MEASUREMENT OF RELATIONSHIP MANAGEMENT SCORE USING 2 STAGES FUZZY LOGIC IN INDEPENDENT RETAILER

THESIS

Submitted to International Program Department of Industrial Engineering in Partial Fulfillment of the Requirement for the Degree of Sarjana Teknik Industri at Universitas Islam Indonesia

Arranged by:

Name : Hafidzah Haryo Samekto

Student Number : 12522293

INTERNATIONAL PROGRAM

INDUSTRIAL ENGINEERING DEPARTMENT

FACULTY OF INDUSTRIAL TECHNOLOGY

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In the name Allah, I hereby certify that this research is based on my own work except for the citations and summaries in which of those is explicitly knowledge. If in the future this statement is proved not right and violates the legal regulation of papers and intellectual property rights, I agree Universitas Islam Indonesia to revoke my bachelor certificate.

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Hanidzah Haryo Samekto

THESIS APPROVAL OF SUPERVISOR

MEASUREMENT OF RELATIONSHIP MANAGEMENT SCORE USING 2 STAGES FUZZY LOGIC IN INDEPENDENT RETAILER

THESIS

By

Name : Hafidzah Haryo Samekto

Student Number : 12 522 293

Yogyakarta, July 2017

Supervisor

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THESIS APPROVAL OF EXAMINATION COMMITTEE

MEASUREMENT OF RELATIONSHIP MANAGEMENT SCORE USING 2 STAGES FUZZY LOGIC IN INDEPENDENT RETAILER

By

Name : Hafidzah Haryo Samekto

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PREFACE

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

Assalamualaikum Warrahmatullahi Wabarakatuh.

Alhamdulillahirabbil 'alamin. Praise to Allah SWT the most glorious and the most merciful. Shalawat and Salam toward our adoration Prophet Muhammad SAW along with his family and followers. The guidance of Allah allows the author to finish this thesis. The accomplishment of this thesis is inseparable from the support of all parties. Therefore, the author profusely convey with great and gratitude to:

1. Allah SWT, for all uncountable blessings every day and also Rasulullah Muhammad SAW for His guidance in the right way.
2. My families for the prayer, support, and motivation.
3. Muhammad Ridwan Andi Purnomo., ST., M.Sc., Ph.D as the supervisor and the Director of International Program Industrial Engineering Universitas Islam Indonesia.
4. My friends in SMA N 3 Yogyakarta, batch of 2012 that still maintain the friendship after all these years and always giving support, inspiration, and happiness for each other.
5. Yulia Dyah Ayu, Galuh, Azizah, Thanks for helping me.
6. Syeikh Abdul Qadir Jaelani, Jalaludin Rumi, and Al Ghazali.

Finally, the Author realizes that there are still shortcomings as well as weaknesses in this report, so the building suggestions and critics are fully expected. The author hopes this paper would bring advantages for everyone who reads this.

Wassalamualaikum Warrahmatullahi Wabarakatuh.

Yogyakarta, July 2017

Hafidzah Haryo Samekto

ABSTRACT

Supplier relationship management framework is used to discover prioritized dimension in supplier management practices and firm operational performance in small independent retailer. It is also used for manager to determine the action in implementation of supplier relationship management by considering a prioritized dimension. The development of minimarket has a great potential, it can be seen by the changes of people's perspective in purchasing a products from traditional market into minimarket. Nowadays, people are more comfortable to purchase a product in minimarket because it has a good layout planning, has a lot of supporting facilities, and a lot of great deals. Researcher use Fuzzy Linguistic Variables. Linguistic variables are the use of words, abbreviations in interview, which create meaningful information for researcher as well as computers.

Keywords: Supplier relationship management, Independent retailer, Fuzzy Logic.

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CHAPTER I

INTRODUCTION

1.1 Background

In globalization era, the competition of a firm is very hard and contending. Firm needs a good strategic management in business competition. A good strategic management is used by a firm to plan, run, and maintain business process. One of the strategic management planning methods to conduct a good business process is supply chain management. Implementation of a supply chain management in a firm is used to make a business process of a firm becomes volatile and agile. Thomas and Griffin (1996) stated that expanding competitive pressures and market globalization are driving a firm to create a supply chain management that can quickly react to customer needs. Therefore, implementation of supply chain management is used as a philosophy of firm's business process.

Supply chain management is a business process to transform raw material into finished product until the finished product is used by customer. Implementing supply chain management will control all the chain business process from creating and distributing a products or services. Beamon (1998) defined a supply chain management as a coordination of business process wherein raw materials are transformed into final products, then distribute to customers. The objectives of implementation of supply chain management are expanding business process become resilient, agile and more competitive (Parkhi, 2015). Li et al. (2006) stated that supply chain management influence the business process in several factors of cost, quality, delivery dependability, product innovation, time to market and it can give a sustainability advantages for a firm.

In order to achieve sustainability advantages of supply chain management in business process, several firms do re-structure management in their supply chain management. Re-structure management consists of revitalize business relationship with

other parties that jointly work together with firm. One of methods to re-structure management in firm is analyzing relationship between firm and third parties. Third parties are used by firm to involve and help in business process. Supply chain management analyze the management of suppliers, manufacturers and warehouse because it used as a coordinated two-way communication system to manage high quality inventory in the most effective and efficient way (Akdogan and Demirtas, 2014; Burt et al., 2012).

Supplier relationship management is used to manage a relationship between firm and supplier in integrated two-way communication to achieve the goal of supply chain management. Venugopalan et al. (2014) stated that buyer supplier relationship management analyzes the important factors of relationship between buyer and supplier in supply chain management. It is a must that considering a supplier relationship management in supply chain management can be used as factor to determine effectiveness and efficiency of business process.

Minimarket is one of firm that conducts supplier relationship management has grown rapidly. It can be seen by development of minimarket in expanding their branch. Edwin Lio stated that development of minimarket for next three years until 2018 will grow about 15.5%, while super market and hypermarket are 7% and 9.2% (Septarini, 2016). *Kementerian Perdagangan* stated that there are now 23.000 units of modern market in Indonesia with 14 % growth in last three years (Sukmana, 2014). The more development of minimarket the better it has to provides a customer need in daily life consumption.

The development of minimarket has a great potential, it can be seen by the changes of people's perspective in purchasing a products from traditional market into minimarket. Nowadays, people are more comfortable to purchase a product in minimarket because it has a good layout planning, has a lot of supporting facilities, and a lot of great deals. Minimarket was dominated by shopper's spending from January to August 2016 based on Indonesian share of wallet (snapcart.asia, 2017). The figure of share of wallet in Indonesia is shown in Figure 1.1.

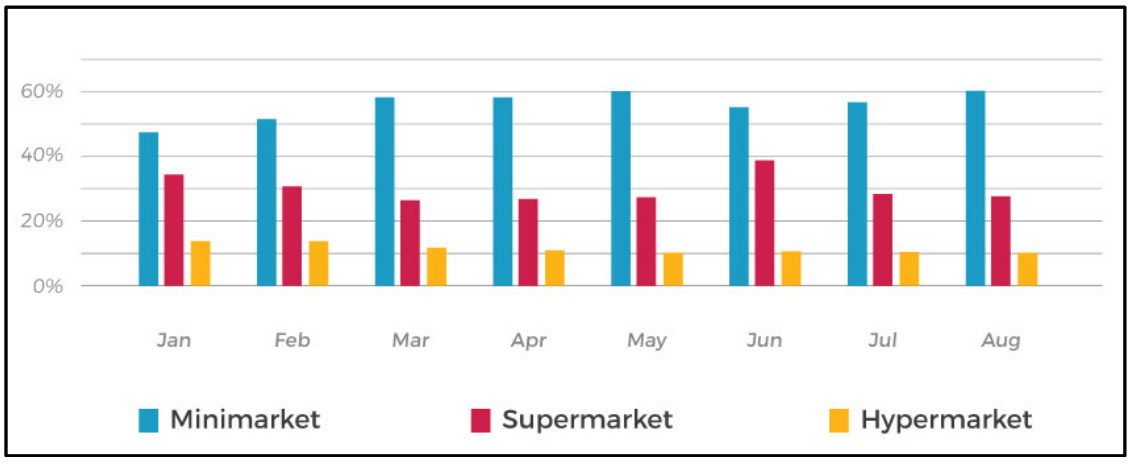


Figure 1.1 Share of Wallet in Indonesia
Source: (snapcart.asia, 2017)

Analyzing of business process in minimarket as retailer is classified into two categories. A research by Praharsi et al. (2014) stated that there are two types of retailer, organized retailer and small-independent retailer. A retailer will be supported by a supplier to supply the products to meet the demand of customer. In Yogyakarta, the development of organized retailer is controlled by a local government. The regulation of moratorium in organized retailer is regulated in Major's regulation (*Peraturan Wali Kota)* Yogyakarta No.79/2010. The impact of regulation in moratorium of organized retailer makes small-independent retailer can keep growing for the future. The existence of above regulation gives a benefit for small-independent retailer. A small-independent retailer is pushed by government to grow their business.

Starting from these conditions, it is necessary for small-independent retailer to analyze their internal business process especially in relationship between small-independent retailers with supplier. Analyzing supplier relationship management in small-independent retailer is used to control the availability of goods. The availability of goods becomes very important for the small-independent retailer because it can attract people's power purchasing.

One of the methods to solve a problem in availability of product is supplier relationship management. In constructing a supplier management relationship for small-independent retailer, researcher builds a research framework of relationship management between supplier and small-independent retailer. The important objective of building up and developing a research framework can be used as an instrumental in

understanding current efforts and guiding a future research (Cannoy, 2006). A research framework is developed to propose a supplier management practices and the variables of performance measurement for small-independent retailer. The framework of relationship management between supplier and independent retailer is expected to gives a literature review references to build a method to analyze strategy to implement the method of supplier relationship management for small- independent retailer.

Supplier relationship management framework is used to discover prioritized dimension in supplier management practices and firm operational performance in small independent retailer. It is also used for manager to determine the action in implementation of supplier relationship management by considering a prioritized dimension. Finding a prioritized dimension in supplier relationship management between small independent retailer and supplier is used to help a small independent retailer in arranging a strategic management by giving attention in one of prioritized dimension. Prioritized dimension as a strategic management give effectiveness information in sustainable supply chain by providing manager a deeper understanding of the supplier relationship management process. Manager is expected to enhance the condition of supplier relationship management by using a prioritized dimension as an action to achieve a strategic goal and restructure management in supply chain. The action of manager is used to handle and choosing a strategy in supplier relationship management process between small independent retailer and supplier.

This research uses a combination of qualitative and quantitative method. Qualitative method is used to gather the information of small-independent retailer according to supplier relationship management practices. An interview with experts will be done to analyze the necessity condition of supplier relationship management practices in developing a research framework model between small-independent retailer and supplier. A Questionnaire is used as a scorecard to transform expert's words, abbreviations, notes, and reports into mathematical expression. In transforming a result of qualitative into quantitative, researcher use Fuzzy Linguistic Variables. Linguistic variables are the use of words, abbreviations in interview, which create meaningful information for researcher as well as computers.

1.2 Problem Formulation

Based on the problem background, the formulations of the problem to be addressed in this study are:

1. What are the prioritized supplier management practices and firm operational performances to be improved for implementation of supplier relationship management of small-independent retailer?
2. What should manager action do in supplier relationship management practices of small-independent retailer?

1.3 Research Objectives

The objectives of this research are:

1. Identify the prioritized aspects of supplier management practices and firm operational performances in implementation of supplier relationship management of small-independent retailer.
2. Identify the action should do by manager's small-independent retailer in implementation of supplier relationship management.

1.4 Research Benefit

This study is expected to provide benefits to the parties involved. The benefits are:

1. For Author

   This study was conducted to obtain a degree in Industrial Engineering.

   Identifying the relational alliances between small-independent retailer and supplier in supplier relationship management.
2. For Company

   The results of the study can be used as consideration evaluation of continuity relation provides actions for manager in supplier relationship management.
3. For other party

   The results of the study can be used as additional knowledge, consideration and comparison for future research, particularly research on supplier evaluation of relationship management.

1.5 Problem Limitation

Problem limitations in this research are:

1. This research focus on small-independent retailer in Yogyakarta
2. The sample size of small independent retailer that used by researcher only one company.
3. A retailer type that used in this research is minimarket.
4. Research was focused only in supplier management practices and firm operational performances framework in analyzing supplier relationship management.

1.6 Writing Systematics

Furthermore, this thesis writing will be continued as follows:

CHAPTER I INTRODUCTION

This chapter contains the background of the problem, the formulation of the problem, research objectives, research benefits, limitation of problem and systematic writing.

CHAPTER II LITERATURE REVIEW

This chapter contains the theory of the concept of Supply Chain Management, Supplier Relationship Management, Supplier Management Practices Framework, and Fuzzy Theory.

CHAPTER III RESEARCH METHODOLOGY

This chapter contains about mindset and measures undertaken research objectives. The study was began with preliminary investigation and identification of the problem and then proceed with the study of literature, collecting and processing of data, then the data are analyzed in order to obtain a conclusion from this study.

CHAPTER IV DATA COLLECTING AND PROCESSING

This chapter contains general data of enterprise, consisting of a general history of the company, the company's vision and mission, the observed data of production process and data necessary to carry out the selection of suppliers.

CHAPTER V DISCUSSION

This chapter describes the result of studies which include data generated during the research and data processing method which has determined.

CHAPTER VI CONCLUSION AND SUGGESTION

This chapter contains the conclusion that the answer for the formulation of the problem that has been established and promoted suggestion that may be required.

CHAPTER II

LITERATURE REVIEW

2.1 Previous Research

Supplier relationship management becomes one of the methods to make strategic alliances between small-independent retailer and firm. Supplier relationship management should analyze dimensions and attributes to support sustainability supply chain management. Supply chain management practices have been defined as a set of activities undertaken in an organization to promote effective management of its supply chain management (S. Li, et al. 2006). The researches on supply chain management practices especially in supplier relationship management have been developed by many researchers related with the problem between retailer and firm.

Chen and Paulraj (2004) identify and consolidate various supply chain initiatives and factors to develop key supply chain management constructs conducive. This research proposed a research framework of supply chain management in buyer-supplier relationship to know supplier and buyer performance. In this research buyer-supplier relationship consist of supplier base reduction, long term relationship, communication, cross-functional teams, and supplier involvement. Min and Mentzer (2004) proposed a general theoretical framework of supply chain orientation and supply chain management and test to business performance. S. Li et al., (2006) develops five dimensions of supply chain management practice (strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing and postponement) and tests the relationships between supply chain management practices, competitive advantage, and organizational performance.

Identifying supply chain management practices and criteria of supplier relationship management are used to investigate customer (firm) and supplier perspectives (Murfield and Esper, 2013). This research is proposed to investigate these

potential relational tensions by exploring supplier's willingness, commitment, and overall perceptions of accommodating customers through supply chain adaptations. Prajogo et al., (2012) researched about dimensional relationships between supplier management practices and firm operational performances. This study demonstrates the relative contributions of different kinds of resources (supplier management practices) to different performance measures. This study tested simultaneously using Structural Equation Modeling (SEM) technique.

Tavana et al., (2016) tried to develop supplier evaluation on supplier selection constitutes a central issues of supply chain management. Dimension like price, location, and technology are an effective criteria in supplier performance. Shin et al. (2000) stated that impact on supply management orientation on the supplier operational performance and buyer competitive strategies using the criteria of cost, quality, delivery, and flexibility.

Praharsi et al., (2014) explored the influence of strategic planning and functional-business strategy in helping small-independent retailers/traditional retailers to survive amidst the competition with organized retailers. This study illustrated the influence of strategic planning and functional-business strategy to retailer–supplier relationship, consumer loyalty program, and retailer performance.

Fuzzy logic is used to convert heuristic control rules stated by human operator into an automatic control strategy (Mamdani and Assilian, 1975). Fuzzy logic is used as method to prevail over the problem solving of uncertainty and ambiguity in human linguistic with the function of fuzzy logic (Zadeh, 1965). Fuzzy logic consist of expert's linguistic which can be concluded that supplier management practices dimension and firm operational dimension to know what is the prioritized factors.

This research tries to continue the previous research conducted by Prajogo et al., (2012) in order to know what is the prioritized dimension in supply chain management practices and firm operational performance. The differences between this research with previous research are the method used and object of research. Previous research's method use Structural Equation Modeling (SEM) technique to know the relationship

between supplier management practices and firm operational performance. This research use fuzzy logic to know the highest prioritized factors. Previous research also tests the framework in all type company, but never tests the framework in specific company like small-independent retailer.

2.2 Background Theory

2.2.1 Supply Chain Management

One of the strategic management planning methods to conduct a good business process is supply chain management. Thomas and Griffin (1996) stated that expanding competitive pressures and market globalization are driving a firm to create a supply chain management that can quickly react to customer needs. Therefore, implementation of supply chain management is used to change business philosophy of firm in business competition. Beamon (1998) defines supply chain management is a production process of manufacturing wherein raw materials are transformed into final products, then distribute to customers.

Business process area that will affect in implementation of supply chain management are procurement material, transformation material and distribution material (Lee and Billington, 1993). Area that controlled by supply chain management gives a benefits to achieve efficiency and effectivity level, minimize the whole system costs and meets service level of customer needs. These benefits can be achieved from supply chain management's objectives. Supply chain management's objectives are reducing inventory investment in the business process, increasing customer service, building competitive advantage for the supply chain and value (Cooper et al., 1997).

Implementing supply chain management should consider several important activities. Analyzing activities of supply chain management are used to reduce the physical chain links, define supply chain responsibilities to a specific core service competency, and decrease the time and cost of getting end user customer products in volume to markets worldwide (Kulkarni & Sharma, 2004). The activities of supply

chain management consist of several parts like plan, source, and make. There are the definitions of supply chain management activities from (Kulkarni and Sharma, 2004):

1. Plan: Planning a strategy for managing all the resources that go towards meeting customer demand for products or services.
2. Source: Choosing a supplier who will deliver goods and services as per specification.
3. Make: This activity involves manufacturing and converting the raw material into a finished products.

Later, Cooper et al. (1997) stated that supply chain management activities include in; marketing research, promotion, sales, and information gathering, research and development, product design, and total system/value analysis. One of the key points of supply chain management activities is decision phase. Supply chain decision phase can be categorized as design, planning, or operational, depending on the time frame that will give a strong impact on profitability and success (Chopra & Meindl, 2004).

Supply chain management consist of three parts process, supply chain management classified into three macro process (Chopra & Meindl, 2004) as shown in Figure 2.3:

1. Customer Relationship Management: Focus on the interface between firm and customers.
2. Internal Supply Chain Management: Focus on internal chain of the firm.
3. Supplier Relationship Management: focus on the interface between the firm and suppliers.

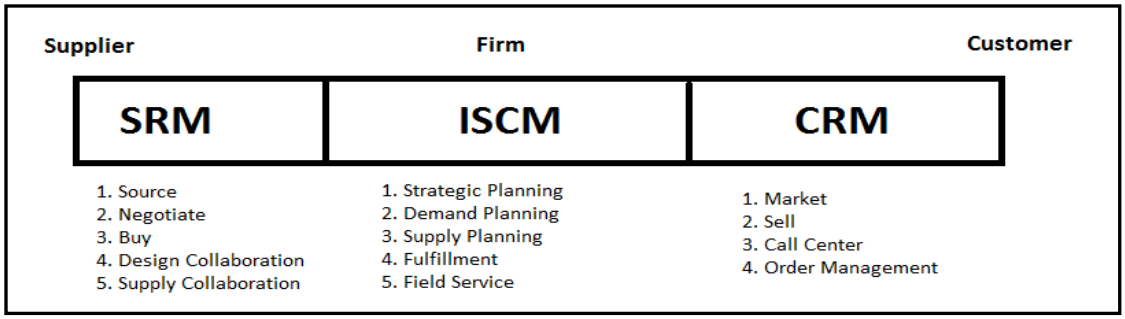


Figure 2.2 A Supply Chain Macro Process
Source: Chopra & Meindl (2004)

Supply chain management organizes business process chain control from upstream until downstream area. Implementation of this strategy needs several

supporting parties. Supply chain management is not a chain of businesses with one to one, business to business relationships, but a network of multiple businesses and relationships and represents a new way of managing the business and relationships with other members of the supply chain management (Lambert and Cooper, 2000).

Managing a relationship with third parties is important for firm. Ineffective management of supply chain risks has caused cost overruns, production delays, quality failures, and program cancellations (Badea et al., 2014). Controlling and coordinating activities in supply chain management make business process become more efficiently, and the company has become success in the competition of industry (Persson, 2004).

Third parties in supply chain management are suppliers, manufacturers, distributors, and retailer (Amaro and Barbosa-Póvoa, 2013). Third parties are required to sharing information and warranting its quality is obviously give contribution (Feldmann & Müller, 2003). Sitompul (2012) stated that collaboration of firm and third parties logistics are often seen as a network where nodes represents facilities or enterprises and arcs that represent flow of goods, information and money. The figure of a supply chain network and supporting factors is shown in Figure 2.1 as follows:

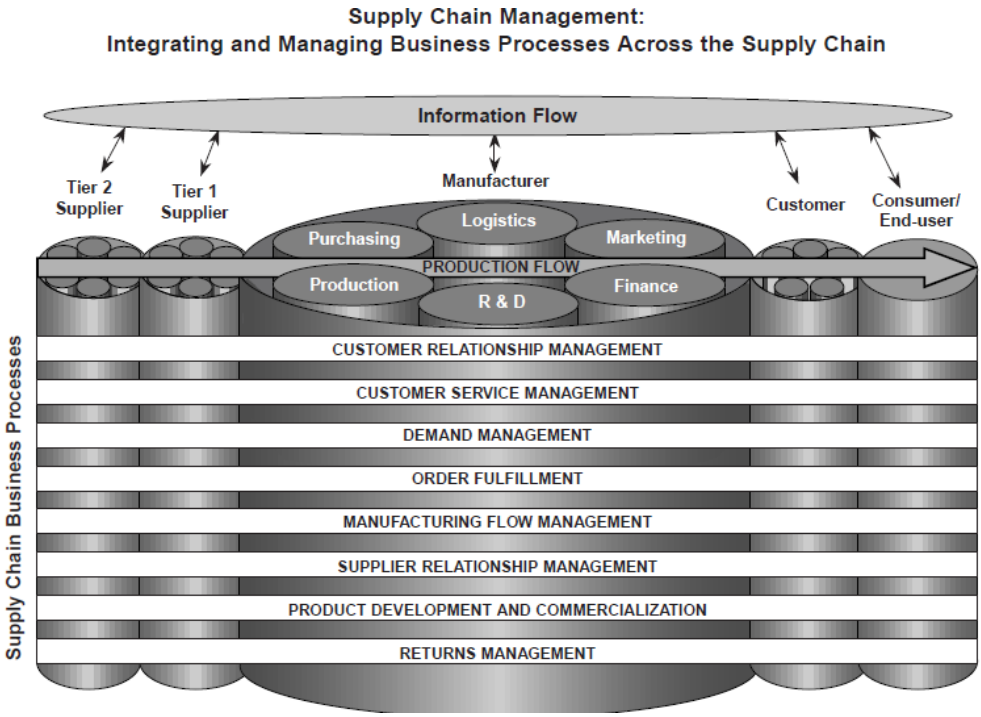


Figure 2.1 A Supply Chain Network
Source: Lambert et al. (1998)

2.2.2 Supplier Relationship Management

One of the factors that should be analyzed in implementation of supply chain management is third parties. Supplier as third party of firm has an important role in supply chain management. Having a collaboration of strategic alliances between firm and suppliers is one of management strategy to re-structure the business process. Collaboration strategic alliances between firm and suppliers are mentioned in definition of supply chain management. Thomas and Griffin (1996) stated that supply chain management is a management of material and information flows both in and between facilities, such as vendors, manufacturing and assembly plants and distribution centers.

Supply chain management have a relationship with vendors, supplier, manufacturer, distributor and other else that have a responsibility in business process of a firm. Spekman (1988) stated that collaboration is the process by which partners adopt a high level of purposeful cooperation to maintain a trading relationship over time. Collaboration strategic alliances between firm and supplier in supply chain management are used to reducing cost production, sharing information, and build an effective and efficient management operation. A Design collaboration of strategic alliances with suppliers help a firm to reduce a cost operation, improve quality, and decrease time to market (Chopra & Meindl, 2004).

One of the strategic alliances between firm and supplier is supplier relationship management. Supplier relationship management is a comprehensive approach to managing a firm's interactions with the organizations that supply the goods and services it uses (Kulkarni & Sharma, 2004). Supplier relationship management is a relationship between buyer and supplier in order to support business process based on agreement between both of them. Buyer and supplier coordination are one of the operational planning in supply chain management that discuss about procurement of materials or subassemblies (Thomas and Griffin, 1996).

Coordination of operational planning between firm and supplier have been cited as a critical factor to the success of Japanese manufacturing firm (Shin, et al., 2000). Integration of business process between firm and supplier help in managing and

analyzing supply chain process. The goal of supplier relationship management is to improve the design of the products that joint with supplier, sharing information, and providing a goods or services. Supplier relationship management consists of source, negotiation, buy, design collaboration and supply collaboration (Chopra & Meindl, 2004).

Supply chain management recognizes that supplier relationship management is an important factors (Forkmann, et al., 2016). Supplier relationship management as one of the strategies to analyze mutual relationship between buyer and supplier is used as a strategy to maintain the business process. Shin, et al. (2000) stated that supply management orientation has better results in quality, customer service, and channel performance.

Supplier relationship management as one of main parts of supply chain management has several benefits. Burt et al. (2012) stated that the primary benefits of supply alliances are:

1. Lower total cost = A result of synergies in reductions of direct and indirect cost associated with labor, machinery, materials, and overhead
2. Reduced time to market = Reducing time to design, develop, and distribute products and services. It is an important key that leads to improve market share and profit margins.
3. Improved quality = The use of both design of experiments and supplier certifications are the norm with supply alliances. The result is improved quality at lower total cost
4. Improved technology flow from suppliers = Openness and institutional trust enhance inflow of technology from alliance partners that leads to many successful new products.
5. Improved continuity of supply = Alliance customer are least likely group to experience supply disruptions.

The relationship between buyer and supplier in business process need a good strategy perspective. Strategic supplier partnership is a principles for long-term relationship between the organization and their supplier, encourages mutual planning,

and problems solving efforts to work more effectively (Li, et al., 2006). Analyzing supplier performance, firm performance in supplier relationship management will have a several benefit to analyze long term contract, cost, product, and quality. A lot of researcher tries to analyze the best strategy to maintain the relationship business process of buyer and supplier.

2.2.3 Research Framework

In planning process to develop strategic management for small-independent retailer, a research framework in supplier relationship management is needed. Supplier management practices are used as research framework to analyze supplier relationship management. The objective of building up and developing a research framework is used as an instrumental in understanding current efforts and guiding future research (Cannoy, 2006).

A research framework is developed to propose a supplier management practices and firm operational performance for small-independent retailer. A research framework is an arrangement of codes organized into categories that have been jointly developed by researchers involved in analysis that can be used to manage and organize the data (Gal et al., 2013). A framework is used to understand the causal relationships among different research to construct a new research method (Ngai et al., 2015). The framework is expected to gives a literature review references to build a method to analyze a strategy of supplier management practices of small-independent retailer.

In building of a research framework for small-independent retailer, the best method is to determine dimensions and attributes for supplier relationship management. In a research framework of supplier relationship management, there are 3 supplier management practices and 4 firms operational performances (Prajogo, et. al., 2012). Supplier management practices consist of long term relationship, supplier assessment, and logistic integration. Firm operational performance consists of price, delivery, flexibility, and quality.

A. Long Term Relationship

Strategic long-term relationship with supplier can be defined as long-term relationships between a firm and its suppliers (S. Li et al., 2006). Relationship between supplier and retailer should be analyzed correctly. A long term relationship gives several benefits between supplier and firm. Increased emphasis on strategic purchasing and supplier evaluation systems are critical for firm seeking to establish long term relationships with their suppliers and managed long-term relationships with key suppliers can have a positive impact on the firm's financial performance (Carr & Pearson, 1999). Through a long-term relationship, supplier becomes a part of a well-managed chain and will have a lasting effect on the competitiveness of the entire supply chain (Taylor et. al, 2014). High level of trust relational exchange are enable to parties for focus on the long-term benefits of the relationship and it will enhancing competitiveness and reducing transaction costs (W. Li, Humphreys, Yeung, & Cheng, 2007). Long term relationship is just as important to direct and indirect suppliers as it is to the auto assemblers (Y. Wang et al., 2015). Buyer and supplier should do a win-win solution in order to implement a long term relationship management (Chen and Paulraj, 2004).

B. Supplier Assessment

Today's business environment with the possibility to source raw materials from almost anywhere in the world, it is possible that cultural/national differences exist with respect to supplier evaluation and assessment (Rhe et al., 2009). Supplier assessment is the assessment of supplier capability and performance compared to the purpose of a firm in the long run business process and improve the buyer firm's performance (Talluri and Sarkis, 2002). Supplier assessment is used by firm to evaluate the performance of supplier in business process and how is the effect on a firm. Important part of assessment are evaluation feedback in order to supplier and firm and meet the expectation of buyers and suppliers for further improvement (Krause et al., 2000). Assessment of a supplier's willingness and ability to share information also has a significant impact on the buying firm's performance (Kannan & Is, 2002).

C. Logistic Integration

The essence of logistics integration is well coordinated flow of materials from suppliers, which allow firm to have a smooth (seamless) production process (Frohlich and Westbrook, 2001). Logistic integration has a positive effect on operational performance in terms of delivery, flexibility (or responsiveness), and cost (or efficiency) (Prajogo et al., 2012).

2.2.4 Fuzzy Logic

A. Definition of Fuzzy

Fuzzy logic is a mathematical expression that is used to represent uncertainty, inaccuracy, lack of information, and ambiguity between true or false at the same time but some great truth and error of a value depends on the weight of its membership. Fuzzy logic is used for state a group or set entities that can be distinguished with other groups based on the degree of crisp membership. The crisp set is a way to dichotomize the individuals in some given universe or discourse into two groups; members and nonmembers (Klir et al., 1995). Fuzzy logic is used to convert heuristic control rules stated by human operator into an automatic control strategy (Mamdani and Assilian, 1975). Fuzzy logic has a three core concepts namely, fuzzy sets, linguistic variables, and possibility distribution (Wu et al., 2011).

B. Fuzzy Sets

Fuzzy set is an extension of classic theory, it is arranged from a set which determined by the membership functions, with the main function of membership function itself give the value of the value elements inside fuzzy set with the range of value which commonly used is the interval [0,1] Klir et al., (1995). A value in the interval [0,] has a degree of membership (=μx) from one member of the fuzzy set (*x)* is said that fuzzy sets are mapped to values in the interval [0,1] by the functions μ. There are only two grades of membership function in a classic set. Membership function in fuzzy classic set is define as follow:

$$\mu_A(x) = \begin{cases} 1 & if \quad x \in A \\ 0 & if \quad x \notin A \end{cases} \tag{2.1}$$

That is $\mu_A(x) = 1$ which means that x be a member of A, and $\mu_A(x) = 0$ for x is not as a member of A, this classic fuzzy set is different with fuzzy logic that using interval 0 and 1. A value in the interval are called membership value is denoted by $\mu_A(x)$, the degree of membership is a value that indicates how much the level of membership of element (x) in a set (A).

C. Membership Functions

Membership function is a curve showing mapping of data input points into the membership value having intervals between 0 and 1. A fuzzy set over the universe of discourse X, $A, \subseteq X$ [0,1], is described by the degree of membership $\mu_A(X) \in [0,1]$ for each $x \in X$. Linear functions of triangular number and trapezoid are popular membership function. The representation of triangular curve number is basically a combination of two linear representation (linear rises curve and linear down curve). Triangular membership function can be defined as:

$$\mu(x; a, b, c) = \begin{cases} \dfrac{x-a}{b-a}, & a \le x \le b \\ \dfrac{c-x}{c-b}, & b < x \le c' \\ 0, & \text{otherwise} \end{cases} \tag{2.2}$$

With a graphic of membership functions is shown in Figure 2.3:

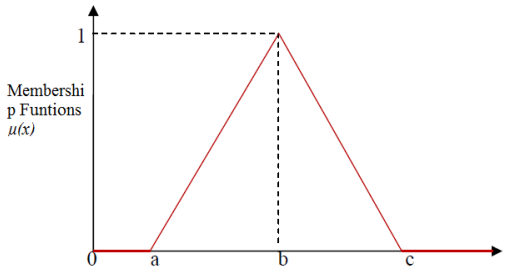


Figure 2.3 Membership Function of Triangular Fuzzy Number

D. Operations in Fuzzy Set

Like the set of crisp sets, there are several operations are used to define specifically to combine and modify fuzzy sets. The membership value as a result of a two-set operation are known as *fire strength* or *α-cut*. There are three basic operators created by Zadeh, as follows: AND, OR, and NOT.

1. AND Operator

   AND operation is related to intersection of the sets number. Intersection of 2 sets is the minimum of each pair of elements on both sets.

   $$\mu_{A \cap B} = \text{MIN}\,(\mu_A(x), \mu_B(y))$$

2. OR Operator

   OR (union) operation is associated with the combined operation of the set. The union of 2 sets is the maximum of each pair of elements on both sets.

   $$\mu_{A \cap B} = \text{MAX}\,(\mu_A(x), \mu_B(y))$$

3. NOT Operator

   NOT operation is related to the compliment operation on the set. NOT operation is obtained by subtracting the membership value elements with the value of 1.

   $$\mu_A = 1 - (\mu_A(x))$$

CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Methodology

This research is conducted by using a combination of qualitative and quantitative approach method. Qualitative research is a variety of research that identifying of a situation that achieved through an holistic perspective and concerned with the opinions, experiences and feelings of individuals as a subject in producing a subjective data (Hancock, 1998). Quantitative research is a methods that involves data collection typically numeric, use mathematical model as the methodology of data analysis (Williams, 2007).

3.2 Location and Object of Research

This research is conducted in small independent retailer/traditional minimarket in Yogyakarta. The case study of small independent retailers that was chosen by researcher in Yogyakarta was Toko Laris Jaya. This company is located in Karangwaru, Tegalrejo, Yogyakarta City, Special Region of Yogyakarta 55241, Indonesia.

Currently, Toko Laris Jaya is a company that runs business process of minimarket retailer. The business concept of Toko Laris Jaya is supermarket but works in small scale of minimarket industry. Toko Laris Jaya sells daily need products of customer like foods and beverages, stationary, medicine, electronics, fresh foods and fast moving consumer goods using modern concept store and provides an easy and comfortable shopping. Toko Laris Jaya was created to adapt in change of consumer perspective in spending of daily need life from monthly to weekly grocery shopping at the nearest store. It also works together with supplier. A supplier will fulfill the requested products in Toko Laris Jaya to meet a demand of customer.

3.3 Place and Time of Research

The research for independent retailer is located in Toko Laris Jaya Yogyakarta. The time of research was on December 2016 until January 2017.

3.4 Problem Identification

This research is about research framework of supplier relationship management. Researcher develops implementation of supplier relationship management strategy in small independent retailer. Retailer is divided into two categories, independent retailer and organized retailer. Every type of retailer has an interesting point to study. One of the interesting points to study for independent retailer is implementation of supply chain management in supplier relationship management. Independent retailer as a single stores, sole proprietorship or owned and run by individuals (Praharsi et al., 2014) needs a lot of development strategies in supplier relationship management to compete with organized retailer.

This research is conducted to suggest small independent retailer to implement in research framework of supplier relationship management strategies. This research develops supplier relationship management practices and firm's operational performance. Supplier relationship management practices are consisting of *long term relationship*, *supplier assessment*, and *logistic integration*. Firm's operational performances are consisting of *quality*, *delivery*, *flexibility*, and *price*. The result of this research is to know the prioritized dimension between supplier management practices and firm's operational performance and the action do by small independent retailer with the prioritized dimension for sustainability supplier relationship management. The development research framework of supplier relationship management in independent retailer is used as strategy to compete with organized retailer.

3.5 Theoretical Research Framework Identification

In building a research framework for research theory, researcher develops a theoretical framework of supplier relationship management practices between small independent

retailer and supplier from several journals. Several dimensions and attributes are taken from Prajogo et al. (2012). Prajogo et al. (2012) stated that in supplier relationship management consist of supplier relationship management practices and firm's operational performance. In last research, Prajogo et al. (2012) tried to identify the multidimensional relationship between supplier relationship management practices and firm's operational performances. The result is long-term relationship and logistics integration have positive relationships with delivery, flexibility, and cost performance. In this research to solve the problems, researcher separated between supplier management practices and firm's operational performances in data processing. Separations between supplier management practices and firm's operational performances are used to know the prioritized dimension and provide a suggestion for manager to suggest an action supplier relationship management between retailer and supplier. The dimensions and attributes measures of research framework are described in figure 3.1 as follows:

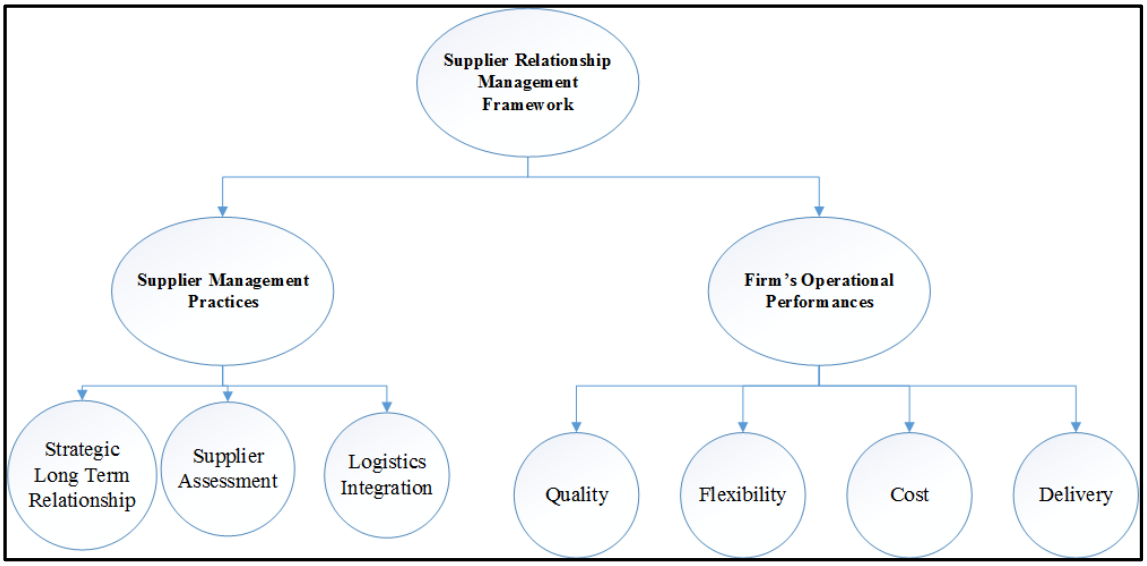


Figure 3.1 Supplier Relationship Management Frameworks

Supplier relationship management frameworks consist of several dimensions and attributes. In supplier management practices consist of *strategic long term relationship*, *supplier assessment*, and *logistics integration*. Firm's operational performances consist of *quality*, *flexibility*, *price*, and *distribution*. The complete dimensions and attributes of supplier relationship management frameworks can be seen in Table 3.2 below:

Table 3.2 Dimensions and Attributes of Supplier Relationship Management

Dimensions	Attributes
Strategic Long Term Relationship	Relationship with key suppliers last a long time
	Collaboration business with key suppliers are improved firms business management for long run
	Suppliers see the relationship as a long term alliance
	Suppliers as an extension of our company
Supplier Assessment	Formal supplier assessment system to determine supplier's capabilities
	Clear metric for measuring performance of suppliers
	Monitor closely the performance of suppliers
	Compare suppliers performance with other similar supplier
Logistics Integration	Inter-organizational logistic activities are closely coordinated with suppliers.
	Logistics activities are well integrated with suppliers logistics activities
	Seamless integration of logistics activities with retailer key suppliers
	Logistics integration is characterized by excellent distribution, transportation and/or warehousing facilities
Quality	Conformance to specification
	Product quality performance
Delivery	On time delivery
	Speed of delivery
Flexibility	Volume or capacity flexibility
	Degree of product variety
Cost	Overall operational cost
	Competitive prices of products

3.5.1 Dimensions and Attributes of Supplier Relationship Management Practices

Prajogo et al. (2012) stated in considering a supplier management practices there are three supply chain management practices. Supplier management practices are:

1. **Strategic Long Term Relationship**

   A firm analyzes strategic long term relationship. Strategic long term relationship is used to analyze conditional relationship between retailer and supplier from the point of view's firm. In this dimensions are consist of four attributes. The attributes are:

   1.1 Relationship with key suppliers to last a long time.

   Firm expect their relationship with key suppliers last a long time.

1.2 Collaboration business with key suppliers is improved suppliers business quality for long run.

Firm expect collaboration with key suppliers to improve firms quality in the long run.

1.3 Suppliers see the relationship as a long term alliance.

Firm expect suppliers use the agreement of relationship business as a long term alliance.

1.4 Suppliers as an extension of our company.

Firms expect to suppliers as an extension of company.

2. Supplier Assessment

Supplier assessment is the assessment on supplier capability and performance compared to the purpose of a firm in the long run business process and to improve the buyer firm's performance (Talluri and Sarkis, 2002). The attributes are:

2.1 Formal supplier assessment system to determine their capabilities.

Firm develop supplier assessment for supplier based on performance supplier in providing goods.

2.2 Clear metric for measuring performance of suppliers.

Firm has a clear metric measurement to determine performance of suppliers.

2.3 Monitor closely the performance of suppliers.

Firm has an action to monitor and control the performance of supplier.

2.4 Compare supplier performance with other similar companies.

Firms do a comparison between each supplier in providing goods.

3. Logistic Integration

The essence of logistics integration is well coordinated flow of materials from suppliers, which allow firms to have a smooth (seamless) production process (Frohlich and Westbrook, 2001). .

3.1 Inter-organizational logistic activities are closely coordinated.

Firm expected that logistics activities are closely coordinated with suppliers as an inter-organizational.

3.2 Logistics activities are well integrated with suppliers' logistics activities.
Firm expected logistics activities are integrated with suppliers.

3.3 Seamless integration of logistics activities with our key suppliers.
Firms expected to have a seamless integration of logistic for goods.

3.4 Logistics integration is characterized by excellent distribution, transportation and/or warehousing facilities.
Firm expected to logistics integration between suppliers and firm is excellent distribution, transportation and warehousing facilities.

3.5.2 Dimensions and Attributes for Firm's Operational Performance

Prajogo et al. (2012) stated in considering Firm's Operational Performance, there are four Firm's Operational Performance. Firm's Operational Performance measurement aspects are:

1. Quality

A quality is a products provided by supplier for an independent retailer. Supplier products with high level of quality will determine the quality product in the process of customer relationship of retailer. The attributes are:

1.1 Conformance to Specification
Specification products that needed should be suitable from the invoice of goods.

1.2 Product Quality Performance
Quality products performance should be suitable from the invoice of goods.

2. Delivery

Delivery is a time of supplier to deliver the products for independent retailer. Supplier should deliver products to independent retailer. The attributes are:

2.1 On Time Delivery
Firms expected that goods are delivered with on time.

2.2 Speed of Delivery
Firms expected that speed of delivery from invoice of goods is suitable.

3. **Flexibility**

Flexibility is a volume or capacity of products that can serve by a supplier. Considering a flexibility is used to know volume or capacity flexibility of supplier in delivering a products and degree of product variety.

3.1 Volume or Capacity Flexibility

A firm expected about volume of invoice of goods is flexible from firms want.

3.2 Degree of Product Variety

Supplier gives a lot of product variety for firm.

4. **Cost**

A cost is used to a price between the products of supplier and retailer. In a cost will consider about overall operational cost of products, and competitive prices of supplier products.

4.1 Overall Operational Cost

Cost of good to sell in customer. The initial price is came from supplier and firm get the profit from selling a product.

4.2 Competitive Prices of Products

Competitive price that is suggested by supplier for retailer.

3.6 Data Collection

This research uses two types of data, which are:

1. **Primary Data**

Primary data is a data that obtained from direct sources. Primary data of this research is obtained from the owner of Toko Laris Jaya Yogyakarta. The data is a description of implementation of development research framework of supplier relationship management based on the implementation of supplier management practices and firm's operational performance.

2. **Secondary Data**

Secondary data is obtained from several literature review that support development research framework of supplier relationship management in small-

independent retailer. Several literature reviews are obtained from journals and books which contain a dimensions and attributes related for this research.

3.7 Method of Collecting Data

The methods of collecting data in this research are interview and observation. Collecting data method is used to get information of development research framework of supplier relationship management in independent retailer. The methods are:

1. **Interview**

   Interview is a method to gather an information directly from participants (Goodman, 2011). Interview is conducted by two parties, there are interviewer asking a question and interviewee gives an answer based on the question from interviewer. Interview is conducted to the owner of Toko Laris Jaya as a representation of independent retailer in Yogyakarta. Interview method is used to know the opinion of the owner of Toko Laris Jaya through the development research framework of supplier relationship management for independent retailer.

   This research applies an *In-depth Interviews. In-depth Interview* are very effectively to obtained a data on individuals personal opinions, histories, perspectives, and experiences especially when a main topics are being explored (Mack, Woodsong, McQueen, Guest, & Namey, 2011). Researcher also use a *Semi structured interviews.* In *Semi structured interviews* researcher use an open ended question based on the topic and a findings areas where the researcher wants to cover (Hancock, 1998). During the semi-structured interview researcher makes a main question prepared in advance to be developed when in the middle of the interview occurred. It is expected to interviewer can dig up more information during the interview.

   Before doing an interview section, researcher makes a guidance of interview section, make a structure of question in a systematic way, and ask to the subject of interviewee.

2. **Observation**

   Observation is used to observe the business process of Toko Laris Jaya. Observation is obtained to gather information on development of supplier relationship management in independent retailer. Observation is a method to get a knowledge on interaction of social context in which topic studies (Polgar and Thomas, 2013)

3.8 Measurement of Research Variables

In translating what is the expert's opinion about supplier relationship management in small-independent retailer to Fuzzy logic inference system, Likert scale is used. Range of Likert scale is distributed from 1 to 5. Results from Likert scale are associated with expert's perspective, point of view and perception in research framework of supplier relationship management. Likert scales will translate dimensions and attributes variables into indicator variable. The indicator variable will be used as a basis to make a fuzzy rule system about the opinions of research framework of supplier relationship management. The range of Likert scale is from very negative to very positive.

1 = Very Poorly

2 = Poorly

3 = Moderate

4 = Quite Good

5 = Very Good

3.9 Data Analysis Technique

The analysis data technique is conducted by using fuzzy multi stages inferences system. In calculating fuzzy inference system, this research uses Matlab 2013. Multi stages fuzzy logic is method to reduce the number of fuzzy rules to obtain a significantly smaller rule base (Adams and Rattan, 2003). The score of prioritized dimension for supplier management practices is affected by 3 factors. The factors are strategic long term relationship, supplier assessment, and logistics integration. The sub dimension of strategic long term relationship are affected by relationship with key supplier to last a long time (A1), collaboration business with key suppliers are improved firms business

management for long run (A2), Suppliers see the relationship as a long term alliance (A3), and suppliers as an extension of our company (A4). The sub dimension of supplier assessment are affected by formal supplier assessment system to determine supplier's capabilities (B1), clear metric for measuring performance of suppliers (B2), monitor closely the performance of suppliers (B3), compare suppliers performance with other similar supplier (B4). The sub dimension of logistics integration are affected by inter-organizational logistic activities are closely coordinated with suppliers (C1), seamless integration of logistics activities with retailer key suppliers (C2), and logistics integration is characterized by excellent distribution (C3), transportation and/or warehousing facilities (C4).

Based on the explanation of supplier management practices dimension and attributes, there are two stages fuzzy logic method to discover the score of prioritized dimension. The first stage is used to calculate strategic long term relationship, supplier assessment, and logistics integration. The second stage is used to calculate supplier management practices based on strategic long term relationship, supplier assessment, and logistic integration. Figure 3.1 shows the diagram of supplier management practices two stages fuzzy logic.

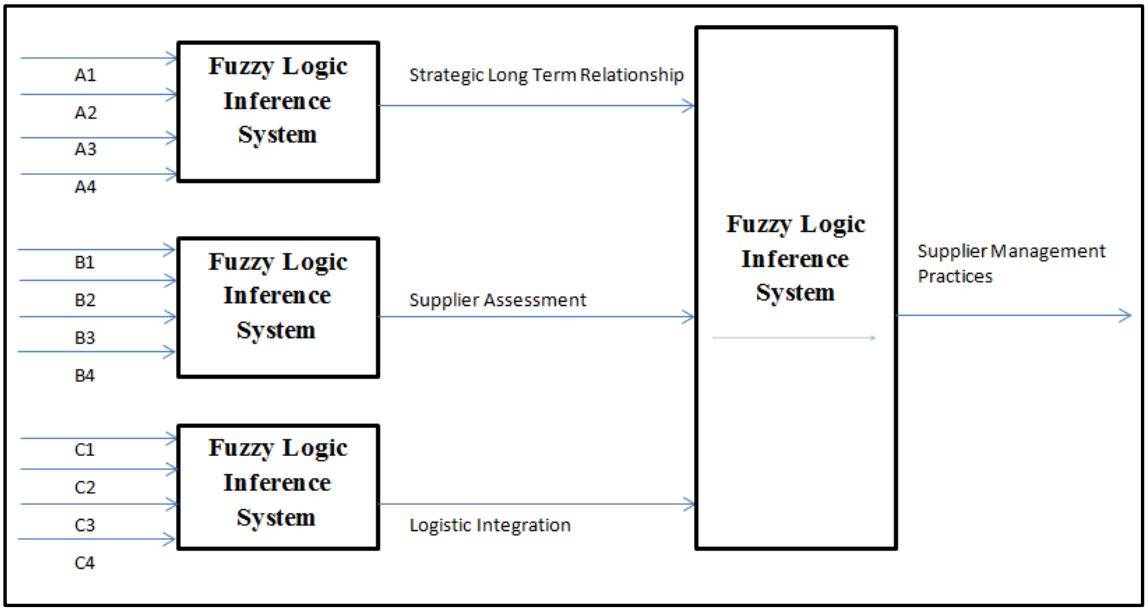


Figure 3.1 Diagram of Supplier management practices of two stages fuzzy logic

In discovering firm's operational performance prioritized dimension is affected by 4 sub dimension. There are quality, delivery, flexibility, and cost. Quality is affected

by conformance to specification and product quality performance. Delivery is affected by on time delivery and speed of delivery. Flexibility is affected by volume or capacity flexibility and degree of product variety. Cost is affected by overall operational costs and competitive prices of products.

Based on the explanation of firm's operational performances dimension and attributes, there are two stages of fuzzy logic method to discover the score of prioritized dimension. The first stage is used to calculate quality, delivery, flexibility and cost. The second stage is used to calculate firm's operational performances based on quality, delivery, flexibility, and cost. Figure 3.2 shows the diagram of firm's operational performances using two stages fuzzy logic inference system.

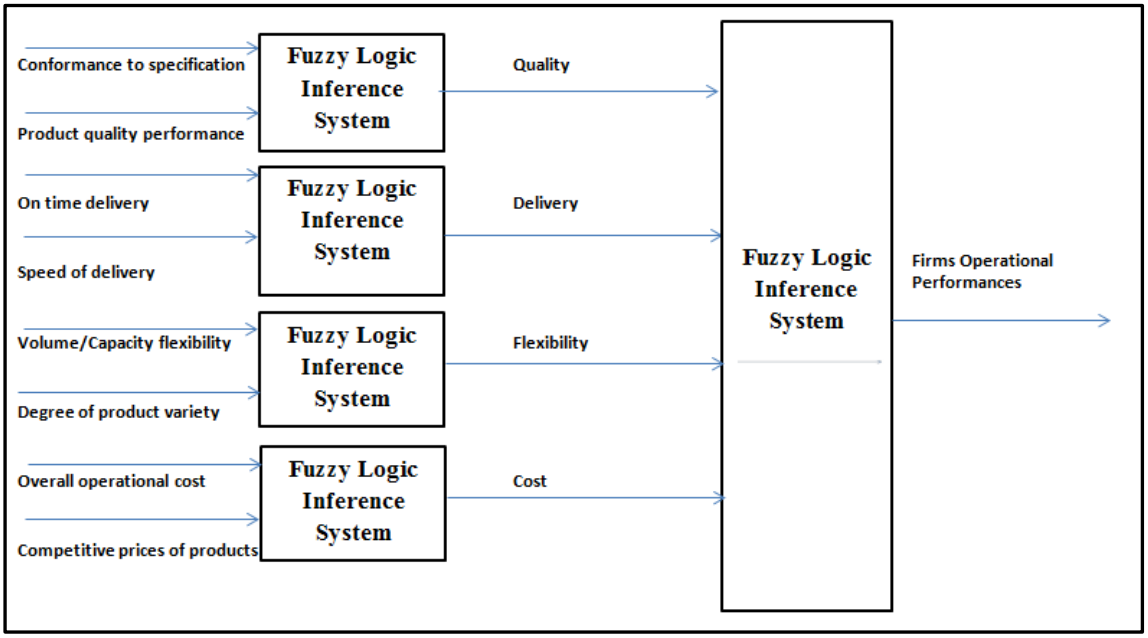


Figure 3.2 Diagram of Firms Operational Performances of two stages fuzzy logic

3.10 Research Flowchart

The research diagram is used to solve problems. Research diagram explain the steps of conducting research from the beginning until final result. The research diagram can be seen in Figure 3.3, as follows:

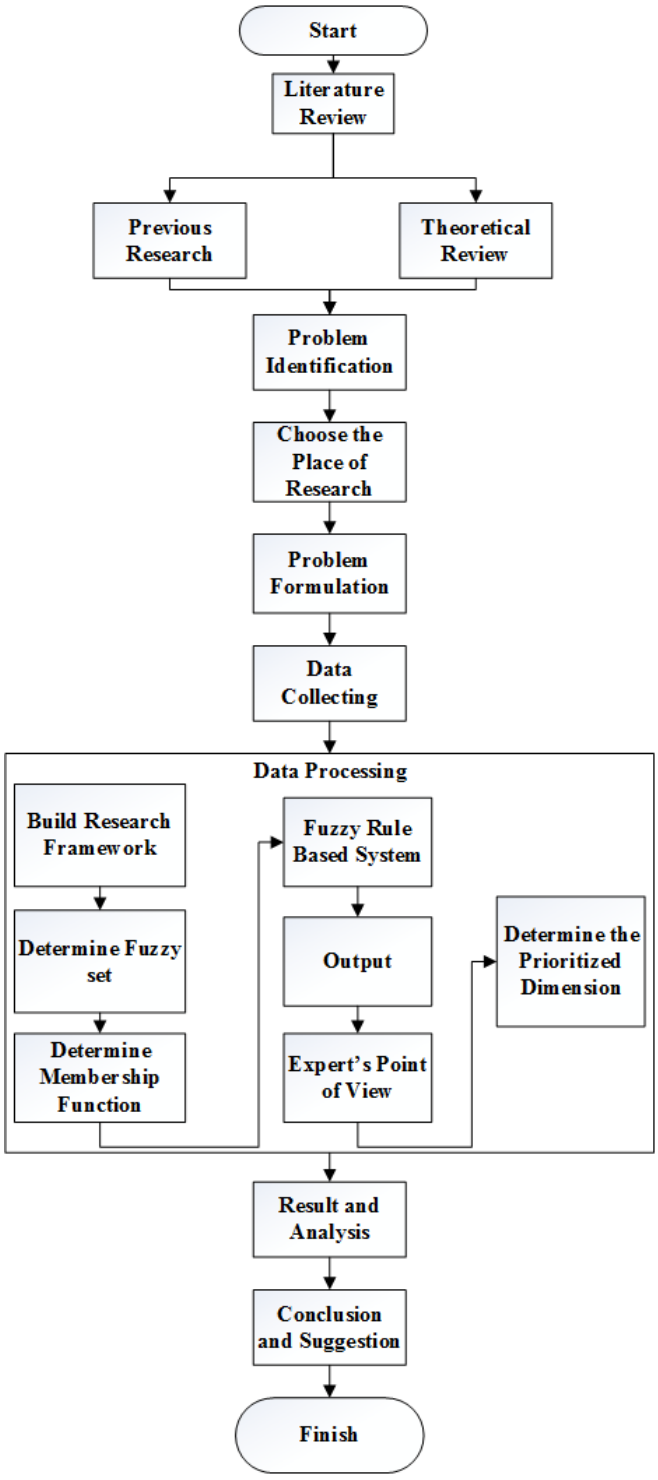


Figure 3.3 Flowchart process of research

CHAPTER IV

DATA COLLECTING AND PROCESSING

4.1 Data Collecting

In this research, the data were obtained from expert's linguistic variables of small independent retailer. This research also used a dimensions and attributes of supplier relationship management framework from (Prajogo, et al. 2012). Data were collected by observation, interview, questionnaire and literatures. Fuzzy rule based system are used to make a value of fuzzy sets and membership function for input and output to find prioritized dimensions and attributes of supplier relationship management framework. The figure of supplier relationship management framework can be seen in Figure 4.1 below:

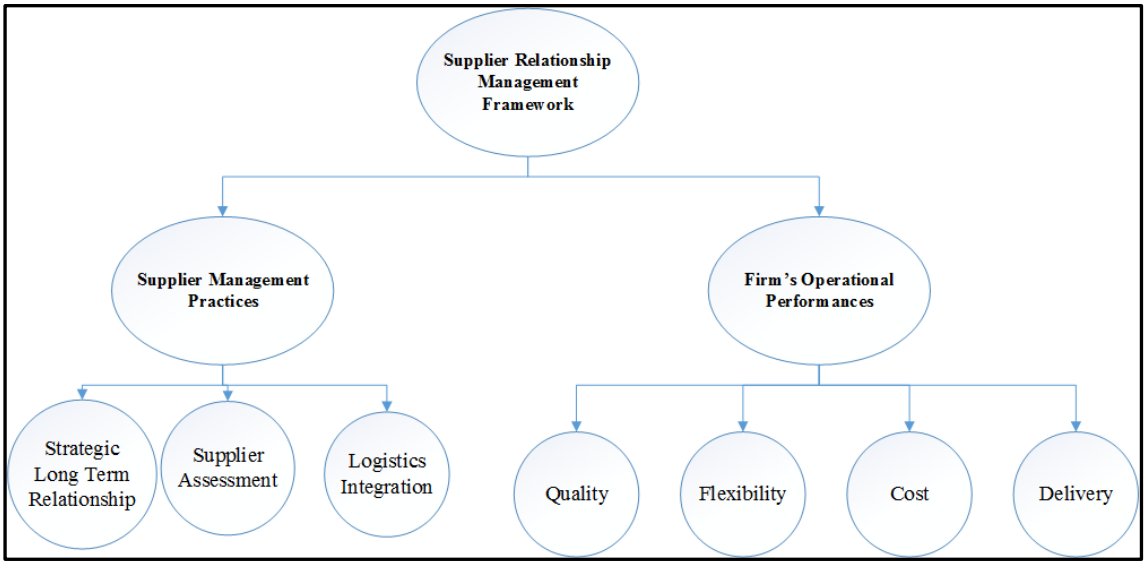


Figure 4.1 Supplier Relationship Management Frameworks

Supplier relationship management frameworks consist of several dimensions and attributes. In supplier management practices consist of *strategic long term relationship, supplier assessment,* and *logistics integration*. Firm's operational performances consist of *quality, flexibility, price,* and *distribution*. The complete dimensions and attributes of supplier relationship management frameworks can be seen in Table 4.2 below:

Table 4.2 Dimensions and Attributes of Supplier Relationship Management

Dimensions	Attributes
Strategic Long Term Relationship	Relationship with key suppliers last a long time
	Collaboration business with key suppliers are improved firms business management for long run
	Suppliers see the relationship as a long term alliance
	Suppliers as an extension of our company
Supplier Assessment	Formal supplier assessment system to determine supplier's capabilities
	Clear metric for measuring performance of suppliers
	Monitor closely the performance of suppliers
	Compare suppliers performance with other similar supplier
Logistics Integration	Inter-organizational logistic activities are closely coordinated with suppliers.
	Logistics activities are well integrated with suppliers logistics activities
	Seamless integration of logistics activities with retailer key suppliers
	Logistics integration is characterized by excellent distribution, transportation and/or warehousing facilities
Quality	Conformance to specification
	Product quality performance
Delivery	On time delivery
	Speed of delivery
Flexibility	Volume or capacity flexibility
	Degree of product variety
Cost	Overall operational cost
	Competitive prices of products

4.2 Data Processing

4.2.1 Fuzzy Inference System Determination

Fuzzy inference systems are used to determine how many input and output each dimensions of supplier relationship management framework. In building a fuzzy inference system, this research uses Mamdani inference model. Fuzzy inference system

each dimensions in supplier relationship management framework will be defined as below:

1. Supplier Management Practices

   In fuzzy interference system, the input dimensions are strategic long-term relationship, supplier assessment, and logistics integration. The output is supplier management practices. The dimensions are used to know what the prioritized dimension in supplier management practices is. To know prioritized dimension of supplier management practices, Mamdani style is used to solve a problem.

   1.1 Strategic Long-term Relationship

   In Strategic Long term Relationship dimension consist of four indicators. Indicators of Strategic Long term Relationship are *relationship with key supplier to last a long time, Collaboration business with key suppliers are improved firms business management for long run*, *Suppliers see the relationship as a long term alliance*, and *Suppliers as an extension of our company.*

   1.2 Supplier Assessment

   In Supplier Assessment dimension consist of five indicators. Indicators of Supplier Assessment are *Formal supplier assessment system to determine supplier's capabilities*, *Clear metric for measuring performance of suppliers*, *Monitor closely the performance of suppliers*, *Compare suppliers performance with other similar supplier*.

   1.3 Logistics Integration

   In Logistics Integration dimension consist of four indicators. Indicators of Logistics Integration are Logistics activities are well integrated with suppliers logistics activities, *Inter-organizational logistic activities are closely coordinated with suppliers*, *Seamless integration of logistics activities with retailer key suppliers*, and *Logistics integration is characterized by excellent distribution, transportation and/or warehousing facilities*.

2. Firm’s Operational Performance

   In fuzzy inference systems, the inputs are price, quality, delivery, and flexibility. The output is firm’s operational performance. The dimensions are used to know what the prioritized dimension in firm’s operational performances is. To know

prioritized dimension of supplier management practices, Mamdani style is used to solve a problem.

2.1 Price

Price dimension consists of two indicators. Indicators are *Overall operational cost* and *Competitive prices of products*.

2.2 Quality

Quality dimension consists of two indicators. Indicators are *Conformance to specification* and *Product quality performance*

2.3 Delivery

Delivery dimension consists of two indicators. Indicators are *On time delivery* and *Speed of delivery*

2.4 Flexibility

Flexibility dimension consist of two indicators. Indicators are *Volume or capacity flexibili*ty and *Degree of product variety*.

4.2.1 Fuzzy Sets Determination

Fuzzy sets determination is used to determine the score of expert's linguistic variables for each dimension and attributes of supplier relationship management framework for small independent retailer. The figure of fuzzy sets determination can be seen in Figure 4.3 below:

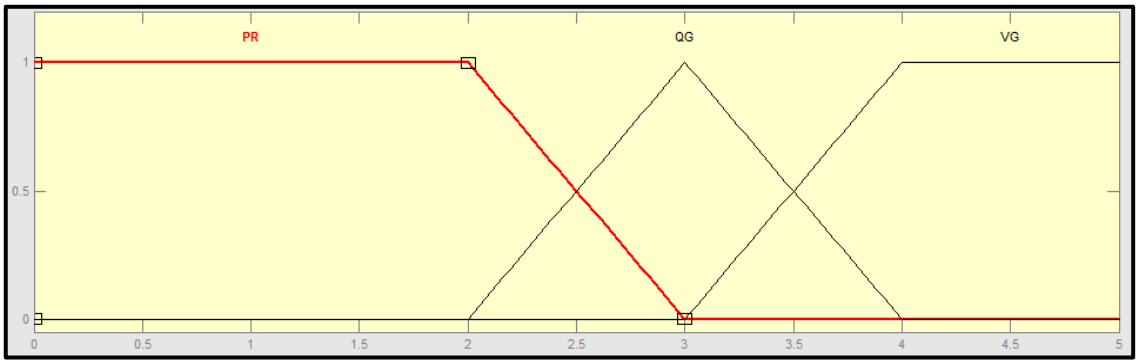


Figure 4.3 Fuzzy Sets Determination from MATLAB

The weights of fuzzy set are based on Likert Scale. The range of Likert scale are Very Poor is 1; Poor is 2; Moderate is 3; Quite Good is 4; Very Good is 5. Likert scale is translated into 3 parameters. Likert scale is translated into Poorly (PR) with the weights

of score are 1, 2,and 3 ; Quite Good weights score are 2,3, and 4; and Very Good weights score are 3,4, and 5.

4.2.2 Membership Function

After define fuzzy set, membership functions are used to define each membership function of dimensions and attributes in supplier relationship management framework.

1. Strategic Long Term Relationship

   Strategic Long Term Relationship has 3 linguistic variables, which are Poorly (PR), Quite Good (QG), and Very Good (VG). Poorly (PR) with the weights of score are 1, 2, and 3; Quite Good weights score are 2, 3, and 4; and Very Good weights score are 3, 4, and 5. Memberships function of Strategic Long term Relationship shown in Figure 4.4 below:

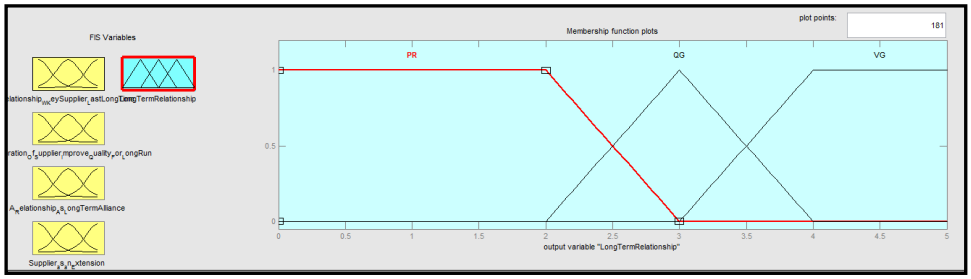


Figure 4.4 Membership Functions of Strategic Long Term Relationship

2. Supplier Assessment

   Supplier Assessment has 3 linguistic variables, which are Poorly (PR), Quite Good (QG), and Very Good (VG). Poorly (PR) with the weights of score are 1, 2, and 3; Quite Good weights score are 2, 3, and 4; and Very Good weights score are 3, 4, and 5. Memberships function of Supplier assessment shown in Figure 4.5 below:

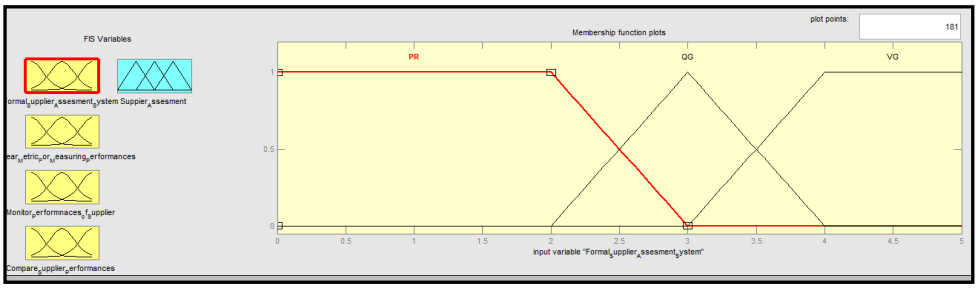


Figure 4.5 Membership Functions of Supplier Assessment

3. Logistics Integration

Logistics Integration has 3 linguistic variables, which are Poorly (PR), Quite Good (QG), and Very Good (VG). Poorly (PR) with the weights of score are 1, 2, and 3; Quite Good weights score are 2, 3, and 4; and Very Good weights score are 3, 4, and 5. Memberships function of Logistics Integration shown in Figure 4.6 below:

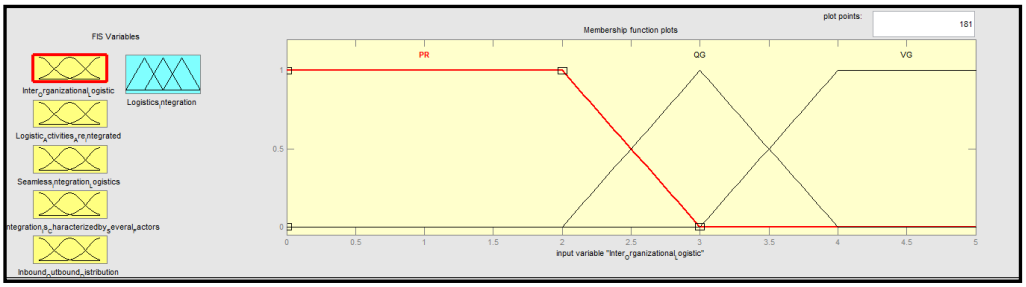


Figure 4.6 Membership Functions of Logistics Integration

4. Price

Price has 3 linguistic variables, which are Poorly (PR), Quite Good (QG), and Very Good (VG). Poorly (PR) with the weights of score are 1, 2, and 3; Quite Good weights score are 2, 3, and 4; and Very Good weights score are 3, 4, and 5. Memberships function of Price shown in Figure 4.7 below:

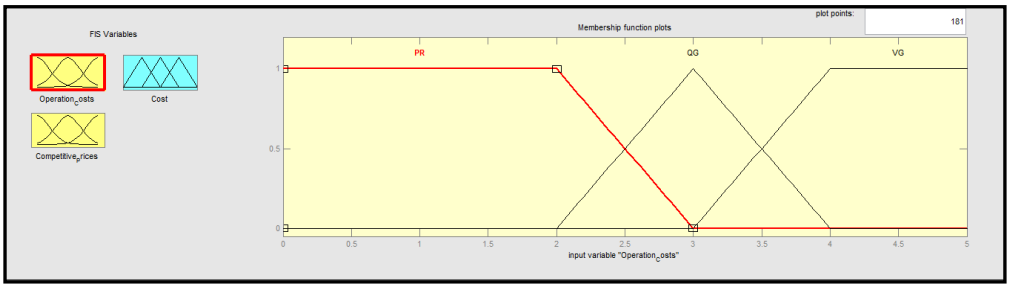


Figure 4.7 Membership Functions of Price

5. Delivery

Delivery has 3 linguistic variables, which are Poorly (PR), Quite Good (QG), and Very Good (VG). Poorly (PR) with the weights of score are 1, 2, and 3; Quite Good weights score are 2, 3, and 4; and Very Good weights score are 3, 4, and 5. Memberships function of Delivery shown in Figure 4.7 below

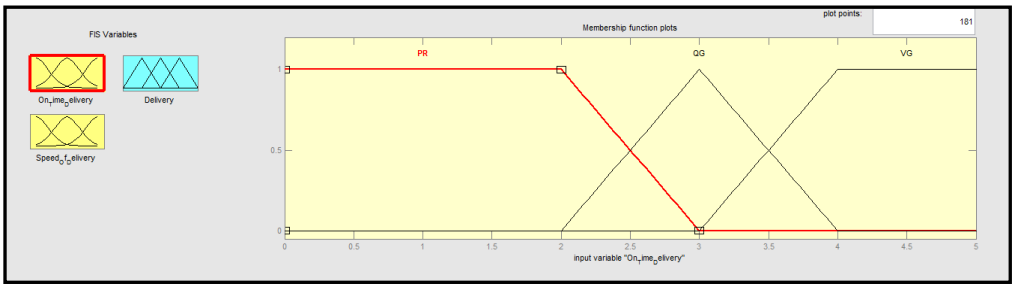


Figure 4.8 Membership Functions of Delivery

6. Quality

   Quality has 3 linguistic variables, which are Poorly (PR), Quite Good (QG), and Very Good (VG). Poorly (PR) with the weights of score are 1, 2, and 3; Quite Good weights score are 2, 3, and 4; and Very Good weights score are 3, 4, and 5. Memberships function of Quality shown in Figure 4.9 below:

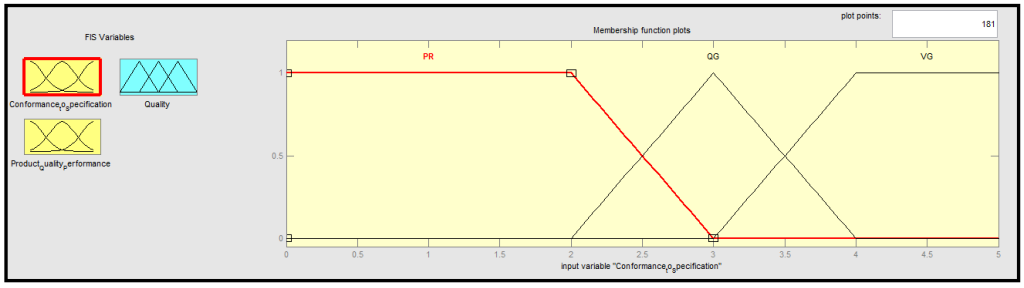


Figure 4.9 Membership Functions of Quality

7. Flexibility

   Flexibility has 3 linguistic variables, which are Poorly (PR), Quite Good (QG), and Very Good (VG). Poorly (PR) with the weights of score are 1, 2, and 3; Quite Good weights score are 2, 3, and 4; and Very Good weights score are 3, 4, and 5. Memberships function of Flexibility shown in Figure 4.10 below:

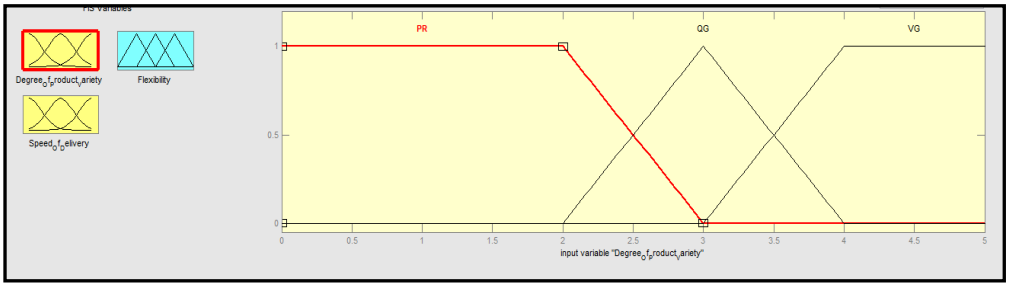


Figure 4.10 Membership Functions of Flexibility

8. Supplier Management Practices

   Supplier management practices have 3 linguistic variables, which are Poorly (PR), Quite Good (QG), and Very Good (VG). Poorly (PR) with the weights of score are 1, 2, and 3; Quite Good weights score are 2, 3, and 4; and Very Good

weights score are 3, 4, and 5. Memberships function of Supplier management practices are shown in Figure 4.11 below:

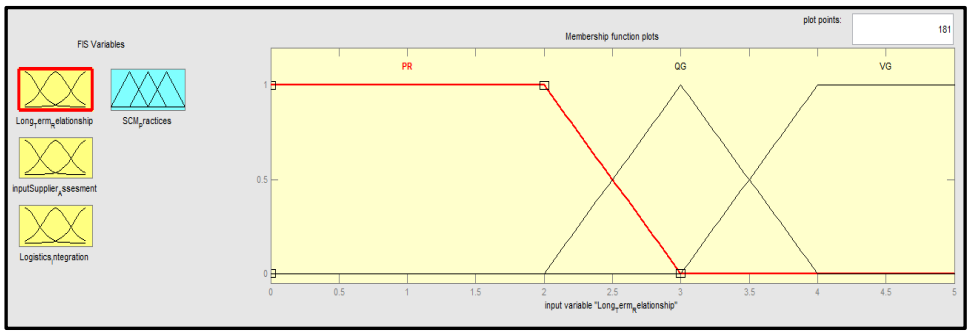


Figure 4.11 Membership Functions of Supplier Management Practices

9. Firm's Operational Performances

Firm's operational performances have 3 linguistic variables, which are Poorly (PR), Quite Good (QG), and Very Good (VG). Poorly (PR) with the weights of score are 1, 2, and 3; Quite Good weights score are 2, 3, and 4; and Very Good weights score are 3, 4, and 5. Membership functions of Firm's operational performances are shown in Figure 4.12 below:

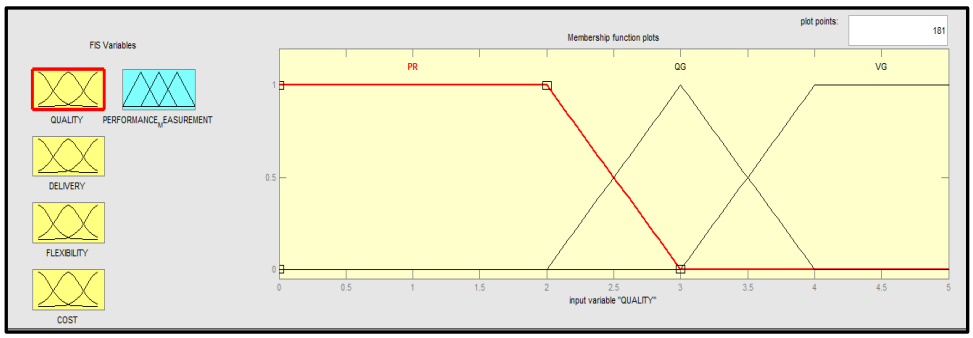


Figure 4.12 Membership Functions of Firm's Operational Performances

4.2.3 Fuzzy Rule System

Development of fuzzy rule system uses Mamdani Inference System. The general form of fuzzy rules is shown as below:

1. Strategic Long term Relationship

1. Strategic Long term Relationship = A
2. Relationship with key supplier to last a long time = a_1
3. Collaboration business with key suppliers is improved firms business management for long run = a_2
4. Suppliers see the relationship as a long term alliance = a_3

5. Suppliers as an extension of our company= a_4

R_1 = IF a_1 is PR AND a_2 is PR AND a_3 is PR AND a_4 is PR THEN A is PR

R_2 = IF a_1 is PR AND a_2 is QG AND a_3 is PR AND a_4 is QG THEN A is PR

R_3 = IF a_1 is PR AND a_3 is PR THEN A is PR

R_4 = IF a_1 is QG AND a_2 is QG AND a_3 is QG AND a_4 is QG THEN A is QG

R_5 = IF a_1 is QG AND a_2 is PR AND a_3 is QG AND a_4 is PR THEN A is QG

R_6 = IF a_1 is QG AND a_2 is VG AND a_3 is QG AND a_4 is VG THEN A is QG

R_7 = IF a_1 is QG AND a_3 is QG THEN A is QG

R_8 = IF a_1 is VG AND a_2 is VG AND a_3 is VG AND a_4 is VG THEN A is VG

R_9 = IF a_1 is VG AND a_2 is QG AND a_3 is VG AND a_4 is QG THEN A is VG

R_{10} = IF a_1 is VG AND a_3 is VG THEN A is VG

2. Supplier Assessment

1. Supplier Assessment = B
2. Formal supplier assessment system to determine supplier's capabilities = b_1
3. Clear metric for measuring performance of suppliers = b_2
4. Monitor closely the performance of suppliers = b_3
5. Compare suppliers performance with other similar supplier = b_4

R_1 = IF b_1 is PR AND b_2 is PR AND b_3 is PR AND b_4 is PR THEN B is PR

R_2 = IF b_1 is QG AND b_2 is PR AND b_3 is PR AND b_4 is QG THEN B is PR

R_3 = IF b_1 is QG AND b_2 is PR AND b_3 is PR AND b_4 is PR THEN B is PR

R_4 = IF b_1 is PR AND b_2 is PR AND b_3 is PR AND b_4 is QG THEN B is PR

R_5 = IF b_1 is QG AND b_2 is QG AND b_3 is QG AND b_4 is QG THEN B is QG

R_6 = IF b_1 is PR AND b_2 is QG AND b_3 is QG AND b_4 is PR THEN B is QG

R_7 = IF b_1 is QG AND b_2 is QG AND b_3 is QG AND b_4 is PR THEN B is QG

R_8 = IF b_1 is PR AND b_2 is QG AND b_3 is QG AND b_4 is QG THEN B is QG

R_9 = IF b_1 is VG AND b_2 is QG AND b_3 is QG AND b_4 is QG THEN B is QG

R_{10} = IF b_1 is QG AND b_2 is QG AND b_3 is QG AND b_4 is VG THEN B is QG

R_{11} = IF b_1 is QG AND b_2 is QG AND b_3 is QG AND b_4 is VG THEN B is QG

R_{12} = IF b_1 is VG AND b_2 is VG AND b_3 is VG AND b_4 is VG THEN B is VG

R_{13} = IF b_1 is QG AND b_2 is VG AND b_3 is VG AND b_4 is VG THEN B is VG

R_{14} = IF b_1 is QG AND b_2 is VG AND b_3 is VG AND b_4 is QG THEN B is VG

R_{15} = IF b_2 is VG AND b_3 is VG THEN B is VG

3. Logistics Integration

1. Logistics Integration = C
2. Inter-organizational logistic activities are closely coordinated with suppliers = c_1
3. Logistics activities are well integrated with suppliers logistics activities = c_2
4. Seamless integration of logistics activities with retailer key suppliers = c_3
5. Logistics integration is characterized by excellent distribution, transportation and/or warehousing facilities suppliers = c_4

R_1 = IF c_1 is PR AND c_2 is PR AND c_3 is PR AND c_4 is PR THEN C is PR

R_2 = IF c_1 is PR AND c_2 is PR AND c_4 is PR THEN C is PR

R_3 = IF c_1 is QG AND c_2 is QG AND c_3 is QG AND c_4 is QG THEN C is QG

R_4 = IF c_1 is VG AND c_2 is VG AND c_3 is VG AND c_4 is VG THEN C is VG

R_5 = IF c_1 is QG AND c_2 is QG AND c_4 is QG THEN C is QG

R_6 = IF c_1 is VG AND c_2 is VG AND c_4 is VG THEN C is VG

R_1 = IF c_1 is PR AND c_4 is PR THEN C is PR

4. Quality

1. Quality = Q
2. Conformance to specification = q_1
3. Product quality performance = q_2

R_1 = IF q_1 is PR AND q_2 is PR THEN Q is PR

R_2 = IF q_1 is PR OR q_2 is PR THEN Q is PR

R_3 = IF q_2 is PR THEN Q is PR

R_4 = IF q_1 is QG AND q_2 is QG THEN Q is QG

R_5 = IF q_2 is QG THEN Q is QG

R_6 = IF q_1 is VG AND q_2 is VG THEN Q is VG

R_7 = IF q_1 is VG OR q_2 is VG THEN Q is VG

5. Delivery

1. Delivery = D
2. On time delivery = d_1
3. Speed of delivery = d_2

R_1 = IF d_1 is PR THEN D is PR

R_2 = IF d_2 is PR THEN D is PR

R_3 = IF d_1 is QG OR d_2 is PR THEN D is PR

R_4 = IF d_1 is PR OR d_2 is QG THEN D is PR

R_5 = IF d_1 is PR AND d_2 is PR THEN D is PR

R_6 = IF d_1 is QG THEN D is QG

R_7 = IF d_2 is QG THEN D is QG

R_8 = IF d_1 is QG OR d_2 is VG THEN D is QG

R_8 = IF d_1 is QG OR d_2 is VG THEN D is QG

R_9 = IF d_1 is VG AND d_2 is QG THEN D is QG

R_{10} = IF d_1 is QG AND d_2 is QG THEN D is QG

R_{11} = IF d_1 is VG THEN D is VG

R_{12} = IF d_2 is VG THEN D is VG

R_{13} = IF d_1 is VG OR d_2 is VG THEN D is VG

R_{14} = IF d_1 is VG AND d_2 is VG THEN D is VG

6. Flexibility

1. Flexibility = F
2. Volume or capacity flexibility = f_1
3. Degree of product variety = f_2

R_1 = IF f_1 is PR AND f_2 is PR THEN F is PR

R_2 = IF f_2 is PR THEN F is PR

R_3 = IF f_1 is QG AND f_2 is QG THEN F is QG

R_4 = IF f_1 is QG OR f_2 is QG THEN F is QG

R_5 = IF f_1 is VG AND f_2 is QG THEN F is QG

R_6 = IF f_1 is VG AND f_2 is VG THEN F is VG

R_7 = IF f_1 is VG OR f_2 is VG THEN F is VG

R_8 = IF f_2 is VG THEN F is VG

7. Cost

1. Cost = Co
2. Overall operational cost = co_1
3. Competitive prices of products = co_2

R_1 = IF co_1 is PR AND co_2 is PR Then Co is PR

R_2 = IF co_1 is PR OR co_2 is PR Then Co is PR

R_3 = IF co_1 is QG OR co_2 is QG Then Co is QG

R_4 = IF co_1 is QG AND co_2 is QG Then Co is QG

R_5 = IF co_1 is VG OR co_2 is VG Then Co is VG

8. Supply Chain Management Practices

1. Supply Chain Management Practices = SCM
2. Strategic long term relationship = A
3. Supplier Assessment = B
4. Logistics Integration = C

R_1 = IF A is PR AND B is PR AND C is PR THEN SCM is PR

R_2 = IF A is QG AND B is PR AND C is PR THEN SCM is PR

R_3 = IF A is VG AND B is PR AND C is PR THEN SCM is PR

R_4 = IF B is PR AND C is PR THEN SCM is PR

R_5 = IF A is QG AND B is QG AND C is QG THEN SCM is QG

R_6 = IF A is PR AND B is QG AND C is QG THEN SCM is QG

R_7 = IF A is VG AND B is QG AND C is QG THEN SCM is QG

R_8 = IF A is QG OR B is QG OR C is QG THEN SCM is QG

R_9 = IF A is VG AND B is VG AND C is VG THEN SCM is VG

R_{10} = IF A is QG AND B is VG AND C is VG THEN SCM is VG

R_{11} = IF B is VG AND C is VG THEN SCM is VG

9. Firm's Operational Performances

1. Firm's Operational Performances = OP
2. Quality = Q
3. Delivery = D
4. Flexibility = F
5. Cost = Co

R_1 = IF Q is PR AND D is PR AND F is PR AND Co is PR THEN OP is PR

R_2 = IF Q is PR AND D is PR AND F is QG AND Co is QG THEN OP is PR

R_3 = IF Q is QG AND D is QG AND F is QG AND Co is QG THEN OP is QG

R_4 = IF Q is QG AND D is QG THEN OP is QG

R_5 = IF Q is VG AND D is VG THEN OP is VG

R_6 = IF Q is VG THEN OP is VG

R_7 = IF Q is PR THEN OP is PR

R_8 = IF Q is PR AND D is PR THEN OP is PR

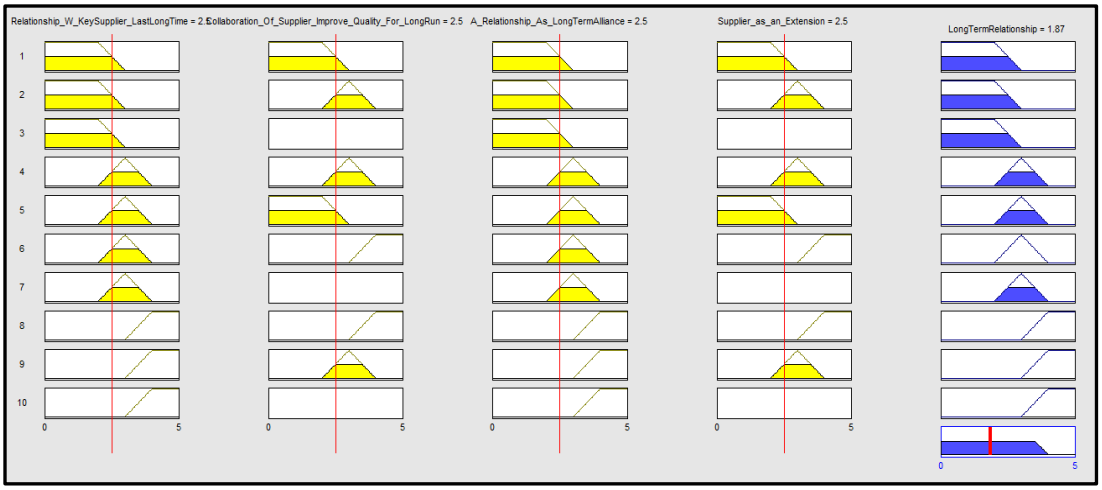
R_9 = IF Q is QG AND D is QG AND F is PR AND Co is PR THEN OP is QG

4.2.4 Defuzzification

Defuzzification is used to obtain the result of final crisp output from fuzzy set. The output of fuzzy set from dimensions and attributes are shown as follows:

1. Strategic Long Term Relationship

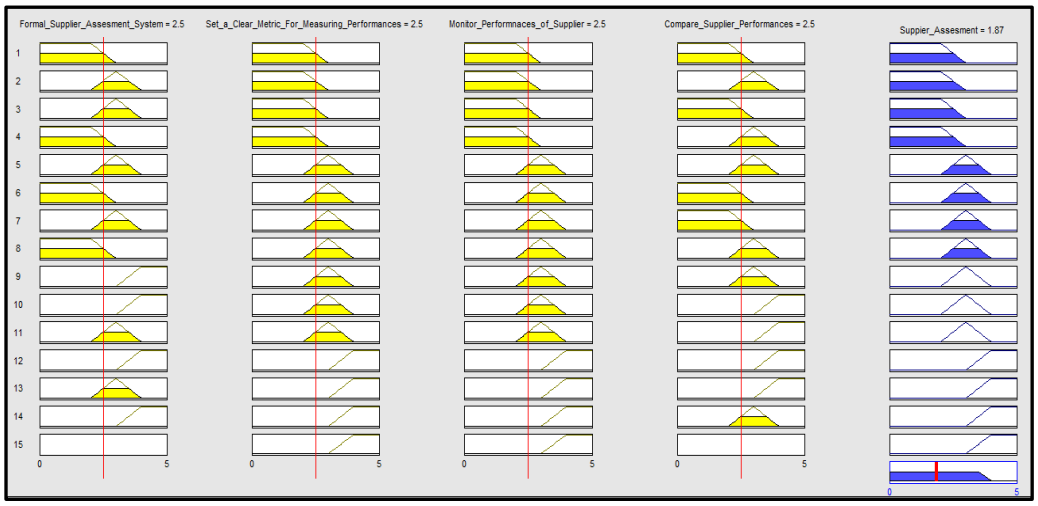
   The calculation process of strategic long term relationship output is 1.87. Relationship with key supplier score is 2.5. Collaboration business with key suppliers is improved firms business management for long run is 2.5. Suppliers see the relationship as a long term alliance is 2.5. A supplier as an extension of Retailer Company is 2.5. The result form fuzzy rule is shown in Figure 4.13.



4.13 Fuzzy Rule Output of Strategic Long Term Relationship

2. Supplier Assessment

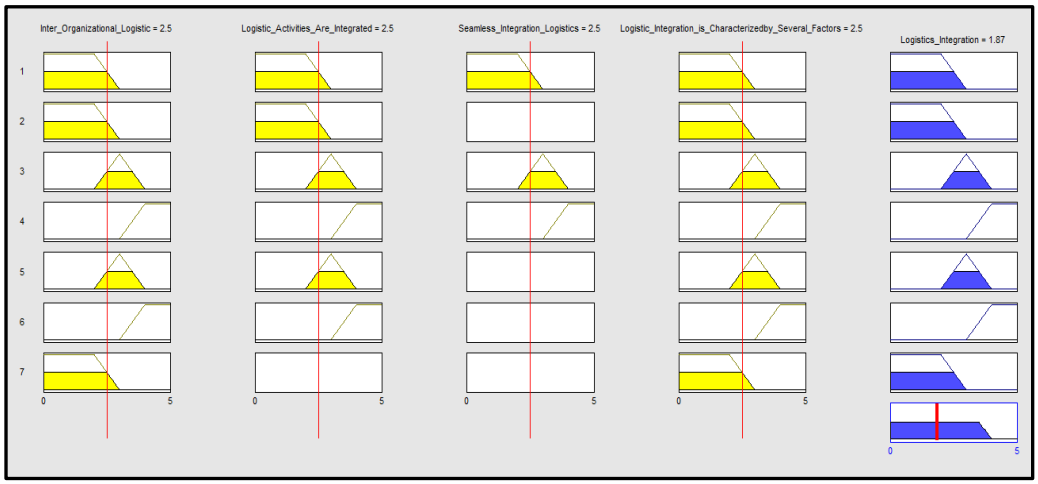
   The calculation process of supplier assessment output is 1.87. Formal supplier assessment system to determine supplier's capabilities is 2.5. Clear metric for measuring performance of suppliers is 2.5. Monitor closely the performance of suppliers is 2.5. Compare suppliers performance with other similar supplier is 2.5. The result form fuzzy rule is shown in Figure 4.14.



4.14 Fuzzy Rule Output of Supplier Assessment

3. Logistics Integration

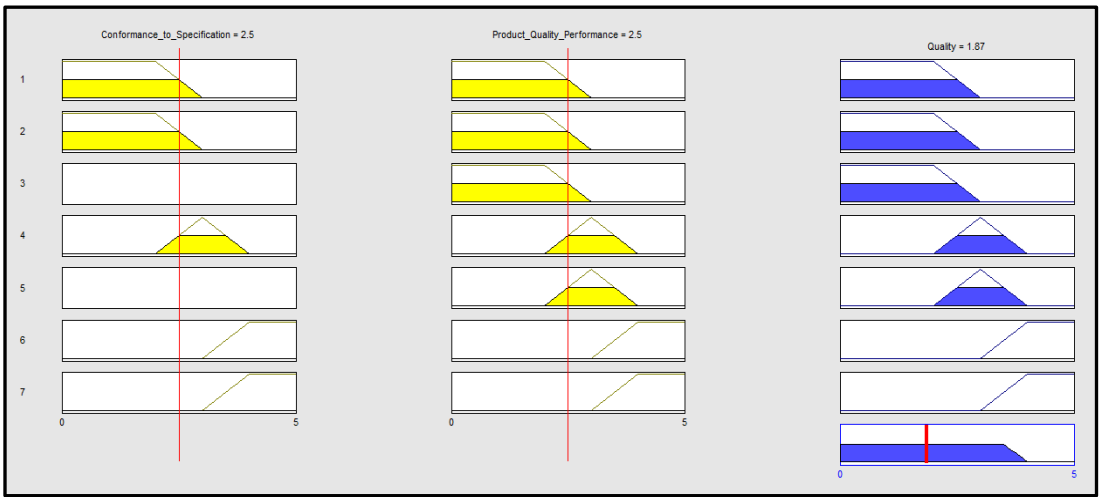
The calculation process of Logistics Integration output is 1.87. Inter-organizational logistic activities are closely coordinated with suppliers is 2.5. Logistics activities are well integrated with supplier's logistics activities is 2.5. Seamless integration of logistics activities with retailer key suppliers is 2.5. Logistics integration is characterized by excellent distribution, transportation and/or warehousing facilities is 2.5. The result form fuzzy rule is shown in Figure 4.15.



4.15 Fuzzy Rule Output of Logistics Integration

4. Quality

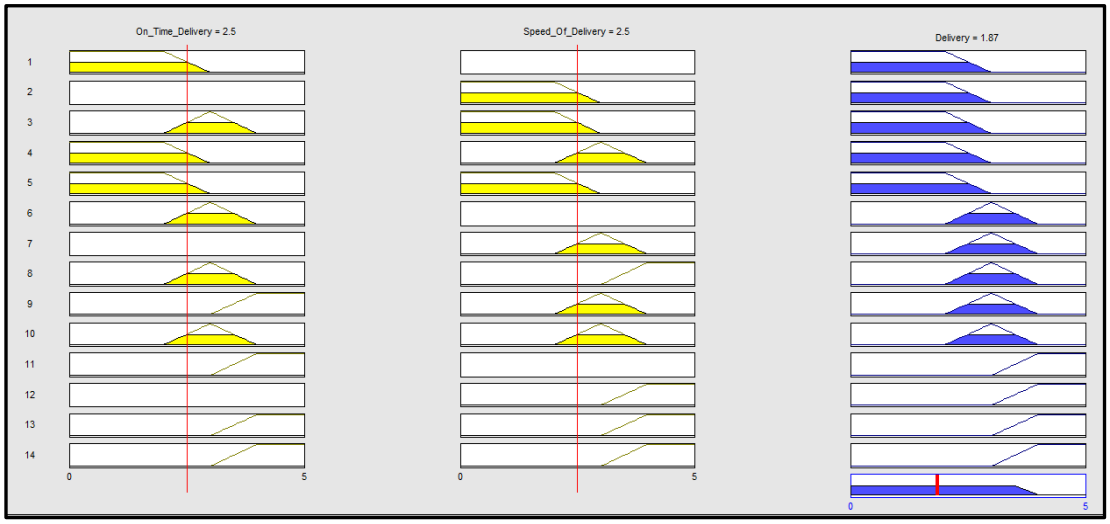
The calculation process of Quality output is 1.87. Conformance to specification is 2.5. Product quality performance is 2.5. The result form fuzzy rule is shown in Figure 4.16.



4.16 Fuzzy Rule Output of Quality

5. Delivery

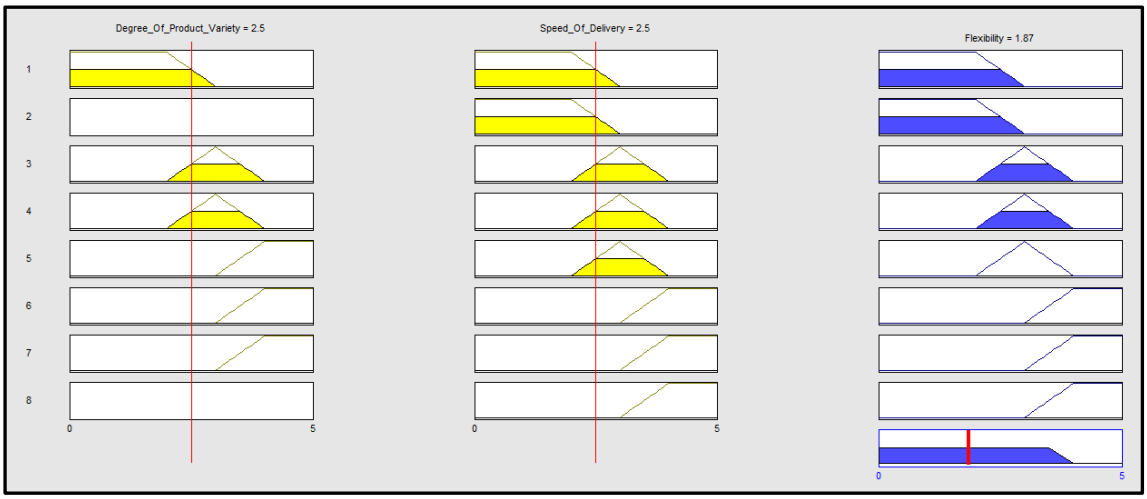
The calculation process of Delivery output is 1.87. On time delivery is 2.5. Speed of delivery is 2.5. The result form fuzzy rule is shown in Figure 4.17.



4.17 Fuzzy Rule Output of Delivery

6. Flexibility

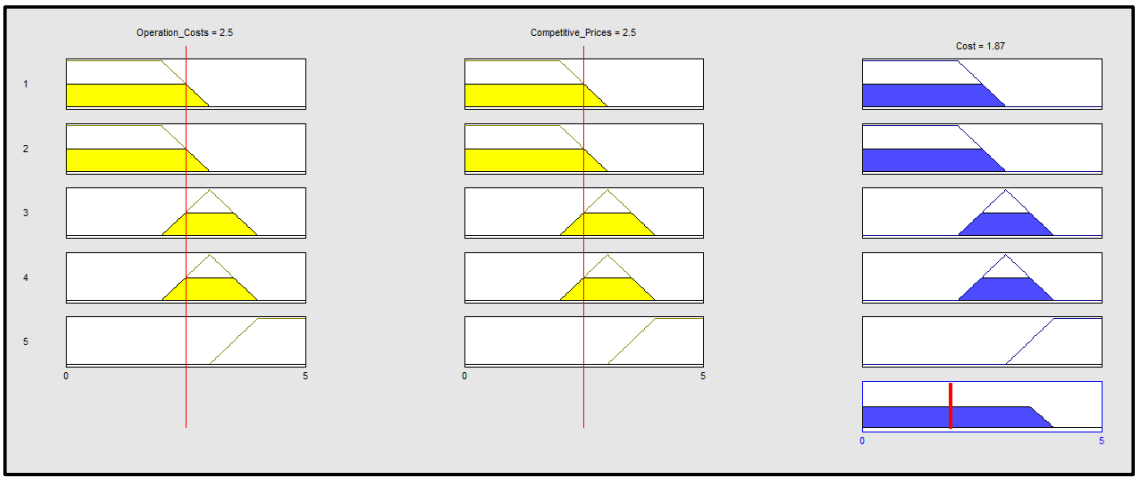
The calculation process of Flexibility output is 1.87. Volume or capacity flexibility is 2.5. Degree of product variety is 2.5The result form fuzzy rule is shown in Figure 4.18.



4.18 Fuzzy Rule Output of Flexibility

7. Cost

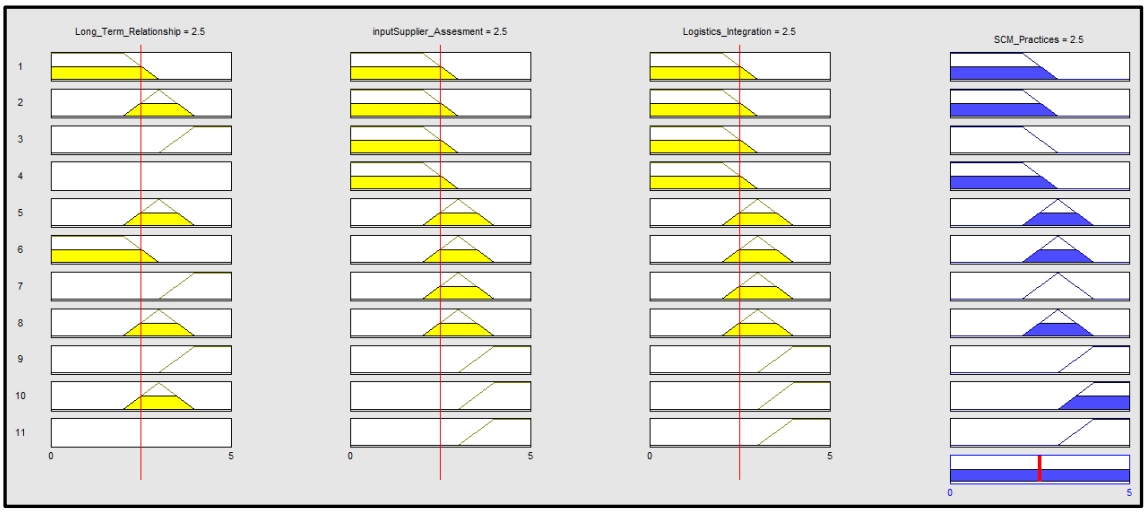
   The calculation process of Cost output is 1.87. Overall operational cost is 2.5. A competitive price of products is 2.5. The result form fuzzy rule is shown in Figure 4.19.



4.19 Fuzzy Rule Output of Cost

8. Supplier Management Practices

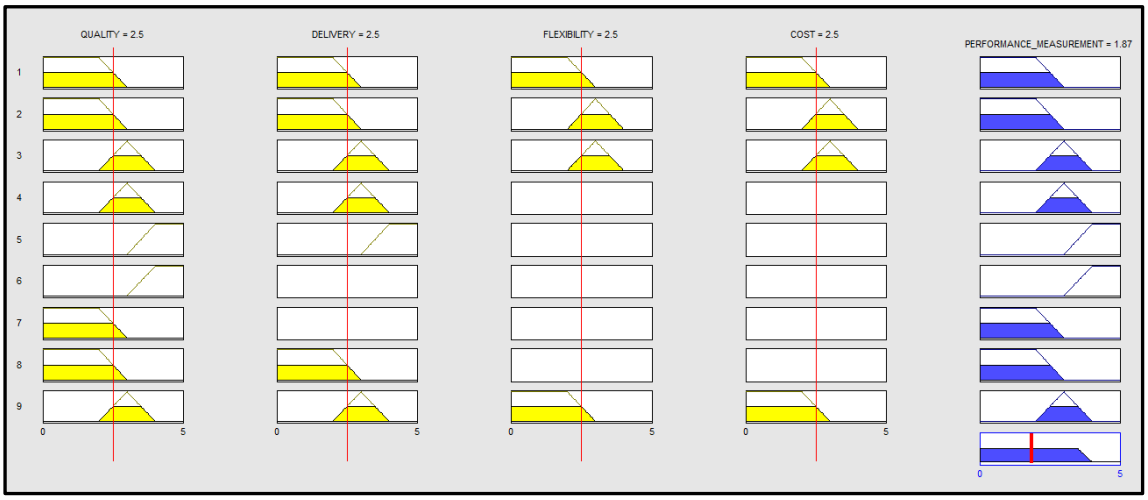
   The calculation process of Supplier Management Practices output is 2.5. Strategic Long Term Relationship is 2.5. Supplier Assessment is 2.5. Logistics Integration is 2.5. The result form fuzzy rule is shown in Figure 4.20.



4.19 Fuzzy Rule Output of Supplier Management Practices

9. Firm's Operational Performances

   The calculation process of Firm's Operational Performances is 1.87. Quality is 2.5. Delivery is 2.5. Flexibility is 2.5. Cost is 2.5. The result form fuzzy rule is shown in Figure 4.20.



4.20 Fuzzy Rule Output of Firms Operational Performances

4.2.5 Experts Point of View

In this part, expert's point of view is used to determine prioritized dimensions and attributes between supplier management practices and firm's operational performances. The calculation of expert's point of view result is calculated as bellow:

1. Supplier Management Practices

   Supplier management practices consist of 3 dimensions. There are strategic long term relationship, supplier assessments and logistics integration. Each dimension

in supplier management practices has their own attributes. The usability of dimensions and attributes is to suggest an action for small independent retailer in determining prioritized dimension for managing a business of small independent retailer.

In dimensions aspect of supplier management practices, there are several rule to determine prioritized dimension from expert's point of view. In calculation output of fuzzy inference system of supplier management practices the score is 2.5. The calculation score of strategic long term relationship is 2.5, supplier assessment is 2.5, and logistics integration is 2.5. The result of this calculation has a same score for 3 dimensions in supplier management practices. It has obstacles in determining prioritized dimension because there is no higher score for supplier management practices score. Concerned with this problem, expert's point of view is developed by modifying the rule based system and by changing the input of fuzzy set in order to find prioritized dimension of supplier management practices.

In developing of expert's point of view, Likert's scale is used to determine the value output of supplier management practices. There are 4 rules from Expert's.

$$R^1 = [1\ 1\ 1] \rightarrow [1.25]$$
$$R^2 = [3\ 1\ 1] \rightarrow [2.45]$$
$$R^3 = [5\ 3\ 2] \rightarrow [3.7]$$
$$R^4 = [5\ 1\ 4] \rightarrow [4.24]$$

In rule 1, the input of strategic long term relationship is 1, input of supplier assessment is 1, and input of logistic integration is 1. That means, the input of strategic long term relationship, supplier assessment, and logistic integration is poor. Based on Likert's range scale 1 is poor. The output of rule 1 is 1.25. It is categorized as poor for supplier relationship management practices output. In rule 4, the input of strategic long term is 5, input of supplier assessment is 1, and input of logistics integration is 4. The output score for supplier management practices is 4.24.

In rule 4, the score of output is 4.24. The highest input score is strategic long term relationship. It means the prioritized dimension is strategic long term relationship. The attributes of strategic long term relationship is used to suggest manager of small independent retailer to give a focus in prioritized attributes to achieve the goal of strategic long term relationship.

R^1 = [2 1 2 1] → [1.25]

R^2 = [1 2 1 4] → [2.5]

R^3 = [4 2 3 3] → [3]

R^4 = [5 1 5 4] → [4.24]

There are 4 rules in attributes of strategic long term relationship. The highest output rule is Rule 4. In rule 4, input score of Relationship with key suppliers last a long time is 5, input score of Collaboration business with key suppliers are improved firms business management for long run is 1, input score of Suppliers see the relationship as a long term alliance is 5, and input score of Suppliers as an extension of our company is 4. It can analyzed that prioritized attributes with highest input score to are Relationship with key suppliers last a long time and Suppliers see the relationship as a long term alliance.

2. Firm's Operational Performances

Firm's operational performances contains of 4 dimensions. There are quality, delivery, flexibility and cost. In calculation of firm's operational performances have same problems with supplier management practices dimensions. There is no prioritized dimension in calculation of fuzzy inference system. All dimensions in firm's operational performances input is 2.5. The output score for firm's operational performances is 1.87. Expert's point of view is developed by modifying the rule based system and by changing the input of fuzzy set in order to find prioritized dimension of Firm's operational performances.

In developing of expert's point of view, Likert's scale is used to determine the value output of supplier management practices. There are 4 rules from Expert's.

R^1 = [1 1 1 1] → [1.25]

R^2 = [3 2 1 2] → [2.5]

$$R^3 = [3\ 3\ 2\ 2] \rightarrow [3]$$

$$R^4 = [4\ 3\ 2\ 2] \rightarrow [4.24]$$

The highest rule output is from Rule 4. In rule 4, input of quality is 4, input of delivery is 3, input of flexibility is 2, and input of cost is 2. The output score for rule 4 is 4.24. It means, the prioritized dimension is quality. In rule 4, the score of output is 4.24. The highest input score is quality. It means the prioritized dimension is quality. The attributes of quality is used to suggest manager of small independent retailer to give a focus in prioritized attributes to achieve the goal of quality.

$$R^1 = [1\ 2] \rightarrow [1.25]$$

$$R^2 = [1\ 4] \rightarrow [2.38]$$

$$R^3 = [3\ 3] \rightarrow [3]$$

$$R^4 = [3\ 4] \rightarrow [4.24]$$

The highest score is from rule 4. Rule 4 has the output score is 4.24. Input score of conformance to specification is 3 and product quality performance is 4. That means the prioritized dimension is product quality performance.

CHAPTER V

DISCUSSION

5.1 Result Analysis

These discussions provide an analysis of development supplier relationship management framework in small independent retailer. In supplier relationship management framework for small independent retailer, there are two core dimensions of supplier management practices and firm operational performance. First, the findings shows prioritized dimension and attributes in supplier management practices and firm operational performance. Supplier management practices have three sub dimensions. The dimensions are strategic long term relationship, supplier assessment, and logistic integration. Strategic long term relationship as a prioritized dimension show there are four things to be considered. There are relationship with key suppliers last a long time, collaboration business with key suppliers are improved firms business management for long run, suppliers see the relationship as a long term alliance, and supplier as an extension of our company. The important attributes to be considered are relationship with key suppliers last a long time and suppliers see the relationship as a long term alliance.

Firm operational performances have four sub dimensions. The dimensions are quality, flexibility, delivery, and price/cost. Quality as a prioritized dimension show there are two things to be considered. There are conformance to specifications and product quality performance. The important attributes to be considered is product quality performance. The result of finding a prioritized dimension and attributes of supplier relationship management framework is use to provides deep understanding for manager to take an action to do in achieve a strategic goal of managing small independent retailer business to enhance supplier relationship management framework. Manager has an optional action to be considered, based on the findings of prioritized dimension between supplier management practices and firms operational performance.

In a boarder perspective of supplier relationship management, a strategic long term relationship has an important position for small independent retailer. A strategic long term relationship is used in sustainability of supply chain management. In strategic long term relationship small independent retailer and supplier better able to enhance the condition of relationship characterized by increasing a communication, cooperation, and coordination of activities (Paulraj and Chen, 2005). In interview section with manager of small independent retailer, the manager want have a good relationship with supplier. In building a good relationship with supplier, manager should consider issues of trust, openness, and commitment (Spekman, 1988). Building a trust, openness, and commitment in strategic long term relationship can be achieved by take action into knowing the supplier and retailer wants. Commitment is one of essentials factor in a relationship between small independent retailer and supplier. A longtime relationship with supplier needs a good commitment and trust. In doing an implementation of supplier relationship management framework, supplier see the relationship as an alliance is used to achieve the goals in strategic long term relationship. In order to implement a relationship between suppliers and firm as a long term alliance several indicators should be considered by manager. Agreements, contracts, and negotiation are a bargaining power for small independent retailer.

In firm operational performances, quality is a prioritized dimension. The finding in quality as prioritized dimension, product quality performance should be concerned. Product quality performances can be achieved by controlling the product from supplier. The example is milk. The quality of milk should be checked. A sometimes leak in milk boxes is appears. A guarantee of quality is needed by small independent retailer. Manager should consider in product quality performance. The quality of product availability will influence in customer satisfaction. Customer wants a good product and good quality. Managing a product quality can be achieved by control checking the incoming product, have a guarantee contract between supplier and firm. In control checking a product quality should consider several factors in product performances, durability of product, distinctive of product, and price as quality indicator. Guarantee or warranty is important in availability of products in small independent retailer. A guarantee claims should consider in guarantee terms and agreement, how flexibility in product return to get a new product.

From theoretical perspective, the result of prioritized dimension in strategic long term relationship and firm's operational performance is used to give a suggestion action for manager of small independent retailer. In developing of supplier relationship management framework, it can be used as a consideration evaluation of continuity relationship between small independent retailer and supplier. In developing of supplier relationship management framework, this research is using one sample size in Yogyakarta. In achieving optimal solution is needed more than one sample size. This research use a measurement of expert's linguistic of point of view.

In context of development supplier relationship management framework of small independent retailer, the research's result provides a deeper understanding in managing a business process of retailer. Managing a business process of retailer is important to enhance the quality of supplier and retailer.

CHAPTER VI

CONCLUSION AND SUGGESTION

6.1 Conclusion

Based on data processing and analysis that has been performed in previous chapter, the conclusion can be drawn as follow:

1. The prioritized dimensions and attributes in supplier management practices and firm operational performances to be improved in order to be implemented in supplier relationship management framework of small independent retailer are strategic long term relationship and quality.
2. The action should do by manager's small-independent retailer in implementation of supplier relationship management is give a focus in A longtime relationship with supplier and supplier see the relationship as an alliance. It can be achieved by considered commitment and trust between supplier and retailer. Manager also considered in product quality of performances. Small independent retailer should check the packaging of products and ask a guarantee of product replacement if broken is appears.

6.2 Suggestion

This research only focuses in small independent retailer in Yogyakarta and the sample size of small independent retailer that used in this research only one company. Further works could be developed in other research area ~~and~~ that has more sample sizes.

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