Determination of Priority Supply Chain Distribution Using DEMATEL Method in Instant Noodle Company

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Abstract. The company has a supply chain aims to improve company performance. The supply chain has a distribution center matches the company goals. Companies produce instant noodles have many branches spread in various regions. In order to achieve this goal, the company must determine the priority of the distribution center in the supply chain and analyze the relationship between each factor affects the distribution center to increase the flow of materials and information and the productivity of the company increase. Determination of company supply chain distribution priorities is done by using the DEMATEL method in knowing the criteria influences the selection of supply chain distribution centers. The criteria used are the four Balance Scorecard criteria, namely Financial, Internal, Customer and Learning & Growth. Then distributing priorities are obtained and the relationship of influence between criteria and distribution center. Based on the analysis of the distribution center in the company (Jambi, Medan, Aceh, Riau and Padang), it is obtained that the weighting value for prioritizing the distribution in sequence is 1,0035; 1,5649; 1,3789; 1,2605 and 1,2688. Then it is find out the level of importance sequentially, namely Medan, Aceh, Padang, Riau and Jambi.

1. Introduction

In this era of globalization with very high business competition, every company is required to develop a business strategy and it can compete with other companies. Companies must begin to develop the process of producing goods or services effectively and efficiently to be distributed to consumers. For most companies, generally using supply chain management to deliver products to the consumers. Supply chain aims to deliver products to arrive at the final consumer. In this chain there are several organizations works in different scopes. The problem often occurs is the criteria that influence the selection of the distribution center are unknown, which is distribution is the priority and the relationship between each criterion exists and its relationship with the distribution center. The company has several distribution centers spread across several regions. From the distribution center, the company does not yet know what factors can affect the performance of the distribution center and has not yet analyzed and determined the priorities of the existing distribution. This condition causes the priority of the distribution center and the criteria influences the distribution of products at the distribution center are unknown. This affects the productivity of the company. The DEMATEL method is used to identify priority distribution centers as well as criteria affects the company. Therefore, it is necessary to determine distribution priorities and factors affects the performance of the distribution center.
The importance of Supply Chain starting from the initial buying operations till providing the services and products to the customers has been increasingly growing in today’s fast market. The future and the challenges of Supply Chain Management (SCM) have been taken the interest of scholars and companies [1]. Supply chain is seen as the internal and external integration of enterprise processes with the customers and suppliers to create value for the customers [2]. The supply chain management has been touted as one of the ways to reduce volatility and improve outcomes for all involved with the supply chain [3]. Supply chain management examines the efficiency and effectiveness of the flow of goods, information and money flow that occurs continuously by involving related parties. In practice, the SCM can integrate manufactures’, suppliers, retailers, and sellers efficiently. So, they can produce and distribute the goods in precise quantity and minimal cost. One of applications of supply chain management is the logistic efficiency system that is reliable. values of the supply chain by optimizing the flow of goods, information, and money in the supply chain so that the products which reach the consumer can provide satisfaction in terms of timeliness of delivery, goods quality, and an affordable price. In turn, it will provide the maximum benefit to all members involved in the supply chain. One of the most important things in supply chain management is the sharing of information, therefore, the material flow, cash flow and information flow are elements in the overall supply chain which need to be integrated [4] [5]. Over the past two decades, supply chain management has proven to be an unavoidable solution to meet these contradictory constraints. As a result, several researchers and practitioners focus on integrating the various supply chain functions to increase flexibility, improve cycle times, and reduce costs. In supply chain management, both functions, production and distribution operations, can be decoupled if there is a sufficient buffer between them. [6].

One of the methods used for supplier selection and criteria priority determination is DEMATEL method. DEMATEL method can be used to analyze and can help companies accurately predict where suitable suppliers by focusing on important factors were found. DEMATEL method can also be used to obtain a causal relationship between each factor can provide a basis for determining the price and also provides the most important reference data for decision makers [7]. DEMATEL method was originally developed by Batelle Memorial Institute of Geneva Research Center. DEMATEL can help managers measure the importance and casual relationship of system components through assessing their direct and indirect relations and constructing a map [8]. Different criteria have different internal relationship with other criteria. Criterion with high prominence should play a more important role in the process of computing comprehensive weight. Therefore, DEMATEL method as an important tool to criteria and supplier selection.

The problem of suppliers and criteria determination has been resolved in previous studies. The research was conducted at one of the fast food industries which is has suppliers and branches spread throughout the world. The study was conducted using the supply chain by Kshitiz Sharma in priorities determination and they could serve consumers well. Low prices and customer satisfaction are the company’s motto and the selected suppliers must have a good criteria [9]. The proposed research model analyzing the relationship among SCM practices and operational performance and its validation using the Vietnam garment industry provided valuable insights both from theoretical and practical perspectives. The textile supply chain is complex structure consist of cotton or other raw material supplier, manufacturer and wholesale distributor, retailer and consumer. It requires some complex processes to supply product to customer. But, irrespective of its complexity, the supply chain has separated links in which communication is carried out as needed with specific methods [10].

Based on the research has been done before, this study uses DEMATEL. The company has a distribution center spread in the country, namely Aceh, North Sumatra, Padang Riau and Jambi. From the distribution center, the company does not yet know what factors can affect the performance of the distribution center and has not yet analyzed and determined the priorities of the existing distribution. The DEMATEL method is used in distribution centers identification and influencing criteria in the supply chain run by the company.
2. Methodology
This study was conducted at one of the companies engaged in the manufacture of food namely instant noodles in the Medan city where the object examined in this study was to find out the criteria needed to determine the priority of the distribution center. The company has many branches and companies need to determine the distribution center selection. The study begins with observations to observe and see the state of the company directly. From the results of observations, it is determined the formulation of the problem in accordance with the conditions that occur in the company and the research objectives can be applied. The research objectives determined are a solution to existing problems. Furthermore, the data collection is the input in conducting this research. The data needed is in the form of SWOT and DEMATEL data from the results of questionnaires. With these data, data processing is carried out with several stages, namely data validity test, data reliability test and variables test between variables and distribution centers. Data validity test is needed to see the relationship between each variable and can be responsible for. Reliability test is needed and the information obtained can be trusted as a data collection tool and is able to reveal actual information in the factory.

Identification determination of criteria needed for the selection of distribution centres spread in the country, namely Aceh, North Sumatra, Padang Riau and Jambi using the DEMATEL method. DEMATEL method can be used to analyze and can help companies accurately predict where suitable suppliers by focusing on important factors were found. DEMATEL method can also be used to obtain a causal relationship between each - each factor can provide a basis for determining the price and also provides the most important reference data for decision makers. Due to its advantages and capabilities, the approach of DEMATEL has received a great deal of attention in the past decade and many researchers have applied it for solving complicated system problems in various areas. In addition, the DEMATEL has been extended for better decision making under different environments since many real-world systems include imprecise and uncertain information. The DEMATEL can confirm interdependence among factors and aid in the development of a map to reflect relative relationships within them and can be used for investigating and solving complicated and intertwined problems. This method not only converts the interdependency relationships into a cause and effect group via matrixes but also finds the critical factors of a complex structure system with the help of an impact relation diagram. As stated earlier, the DEMATEL technique can convert the interrelations between factors into an intelligible structural model of the system and divide them into a cause group and an effect group. Hence, it is an applicable and useful tool to analyze the interdependent relationships among factors in a complex system and rank them for long-term strategic decision making and indicating improvement scopes. The formulating steps of classical DEMATEL are generate the best result for criteria and supplier selection [11].

3. Result and Discussion

3.1. Validity Data Test
Validity data test is done to see the relationship between each variable. Test validity is based on perspective parameters, namely the perspective section of Balance Scorecard, Financial perspective section, Internal perspective section, Customer perspective section, Learning & Growth perspective section, BSC of the distribution center (Financial), BSC of the distribution center (internal), BSC section of the distribution center (Costumer), BSC of the distribution center (Learning & Growth) and the distribution center for the Financial perspective. Balance Scorecard perspective section has 12 relationships, Financial perspective section has 3 relationships, Internal perspective section has 4 relationships, Costumer perspective section has 4 relationships, Learning & Growth perspective section has 4 relationships, BSC section of the distribution center (Financial) has 5 relationships, BSC of the distribution center (Internal) has 5 relationships, BSC of the distribution center (Costumer) has 5 relationships, BSC of the distribution center (Learning & Growth) has 5 relationships and the distribution center for the Financial perspective has 5 relationships. The results obtained indicate the overall parameters are valid.
3.2. Reliability Data Test
Reliability data test is needed, and the information obtained can be trusted as a data collection tool and is capable to reveal actual information in the factory. The results recapitulation of the calculation of reliability data test can be seen in Table 1.

| Parameter                              | Category |
|----------------------------------------|----------|
| Balance Scorecard Perspective          | Reliable |
| Financial Perspective                  | Reliable |
| Internal Perspective                   | Reliable |
| Costumer Perspective                   | Reliable |
| Learning & Growth Perspective          | Reliable |
| Financial of Distribution Centre Perspective | Reliable |
| Internal of Distribution Centre Perspective | Reliable |
| Costumer of Distribution Centre Perspective | Reliable |
| Learning & Growth of Distribution Centre Perspective | Reliable |
| Distribution Centre of Financial Perspective | Reliable |

3.3. Calculation of Distribution Centre
The Distribution Center consists of Jambi, Medan, Aceh, Riau, and Padang. From the results of calculation, it is known that the D + R value from a balanced scorecard perspective is 1.0631; 1.5516; 1.3994; 1.3090 and 1.3133. The results of calculation with D-R are obtained -0.3141; -0.8934; -0.5300; -0.6386 and -0.7327. Then it can be seen in order of importance, namely Medan, Aceh, Padang, Riau, and Jambi.

4. Conclusion
The problem of distribution priorities determination often occurs in large companies because they do not know the appropriate criteria in supplier selection. Validity and reliability tests show the results of questionnaires are valid and reliable. The DEMATEL method is one method can be used in overcoming the problem of distribution centers and selection criteria determination. The results obtained by this method shows that the criteria influences the selection of the companies distribution center in the supply chain are based on the balance scorecard perspective consisting of Financial, Internal, Customer and Learning & Growth perspective. By using the DEMATEL method, it can be seen the priority distribution center is Medan followed by Aceh, Padang, Riau, and Jambi.

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References
[1] Faruk Hasanspabic 2013 *Global Business and Economic Research Journal* 2 (6) 26-37.
[2] Phuoc Van Nguyen 2018 *European Journal of Economic Management* 7 (1) 11-18.
[3] Julio Kyosen Nakatani, Marcos Fava Neves 2018 *Journal of Business Administration* 4 (30) 1-11.
[4] Natelda R. Timisela, Ester D. Leatemia, Febby J. Polnaya, Rachel Breemer 2018 *Journal of Applied Management* 15 (1) 135-145.
[5] Dunne A.J. 2001 *Australian Agrobusiness Perspectives*. 
[6] Achraf Touil, Abdelwahed Echchatbi, Abdelkabir Charkaoui 2019 International Journal of Supply and Operations Management 6 (1) 30-50.
[7] Fu Xiaoyong, dkk 2010 A Grey-Dematel Methodology For Green Supplier Development Program Evaluation (Guangzhou: GPMI Working).
[8] Tianyu Liu, Yong Deng, Felix Chan 2017 International Journal of Fuzzy Systems.
[9] Kshitiz 2013 Asia Pacific Journal of Marketing and Management Review 2 (1) 112-120.
[10] Phouc Van Nguyen 2017 Department of International Business Administration
[11] Sheng-Li Si, Xiao Yue You, Hu Chen Liu, Ping Zhang 2018 Mathematical Problems in Engineering 1-33