

Decision Support System Model to Support The Selection of The Best Supplier for Small Medium Enterprise Supply Chain Management

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Abstract

One important component that supports the performance of production SMEs is Supply Chain Management because Supply Chain Management or SCM integrates the raw material procurement process to the sales process. One of the important parts of SCM for the procurement of raw materials for SME production is determining the best supplier who can provide raw materials with several predetermined criteria such as competitive prices, quality products and others. However, the selection of suppliers who provide raw materials for SMEs is currently still done manually, resulting in inappropriate supplier selection decisions. On the other hand, a Decision Support System or DSS is a computer-based system built to assist the decision-making process by considering criteria and alternatives. Thus, the

purpose of this research is to build a DSS model to help SMEs determine the best supplier. The research method uses a qualitative approach through observation to SMEs to see problems related to supplier selection. Literature studies are used to find alternative solutions with information technology.

Keywords

DSS, SMEs, SCM, Supplier Selection.

1. Introduction

SCM is a very important field in the business world because it is directly connected to the competitiveness of companies including SMEs (Le et al. 2019) (Erceg and Jovanka 2019) (Jo and Chulhwan 2021). SCM itself is the management and supervision of the cycle chain starting from raw materials or goods, payments, information from suppliers to producers, wholesalers checking to consumers. The supply chain is a physical network so that all companies will play a role in supplying raw materials, producing goods to sending them to end users or consumers. For supply chain management itself becomes a tool, method or management (Wang and Xi 2022) (Hasan 2021) (Trisulo et al. 2022).

There are several purposes for using SCM, the most basic of which is being able to match demand with existing supply. In addition, there are several obstacles or problems that are often experienced when running a supply chain such as procurement management, supplier management, managing customer relationships, identifying problems and then responding to these problems, risk management, and so on. In order to be a winner in the supply chain, it is important for the supply chain to be able to provide products that are not only cheap, but of high quality, varied, and also provided on time (Tumpa et al. 2019) (Wu et al. 2019) (O'Connor et al. 2018).

One part of the supply chain is a supplier or supplier. Supplier is a company, individual or organization that cooperates with other companies in terms of supplying raw materials or other goods related to the company's operational processes. In this case, suppliers have a very important role for a company because almost every company's operational activities, the first thing to look at is raw materials that depend on suppliers. In SCM there are five supplier selection strategies, namely many suppliers, few suppliers, vertical integration, keiretsu networks and virtual companies (Heizer and Barry, 2011). In this strategy, of course the company has considerations to choose one of the five strategies. One of them is to choose many suppliers, because the thing to consider is that there will be various comparisons regarding prices and product specifications (Nagy et al. 2018) (Pettit et al 2019) (Zhu and Kee 2019).

Currently, the selection of suppliers by SMEs uses manual calculations so that the resulting decisions are not as expected by SMEs. The purpose of this study is to build a DSS model with the Analytic Hierarchical Processing (AHP) method to help SMEs determine the best supplier to support the SME supply chain process. The research method uses a qualitative approach through observation to SMEs to see problems related to supplier selection. Literature studies are used to find alternative solutions with information technology.

2. Literature Review

Decision Support System

Decision Support System is part of a computer-based information system (including a knowledge-based system/knowledge management) that is used to support decision making in an organization or company or a computer system that processes data into information for making decisions on specific semi-structured problems (Kumar 2020) (Laila and hengki 2020) (Sutton et al. 2020).

The purpose of DSS is to serve the management, operations, planning level of the organization, increase effectiveness in decision making and help people make decisions about problems that may change quickly and are not easy to solve. In general, there are three basic components of DSS design, namely: Database or knowledge base, Model which includes decision context and user criteria and User interface (UI). decision. The second stage is to develop and analyze possible alternative courses of action from the solution. The third stage is choosing an action between the two previous stages. The last stage is to use the selected action in the action decision-making situation (Yulaintini et al. 2019) (Allaoui et al. 2019) (Kitsios and Maria 2018).

Knowledge Base

knowledge base is a type of database used for knowledge management. These databases provide facilities for the collection, organization, and retrieval of computerized knowledge. The most important thing about a knowledge base is the quality of the information it contains. The best knowledge bases have well-written articles that are kept up to date, have a good retrieval system and carefully designed content formats and classification structures (Al-Emran et al. 2018) (Ayatollahi and Kimia 2020) (Manesh et al. 2020).

A knowledge base consists of several large data packets and a large set of rules. In general, the knowledge base has a dynamic nature, with the ability and capacity to learn, so it is close to the topic of artificial intelligence. To manage a knowledge base, it takes a knowledge base management system which usually can make inferences based on rules, data descriptions, and facts to generate new information. This is needed because system users must be able to draw conclusions even with incomplete information. The second is the Mechanism for updating such as inserting, deleting, or modifying the knowledge base. The third is the ability to optimize queries. If the system does not have a query, the information search activity can take a long time. another capability is the ability to integrate diverse knowledge bases. This kind of ability is needed, especially by organizations that are scattered in various locations (Larkin et al. 2021) (Paille and Norrin 2019) (Sagiyeva et al. 2018).

Models in Decision Support System

All DSS above the simplest data-oriented ones are based on models. Their purpose is to hence the decision maker who is using it to predict what would happen in the real world if certain choices were made. This enables the decision maker to evaluate alternative actions without trying them out in practice – obviously saving in time, expense, and overall hassle to say nothing of reducing the likelihood of seriously wrong decision that could do major damage to an organization. Another hand, model is a representation of an actual system. Models embody system characteristics that are important to the model's users. At the same time, models simplify reality by eliminating other characteristics that are not important for their purpose (Psarommatitis et al. 2022) (Sarker 2021) (Gillingham 2019).

The central idea of a model is that important relationships that apply to the system being modeled also apply to the model. There are several types of models such as Static vs Dynamic Models. Static Models shows the values that system attributes take when the system is in balance. Static model can model either a static system or a dynamic system. Showing when a system is in balance, can tell decision makers how the system will eventually stabilize even if it does not show them how it gets to that point. Because it involves much less data, it can be easier for a decision maker to analyze (Koopailipoor et al. 2019) (Wang et al. 2018) (Zhao et al. 2019).

Other models are Continuous VS Discrete-Event Model Continuous models describe physical or economic processes in which the numbers that describe the system vary continuously. Discrete-event models Deal with systems in which individual events occur at identifiable points in time and change the state of the system instantaneously from one value to a different one. Discrete-event Simulation Models allows us to predict the behavior of a business system by modelling the expected behaviors and interactions of its components over time (Ead et al. 2019) (Reinhardt et al. 2022) (Karaka et al. 2022).

3. Methods

Figure 1 explains the research method. Supply chain management is an important part for SMEs because in SCM there are 3 main components that greatly affect the overall performance of SMEs, namely the supply side, production side and sales side. This research focuses on SME problems related to the supply side where one of the important factors on the supply side is determining the supplier as the party that provides raw materials for the production of SMEs. The finding of SME problems related to suppliers is that the supplier selection process is carried out manually without using a special method that has been tested so that the resulting selection results are not in accordance with the needs of SMEs. After finding the problem, the research continued by identifying alternative solutions using information technology through literature studies and establishing DSS as the solution. The final stage of research is to build a DSS model to help SMEs choose the best supplier that will support their supply side.

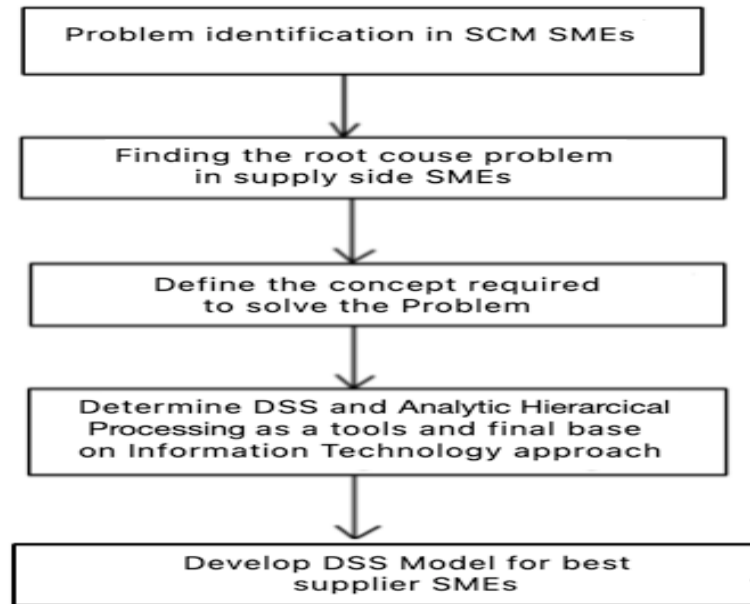


Figure 1. Research method.

4. Results and Discussion

Figure 2 shows the proposed model. The built model consists of 3 main parts, namely: knowledge base and model base as input side, DSS engine as process side and SMEs as user. The knowledge base is a collection of knowledge that SMEs need for supplier selection. A minimum of 3 knowledge needed for SMEs to be processed by the DSS engine, namely information and knowledge from supplier candidates. This information is related to supplier transaction history, supplier criteria, suppliers who have become SMEs partners and suppliers who will become SMEs partners.

The second part of the knowledge base is the knowledge of SMEs about supply chain processes. This information is needed because supplier selection is part of the overall supply chain process so that SMEs' knowledge of SCM is needed so that the integration between the supplier selection process and other processes in SCM can be considered in the process in the DSS engine. The last part of the knowledge base is technology support that helps SMEs adopt DSS. The second part of the input side is the Model Base. The base model is the model that SMEs will use to display information on the results of the DSS engine processing. Several types of models can be used by SMEs depending on the information they have as input data on the DSS engine, and the information output needed by SMEs.

The second part of this model is the DSS engine which is designed with 2 additional features, namely the request analyser and the mechanism selector. These 2 functions are built to make it easier for SMEs to meet the needs of SMEs based on the information obtained by SMEs and the output of information needed by SMEs. Mechanism selector is a function provided to determine the selection process for SME suppliers. These 2 functions are part of the DSS engine that will meet the information needs of supplier selection and help SMEs make their choice.

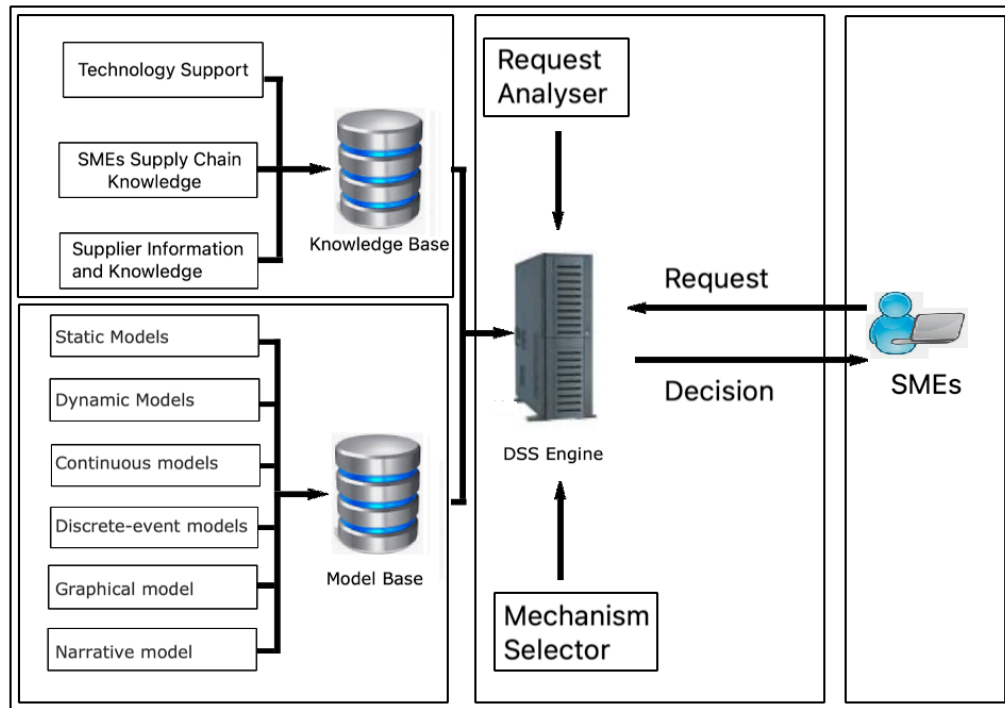


Figure 2. DSS for SMEs Best Supplier

5. Conclusion

Supplier selection for SMEs is an important process because the best suppliers will provide the best services for SMEs. The best service from suppliers will affect the effectiveness and efficiency of the SME supply chain and will ultimately affect the overall performance of SMEs. Thus, the adoption of DSS for supplier selection is very helpful for SMEs to choose suppliers based on the criteria determined by SMEs. The request analyzer which is part of the proposed model increases the flexibility of the DSS to be able to offer analysis capabilities of the existing problem. Likewise, the mechanism selector feature enhances the functionality of the DSS which supports several selection methods that can be used by SMEs

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