50,000,000,000.00 (fifty billion rupiah).

## 2.4 Analytic Network Process

The Analytic Network Process (ANP) is a multi-criteria measurement technique used to calculate the relative priority scale for the assessment's absolute figures (Bottero & Lami, 2010). This technique is a refinement of the Analytic Hierarchy Process (AHP) technique. The essential distinction between these two methods is that ANP enables interaction and feedback between criteria elements (inner dependence) and between criterias (outer dependence) (Saaty, 2004).

ANP is composed of two components: a hierarchical control or criteria network and sub criteria that govern interactions, and a network that defines the interaction between elements (Saaty, 2004).

ANP's fundamental principles are as follows: (1) Decomposition Principle. It is used to decompose complicated problems into a hierarchical framework or network of criterias, sub-criterias, and sub-sub-criterias. Thus, this principle entails the incorporation of a problem modeling approach into the ANP framework. (2) Comparative evaluation is a step in which all combinations of components in the criteria are compared pairwise from the central criteria. This property is used to determine which items in a criteria have the highest priority.



**Figure 4** Example of ANP Model  
(Saaty, 2004)

(3) It is envisaged that hierarchical or synthetic compositions will transfer the local priority of criteria members to the global priority of the parent element, resulting in global priorities across hierarchies that will be added together to generate global priorities for the lowest level element.

## 2.5 Triple Helix

The triple helix model illustrates how innovation occurs as a result of a balanced, reciprocal, and continuous link between academics (universities and research and development institutes), government, and business actors/sectors (enterprises) (Wahjusaputri, Fitriani, Diponegoro, & Indah, 2018). ABG is the acronym for the synergy of the three components (Academic, Business, and Government). Triple Helix underlines the critical role of interaction between the three ABG components in fostering the emergence of innovation, skills, creativity,

and ideas in the development of the creative economy for SMEs (Etzkowitz & Leydesdorff , 1995). This idea is frequently utilized by scholars as a normative framework for analyzing the interconnections between important players in system innovation. Additionally, it is a broad method utilized by the government to foster innovation in policy development. One of the Triple Helix thesis's central assumptions is that academics, industry, and government all contribute to the best environment for innovation (Etzkowitz & Leydesdorff, 2000).

## CHAPTER III RESEARCH METHOD

The methods that will be used in the research will be explained in this chapter. The research schedule, research design, data used, data collection techniques, research variables, sampling techniques, research subjects, research populations and samples, research hypotheses, data processing techniques, and research flow charts are all discussed in the research methodology section.

### 3.1 Research Schedule

This research will be carried out for 3 months, starting from October to December 2021. The details of the activities of this research are presented in the Table 3.

**Table 2** Research Timeline

No	Activity	October				November				December			
		I	II	III	IV	I	II	III	IV	I	II	III	IV
1	Problem Analysis												
2	Literature Study												
3	Research Method Development												
4	In-depth interview & FGD												
5	Framework & Questionnaires Development												
6	Data Collection From The Questionnaire Respondents												
7	Data Processing												
8	Building Conclusions & Suggestions												

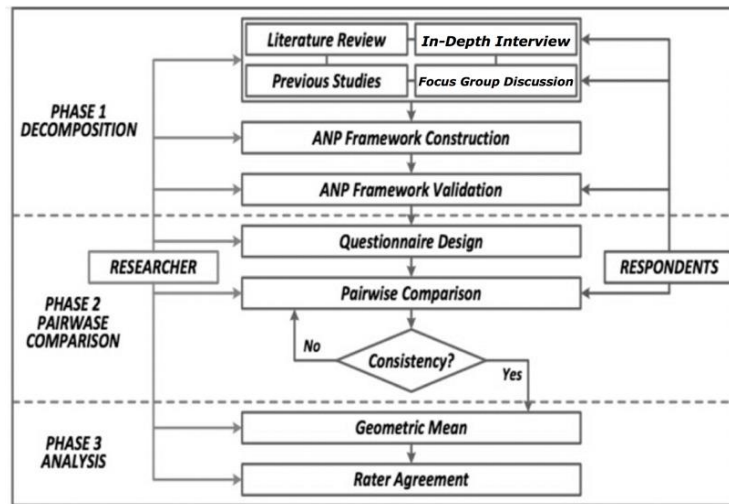
### 3.2 Research Design

The Analytical Network Process (ANP) analysis method is used in this study, which is the development of the Analytical Hierarchy Process (AHP). This method possesses the ability to mathematically control circumstances and inputs depending on a variety of criteria, which can aid in the process of making decisions about numerous options and complex data (Soon, Chandia, & Regenstein, 2017) (Hashim & Shariff, 2016) (Haleem, Khan, & Khan, 2020) (Wilson & Liu, 2010). The stages of this research will be discussed in greater detail in Figure 5. The stages of research using the ANP method consist of 3 phases. The first phase is constructing the ANP model which is prepared in accordance with the literature review as well as conducting FGD or in-depth interview with experts and practitioners to obtain more in-depth information. To be effective, the ANP requires that all responders have the necessary expertise, skill, and experience in halal supply chain management (Ascarya, 2005). Academic responses must have experience in the halal sector and understanding of supply chain management, as shown by published research on the topic. Practitioners must be halal-certified business actors, which ensures that the information presented is significantly more specific. Similarly, responders to the regulators must have significant positions and demonstrate expert understanding of halal supply chain management. Thus, in this research, respondents were chosen using a purposive sample procedure that included these specific criteria in order to assure accurate and relevant replies. Purposive sampling is an acceptable sampling technique since certain criteria must be satisfied in order for a responder to be picked. As a result, respondents who match these established criteria may provide useful replies. The quantity of respondents is not used as an indicator for validity in ANP's study (Firmansyah & Sukmana, 2014).

The second phase is model quantification by distributing questionnaires to respondents in the form of pairwise comparison statements or pairwise comparisons between sub-criterias.

This stage is referred to as the model quantification stage since it is characterized by the following questions: The Analytical Network Process questionnaire includes pairwise comparisons of the elements' collection and distribution and the factors that have a greater influence (Soon, Chandia, & Regenstein, 2017). This is intended to find out which has the greater influence and to find the size of the difference by using a comparison scale.

The questionnaire responses were then processed using the Analytical Network Process approach in conjunction with the Super Decision program to derive conclusions and priority levels for problems, solutions, and mapping plan for the implementation of halal supply chain management in SMEs. Kendall's Coefficient of Concordance is used to determine rater agreement, with  $W = 1$  indicating a perfect match. In this stage, the writer will calculate the geometric mean. The geometric mean is a special case of an average computation that demonstrates a certain trend or value (Ascarya, 2005).



**Figure 5** Stages of Analytical Network Process  
(Ascarya, 2005)

The weight of the respondent's assessment is stated by determining the geometric mean of the assessment given by all respondents (Kurniawan, Hasibuan, & Nugroho, 2017).

Based on the data that has been collected and processed using the ANP method so as to get priority results from all variables, the researcher will then analyze it. The priority results are the results which is obtained from the average value on the eigenvector and provides policy recommendations. The closer the value is to 1, the element is a priority. Furthermore, researchers can draw conclusions from the results and existing discussions.

### 3.3 Data

Data is a critical tool for facilitating the execution of research. The contribution of diverse data, both qualitative and quantitative, can bolster the conclusions of more balanced study when using the Analytical Network Process approach. Data were gathered from the questionnaire source and in-depth interviews were conducted to assess respondents' ability to make multi-criteria decisions (Ali & Suleiman, Eleven shades of food integrity: A halal supply chain perspective, 2018). Respondents in this study were chosen based on their competency and knowledge of the implementation of halal supply chain management. The only way to ensure respondents' veracity is to acquire data from experts in their fields (van der Spiegel, et al., 2012). The data for this study were gathered from respondents with backgrounds in academia, practice, and government.

**Table 3 Data**

<b>Types</b>	<b>Required Data</b>	<b>Method</b>
Primary	Sub-criterias to problems, solutions, and strategies	In-depth interview with experts
	Weighting sub-criterias of problems, solutions, and strategies	Questionnaire filled out by experts
Secondary	Sub-criterias to problems, solutions, and strategies	Literature Studies



## CHAPTER IV ANALYSIS

In this chapter, the process and stages in mapping the barriers, solutions, and strategies to implement halal supply chain in small and medium enterprises will be discussed. This chapter also consists of a summary of research results, the results of data processing using SuperDecision software and managerial relevancy.

### 4.1 Literature Review

As one of the earliest method conducted, list of the literature review result is mentioned as follows.

**Table 4** Result of Literature Review

Code	Level	Criteria	Sub-Criteria	References
A1	Problem	Process	Weaknesses in handling, monitoring, processing and tracing along the halal supply chain because supply chain information from upstream to downstream in the halal industry is not transparent	(Ali & Suleiman, 2018) (Novianti, Arkeman, Almunawar, Haditjakoro, & Ismayana, 2020)
A3	Problem	Process	The processing of Halal products using equipment that is contaminated with substances that are Najis	(Shafie & Othman, 2006) (Tieman M. , 2008) (World Halal Forum, 2009)
A4	Problem	Process	Halal products have a direct contact with non-halal products	(Iberahim et al., 2012)
B1	Problem	Package	Halal status of packaging materials is less considered	(Iberahim et al., 2012) (Riaz & Chaudry, 2003)
B2	Problem	Package	There is no specialized and dedicated group of workers to handle and monitor the halal product packaging from health perspective	(Iberahim et al., 2012) (Riaz & Chaudry, 2003)
B3	Problem	Package	Packaging can't protect goods from any cross-contamination between halal and non-halal substance	(Mohamed et al., 2013)
C1	Problem	Storage	Cross-contamination between halal and non-halal ingredients is not prevented in the storage	(Talib et al., 2010) (Nakyinsige et al., 2012) (Riaz & Chaudry, 2003)
C2	Problem	Storage	Tools to handle packaged halal products must not be mixed together with the one used for non-halal products	(Talib et al., 2010)
D1	Problem	Transport	Cross-contaminated during delivering due to the transport or containers being contaminated	(Zulfakar et al., 2012)
D2	Problem	Transport	Lack of dedicated assets and facilities in handling halal products during consignments passing	(Omar & Jaafar, 2011)

Code	Level	Criteria	Sub-Criteria	References
<b>D3</b>	Problem	Transport	Difficult to track and trace the drivers' attitudes and procedures during the delivery of halal products	(Ab Talib, et al., 2013)
<b>E1</b>	Problem	Fundamental	There is no single agreed definition of halal supply chain management	(van der Spiegel et al., 2012)
<b>E2</b>	Problem	Fundamental	There is no international agreement on how to audit the halal supply chain	(van der Spiegel et al., 2012)
<b>F1</b>	Problem	Policy	Stakeholders who are considered less disciplined in giving permits to the halal industry	(Ali et al., 2021)
<b>F2</b>	Problem	Policy	The process of inspecting halal products has too many stages and is still done manually so that inspection errors are likely to occur	(Ali et al., 2021)
<b>H1</b>	Solution	Process	Improvements in raw material traceability, asset specificity for halal products, quality assurance, level of trust, and commitment	(Zulfakar et al., 2012)
<b>K1</b>	Solution	Transport	Halal industry stakeholders should be more innovative in manufacturing assets and special systems for halal product transportation	(Talib et al., 2010)
<b>L1</b>	Solution	Fundamental	Propose one definition of halal supply chain management because there are too many narrow definitions reported in the literature	(Talib et al., 2010) (Imran et al., 2018)
<b>L2</b>	Solution	Fundamental	Initiating a global halal label that is acceptable to various types of Muslim groups	(van der Spiegel et al., 2012)
<b>M1</b>	Solution	Policy	Tightening rules and regulations against violators of halal supply chain policies	(McElwee et al., 2017)
<b>M2</b>	Solution	Policy	Halal certification on packaging	(Syazwan Ab Talib et al., 2012)
<b>M3</b>	Solution	Policy	Government authorities must ensure that the production process follows the correct principles of halal procedures throughout the process	(Mohamed et al., 2013)
<b>M4</b>	Solution	Policy	Producers must be more transparent in providing information regarding the source of the ingredients used and their halal status	(Mohamed et al., 2013)

Code	Level	Criteria	Sub-Criteria	References
N1	Solution	Technology	Adoption of blockchain technology, IoT Technology, RFID tag, and quick response (QR) codes, which will increase the visibility, transparency and traceability of all activities in the halal supply chain	(Ali et al., 2021) (Rejeb et al., 2021)
O1	Strategy	Process	Taking consideration for the origin of the product, production and facilities, sources of materials and raw materials	(Soon et al., 2017)
O2	Strategy	Process	PCR-based & protein based technique for pork detection, analytical technique for lard detection	(Nakyinsige et al., 2012)
O3	Strategy	Process	Mitigation of the risk of exposure to halal products by non-halal substances	(Ali et al., 2014)
S1	Strategy	Fundamental	The establishment of widely accepted audit methods and the audit information obtained must be transparent and traceable to all parties	(van der Spiegel et al., 2012)
T1	Strategy	Policy	Giving higher penalties to violators of halal policy, and assessing cases of violations as criminal conspiracy, not just cheating	(McElwee et al., 2017)
T2	Strategy	Policy	Transparency, dedicated infrastructures, and world-based standardised halal standards	(Zulfakar et al., 2012)
U1	Strategy	Technology	Construction of a blockchain system to track the halal supply chain	(Novianti, Arkeman, Almunawar, Haditjakoro, & Ismayana, 2020)

## 4.2 Respondents

A total of 9 respondents were chosen, including government, practitioners, and academia. Table 7 and Table 8 shows the list of respondents as well as their affiliations. The validity of the findings of the ANP analysis is determined by competence rather than the quantity of respondents (Firmansyah & Sukmana, 2014). The questionnaire was designed on a scale of 1–9 to enable the indicated features to be scored and rated based on the respondents' perceptions of their relevance and priority. In Table 6, the priority scale is delivered.

**Table 5** Score of Respondent

Score	Classification
1	Not important/influential/relevant
3	Less important/influential/relevant
5	Important/influential/relevant
7	Very important/influential/relevant

Score	Classification
9	Absolutely important/influential/relevant
2,4,6,8	Intermediate Values

#### 4.2.1 In-depth Interview

List of the names of the experts and their affiliation who have carried out in-depth interview is mentioned as follows.

**Table 6** List of Interview

No	Name	Institution	Position	Representative
1	Dr. Firdaus Fanny Putera Perdana	Innovation Associates Consulting, Malaysia	Consultant in Halal Industry	Practitioner
2	Drs. H. Moch. Amin Mahfud M.Pd.L	Ministry of Religion of East Java	Head of Division	Government
3	Anung Hendhi Pramono	Ministry of Religion of East Java	Halal Task Force	Government
4	Prof. Setiyo Gunawan ST, Ph.D	Sepuluh Nopember Institute of Technology	Researcher and Lecturer	Academia

#### 4.2.2 Questionnaire

List of the names of the experts and their affiliation who have filled in the questionnaire are mentioned as follows.

**Table 7** List of Respondent

No	Name	Institution	Position	Representative
1	Muhammad Ubaidillah Al Mustofa	Airlangga University	Researcher and Lecturer	Academia
2	Tika Widiastuti	Airlangga University	Researcher and Lecturer	Academia
3	Iwan Vanany	Sepuluh Nopember Institute of Technology	Researcher and Lecturer	Academia
4	Calvin Han	PT.Pangan Unggul Sentosa (Boksa Bakso)	Director	Practitioner
5	Linda Merpati Oktavia	CV Cokro Bersatu	HR Manager	Practitioner
6	Purnawati Wijayaningrum	D'jamoe	Owner	Practitioner
7	Ustadz Usman Hadi S.Pd.I	MUI	Member of the Fatwa Commission	Government
8	Ustadz Hebni Syarif	MUI	Deputy Branch Manager	Government
9	KH DR Marsudi Syuhud	MUI	Vice Chairman	Government

#### 4.3 Problem Identification

Numerous problems on implementation of halal supply chain in Small and Micro Enterprises were discovered via the literature study, focus group discussions, and interviews with reputable respondents. These problems may be classified as follows: process, package, storage, transport, fundamental, and policy.

In term of the process, the first recognized problem (A1) was weaknesses in handling, monitoring, processing and difficulty of tracing halal food along the supply chain as the supply chain information from the upstream to downstream in the food industry is not transparent. The

second problem (A2) was lack of consistency of halal supply chain implementation after obtaining halal certification. The third identified problem (A3) was the processing of Halal products using equipment that is contaminated with substances that are Najis. The fourth problem (A4) was halal products have a direct contact with non-halal food or non-halal products.

In term of the package, the first recognized problem (B1) was halal status of packaging materials is less considered. The second problem (B2) was there is no specialized and dedicated group of workers to handle and monitor the halal food packaging from health perspective. The third problem (B3) was packaging can't protect goods from any cross-contamination between halal and non-halal substance.

In term of the storage, the first recognized problem (C1) was cross-contamination between halal and non-halal ingredients is not prevented in the storage. The second problem (C2) was tools to handle packaged halal products must not be mixed together with the one used for non-halal products.

In term of the transport, the first recognized problem (D1) was cross-contaminated during delivering due to the transport or containers being contaminated. The second problem (D2) was lack of dedicated assets and facilities in handling halal products during consignments passing. The third problem (D3) was difficult to track and trace the drivers' attitudes and procedures during the delivery of halal products.

In term of the fundamental, the first recognized problem (E1) was there is no single agreed definition of halal supply chain management. The second problem (E2) was there is no international agreement on how to audit the halal supply chain.

In term of the policy, the first recognized problem (F1) was stakeholders who are considered less disciplined in giving permits to the halal industry. The second problem (F2) was the process of inspecting halal products has too many stages and is still done manually so that inspection errors are likely to occur. The third problem (F3) was ineffective implementation of existing regulations. The fourth problem (F4) was illegal halal product trade. The fifth problem (F5) was the lack of effective collaboration between the religious and the health department has questioned the integrity of the halal status audit.

In term of technology, the first recognized problem (G1) was blockchain manufacturing is expensive, especially for SMEs. The second problem (G2) was there is no regulation regarding blockchain technology in the management of halal supply chains.

#### **4.4 Solutions Identification**

Several solutions were proposed in response to each of the problems mentioned above: for the process solution: (H1) improvements in raw material traceability, asset specificity for halal products, quality assurance, level of trust, and commitment, (G2) socialization within the community to improve the integrity of business actors' halal status, (H3) socialization to the owners of business establishments (malls, markets, etc.). For the policy solution: (I1) manufacturer's discipline in checking the packaging to be used, and (I2) training and debriefing for specialized groups of workers who handle the packaging of halal products. For the storage solution: (J1) allocating a separate storage space for halal products, and (J2) procurement of media specifically used for halal products. For the transport solution: (K1) halal industry stakeholders should be more innovative in manufacturing assets and special systems for halal product transportation, and (K2) utilization of separate containers for halal products. For the fundamental solution: (L1) propose one definition of halal supply chain management because there are too many narrow definitions reported in the literature, and (L2) initiating a global halal label that is acceptable to various types of Muslim groups. For the policy solution: (M1)

tightening rules and regulations against violators of halal supply chain policies, (M2) halal certification on packaging, (M3) government authorities must ensure that the food production process follows the correct principles of halal procedures throughout the process, (M4) producers must be more transparent in providing information regarding the source of the ingredients used and their halal status. For the technology solution: (N1) adoption of blockchain technology, IoT Technology, RFID tag, and quick response (QR) codes, which will increase the visibility, transparency and traceability of all activities in the halal supply chain, (N2) formulation of laws on the use of blockchain technology, especially in halal supply chain management.

#### 4.5 Strategy Identification

In accordance with the solutions found, the following strategies were developed: for the process: (O1) taking into consideration the origins of products, production and facilities, global sourcing of ingredients and raw materials, halal product trade and halal as a way of life leads to a definition of halal integrity, (O2) PCR-based & protein based technique for pork detection, analytical technique for lard detection, (O3) mitigation of the risk of exposure to halal products by non-halal substances. For the package: (P1) provide an additional layer of protection on the smallest packaging in halal products, and (P2) the establishment of strict SOPs for inspecting halal products for even the tiniest packaging defects. For the storage: (Q1) providing space or a partition that separates halal products from non-halal products, and (Q2) specialized markings to media used to handle halal products. For the transport: (R1) conducting research on the development of halal-specific assets for halal product transportation, and (R2) providing space in containers to separate halal products from non-halal products. For the fundamental: (S1) the establishment of widely accepted audit methods and the audit information obtained must be transparent and traceable to all parties, and (S2) establishment of halal labeling formats that represent agreed to global certification process. For the policy: (T1) giving higher penalties to violators of halal policy, and assessing cases of violations as criminal conspiracy, not just cheating, (T2) transparency, dedicated infrastructures, and world-based standardised halal standards, and (T3) routine monitoring from the auditor. For the technology: (U1) construction of a blockchain system to track the halal supply chain, (U2) increase the priority of legal regulation that regulate blockchain systems.

#### 4.6 Analytics Network Process Model

An ANP network structure was designed based on the above-mentioned identification towards implementation of halal supply chain management in Small and Medium Enterprises problems, solutions, and strategies as shown in Figure 6.

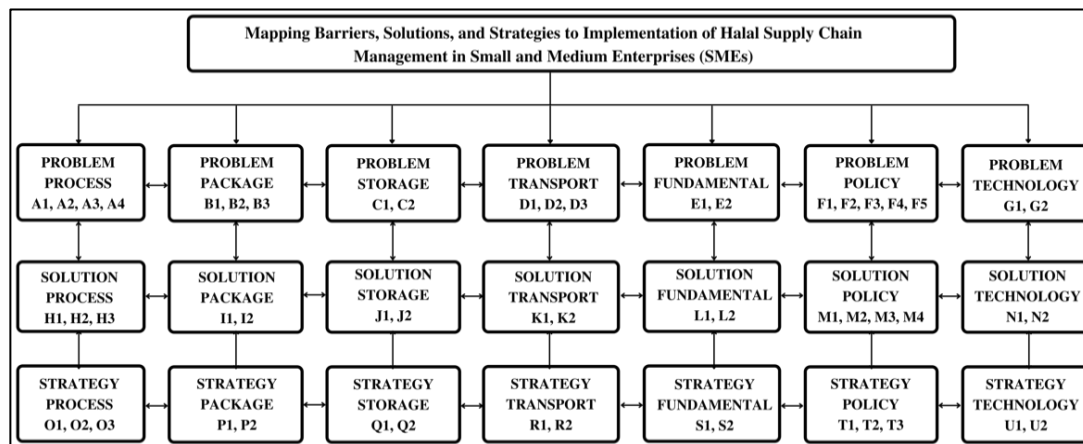


Figure 6 ANP Model

#### 4.7 Analysis of Findings

Table 7 summarizes the ANP findings about the implementation of halal supply chain management in Small and Medium-Sized Enterprises, including problems, solutions, and strategies. This section will discuss the most significant sub-criteria within each criteria (process, package, storage, transport, fundamental, policy, and technology). The most dominant problem for the process criteria was weaknesses in handling, monitoring, processing and tracing along the halal supply chain because supply chain information from upstream to downstream in the halal industry is not transparent. For the package criteria, the most dominant problem was halal status of packaging materials is less considered. In the storage criteria, the most dominant problem was cross-contamination between halal and non-halal ingredients is not prevented in the storage. The most dominant problem for the transport criteria was cross-contaminated during delivering due to the transport or containers being contaminated. For the fundamental criteria, the most dominant problem was there is no international agreement on how to audit the halal supply chain. In the policy criteria, the most dominant problem was ineffective implementation of existing regulations. Lastly, the most dominant problem for the technology criteria was blockchain manufacturing is expensive, especially for SMEs. At the level of solution, the most dominant solution to solve the obstacles within the process criteria was socialization within the community to improve the integrity of business actors' halal status and to the owners of business establishments (malls, markets, etc.) to separate halal and non-halal businesses. For the package criteria, the most dominant solution was manufacturer's discipline in checking the packaging to be used. In the storage criteria, the most dominant solution was allocating a separate storage space for halal products. The most dominant solution for the transport criteria was utilization of separate containers for halal products. For the fundamental criteria, the most dominant solution was initiating a global halal label that is acceptable to various types of Muslim groups. In the policy criteria, the most dominant solution was producers must be more transparent in providing information regarding the source of the ingredients used and their halal status. Lastly, the most dominant solution for the technology criteria was adoption of blockchain technology, IoT Technology, RFID tag, and quick response (QR) codes, which will increase the visibility, transparency and traceability of all activities in the halal supply chain. At the level of strategy, taking into consideration the origins of products, production and facilities, global sourcing of ingredients and raw materials, food trade and halal as a way of life leads to a definition of halal integrity was found as the best process approach. For the package criteria, the most dominant strategy was the establishment of strict SOPs for

**Table 8** ANP result

Level	Criteria	Co-de	Name	Contribution of sub criteria to criterias	Contribution of sub criteria to level	Contribution of sub criteria to the model
Problem	Process	A1	Weaknesses in handling, monitoring, processing and tracing along the halal supply chain because supply chain information from upstream to downstream in the halal industry is not transparent	0,2631023	0,0375861	0,0125287
		A2	Lack of consistency of halal supply chain	0,2399849	0,0342836	0,0114279

Level	Criteria	Co-de	Name	Contribution of sub criteria to criterias	Contribution of sub criteria to level	Contribution of sub criteria to the model
			implementation after obtaining halal certification			
		A3	The processing of Halal products using equipment that is contaminated with substances that are Najis	0,1870763	0,0267252	0,0089084
		A4	Halal products have a direct contact with non-halal products	0,1652105	0,0236015	0,0078672
	Package	B1	Halal status of packaging materials is less considered	0,3787135	0,0541019	0,0180341
		B2	There is no specialized and dedicated group of workers to handle and monitor the halal product packaging from health perspective	0,2170321	0,0310046	0,0103349
		B3	Packaging can't protect goods from any cross-contamination between halal and non-halal substance	0,3103492	0,0443356	0,0147787
	Storage	C1	Cross-contamination between halal and non-halal ingredients is not prevented in the storage	0,4602026	0,0657432	0,0219146
		C2	Tools to handle packaged halal products must not be mixed together with the one used for non-halal products	0,4534289	0,0647756	0,0215921
	Transport	D1	Cross-contaminated during delivering due to the transport or containers being contaminated	0,3501198	0,0500171	0,0166725
		D2	Lack of dedicated assets and facilities in handling halal products during consignments passing	0,3464071	0,0494867	0,0164957
		D3	Difficult to track and trace the drivers' attitudes and procedures during the delivery of halal products	0,2301635	0,0328805	0,0109603
	Fundamental	E1	There is no single agreed definition of halal supply chain management	0,4260956	0,0608708	0,0202904
		E2	There is no international agreement on how to audit the halal supply chain	0,5199541	0,0742792	0,02476
	Policy	F1	Stakeholders who are considered less disciplined	0,1157316	0,0165331	0,0055109



Level	Criteria	Co- de	Name	Contri- bution of sub criteria to criterias	Contri- bution of sub criteria to level	Contri- bution of sub criteria to the model
Solution	Technology		in giving permits to the halal industry			
		F2	The process of inspecting halal products has too many stages and is still done manually so that inspection errors are likely to occur	0,1474956	0,0210708	0,0070236
		F3	The expensive and long-term halal certification process causes the COGS of halal products to be higher	0,1650253	0,023575	0,0078582
		F4	Ineffective implementation of existing regulations	0,2703255	0,0386179	0,0128724
		F5	The lack of effective collaboration between the religious and the health department has questioned the integrity of the halal status audit	0,1801578	0,0257368	0,0085789
		G1	Blockchain manufacturing is expensive, especially for SMEs	0,560813	0,0801162	0,0267053
		G2	There is no regulation regarding blockchain technology in the management of halal supply chains	0,3991517	0,0570217	0,0190074
	Process	H1	Improvements in raw material traceability, asset specificity for halal products, quality assurance, level of trust, and commitment	0,2794457	0,0399209	0,0133071
		H2	Socialization within the community to improve the integrity of business actors' halal status	0,3341648	0,0477379	0,0159128
		H3	Socialization to the owners of business establishments (malls, markets, etc.) to separate halal and non-halal businesses	0,3341648	0,0477379	0,0159128
	Package	I1	Manufacturer's discipline in checking the packaging to be used	0,5764745	0,0823536	0,0274515
		I2	Training and debriefing for specialized groups of workers who handle the packaging of halal products	0,3871353	0,0553051	0,0184352

Level	Criteria	Co-de	Name	Contribution of sub criteria to criterias	Contribution of sub criteria to level	Contribution of sub criteria to the model
	Storage	J1	Allocating a separate storage space for halal products	0,5199555	0,0742794	0,0247601
		J2	Procurement of media specifically used for halal products	0,4457287	0,0636756	0,0212255
	Transport	K1	Halal industry stakeholders should be more innovative in manufacturing assets and special systems for halal product transportation	0,3848507	0,0549787	0,0183264
		K2	Utilization of separate containers for halal products	0,5199545	0,0742793	0,02476
	Fundamental	L1	Propose one definition of halal supply chain management because there are too many narrow definitions reported in the literature	0,3131215	0,0447317	0,0149107
		L2	Initiating a global halal label that is acceptable to various types of Muslim groups	0,6126122	0,0875161	0,0291723
	Policy	M1	Tightening rules and regulations against violators of halal supply chain policies	0,18827	0,0268957	0,0089654
		M2	Halal certification on packaging	0,1398019	0,0199717	0,0066573
		M3	Government authorities must ensure that the production process follows the correct principles of halal procedures throughout the process	0,2824123	0,0403447	0,0134483
		M4	Producers must be more transparent in providing information regarding the source of the ingredients used and their halal status	0,3030572	0,0432939	0,0144314
	Technology	N1	Adoption of blockchain technology, IoT Technology, RFID tag, and quick response (QR) codes, which will increase the visibility, transparency and traceability of all activities in the halal supply chain	0,5036026	0,0719433	0,0239811
		N2	Formulation of laws on the use of blockchain	0,4181252	0,0597322	0,0199109

Level	Criteria	Co-de	Name	Contribution of sub criteria to criterias	Contribution of sub criteria to level	Contribution of sub criteria to the model
Strategy	Process		technology, especially in halal supply chain management			
		O1	Taking consideration for the origin of the product, production and facilities, sources of materials and raw materials	0,3452895	0,0493271	0,0164425
		O2	PCR-based & protein based technique for pork detection, analytical technique for lard detection	0,3134289	0,0447756	0,0149254
	Package	O3	Mitigation of the risk of exposure to halal products by non-halal substances	0,2653123	0,0379018	0,0126341
		P1	Provide an additional layer of protection on the smallest packaging in halal products	0,3421781	0,0488826	0,0162942
		P2	The establishment of strict SOPs for inspecting halal products for even the tiniest packaging defects	0,5901292	0,0843043	0,0281016
	Storage	Q1	Providing space or a partition that separates halal products from non-halal products	0,5260788	0,0751542	0,0250516
		Q2	Specialized markings to media used to handle halal products	0,4509764	0,0644253	0,0214754
	Transport	R1	Conducting research on the development of halal-specific assets for halal product transportation	0,3466841	0,0495263	0,0165088
		R2	Providing space in containers to separate halal products from non-halal products	0,6299588	0,0899942	0,0299982
	Fundamental	S1	The establishment of widely accepted audit methods and the audit information obtained must be transparent and traceable to all parties	0,5715669	0,0816525	0,0272179
		S2	Establishment of halal labeling formats that represent agreed to global certification process	0,3916927	0,0559562	0,0186523
	Policy	T1	Giving higher penalties to violators of halal policy, and assessing cases of	0,3200296	0,0457186	0,0152397

Level	Criteria	Co-de	Name	Contribution of sub criteria to criterias	Contribution of sub criteria to level	Contribution of sub criteria to the model
			violations as criminal conspiracy, not just cheating			
		T2	Transparency, dedicated infrastructures, and world-based standardised halal standards	0,2963073	0,0423297	0,0141101
		T3	Routine monitoring from the auditor	0,2799602	0,0399943	0,0133316
	Technology	U1	Construction of a blockchain system to track the halal supply chain	0,487081	0,0695831	0,0231945
		U2	Increase the priority of legal regulation that regulate blockchain systems	0,4656277	0,0665183	0,0221728

inspecting halal products for even the tiniest packaging defects. In the storage criteria, the most dominant strategy was providing space or a partition that separates halal products from non-halal products.

The most dominant strategy for the transport criteria was providing space in containers to separate halal products from non-halal products. For the fundamental criteria, the most dominant strategy was the establishment of widely accepted audit methods and the audit information obtained must be transparent and traceable to all parties. In the policy criteria, the most dominant strategy was giving higher penalties to violators of halal policy, and assessing cases of violations as criminal conspiracy, not just cheating. Lastly, the most dominant strategy for the technology criteria was construction of a blockchain system to track the halal supply chain.

The analysis stated above may also be used to explain the contribution of each sub-criteria at the problems, solutions, and strategies levels. Blockchain manufacturing is expensive, especially for SMEs, was the most dominant problem at the problem level followed by there is no international agreement on how to audit the halal supply chain and cross-contamination between halal and non-halal ingredients is not prevented in the storage in the second and third place. At the solution level, initiating a global halal label that is acceptable to various types of Muslim groups was determined to be the optimum solution followed by manufacturer's discipline in checking the packaging and allocating a separate storage space for halal products in the second and third place. Finally, providing space in containers to separate halal products from non-halal products was the most dominant strategy followed by the establishment of strict SOPs for inspecting halal products for even the tiniest packaging defects and the establishment of widely accepted audit methods and the audit information obtained must be transparent and traceable to all parties in the second and third place. Looking at the contributions of each sub-criteria on the model, it was discovered that providing space in containers to separate halal products from non-halal products was the most dominant component of the model.

#### 4.8 Managerial Relevancy

The highlights of the discussion are about blockchain implementation, widely accepted label and audit method, and contamination prevention. As other new technology and mechanism, blockchain establishment require a lot of research to be implemented properly.

With that fact on the table, it is clear to claim that implementing blockchain system to solve traceability and transparency problem to implementation of halal supply chain management will cost a huge bag of money. Moreover, in SMEs, there is a need to develop not only the mechanism, but also the human resource for all parties in the halal supply chain ecosystem to understand the new technology. Unfortunately, blockchain implementation for SME is considered so expensive. This is in line with a study that has been conducted. Because developing a blockchain system is costly, the cost of modification will be quite high (Nur, Amrozi, & Hakim, 2020). Many supply chains continue to rely on old techniques for a variety of tasks, making change difficult to manage (Nur, Amrozi, & Hakim, 2020). Besides, there is no regulation found in our law, talking about blockchain implementation. The only regulation talks about blockchain is in law number 10 year 2011, even that regulation only talk about blockchain as a commodity and not the implementation.

Beside conducting some research, world-wide regulator will also take a very important role in term of blockchain implementation in halal supply chain management. In order to create a strong and profitable regulation, strong-widely-accepted fundamental problems need to be fixed. The definition, label, and audit method should be accepted by a world wide community of the ecosystem. Not only the regulator, but the halal business practitioner plays an important role in halal supply chain management ecosystem. Details like packaging, storing, and transportation quite often provide contamination problem. Food delivery services are located at the extreme end of the food supply chain, just prior to the food reaching clients (Nizar & Zainal Abidin, 2021). However, this step, particularly in the halal food supply chain, may make or break a wholesome food production (Nizar & Zainal Abidin, 2021). Therefore, separation of halal products and non-halal products must be guaranteed.

## **CHAPTER V**

### **CONCLUSIONS AND SUGGESTIONS**

In this chapter, conclusions that address the formulation of the problem in terms of mapping the barriers, solutions, and strategies to implementation of halal supply chain, as well as technical planning and risk management will be formed.

#### **5.1 Conclusions**

This study investigates the problems, solutions, and strategies related to implementation of halal supply chain management in small and medium enterprises using the Analytical Network Process method. Most dominant problem found was blockchain manufacturing is expensive, especially for SMEs. While the most dominant solution found was initiating a global halal label that is acceptable to various types of Muslim group. Lastly, providing space in containers to separate halal products from non-halal products was found to be the most dominant strategy. The finding showed that small details like contamination prevention, fundamental definition and audit method, also the cost of new technology are the main priority to be considered in the halal supply chain management ecosystem.

#### **5.2 Suggestions**

As a suggestion, we recommend that technology development should be continued and accelerated, accompanied by the regulation. Global halal label should always be discussed, developed, and implemented. Lastly, each party in the ecosystem should not underestimate any islamic law and put attention on the whole halal supply chain mechanism. The scope of this research is limited by the fact that it was performed in one of Indonesia's provinces. Additionally, this research employs a single-level Analysis Network Process method, with an attention on issue identification, solution development, and strategy formulation. Future study may be conducted with a greater scope, or on a bigger national scale. However, a two-level Analysis Network Process model, such as Analysis Network Process with benefit, opportunity, cost, and risk analysis (BOCR), may be used.

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## APPENDIX

### Appendix 1 Thesis Tutoring Sheet of Supervisor

#### LEMBAR BIMBINGAN SKRIPSI

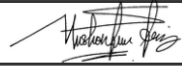

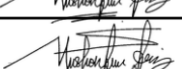
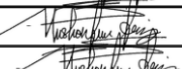



NRP : 09111840000011  
 Nama Mahasiswa : Gde Dharma Ardyansyah  
 Judul Skripsi : PEMETAAN HAMBATAN IMPLEMENTASI HALAL SUPPLY CHAIN  
 : MANAGEMENT PADA USAHA MIKRO, KECIL DAN MENENGAH  
 (UMKM)  
 Dosen Pembimbing : Dewie Saktia Ardiantono, S.T., M.T.  
 Dosen Ko-Pembimbing : Mushonnifun Faiz Sugihartanto, S.T., M.Sc.

No	Tgl Bimbingan	Keterangan	Paraf
1	12 Sep 2021	Discuss about research main points and expected findings	
2	19 Sep 2021	Building background, research questions, and research objectives	
3	26 Sep 2021	Analyzing previous studies	
4	03 Okt 2021	Selecting the best method to be implemented on the research	
5	10 Okt 2021	Working on theory literature	
6	17 Okt 2021	Constructing research method	
7	21 Okt 2021	Final recap	

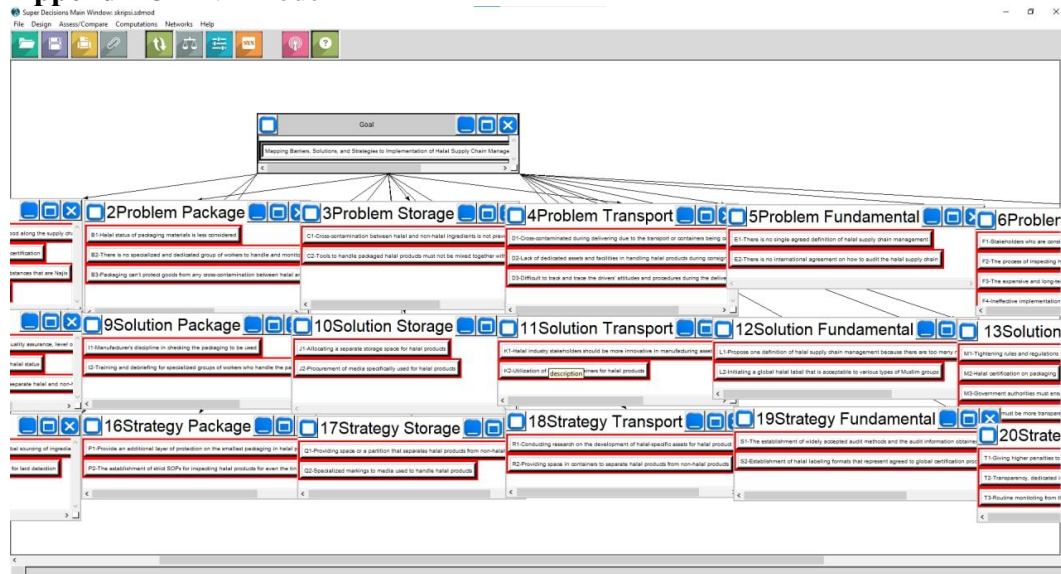
## Appendix 2 Thesis Tutoring Sheet of Co-Supervisor

### LEMBAR BIMBINGAN SKRIPSI

NRP : 09111840000011  
Nama Mahasiswa : Gde Dharma Ardyansyah  
Judul Skripsi : PEMETAAN HAMBATAN IMPLEMENTASI HALAL SUPPLY CHAIN  
MANAGEMENT PADA USAHA MIKRO, KECIL DAN MENENGAH (UMKM)  
Dosen Pembimbing : Dewie Saktia Ardiantono, S.T., M.T.  
Dosen Ko-Pembimbing : Mushonnifun Faiz Sugihartanto, S.T., M.Sc.

No	Tgl Bimbingan	Keterangan	Paraf
1	12 Sep 2021	Discuss about research main points and expected findings	
2	19 Sep 2021	Building background, research questions, and research objectives	
3	26 Sep 2021	Analyzing previous studies	
4	03 Okt 2021	Selecting the best method to be implemented on the research	
5	10 Okt 2021	Working on theory literature	
6	17 Okt 2021	Constructing research method	
7	21 Okt 2021	Final recap	

## Appendix 3 ANP Model



## Appendix 4 Questionnaires

### QUESTIONNAIRE OF MAPPING OBSTACLES, SOLUTIONS, AND STRATEGIES TO THE IMPLEMENTATION OF HALAL SUPPLY CHAIN IN SMALL AND MEDIUM ENTERPRISES (SMEs)

**Full Name** :

**Institution** :

**Department** :

**Date** :

#### GENERAL INSTRUCTIONS

This questionnaire is a medium to gain weighting for problems, solutions, and strategies in the implementation of halal supply chain management in SMEs. The main purpose of this questionnaire is to find out the most important/influential/relevant problems, solutions, and strategies. It should be understood that this questionnaire has no commercial purpose. The researcher will ensure the confidentiality of the answers to this questionnaire. Your cooperation in providing honest and candid input will help this study to be able to take pictures and objectively know the current situation and conditions. The estimated duration of filling out the questionnaire is 10 to 15 minutes.

Please answer this questionnaire honestly according to your perception and information. This questionnaire is not a test so there are no wrong answers. Filling is done by putting a cross on the choice that is considered appropriate. All sub-criteria in this questionnaire are mandatory to be answered.

Instruction:

1 = Not important/influential/relevant

3 = Less important/influential/relevant

5 = Important/influential/relevant

7 = Very important/influential/relevant

9 = Absolutely important/influential/relevant ‘

1. From the perspective of **Process**, which alternative is the **problem** in implementing halal supply chain for SMEs?

No.	Process Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Weaknesses in handling, monitoring, processing and difficulty of tracing halal food along the supply chain as the supply chain information from the upstream to downstream in the food industry is not transparent									
2.	Lack of consistency of halal supply chain implementation after obtaining halal certification									
3.	The processing of Halal products using equipment that is contaminated with substances that are Najis									

No.	Process Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
4.	Halal products have a direct contact with non-halal food or non-halal products									

2. From the perspective of **Package**, which alternative is the **problem** in implementing halal supply chain for SMEs?

No.	Package Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Halal status of packaging materials is less considered									
2.	There is no specialized and dedicated group of workers to handle and monitor the halal food packaging from health perspective									
3.	Packaging can't protect goods from any cross-contamination between halal and non-halal substance									

3. From the perspective of **Storage**, which alternative is the **problem** in implementing halal supply chain for SMEs?

No.	Storage Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Cross-contamination between halal and non-halal ingredients is not prevented in the storage.									
2.	Tools to handle packaged halal products must not be mixed together with the one used for non-halal products									

4. From the perspective of **Transport**, which alternative is the **problem** in implementing halal supply chain for SMEs?

No.	Transport Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Cross-contaminated during delivering due to the transport or containers being contaminated									
2.	Lack of dedicated assets and facilities in handling halal products during consignments passing									
3.	Difficult to track and trace the drivers' attitudes and procedures during the delivery of halal products									

5. From the perspective of **Fundamental**, which alternative is the **problem** in implementing halal supply chain for SMEs?

No.	Fundamental Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	There is no single agreed definition of halal supply chain management									
2.	There is no international agreement on how to audit the halal supply chain									

6. From the perspective of **Policy**, which alternative is the **problem** in implementing halal supply chain for SMEs?

No.	Policy Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Stakeholders who are considered less disciplined in giving permits to the halal industry									
2.	The process of inspecting halal products has too many stages and is still done manually so that inspection errors are likely to occur									
3.	The expensive and long-term halal certification process causes the COGS of halal products to be higher									
4.	Ineffective implementation of existing regulations									
5.	The lack of effective collaboration between the religious and the health department has questioned the integrity of the halal status audit									

7. From the perspective of **Technology**, which alternative is the **problem** in implementing halal supply chain for SMEs?

No.	Technology Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Blockchain manufacturing is expensive, especially for SMEs									
2.	There is no regulation regarding blockchain technology in the management of halal supply chains									

8. From the perspective of **Process**, which alternative is the **solution** in implementing halal supply chain for SMEs?

No.	Process Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Improvements in raw material traceability, asset specificity for halal products, quality assurance, level of trust, and commitment									
2.	Socialization within the community to improve the integrity of business actors' halal status									
3.	Socialization to the owners of business establishments (malls, markets, etc.) to separate halal and non-halal businesses									



9. From the perspective of **Package**, which alternative is the **solution** in implementing halal supply chain for SMEs?

No.	Package Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Manufacturer's discipline in checking the packaging to be used									
2.	Training and debriefing for specialized groups of workers who handle the packaging of halal products									

10. From the perspective of **Storage**, which alternative is the **solution** in implementing halal supply chain for SMEs?

No.	Storage Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Allocating a separate storage space for halal products									
2.	Procurement of media specifically used for halal products									

11. From the perspective of **Transport**, which alternative is the **solution** in implementing halal supply chain for SMEs?

No.	Transport Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Halal industry stakeholders should be more innovative in manufacturing assets and special systems for halal product transportation.									
2.	Utilization of separate containers for halal products									

12. From the perspective of **Policy**, which alternative is the **Solution** in implementing halal supply chain for SMEs?

No.	Policy Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Tightening rules and regulations against violators of halal supply chain policies									
2.	Halal certification on packaging									
3.	Government authorities must ensure that the halal production process follows the correct principles of halal procedures throughout the process									
4.	Producers must be more transparent in providing information regarding the source of the ingredients used and their halal status									

13. From the perspective of **Fundamental**, which alternative is the **solution** in implementing halal supply chain for SMEs?

No.	Fundamental Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Propose one definition of halal supply chain management because there are too many narrow definitions reported in the literature									
2.	Initiating a global halal label that is acceptable to various types of Muslim groups									

14. From the perspective of **Technology**, which alternative is the **solution** in implementing halal supply chain for SMEs?

No.	Technology Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Adoption of blockchain technology, IoT Technology, RFID tag, and quick response (QR) codes, which will increase the visibility, transparency and traceability of all activities in the halal supply chain									
2.	Formulation of laws on the use of blockchain technology, especially in halal supply chain management									

15. From the perspective of **Process**, which alternative is the **strategy** in implementing halal supply chain for SMEs?

No.	Process Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Taking into consideration the origins of products, production and facilities, global sourcing of ingredients and raw materials, trade and halal as a way of life leads to a definition of halal integrity									
2.	PCR-based & protein based technique for pork detection, analytical technique for lard detection									
3.	Mitigation of the risk of exposure to halal products by non-halal substances									

16. From the perspective of **Package**, which alternative is the **strategy** in implementing halal supply chain for SMEs?

No.	Package Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Provide an additional layer of protection on the smallest packaging in halal products									

No.	Package Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
2.	The establishment of strict SOPs for inspecting halal products for even the tiniest packaging defects									

17. From the perspective of **Storage**, which alternative is the **strategy** in implementing halal supply chain for SMEs?

No.	Storage Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Providing space or a partition that separates halal products from non-halal products									
2.	Specialized markings to media used to handle halal products									

18. From the perspective of **Transport**, which alternative is the **strategy** in implementing halal supply chain for SMEs?

No.	Transport Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Conducting research on the development of halal-specific assets for halal product transportation									
2.	Providing space in containers to separate halal products from non-halal products									

19. From the perspective of **Policy**, which alternative is the **strategy** in implementing halal supply chain for SMEs?

No.	Policy Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Giving higher penalties to violators of halal policy, and assessing cases of violations as criminal conspiracy, not just cheating									
2.	Transparency, dedicated infrastructures, and world-based standardised halal standards									
3.	Routine monitoring from the auditor									

20. From the perspective of **Fundamental**, which alternative is the **strategy** in implementing halal supply chain for SMEs?

No.	Fundamental Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9

1.	The establishment of widely accepted audit methods and the audit information obtained must be transparent and traceable to all parties								
2.	Establishment of halal labeling formats that represent agreed to global certification process								

21. From the perspective of **Technology**, which alternative is the **strategy** in implementing halal supply chain for SMEs?

No.	Technology Alternatives	Point Of Scale								
		1	2	3	4	5	6	7	8	9
1.	Construction of a blockchain system to track the halal supply chain									
2.	Increase the priority of legal regulation that regulate blockchain systems									



Gde Dharma is graduated with Bachelor degree at Sepuluh Nopember Institute of Technology majoring in Business Management. He focuses on financial industry especially in, financial technology and financial planning (certified). He has a strong interest in integrating finance and marketing with the support of data analytic. He also has capability on basic programming and data analysis.