



**ADDIS ABABA UNIVERSITY
SCHOOL OF COMMERCE
DEPARTMENT OF LOGISTICS & SUPPLY CHAIN MANAGEMENT
(LSCM)**

**Packing Carton Box Suppliers' Evaluation and Selection in
Large & Medium Scale Manufacturers of Food Products and
Beverages in Addis Ababa City**

*A Thesis Submitted in Partial Fulfillment of the Requirement for the Award of
Degree of Master of Arts in Logistics and Supply Chain Management*

BY: Birhanu Chane (GSE 0755/06)

ADVISOR : Teklegiorgis Assefa (Asst.Prof.)

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DECLARATION

I, the undersigned, declare that this submission is my own work and prepared under the guidance of my advisor Teklegiorgis Assefa (Asst.Prof.) and to the best of my knowledge and belief it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning.

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Date

CERTEFICATION STATEMENT

I hear by declare that the study presented in this thesis entitled ” **Packing Carton Box Suppliers` Evaluation and Selection in Large & Medium Scale Manufacturers of Food Products and Beverages in Addis Ababa City**” conducted by Birhanu Chane for Partial Fulfillment of the Requirement for the Award of Master of Arts in Logistics and Supply Chain Management to the best of my knowledge is original work and carried by him, and belief it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning.

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Acronyms and Abbreviations

- AHP** - Analytical Hierarchy Process
- CSA** - Central Statistics Agency
- EIC** - Ethiopian Investment Commission
- ISO** - International Organization for Standardization
- LSCM** - Logistics & Supply Chain Management
- MCDM**- Multi Criteria Decision Making
- SCM** - Supply Chain Management
- SLM** - Supplier Relationship Management
- SPSS** - Statistical Package for Social Science

Abstract

Supplier selection process is a process to select the best supplier that can offer the best deal on all required criteria among other related suppliers which compete with in the same industry. Selecting a supplier is not a simple task rather it is a complex problem which involves qualitative and quantitative multi-criteria. The objective of the study is to recommend the importance of a multi criteria decision making approach which is analytical hierarchy process (AHP) for supplier evaluation and selection. To reduce the time and effort in selecting a supplier, a multi-criteria decision model is used for evaluation and selection of suppliers with the proposed AHP model by scoring the performance of suppliers. The Analytical Hierarchy Process (AHP) is one of the various supplier selection approaches that are used to select the appropriate supplier. Therefore, an AHP supplier selection model is formulated and then applied to a given set of data for food and beverage manufacturing companies in Addis Ababa. The model provides a clear step to evaluate four criterion and thirteen sub criteria, depending on its importance in order to select the right supplier. In this study, probability sampling method is used. In order to undertake this research, by using simple random sampling techniques sample size of 35 food and beverage manufacturing industries in Addis Ababa were drawn from the valid target population of the study which is 39. Primary type of data was collected with the help of standard questionnaires and SPSS also used for the simple descriptive data to compute the percentage scores of each criterion and sub criteria. Summary of the findings of the study indicate that among the selected four criteria, quality is the first or best supplier selection criterion followed by price, delivery and service in respectively and among the suppliers considered in the study, Burayu Packaging and Printing Industry is the most preferred supplier followed by Ethiopian Pulp and Paper ,Unlimited Packaging and Minaye Packaging in respectively. Based on the findings the researcher recommended food and beverage manufacturing companies to give a high emphasis for quality during purchasing of packaging materials so as to save the overall implicit and explicit costs of companies and better to have a long term business relationship supply chain agreement with Burayu Packaging and Printing Industry or the next most preferred supplier which is Ethiopian Pulp and Paper so as to save a sustainable and consistent packaging supply.

Key words: Supplier selection, Supplier selection Criteria, Analytical Hierarchy Process, Supplier Evaluation, Purchasing, Supply Chain Management

Chapter One

1. Introduction

1.1 Background of the Study

No matter what industry a business is, if its motto is to avail its products to respected customers safely and attractively, it must become aware of the different packing materials in order to avoid damaging during shipment time. Packaging is a complex industry which meets the needs of other industries through the delivery of packaging materials. “The Package is the silent salesman” (Rundh, 2005). Good packaging promotes the image of the owner organization of the product and vice versa.

Packaging commonly involves carton box, paper wrapper, plastic, glass, bottle, packet, wood, metal and etc. Among these carton boxes are the most familiar form of packaging and it has made significant contributions either as a primary pack or secondary pack. Carton boxes have successfully replaced other forms of packaging and are now being widely used for packaging of fruits and vegetables, chemicals, flowers, canned food stuffs, soap & detergent products, etc.

Previously manufacturing industries had been exercising a traditional slogan “just produce a good product with the least price and it will sell itself”. However, nowadays, following the emergence of several local and imported products cutthroat competition the marketing philosophy is getting changed. In today’s highly competitive environment, an effective supplier selection is very important to the success of any manufacturing organization (Liu & Hai, 2005). Simply looking for vendors offering the least price is not an efficient sourcing any more.

Carton Box is supplied by both domestic producers in Ethiopia and foreign suppliers through importing. Following various carton box suppliers have varied strengths and weaknesses, evaluating and selecting the best and suitable supplier is very important for buyers. Suppliers have to be selected carefully, as they can have a very positive or a very adverse impact on the overall performance of the organization (Ramanathan, 2007).

“In manufacturing industries the procurement cost of raw materials from the outside suppliers and the other unquantifiable attributes such as quality of the materials and the time of delivery are substantially crucial and nearly 70 to 80 percent of the total cost involved in the

whole product development phase. Selecting the right suppliers is key to the procurement process and represents a major opportunity for companies to reduce costs. On the other hand, selecting the wrong suppliers can cause operational and financial problems”(Weber, Current, & Benton, 1991) as cited in Ussein C., Mohammad D. and Muthu S.(2014).

In our country usually buyers have not been using a scientific way of selecting the right supplier (Tewodros Mesfin, 2007). Moreover, the researcher observed that price is a major supplier selection criterion and in some cases a sole criterion to evaluate and select the winner supplier. Therefore wise and an effective supplier evaluation and selection process is a decisive process for sourcing department and it can play a key role in overall cost reduction.

According to Bernard W. Taylor (2006) there are three techniques that can be used to solve problems when organizations have multiple objectives. These are Goal Programming, the Analytical Hierarchy Process (AHP) and Scoring Models. The AHP is identified to assist in decision making to resolve the supplier selection process in choosing the optimal supplier combination (Tam & Tummala, 2001). In this regard, an interesting work on supplier selection problem was studied by Dickson and many other researchers.

As cited in (Tahriri et al 2008), Dickson’s study was based on a questionnaire sent to 273 purchasing agents and managers selected from various companies and he used 23 criteria in his study and these 23 criteria ranked with respect to their importance observed in 1966. Dickson asked the respondents to assess the importance of each criterion on a five point of scale of extreme, considerable, average, slight and no importance. Based on respondents reply “quality” is the most important criterion followed by “on time delivery” & “performance history”.

Accordingly, as cited in Tahriri et al.(2008), Weber et al.(1991) investigated 74 published articles on supplier selection in between 1966 & 1991 and Zhang ,Lia, Cao & Ng (2003) conducted on 49 published articles on supplier selection in between 1991 & 2003 based on the 23 criteria of Dickson’s study. The studies concluded that price, quality and delivery were the most important supplier selection criteria (Alsuwehri, 2011).

According to Temesgen Garoma and Shimels Diriba (2014) it is believed that AHP is quiet a powerful model particularly in multi-criteria decision making given the complexity of the problem in supplier selection, however it is not familiar in various industries.

Based on various literatures using AHP approach some most frequently top ranked supplier selection criteria used for the supplier selection process of carton box suppliers in food and beverage producers who need carton box so as to pack, avail and distribute their products safely to their customers who dwells in all directions of Ethiopia region. Effective packaging can help control inventory carry costs and help logistics efficiency (Rundh, 2005).

Therefore here the researcher considered important using the AHP for carton box suppliers' evaluation selection in large and medium scale food and beverage industries located in Addis Ababa. As a result the study would help the selected manufacturing firms on how to select the appropriate supplier(s) in reducing purchasing risk as well as optimizing the overall procurement cost using the above mentioned scientific approach.

1.2 Statement of the Problem

Decision making through a thorough and wise form of supplier evaluation and selection is one of the most important activities in companies and making the right decisions have a significant outcome on companies' profit and success. Purchasing managers or concerned heads need reliable and true forecasts for their decisions and they should consider scientific criteria. The selection of appropriate supplier(s) is a very important problem for any organization and requires consideration of a multitude of factors, some of which can be quantitative, while some can be qualitative (Ramanathan, 2007).

According to Bernard W. Taylor (2006) a decision making problem is selecting the most appropriate and suitable alternative criteria and the supplier selection problem can be solved with Multiple-Criteria Decision Making (MCDM). In MCDM, a problem is affected by several conflicting factors in supplying selection, for which a purchasing manager must analyze the trade-off among several criteria. MCDM techniques support the decision-makers in evaluating a set of alternatives. Depending upon the purchasing situations, criteria have varying importance, and there is a need to weight them (Dulmin and Mininno, 2003). To choose the right supplier(s), different methods can be used. In this paper the researcher used AHP model to determine the appropriate carton box packaging supplier(s) for the food and beverage manufacturing industries who dwell in Addis Ababa.

The supplier evaluation and selection process deploys a remarkable amount of any organization's financial resources. In return, organizations expect significant benefits from contracting with suppliers offering high value. Supplier selection is not a process of selecting suppliers who offer the least price amongst the competitors. Rather it is a process of selecting the best supplier(s) who can fulfill the best deal of the buyer based on the criteria set for competitors as well. The most important criteria in potential supplier evaluation and selection are: Quality, Delivery, Cost and Innovation (Tahriri *et al.* 2008). The three criteria most often considered by firms for selecting new suppliers are price, quality and delivery (Matiwos,2011).

“Packaging has a sales promotion role on products beyond wrapping products and it helps to attract and influence consumers’ attention towards the product from wide range of similar products. When given the choice between two products, equal in price and function, targeted consumers buy the one they consider to be more attractive” (Rundh,2005). According to Tewodros Mesfin(2007), this fact has been disregarded by our indigenous manufacturing industries and it has been wrongly interpreted that sourcing packaging items at lower price contributes a lot in minimizing the total cost of production and maximize profit as well.

According to Matiws (2011), the main activities of a purchasing manager were to beat up potential suppliers on price and they buy products from the lowest cost supplier that could be found. Similarly, while the researcher was working at one of local well known carton box packaging suppliers, he observed that many carton box packaging users used to evaluate and select potential suppliers using price. The potential supplier who offers least price declared to be the winner supplier and used to take the award of the offer.

Nevertheless, getting inputs at lesser price, not necessarily assist in maximizing the overall profit of the company rather the vice versa may happen. Therefore using only one or two criterion is insufficient to choose the right supplier whether it is price or any other criteria. According to Monczka,Trent, and Hadfield (2005) most purchasing experts agree that there is no one best way to evaluate and select suppliers. Carton box packaging Suppliers evaluation and selection is currently a subject of great importance to food manufacturing industries in Ethiopia, because it has a connection with food safety and sanitation to the society.

Especially for packaging, selecting the potential supplier who merely offered least price has the connotation of disregarding at least one relevant criteria including quality of packaging which might cause for contamination of the packed food. In accordance with the Food, Medicine & Healthcare Administration & Control proclamation no. 661/2009 of Ethiopia ,using poor package has a directly impact on the packed food and which is hazard for the users and the society at large and the proclamation required manufacturers to use standard primary and secondary packages for their food products.

The procurement departments of many manufacturing industries in Ethiopia has been using least price selection criteria and quality of items is often compromised (Tewodros Mesfin, 2007). A traditional way of supplier selection method usually focuses on one or two criterion to select the winner supplier for their sourcing of packaging materials knowingly or unknowingly without giving a due attention for other decisive supplier selection criteria.

While the researcher was working at one of local well known carton box packaging suppliers, he observed that many carton box packaging users of food and beverage manufacturing firms who dwell in Addis Ababa and other regions used to select among carton box suppliers who use to offer least price by disregarding other features of packaging like quality and services and these users since they used price only for comparison, they might award various carton box suppliers for same product at various times when they demand it. This habit lay them in difficulty of having a reliable, strategic and long term supplier and susceptible to have a loose bondage in forming supplier relationship Management (SLM). The researcher also observed that, carton box packaging users of food and beverage manufacturing firms who dwell in Addis Ababa used to face a number of complaints and reactions from their downstream customers due to poor quality of packaging and related defects in facilitating the logistics and transport activity till the products avails to every corner of the country.

Therefore the study took in to consideration the main criteria and sub criteria which are fundamental in evaluating and selecting carton box packaging suppliers using a scientific approach. The study tried to develop a model for selecting the best carton box packaging supplier(s) mix who is/are more capable of satisfying carton box packaging users or buyers than its competitors with in the same industry.

1.3 Research Questions

To achieve its objectives, based on the average respondents' opinion the study has raised the following research questions:-

- What looks the preferred weight priority result of each selected criteria & sub criteria?
- Which supplier selection criterion is/are most preferred criteria?
- Which supplier(s) is/are the most preferred supplier among others considered in the study?
- What looks the rank given by the respondents for few main domestic carton box suppliers with regards to some selected criteria?

1.4 Objectives of the Study

The overall objective of the study is to make available the basis of a multi criteria decision making approach for supplier evaluation and selection in order to solve supplier selection problems through developing supplier evaluation & selection model using AHP.

The specific objectives are:-

- To identify the weight priority result of selected criteria and sub criteria amongst the selected manufacturing industries
- To identify the criteria that have the majority weight among other criteria after the supplier selection process
- To determine the most important priorities to be adopted in the supplier selection process
- To identify the ranks given for few main domestic carton box suppliers in regards to some selected criteria.

1.5 Significance of the Study

By developing a multi-criteria decision making model to identify the degree of importance of some selected criteria for supplier selection process on carton box suppliers' evaluation and selection process on large and medium scale food and beverage manufacturing industries using AHP which enables them to maximize the value creation amongst the supply chain members.

This study believed to contribute on how to select appropriate carton box suppliers in suitable manner so as to reduce purchasing risk as well as optimizing the overall procurement costs using AHP approach by undertaking the suppliers' evaluation and selection process.

1.6 Scope and Limitations of the Study

The scope of this study demarcates to carton box packaging only on large and medium scale food and beverage producers in Addis Ababa and which makes the study specific on the packaging type usually used for packaging of food products in Addis Ababa only. Moreover since the presence of too many criteria in AHP criteria makes the pair wise comparison difficult and time consuming, for the effectiveness of the study only four criteria and thirteen sub criteria used to evaluate and select the right supplier(s).

The study used only standard questionnaire, quantitative method of data analysis and only primary data's were analyzed. Better result could have been obtained by conducting in-depth interviews with food and beverage manufacturing firms purchasing managers, concerned heads and other experts. The result of the study may have limitations to make generalizations and make them applicable to other factories which dwelled all over the country. Moreover, due to time shortage the study did not consider the opinions of carton box packaging suppliers.

1.7 General Outline of the Paper

The thesis is composed of five chapters which are constructed systematically and the information is flown coherently as follows:-

Chapter one is the introduction which includes background of the study, statement of the problem, research questions, objectives of the study, significance of the study, scope & limitations of the study and general outline of the paper.

The second chapter is review of related literatures which deals on introduction, theoretical review, objectives of purchasing, procurement functions, responsibilities of purchasing, principles of purchasing, types of suppliers, supplier selection process, supplier selection stages, supplier selection using AHP method, supplier selection criteria used in the previous studies, description of selected criteria considered in this study, pair-wise comparison steps with respect to the selected criteria, overview of the practice of supplier selection using AHP and conceptual framework.

The third chapter deals with methodology which covers research design, the selection of target population, sampling technique and sample size, data types and source, research strategy, research framework used in this study, data analysis & interpretation and ethical consideration.

Chapter four holds the discussion and analysis part of the study which covers pair wise comparison with respect to four criteria, pair wise comparison with respect to quality sub criteria, pair wise comparison with respect to price sub criteria, pair wise comparison with respect to delivery sub criteria, pair wise comparison with respect to service sub criteria and pair wise comparison of four local suppliers.

The last chapter which is chapter five deals on the summary of the findings, conclusion and recommendations of the study.

Chapter Two

2. Related Literature Review

The second chapter is review of related literatures which deals on introduction, theoretical review, objectives of purchasing, procurement functions, responsibilities of purchasing, principles of purchasing, types of suppliers, supplier selection process, supplier selection stages, supplier selection using AHP method, supplier selection criteria used in the previous studies, description of selected criteria considered in this study, pair-wise comparison steps with respect to the selected criteria, overview of the practice of supplier selection using AHP and conceptual framework.

2.1 Introduction

Supplier selection is the responsibility of the purchasing department or other concerned department and it requires a consideration of several factors. Liu and Hai (2005) indicated that the main function of the purchasing department includes the acquisition of required material, services and equipment for all types of organizations. If the buyer chooses the right supplier, the buyer can promote its competitive advantage in the market.

2.2 Theoretical Review

Analytical Hierarchy Process is a method for ranking decision alternatives and selecting the best one given multiple criteria (Bernard W.,2006).

Procurement is a process of obtaining goods and services by various means (Matiwos, 2011). It is favorable that the goods/services are appropriate and that they are procured at the best possible cost to meet the needs of the purchaser in terms of quality and quantity, time, and location (Mangan, Lawani, and Butcher, 2008).

Purchasing is a process by which a company contracts with third parties to obtain goods and services required to fulfill its business objectives in the most timely and cost effective manner (Matiwos,2011) .

Sourcing refers to the value added strategic management tool to ensure access to adequate resources (Vasina, 2008).

Supplier refers to the partner of supply chain members who offer the required goods and services (Johan,2011).

Supplier Evaluation refers to measurement of suppliers service in all aspects so as to have a sustainable co-operation between the customer firm and the supplier (Mangan *et al*, 2008).

Supplier Selection refers to the specific function associated with identifying the preferred suppliers of goods and services from suppliers (Vasina, 2008).

Supplier Selection Process is the process by which firms identify, evaluate, and contract with suppliers (Van Weele , 2009) .

2.3 Objectives of Purchasing

Among various functions of any organization, purchasing is one of the decisive functions. The objective for the purchasing is "to acquire the right quality of material, at the right time, in the right quantity, from the right source, at the right price" (Baily, 2005). Though this definition is describing the basic principle of the purchasing it also simplifies the whole process too much as it is very hard to actually say how quality is the "right quality" for the packaging materials. Similarly, if the price would seem to be "right" for the seller it doesn't mean that the given price is the "right price" from the buyer's point of view. Therefore it is also good to take a look for the more concrete definitions and objectives for the purchasing (Vasina, 2008).

There are „six rights“ in procurement and they can be achieved through following specific objectives of procurement (Benslimane Y.; Plaisent, M.; and Bernard, 2005). These specific objectives are:-

- To buy quality materials, items and services economically from reliable sources;
- To ensure timely delivery through the selection of capable and efficient suppliers;
- To continuously locate, evaluate and develop economical and reliable supply sources;
- To identify the most reliable sources of supply through either open tender, multi-stage tendering (pre-qualifying suppliers and retaining only those that are capable of meeting the organization's requirements; strategic sourcing) and limited tendering.
- To investigate the availability of new materials and monitor trends in market prices;
- To buy in accordance with organizations policies;

2.4 Procurement Functions

As cited in Matiwas (2011), according to Hugos(2003) the procurement function can be broken in to five main activity categories: These are purchasing, consumption management, vendor selection, contract negotiation and contract management.

2.4.1 Purchasing

No organization is self-sufficient. Every organization is dependent on materials and services supplied by other organization and these requirements are acquired from others through purchasing activities. According to Matiwas (2011), purchasing activities are the routine activities related to issuing purchase orders for needed products which can be direct or indirect products.

2.4.2 Consumption Management

So as to provide uninterrupted flow of materials or services organizations need to know their annual consumption. According to Matiwas (2011), consumption management refers to an understanding of how much of what kinds of products are bought from whom and at what price.

2.4.3 Vendor Selection

Once there is an understanding of the actual consumption, the next activity is searching and selecting viable suppliers (Matiwas,2011).

2.4.4 Contract Negotiation

As particular business needs arise, contracts must be negotiated with individual vendors on the preferred vendor list (Matiwas, 2011).

2.4.5 Contract Management

Once contracts are in place, vendor performance against these contracts must be measured and managed (Matiwas,2011).

2.5 Responsibilities of Purchasing

The overall responsibility of the purchasing function is to make materials and services requirements available for use to ensure smooth operations of the organizations. As cited in

Mikael J.(2009), according to Leenders (2002) some of the responsibilities of purchasing are mentioned as follows:-

2.5.1 Provide Un interrupted flow of materials and services

If materials or services are not available when it is required, the operation of the organization will not be smooth. Therefore it is the responsibility of the purchasing managers to make sure that the required materials and services are available for use.

2.5.2 Maintain Adequate Quality Standards

The materials or services purchased should not only be in sufficient quantity but also it should be the desired quality.

2.5.3 To buy competitively and wisely

It refers to buying materials from the market when they are abundant.

2.5.4 Develop Reliable Supplier

It refers to organizations or firms from which the buyers buy goods and services.

2.5.5 Achieve a harmonious relationship with partners

It refers to working closely with suppliers, other functional groups and etc supply chain members.

2.6 Principles of Purchasing

Purchasing is an organizational activity which concerned with the acquisition of materials and services. According to Baily (2001) the principles of purchasing are Right Quantity, Right Quality, Right Place, Right Time, Right Supplier , Right Price and Right Service as follows:-.

2.6.1 Right Quantity

It refers to acquiring the required number of materials or services for the smooth operation of any organization or firm.

2.6.2 Right Quality

It refers to acquiring the desired state of condition or specification of materials or services for the smooth operation of any organization or firm.

2.6.3 Right Place

It refers to acquiring the required materials or services at the place where it is needed for the smooth operation of any organization or firm.

2.6.4 Right Time

It refers to acquiring the required materials or services at the time when it is needed for the smooth operation of any organization or firm.

2.6.5 Right Supplier

It refers to acquiring the required materials or services from the appropriate supplier for the smooth operation of any organization or firm.

2.6.6 Right Price

It refers to acquiring the required materials or services from the appropriate supplier with an affordable price for the smooth operation of any organization or firm.

2.6.7 Right Service

It refers to acquiring the required materials or services from the appropriate supplier with the required additional values for the smooth operation of any organization or firm.

2.7 Types of Suppliers

According to Lesonsky (2001) Suppliers can be divided into four general categories: These are manufacturers, distributors, independent craftspeople and importation sources.

The first category is the manufacturers who most retailers buy through company salespeople or independent representatives who handle the wares of several different companies. Prices from these sources are usually lowest, unless the retailer's location makes shipping freight costly (Lesonsky, 2001).

The second type of suppliers is the distributors who are also known as wholesalers, brokers or jobbers, distributors buy in quantity from several manufacturers and warehouse the goods for sale to retailers. Although their prices are higher than manufacturers, they can supply retailers with small orders from a variety of manufacturers. A lower freight bill and quick delivery time from a nearby distributor often compensates for the higher per-item cost (Lesonsky,2001).

The third kind is the independent craftspeople that are exclusive distributors of unique creations frequently offered by these independent craftspeople, who sell through representatives or at trade shows (Lesonsky,2001).

The last category of suppliers is the importation sources in which many retailers buy foreign goods from a domestic importer, who operates much like a domestic wholesaler. Or, depending on the company's familiarity with overseas sources, they may want to import goods (Lesonsky,2001).

2.8 Supplier Selection Process

Supplier selection is the process by which buyers identify, evaluate, and form a contractual agreement with the preferred supplier(s). When an organization decides to acquire a product or service from other organizations, supplier selection will be an important issue. As cited in Johan (2011), according to de Boer, L., Labro, E. and Morlacchi, P. (2001) the supplier selection process is divided into four phases. These are problem definition, formulation of criteria, qualification and final selection.

2.8.1 Problem Definition

The first phase is characterized by the objective to determine the ultimate problem of why supplier selection is an appropriate line of action. It can also be described as finding out what an organization wants to achieve by selecting a supplier (Johan, 2011).

2.8.2 Formulation of Criteria

The second phase is the formulation of criteria where relevant criteria are defined. These criteria should reflect what the buying organization demands from a potential supplier (Johan, 2011).

2.8.3 Qualification

The third phase is not always easily distinguished from final selection, and may therefore not always be easily identified in a real life context per definition. Nevertheless, the qualification phase refers to the process of reducing the set of all available suppliers to a more narrow set of acceptable suppliers (Johan, 2011).

2.8.4 Final Selection

The last phase in the supplier selection process is referred to as final selection or choice. In this phase the buying organization selects a supplier or a number of suppliers to solve the problem stated in the first phase. The final selection phase takes the magnitude of the actual selection into consideration. More specific, the final selection phase can be characterized as single-deals, package-deals or multiple deals (Johan, 2011).

2.9 Supplier Selection Stages

According to Vasina (2014), the main stages in the process of supplier selection are categorized into seven phases. These are defining business need, determining specification, agreeing on measuring criteria, identifying alternatives, supplier selection, purchasing and performance evaluation.

2.9.1 Defining Business Need

“The first and one of the most challenging steps is defining the importance of some business need. The decision can be simple or complicated. While someone can simply answer the question “Do we need it?” another (with his different point of view) can continue with the question “Why do we need it?”, and finally the last person would argue with “Do we really need it?”. The dilemma always takes place in many situations, and purchasing is not an exception. From the very beginning it is necessary to understand the full picture of the actions that are going to be done, to realize the current situation and the problem that requires solution, to identify the initial risks in the procurement process, and make sure that development is relevant for the business need” (Vasina, 2014).

2.9.2 Determining Specification

At the stage of determining specifications a company identifies specific issues or parameters concerning the expected product or service. This stage is about estimating what the company would like to get at the end or so called “ideal end product”. In other words, determining specifications is the information that can describe the product and set a minimum\maximum requirement (Vasina, 2014).

2.9.3 Agreeing on Measuring Criteria

After all criteria are listed, they need to be prioritized and a scoring mechanism needs to be developed at this stage. This should be done in order to minimize the time for later criteria evaluation and automate the process. The stage of agreeing measuring criteria can also include preparation of questionnaire or any other relevant documentation to be issued (Vasina, 2014).

2.9.4 Identifying Buying Alternatives

The stage four purchasing process is identifying buying alternatives. There are two main questions to be covered during this stage: who are the potential suppliers and where to get information about them, and which sourcing strategy to choose. The first question is quite simple. There are many sources how to obtain information. The easiest way is, of course, the internet (Vasina, 2014).

2.9.5 Supplier Selection

Supplier Selection is part of the purchasing process and it requires significant work in the area of management and includes several steps such as creating the initial list of potential suppliers, evaluating its suitability to the organizational goals and objectives, supplier pre-selection, negotiation, final supplier selection, negotiating terms of agreement and contract, and, as final step, the reviewing and approval of decision (Vasina, 2014).

2.9.6 Purchasing

After negotiation is done and the final step of agreeing on the contract terms is finalized, the supplier can be approved by the manager, and the operational process of physical obtaining goods can be started (Vasina, 2014).

2.9.7 Performance Evaluation

The last stage represents performance evaluation and continuous improvement. The objective of this stage is to reduce the future risks connected to purchases and to both new and already known suppliers, to reduce costs, to save time by automating the purchasing process, to mitigate the negative effect in case of uncertainty. The performance criterion is used to evaluate the partnership including all aspects starting from the negotiation process to the final results (Vasina, 2014).

2.10 Supplier Selection using AHP Method

Supplier selection methods are the models or approaches used to conduct the supplier selection process (Li, C.C. and Fun, Y.P, 1997). There are several well-known multi-criteria decision making criteria used for supplier selection or to solve various problems when they have multiple objectives. Some of the techniques are Goal programming, Linear Programming, Score Model, AHP etc. Among these, AHP was introduced by Saaty in 1980. According to Omkarprasad & Kumar (2006), it is one of the most widely used multiple criteria decision-making tool at the hands of decision makers and researchers. Yahya and Kinsman (1999) used Saaty's (1980) AHP method to determine priority in selecting suppliers.

The AHP method consists of several important steps: outlining the shapeless problem into shape, obtaining the AHP hierarchical relationships, forming pair wise comparison matrices, approximating the relative weights, examining the consistency and finally attaining the overall ranking (Lee, Chen and Chang, 2008). Giving weight to every criterion can defer each criterion from another depends on its importance. The AHP approach uses this principle to evaluate alternatives.

The AHP method is identified to assist in decision making to resolve the supplier selection problem in choosing the optimal supplier combination (Yu & Jing, 2004). Considering the existing problems in the company initiating from wrong supplier selection, owing to the human mistakes in judging the raw materials, or paying too much attention to one criteria only, such as price, cost and other similar and unexpected problems, the AHP model is highly recommended to handle the supplier selection more accurately in order to alleviate, or better yet, eradicate the mistakes in this line.

There are many strongest features of the AHP, for example it generates numerical priorities from the biased knowledge articulated in the estimates of paired comparison matrices. The method is surely useful in evaluating suppliers' weights in marketing, or in ranking order for instance. It is, however, difficult to determine suitable weight and order of each alternative. It has been shown that different weights among objects give rise to different results in ranking (Liu & Hai, 2005).

According to Tahriri, Osman, Ali and Yusuf (2008), AHP is the most commonly used tool for supplier selection problem as compared to several other mathematical as well as analytical tools.

This statement is also supported by other studies such as Politis, Klumpp and Celebi, 2010; Chakraborty, Ghosh and Dan, 2011; Onder and Dag, 2013; Ayhan, 2013. Since it is relatively simple to use, understand and incorporates qualitative and quantitative criteria, AHP is one of the most commonly applied methods in supplier selection practice. Thus the purpose of this study was to develop a model using AHP approach for carton box packaging suppliers evaluation & selection process for the selected food and beverage manufacturing industries here in Addis Ababa based on some selected supplier selection criteria which were taken from related previous studies.

2.11 Supplier Selection Criteria used in the Previous Studies

A number of conceptual papers have been published in the last decades that emphasized the designed importance of the supplier selection process and evaluated the relative importance of various suppliers and evaluation selection criteria and other supplier attributes in the supplier selection process.

Previous studies had been surveyed to find out the most important criteria for supplier selection. They have indicated that supplier selection is of great importance for both the private and public sectors and should not be done without complete evaluation of those criteria influencing the selection process (Weber *et al.*, 1991) as cited in Maher H. Al-Rafati , 2008 .

The analysis of criteria for evaluation and selection of vendors has been the focus of many academicians and practitioners since mid of 1960s. As cited in Tahriri *et al* 2008, Shpend IMERI 2013 ,Hussein *et al* 2014 and Temesgen Garoma and Shimels Diriba 2014 some of these authors are Dickson(1966), Cardozo and Cagley (1971), Lamberson, L.R.,Diederich,D.,&Wuori, J (1976), Monczka, M.R., Giunipero, C.L., Reck, F.R (1981), Browning, J.M., Zabriskie, N.B., Huellmantel, A.B (1983), Buffa and Jackson (1983),Bender, P. S., Brown, R. W., Isaac, M. H., & Shapiro J. F (1985), Ansari Modarress (1986), Hahn, C.K., Kim, K.H. and Kim, J.S.(1986), Soukup(1987), Burton (1988), Bragg and Hahn(1989), Bernard (1989), Weber, C. A., J. r. Current & W. C. Benton (1991), Birch (2001), Zhang, Z., J. Lei, N. Cao, K.To& K. Ng (2003), Gonzalez, M.E., Quesada, G., Mora Monge, C.A (2004) and Guler (2008).

As cited in Tahriri *et al* 2008, Dickson (1966) was the first researcher who performed an extensive study on criteria. His study was to determine, identify, and analyze what criteria were

used in the selection of a firm as a supplier. According to Dickson(1966) the identified supplier selection criteria were twenty three in number .These are quality, delivery, performance history, warranties and claim policies, production facilities and capacities, price, technical capability, financial position, procedural compliance, communication system, reputation and Position in Industry, desire for business, management and organization, operating controls , repair service, attitude , impression , packaging ability, labor relations record, geographical location, amount of past business, training aids and reciprocal arrangements.

According to Cardozo and Cagley (1971) the identified important decision making criteria in selecting the right supplier were five in number .These are net price, delivery, quality, reputation and position in Industry. They provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that net price, delivery and quality have received the great amount of attention. According to their investigation, they ranked net price as the most important factor in the selection process followed by delivery, quality, reputation and position in Industry.

According to Lamberson *et al.* (1976) the identified supplier selection criteria were eight in number. These are quality, delivery, performance history, production facilities and capacities, net price, technical capability, financial position and management and organization. They provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, delivery and performance history have received the great amount of attention. According to their investigation, they ranked quality as the most important factor in the selection process followed by delivery, performance history, production facilities and capacities, net price, technical capability, financial position and management & organization.

According to Monczka *et al.* (1981) the identified supplier selection criteria were ten in number. These are quality, delivery, performance history, production facilities and capacities, net price, financial position, reputation and position in Industry, management and organization, labor relations record and geographical location. The researcher provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, delivery and performance history have received the great amount of attention. According to their investigation, they ranked quality as the most important factor in the selection process followed by delivery, performance history, production facilities and capacities, net price, financial

position, reputation and position in Industry, management & organization, labor relations record and geographical location.

According to Browning *et al.* (1983), the identified supplier selection criteria were five in number. These are delivery, quality, net price, technical capability and production facilities and capacities. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that delivery, quality and net price have received the great amount of attention. According to their investigation, they ranked delivery as the most important factor in the selection process followed by quality, net price, technical capability and production facilities and capacities.

According to Buffa and Jackson (1983) the identified supplier selection criteria were four in number. These are quality, delivery, performance history and net price. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, delivery and performance history have received the great amount of attention. According to their investigation, they ranked quality as the most important factor in the selection process followed by delivery, performance history and net price.

According to Bender *et al.* (1985), the identified supplier selection criteria were five in number. These are quality, delivery, performance history, production facilities and capacities and net price. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, delivery and performance history have received the great amount of attention. According to their investigation, they ranked quality as the most important factor in the selection process followed by delivery, performance history, production facilities and capacities and net price.

According to Ansari Modarress (1986) the identified supplier selection criteria were six in number. These are quality, delivery, net price, geographical location, attitude and packaging. The researcher provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, delivery and net price have received the great amount of attention. According to his investigation, he ranked quality as the most important factor in the selection process followed by delivery, net price, geographical location, attitude and packaging.

According to Hahn *et al.* (1986) the identified supplier selection criteria were six in number. These are quality, delivery, production facilities and capacities, net price, technical capability and geographical location. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, delivery and production facilities have received the great amount of attention. According to their investigation, they ranked quality as the most important factor in the selection process followed by delivery, production facilities and capacities, net price, technical capability and geographical location.

According to Soukup (1987) the identified supplier selection criteria were ten in number. These are quality, delivery, production facilities and capacities, net price, technical capability, financial position, desire for business, management and organization, attitude, and geographical location. The researcher provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, delivery and production facilities have received the great amount of attention. According to his investigation, he ranked quality as the most important factor in the selection process followed by delivery, production facilities and capacities, net price, technical capability, financial position, desire for business, management and organization, attitude, and geographical location.

According to Burton (1988) the identified supplier selection criteria were ten in number. These are quality, delivery, production facilities and capacities, net price, technical capability, packaging ability , geographical location, training aids, management and organization and operational and control. The researcher provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, delivery and production facilities have received the great amount of attention. According to his investigation, he ranked quality as the most important factor in the selection process followed by delivery, production facilities and capacities, net price, technical capability, packaging ability , geographical location, training aids, management and organization and operational & control.

According to Bragg and Hahn (1989) the identified supplier selection criteria were two in number. These are delivery and production facilities & capacities. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that delivery and production facilities and capacities have received the great amount of attention.

According to Bragg and Hahn (1989) investigation, they ranked delivery as the most important factor in the selection process followed by production facilities & capacities.

According to Bernard (1989) the identified supplier selection criteria were five in number. These are quality, delivery, net price, management and organization and service. The researcher provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, delivery and net price have received the great amount of attention. According to his investigation, he ranked quality as the most important factor in the selection process followed by delivery, net price, management and organization and service.

According to Weber *et al.* (1991) the identified supplier selection criteria were eight in number. These are quality, net price, delivery, production facilities and capacity, technical capability, financial position, performance history, warranties and claims. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, net price and delivery have received the great amount of attention. According to their investigation, they ranked delivery as the most important factor in the selection process followed by net price, delivery, production facilities and capacity, technical capability, financial position, performance history, warranties and claims.

According to Birch (2001), the identified supplier selection criteria were five in number. These are cost, logistics, quality, development and management. The researcher provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that cost, logistics and quality have received the great amount of attention. According to his investigation, he ranked cost as the most important factor in the selection process followed by logistics, quality, development and management.

According to Zhang *et al.* (2003), the identified supplier selection criteria were three in number. These are net price, quality and delivery. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that net price, quality and delivery have received the great amount of attention. According to their investigation, they ranked net price as the most important factor in the selection process followed by quality and delivery.

According to Gonzalez *et al.* (2004) the identified supplier selection criteria were three in number. These are quality, cost and productivity. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, cost and productivity have received the great amount of attention. According to their investigation, they ranked quality as the most important factor in the selection process followed by cost and productivity.

According to Tahriri, F. *et al.*(2008), the identified supplier selection criteria were four in number. These are quality, price, reliability, and capacity. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, price and reliability have received the great amount of attention. According to their investigation, they ranked quality as the most important factor in the selection process followed by price, reliability, and capacity.

According to Guler (2008) the identified supplier selection criteria were seven in number. These are product quality and performance, lead time, price, punctuality, quality practices, flexibility and level of cooperation. The researcher provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that product quality and performance, lead time and price have received the great amount of attention. According to his investigation, he ranked product quality and performance as the most important factor in the selection process followed by lead time, price, punctuality, quality practices, flexibility and level of cooperation.

According to Temesgen Garoma and Shimels Diriba (2014) the identified supplier selection criteria were six in number. These are quality, price, after sales service, delivery, financial position and reputation. The researchers provided a broad view of the criteria that might be considered in supplier selection decisions. It showed that quality, price and after sales service have received the great amount of attention. According to their investigation, they ranked quality as the most important factor in the selection process followed by price, after sales service, delivery, financial position and reputation.

According to Maher H. (2008) ,the findings of previous researches indicate that the importance of supplier selection criteria does vary based on the type of purchase and product and there is no common list of criteria used across supplier selection studies. To summarize, the supplier

selection process should not only consider price, but also a wide range of factors such as quality, delivery, service, performance history with a view to decision making by considering the whole seller capability in a long-term and sustainable way.

As it is mentioned above various authors identified and ranked many important decision making criteria in selecting the right supplies based on the subject matter they used to study. Among many supplier selection criteria identified by many authors: quality, price, delivery and service are the most frequently top ranked supplier selection criteria . So that this thesis considered the above mentioned four supplier selection main criterion evaluating and selection of carton box packaging suppliers.

2.12 Description of Selected Criteria Considered in this Study

The above mentioned research studies showed that supplier selection criteria changed from one author to the other author depends on the type of purchase and related matters. These criteria are key issues in the supplier selection process since it measures the performance of the suppliers. Among the above mentioned many criteria the supplier selection criterion which has been more frequently identified by various authors in the supplier selection such as quality, price, delivery and service level considered as a supplier selection criterion with some conveniently selected sub criteria which has used for supplier selection in this thesis. According to Alsuwehri (2011) and Temesgen Garoma and Shimels Diriba (2014) the selected four main criteria are mentioned as follows:-

2.12.1 Quality

It is the ability of suppliers to meet the customers` required specifications consistently. This criterion has been measured on the basis of the importance of the following sub criteria: package strength, quality consistency, quality system (ex. Certifying ISO 9000).

2.12.2 Price

The firm always requires the minimum price of the product to increase the profitability. The firm therefore must find a low-cost supply base where it can minimize manufacturing cost related to the production of the product. This criterion has been measured on the basis of the importance of the following sub criteria: competitive price, payment term, credit facility and standard price.

2.12.3 Delivery

It is the ability of suppliers to follow the predefined delivery schedule. This criterion has been measured on the basis of the importance of the following sub criteria: delivery speed, transportation facility and delivery commitment.

2.12.4 Service Levels

It refers to the performance of suppliers in providing holistic service to the manufacturers. This criterion has been measured on the basis of the importance of the following sub criteria: after sales service, technical support and ability to modify packaging.

2.13 Pair-wise Comparison steps with Respect to the Selected Criteria

According to Bernard W. Taylor (2006), in AHP the decision maker calculates how well each alternative scores on a criterion by using pair wise comparisons. In a pair wise comparison, the decision maker compares two alternatives or pairs according to one criterion and indicates a preference. For example, some top ranked selected criteria and sub criteria might compare with one another and some selected carton box packaging suppliers might compare with one another and it enables to decide which criteria is/are best criteria and which supplier is/are the strongest supplier amongst few selected and familiar carton box packaging suppliers. These comparisons are made by using a preference scale, which assigns numeric values to different levels of preference. In a pair wise comparison, two alternatives are compared according to a criterion, and one is preferred.

The AHP approach, as applied to the supplier selection problem, consists of the following five steps (Dickson 1966) as cited in Tahriri *et al* 2008 :-

1. Specify the set of criteria for evaluating the supplier's proposals.
2. Obtain the pair wise comparisons of the relative importance of the criteria in achieving the goal, and compute the priorities or weights of the criteria based on this Information
3. Obtain measures that describe the extent to which each supplier achieves the criteria.
4. Using the information in step 3, obtain the pair wise comparisons of the relative importance of the suppliers with respect to the criteria, and compute the corresponding priorities.
5. Using the results of steps 2 and 4, compute the priorities of each supplier in achieving the goal of the hierarchy.

According to Taylor, Bernard W.(2006), the steps incorporated under a pair wise comparison are the followings:-

Step 1 -Put a preference scale from number 1 to 9 for pair wise comparisons

Step 2 -Summing up of each values obtained in each column

Step 3 -Dividing each values obtained by its respected column sum value

Step 4 - Converting all fraction numbers of the column sum value to the nearest two digit decimal number

Step 5 - Computing the average value in each row

Step 6 - Getting the average rank of each criterion from the computed average value in each row

Step 7 - Identify the most preferred criteria among the other criteria considered in the analysis

2. 14 Overview of the Practice of Supplier Selection using AHP

According to Temesgen Garoma and Shimels Diriba (2014) in today's dynamic environment supplier selection decision presents organizations with a complex scenario and the age old tradition of selecting suppliers based on solitary criteria, mainly price and the practice of engaging in adversarial relation with suppliers is only history and in these parts of the world including Ethiopia the application of tools and models for supplier selection problem, in this case AHP approach, is not yet practiced as such in our country.

AHP is a powerful decision-aiding tool that can be used when making decisions considering the suitability of large number of selection factors and alternatives. It enables decision makers to use a simple hierarchy structure to deal with a complicated problem and to evaluate both quantitative and qualitative data in a systematic methodology under conflicting multi-criteria (Lee et al., 2008).

According to Tewodros Mesfin (2007) the procurement departments of many manufacturing industries in Ethiopia has been using a least price suppliers selection trends and they are unfamiliar with AHP supplier evaluation and selection approach. Therefore, since a traditional way of supplier selection method usually focuses on one or two criterion to select the winner

supplier for sourcing of packaging materials ,it is being wise to practice the scientific way of suppliers evaluation and selection process in this case using AHP method.

Oslah (2012) in his thesis concluded that there is limited scope to incorporate supplier performance evaluation in purchase decision of core products and even less for support products in Kenya Air ways. The study also concluded that as there was a low level practice of supplier performance evaluation in purchasing activity of both support and core products and the difficulty in implementing supplier performance evaluation with every employee who makes purchasing decisions.

2.15 Conceptual Framework

Since supplier evaluation and selection is a part of organizations main decisions, it is important to undertake a scientific approach of suppliers" evaluation and selection for the success of the food and beverage manufacturing organizations considered in the study. Figure 1 below is a representation of the conceptual framework around which this thesis evolves.

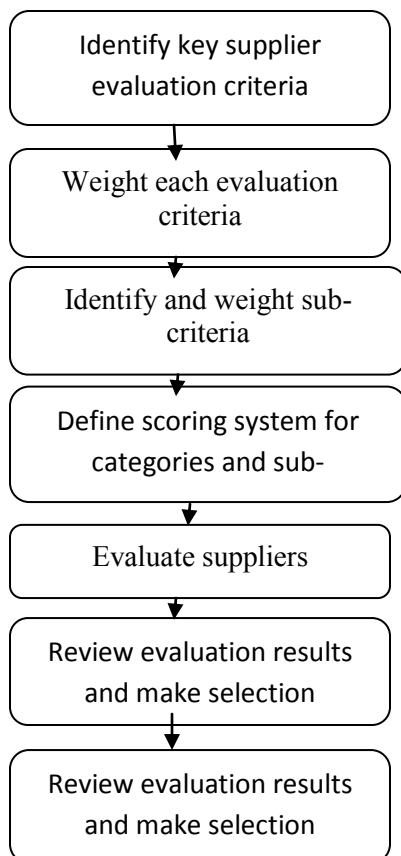


Figure 1 Conceptual framework adopted from Vasina E. (2014)

Chapter Three

3. Research Methodology

The third chapter deals with a description of the research methodologies used in this thesis which covers research design, the selection of target population, Sampling technique and sample size, data types and source, research strategy , research framework used in this study, data analysis & interpretation and ethical consideration as follows:-

3.1 Research Design

The research design adopted for the research consisted of five main stages:-

Stage 1

Related literatures on supplier selection criteria were briefly reviewed to identify the major selection criteria and sub criteria. These criteria and sub criteria were described in chapter two.

Stage 2

The selection criteria that were identified in stage one were used as a basis for formulating the standard pair wise comparison questionnaire.

Stage 3

In this stage, the standard pair wise comparison questionnaire was distributed to thirty five purchasing managers &/or supply chain managers working in the selected food and beverage manufacturing industries located in Addis Ababa.

Stage 4

Develop the priority ratings in Saaty's 9-point scale for the analysis of Analytical Hierarchy Process based supplier selection framework analysis.

Stage 5

Apply the model using a survey study and discuss the results of the application and give any necessary recommendations.

3.2 Selection of the Target Population

Target Population is the set of all elements that belong to a certain defined group to be studied to which the investigator wants to generalize his/her results. The target population for the study has included large and medium scale food manufacturing industries dwelling in Addis Ababa. According to Central Statistics Agency (2009/2010) the number of large and medium scale manufacturers of food products and beverages are 255 in number. As it is mentioned on table 3, even though flour factories, animal feed, cake, bakery and pastry companies categorized under food and beverage producers, since they do not use carton box packaging for their products it is excluded from the study and the valid target population for the study will be 39 factories.

According to Hussein *et al* 2014 reputation followed by past solid years supplier performance are the basic grounds to assess supplier capability. The study considered four local well known suppliers who have an annual production capacity of at least 10,000 ton & more than ten solid years" experience in producing carton box (EIC Annual Report, 2015). These are Ethiopian Pulp & Paper (Supplier 1), Burayu Packaging and Printing Industry (Supplier 2), Minaye Packaging (Supplier 3) & Unlimited Packaging (Supplier 4). Similarly those carton box users who have a solid experience of producing products which need carton box packaging were considered in the study so that the Central Statistics Agency (CSA) data for the year 2009/10 has been considered intentionally.

Table 1 Large and Medium Scale Food Manufacturing Industries in Addis Ababa

International Standard Industrial	Category	Number of Factories	Potential Packaging type	Remark
1511	Juice & Meat	4	Carton Box	Relevant for the study
1514	Edible oil	9	Carton Box	Relevant for the study
1531	Flour	46	Plastic Bag	Irrelevant for the study
1533	Animal Feed	14	Plastic Bag	Irrelevant for the study
1541	Café, Pastry & Bakery	156	Plastic Bag and Paper wrapper	Irrelevant for the study
1542	Candy	8	Carton Box	Relevant for the study
1544	Pasta, Macaroni & Biscuit	11	Carton Box	Relevant for the study
1549	Tea & coffee pack	3	Carton Box	Relevant for the study
1551	Liquor	2	Carton Box	Relevant for the study
1552	Wine	1	Carton Box	Relevant for the study
1553	Beer	1	Carton Box	Relevant for the study

Source: Central Statistics Agency Report (2009/2010)

3.3 Sampling Technique and Sample Size

Sample selection method can be probability or non-probability sampling method. A probability sampling method is a selection of sampling techniques in which the probability of each case being selected is known and is often equal for all cases. In this thesis a simple random sampling technique has been used.

One of the useful websites suggested by Adams (1999:95) for various sample size calculations is <http://www.surveysystem.com/sscalc.htm>. Thus, the sample size of this study will be 35 out of a valid target population size of 39 based on sample size calculator utilized on <http://www.surveysystem.com/sscalc.htm> at confidence level of 95 percent and confidence interval of 5 percent.

List of selected food and beverage manufacturing industries drawn using simple random sampling technique are : Universal Food, Abysson Food, Fafa Food, Addis Mojo Edible Oil, Kaliti Food, Yami Juice, National Alcohol, St.George Beer, Awash Wine, Boez Pasta, KOJJ Pasta, Meaza Juice, Upper Awash Agro Industry, Nas Food, Zewdu Mola Edible Oil Fac, Kokeb Flour Factory, D.H Geda flour factory, Presedent Food, Icha Flour Factory, Misrak Bread and Biscut, Shewa Bakery, Mexico Pastry, Roba Bakery, Alfarag, Abysiniya, Sarem Food, National Tobacco, Embut Bakery, Dil Edible Oil Factory, Tena edible oil, Kayo Candy, Yeab Pasta, Ethio agriseft, Selewa Candy and Tomoka Coffee.

3.4 Data types and sources

In this study, both primary and secondary data were used.

3.4.1 Primary data

The primary data was gathered through survey using standard questionnaires adopted from Maher H. (2008). It includes survey questionnaire to 35 purchasing managers or other concerned heads of selected manufacturing industries:-

- ✓ so as to identify the degree of importance of each criterion in their eyes
- ✓ to compare each pair of the criteria, sub criteria and alternatives (suppliers) used in the supplier selection and
- ✓ to identify to what extent one criterion or alternative is more/less important/preferred to another.

3.4.2 Secondary data

The main sources for the required secondary data for this research were previously conducted researches on supplier selection, published and unpublished journals, books and other relevant literatures which enable the study to realize the intended objective.

3.5 Research Strategy

The type of research strategies are often classified in to: survey, experimental, case study, focus group discussion, content analysis, etc. Among these based on data collection from the respondents a survey strategy has been used using standard questionnaires adopted from Maher H.(2008).

3.6 Research Framework used in this Study

Based on Alsuwehri (2011) the research paper followed six major steps in implementing AHP in supplier selection process:-

3.6.1 Define Criteria for Supplier Selection

The first step in any supplier rating procedure is to establish the criteria to be used for assessing the supplier. To comply with the criteria for supplier selection and their importance required data were collected based on the consideration of various literatures and in this case four relevant criteria selected from various related literatures (Alsuwehri, 2011).

3.6.2 Define Sub-criteria for Supplier Selection

The definition of the sub criteria has been done for supplier selection based on the above mentioned criteria with the consideration of selected relevant literatures and in this case thirteen sub criteria has been selected (Alsuwehri, 2011).

3.6.3 Structure the Hierarchical Model

This step refers to building the AHP hierarchy model and calculating the weights of each levels of supplier selection model (Alsuwehri, 2011).

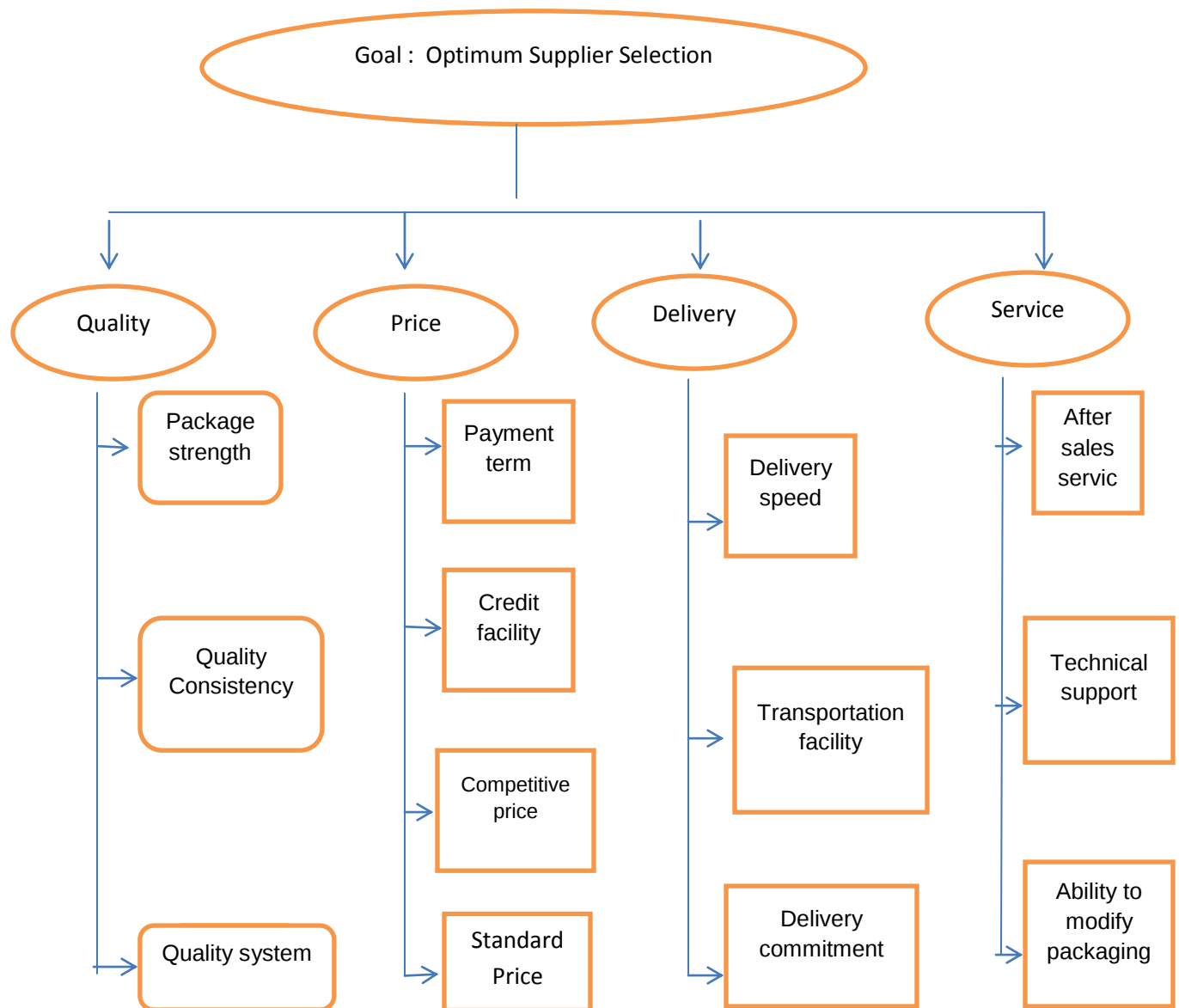


Figure 2 An Illustrative Decision Hierarchy for Supplier Selection

Source: Alsuwehri (2011)

According to Bernard (2006), goal programming is a method that provides us with a mathematical "quantity" for the decision variables that best achieves a set of goals. It answers the question "How much?" The analytical hierarchy process (AHP), developed by Thomas Saaty, is a method for ranking decision alternatives and selecting the best one when the decision maker has multiple objectives, or criteria, on which to base the decision. Thus, it answers the question "Which one?" A decision maker usually has several alternatives from which to choose when making a decision.

For example, someone buying a house might have several houses for sale from which to choose; someone buying a new car might have several makes and styles to consider; and a prospective student might select a college to attend from a group of schools. In each of these examples, the decision maker would typically make a decision based on how the alternatives compare, according to several criteria. For example, a home buyer might consider the cost, proximity of schools, trees, neighborhood, and public transportation when comparing several houses; a car buyer might compare different cars based on price, interior comfort, mileage per gallon, and appearance. In each case, the decision maker will select the alternative that best meets his or her decision criteria.

In AHP, it uses pair-wise comparisons to determine preferences between alternatives. It is to compare two elements at a time. This method tried to construct the relative importance matrix of the various criteria using the nine-point scale developed by Saaty as demonstrated on table 2.

Table 2 Preference Scale for Pair wise Comparisons

S. No	Intensity of importance	Definition	Explanation
1	9	Extreme importance	The evidence favouring one element over another is of the highest possible order of affirmation
2	7	Very strong importance	One element is favoured very strongly over another
3	5	Strong importance	Experience and judgement strongly favour one element over another
4	3	Moderate importance	Experience and judgement slightly favour one element over another
5	1	Equal importance	Two elements contribute equally to the objective
6	2,4,6&8		Intermediate values between two adjacent judgments (when compromise is needed)

Souce: Saaty(2000)

In the fundamental scale shown on table 2 above it can be seen three different columns excluding the serial number column. The most common way to display the intensity of importance of certain factor compared to another is to make a scale of 9 different steps.

This scale shouldn't be viewed in a way that how many times is one larger than the other (1 vs. 2), but rather to think how large a fraction is one out of the other .

As fundamental scale is describing the small differences of importance's between two objectives it is very hard to determine a strict line between two intensity of importance. So according to Thomas Saaty, to get a bit more distinction between the importance's it is widely agreed to leave out the 2nd, 4th, 6th and 8th intensity of importance out and use only the uneven levels (i.e S.No. 1-5 of table 1). This way the distinction between two factors can be done more specifically and easily than just by guessing the distinction in one way or the other (Saaty, 2000). After constructing the pair-wise comparison matrix and making the normalization computation to form the matrix elements into a common scale, we can obtain the priority ranking of the criteria through calculating row averages.

Meanwhile, doing a consistency check is an essential step of implementing the AHP method. It verifies the consistency, thus the acceptance, of priority judgments. It measures how consistent the judgments have been comparing to large samples of purely random judgments.

The consistency ratio (CR) computation formula is: $CR = \text{Consistency Index (CI)} / \text{Random Consistency Index (RI)}$. As $Ax = \lambda_{\max}X$, where A is denoted as the pair-wise comparison matrix and X as row averages, CI can be calculated by

$$CI = (\lambda_{\max} - n) / (n - 1) \quad \text{where } n \text{ represents the number of criteria}$$

Then the corresponding value of RI is found in the Saaty's table below (Table 3)

Table 3 RI Values for n Items Being Compared

N	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.51

Using the responding RI found in the above table, we can receive the consistency ratio $CR = CI/RI$. If the CR value is less than 0.1(10 percent), then we can say the judgments are consistent and acceptable. Similarly, if the CR value is more than 0.1 or 10 percent , then we can say the judgments are inconsistent and not acceptable.

3.6.4 Prioritize the Order of Criteria/Sub-criteria

Having completed mathematical calculations, comparisons of criteria and allocating weights for each criterion in each level is performed; the next step is prioritizing the order of criteria or sub-criteria according to the results of each criterion and respective sub criteria weight score (Alsuwehri, 2011).

3.6.5 Measure Supplier Performance

After weighting the AHP model for determining priority weight for alternatives and testing the model, the next step is measuring the suppliers' performance so as to identify their preference ranks with regards to the four criteria (Alsuwehri, 2011).

According to Hussein *et al* 2014 reputation followed by past solid years supplier performance are the basic grounds to assess supplier capability. The study considered four local well known suppliers who have an annual production capacity of at least 10,000 ton & more than ten solid years' experience in producing carton box (EIC Annual Report, 2015). These are Ethiopian Pulp & Paper (Supplier 1), Burayu Packaging and Printing Industry (Supplier 2), Minaye Packaging (Supplier 3) & Unlimited Packaging (Supplier 4). Similarly those carton box users who have a solid experience of producing products which need carton box packaging were considered in the study so that the Central Statistics Agency (CSA) data for year 2009/10 has been considered intentionally.

3.6.6 Identify Supplier Priority and Selection

After the final score of each supplier's result and identified rank, the last step is selecting the appropriate/best supplier(s) in supplier selection process with respect to each criterion (Alsuwehri, 2011).

3.7 Data Analysis and Interpretation

This thesis considered that once data obtained from the pair wise comparison questionnaire (Appendix 1) which stated in the form of likert scale questionnaire get responded from the respondents, the following step was analyzing the data using AHP model. Here the respondents averagely preferred suggestion with regards to each criteria and sub criteria has been analyzed and interpreted accordingly. Statistical package for social science also used for the simple descriptive data to compute the percentage scores of each criterion and sub criteria. Having done

such analysis, it is presented using tables, figures and percentages. Ultimately, interpretation of data and discussions of the findings follows.

3.8 Ethical Consideration

In order to secure the consent of the research, the researcher communicated to the respondents about the details and the aims of the study. And the researcher stated to the participants that they have to participate in the research willingly. Moreover, the researcher ensured to the respondents not to disclose all of the data collected from their end and the researcher assured them that all the collected data used only for this study.

Chapter Four

4. Discussion and Analysis

A survey questionnaire approach was used for gathering the data to assess the order of importance of the supplier selection criteria. From the hierarchy tree, the researcher developed a questionnaire to enable pair wise comparisons between all the selection criteria at each level in the hierarchy. The pair wise comparison process elicits qualitative judgments that indicate the strength of a group of decision makers' preference in a specific comparison according to Saaty's 1-9 scale.

A purchasing manager &/or supply chain manager of each selected manufacturing firms were requested to respond to several pair wise comparisons where two categories at a time were compared with respect to the goal. Result of the survey questionnaire technique was then used as input for the AHP.

The data shown in the under mentioned tables deployed to derive estimate of the criteria priorities. The priorities provide a measure of the relative importance of each criterion. Essentially, the following four steps can be utilized to synthesize the pair wise comparison matrix. These are:-

- a) Total the elements or values in each column
- b) Divide each element of the matrix by its column sum
- c) Conversion of all values to decimal numbers
- d) Determine average value and the priority rank of each criteria by finding the row averages

A decision maker usually has several alternatives from which to choose when making a decision. The objective of the study is to select the best criteria mix of supplier selection for carton box packaging amongst food manufacturing industries who dwelled in Addis so as to expedite the smooth flow of their operation.

Using pair wise comparison the researcher tried to analyze the empirical data obtained from the 90 percent of the total respondents summarized in the under mentioned table manner. Among 35 respondents 31 respondents correctly filled and returned the questionnaire and the remaining 3 questionnaire were not returned and 1 questionnaire was incomplete so that the valid data generated from 31 respondents thoroughly analyzed accordingly.

Chapter four holds the discussion and analysis part of the study which covers pair wise comparison with respect to four criteria, pair wise comparison with respect to quality sub criteria, pair wise comparison with respect to price sub criteria, pair wise comparison with respect to delivery sub criteria, pair wise comparison with respect to service sub criteria and pair wise comparison of four local suppliers as follows:-

4.1 Pair wise Comparison with Respect to Four Criteria

The selected supplier selection criteria in the study are quality, price, delivery and service. The respondents' average response analysis is computed in the under mentioned tables (i.e. table 4 to table 9) as follows. Among the various supplier selection criteria the preference scale for pair wise comparison is mentioned on table 4.

Therefore in the under mentioned table a good performance on quality, the criterion for the second row, is equally to moderately preferred than price (shown by the value of 2), which is moderately preferred than delivery and service (shown by the values of 3). A good performance on price, the criterion for the third row, is equally to moderately preferred than delivery (shown by the value of 2) and moderately to strongly preferred than service (shown by the value of 4). A good performance on delivery, the criterion for the fourth row, is equally to moderately preferred than service (shown by the value of 2). Similarly for fraction values for example, assuming that the pair-wise comparison of quality to delivery is 3, or equivalently a 3 to 1 ratio, it follows that the pair-wise comparison of delivery to quality is a 1 to 3 ratio, or $1/3$ and etc... . A value of 1 is assigned to the diagonal elements since quality (row) is equally preferred to quality (column) and etc....

Table 4 Pair-wise Comparison Matrix with Respect to the Selected Criteria

S.N	Criteria	Quality	Price	Delivery	Service
1	Quality	1	2	3	3
2	Price	$\frac{1}{2}$	1	2	4
3	Delivery	$\frac{1}{3}$	$\frac{1}{2}$	1	2
4	Service	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{2}$	1

The above table depicts that based on Saaty's scale, the average respondents' response implies that, quality is equally to moderately preferred, moderately preferred and moderately preferred than price, delivery and service in respectively. Using table 4 the researcher tried to follow an AHP analysis steps and the next step is summing up of each values in each column in the under mentioned table manner.

Table 5 Pair-wise Comparison Matrix and Column Sums of the Selected Criteria

S.N	Criteria	Quality	Price	Delivery	Service
1	Quality	1	2	3	3
2	Price	$\frac{1}{2}$	1	2	4
3	Delivery	$\frac{1}{3}$	$\frac{1}{2}$	1	2
4	Service	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{2}$	1
SUM		13/6	15/4	13/2	10

Once the column sums of the selected criteria computed, the next step is dividing each elements by its respected column sum value as per the under mentioned table detail.

Table 6 Division of Each Value in a Column by Its Corresponding Column Sum

S.N	Criteria	Quality	Price	Delivery	Service
1	Quality	6/13	8/15	6/13	3/10
2	Price	3/13	4/15	4/13	4/10
3	Delivery	2/13	2/15	2/13	2/10
4	Service	2/13	1/15	1/13	1/10

Having the ratio of each value with column sum, the next step is converting all fraction numbers to the nearest two digit decimal number as follows:-

Table 7 Conversion of All Values to Decimal Numbers

S.N	Criteria	Quality	Price	Delivery	Service
1	Quality	0.46	0.53	0.46	0.30
2	Price	0.24	0.27	0.31	0.40
3	Delivery	0.15	0.13	0.15	0.20
4	Service	0.15	0.07	0.08	0.10

Once all AHP values in decimal number form computed, the next step is computing the average value in each row as per the under mentioned table manner.

Table 8 Average Value of Each Row

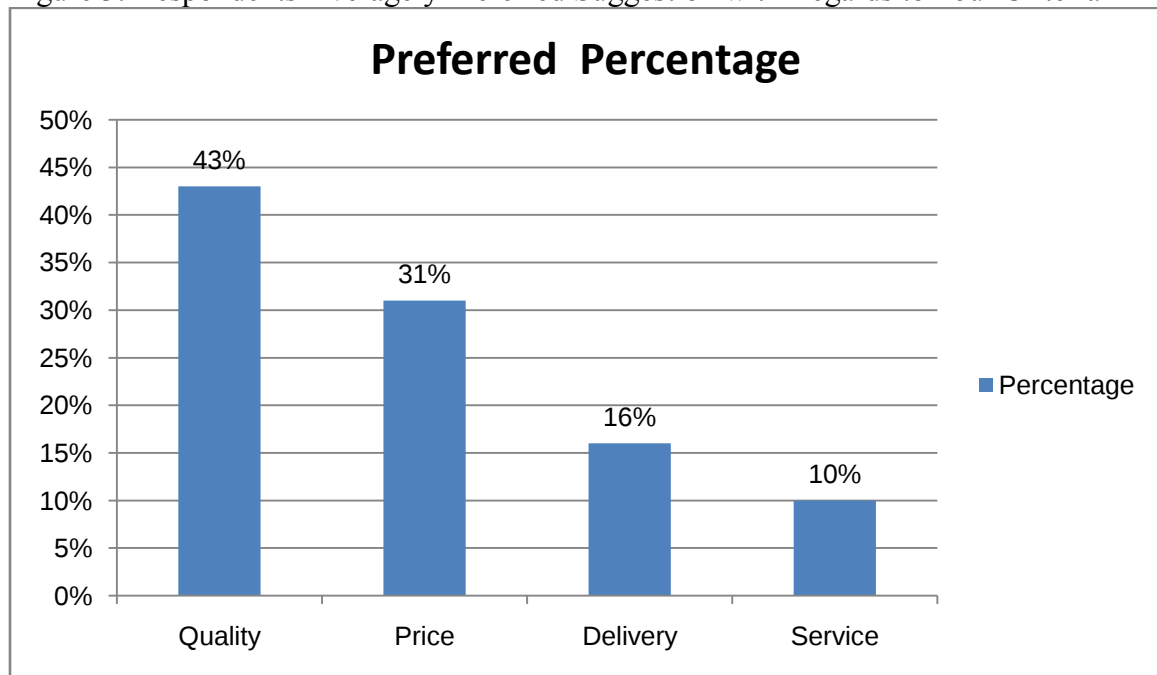
S.N	Criteria	Quality	Price	Delivery	Service	Average Value
1	Quality	0.46	0.53	0.46	0.30	0.43
2	Price	0.24	0.27	0.31	0.40	0.31
3	Delivery	0.15	0.13	0.15	0.20	0.16
4	Service	0.15	0.07	0.08	0.10	0.10

Table 9 Priority Rank of Various Criteria

S.N	Criteria	Average Value	Priority Rank
1	Quality	0.43	1 st
2	Price	0.31	2 nd
3	Delivery	0.16	3 rd
4	Service	0.10	4 th

The average computed values for quality, price, delivery and service are 0.43, 0.31, 0.16 and 0.10 in respectively. Table 9 shows that quality is the best supplier selection criterion followed by price, delivery and service.

Figure 3: Respondents Averagely Preferred Suggestion with Regards to Four Criteria



As per the analytical hierarchy process which is a method for ranking decision alternatives and selecting the best one when the decision maker has multiple objectives, or criteria, on which to base the decision quality, price, delivery and service has got 1st, 2nd, 3rd and 4th rank in respectively. This means while evaluating and selecting potential suppliers, food manufacturing companies could be intelligent to give 43 percent priority for quality, 31 percent priority for price, 16 percent priority for delivery and the remaining 10 percent priority for service. This helps food manufacturers to procure quality carton box packaging and by this to deliver quality products as per their customers' preference so as to have a sustainable competitive advantage over its rivals and the like.

So as to demonstrate how to compute the consistency index (CI), the researcher checked the consistency of the pair wise comparisons for the above mentioned four selection criteria according to Bernard W. (2006). Here the steps need to be followed is by taking all the values mentioned on table 4 and multiply each value with the average value computed on table 9 in respective with each criteria as follows:-

$$\left\{ \begin{array}{ccccc} & \text{Quality} & \text{Price} & \text{Delivery} & \text{Service} \\ \text{Quality} & 1 & 2 & 3 & 3 \\ \text{Price} & 1/2 & 1 & 2 & 4 \\ \text{Delivery} & 1/3 & 1/2 & 1 & 2 \\ \text{Service} & 1/3 & 1/4 & 1/2 & 1 \end{array} \right\} \times \left\{ \begin{array}{c} 0.43 \\ 0.31 \\ 0.16 \\ 0.10 \end{array} \right\}$$

Here the next step is computing the total value of each criterion as follows:-

$$\text{Quality} = (1 \times 0.43) + (2 \times 0.31) + (3 \times 0.16) + (3 \times 0.10) = \mathbf{1.83}$$

$$\text{Price} = (1/2 \times 0.43) + (1 \times 0.31) + (2 \times 0.16) + (4 \times 0.10) = \mathbf{1.24}$$

$$\text{Delivery} = (1/3 \times 0.43) + (1/2 \times 0.31) + (1 \times 0.16) + (2 \times 0.10) = \mathbf{0.65}$$

$$\text{Service} = (1/3 \times 0.43) + (1/4 \times 0.31) + (1/2 \times 0.16) + (1 \times 0.10) = \mathbf{0.40}$$

Once the total value of each criterion computed, the next step need to be divide each of these values by the corresponding weights from the criteria preference vector by their respected ranked average value i.e. 0.43, 0.31, 0.16 and 0.10 for quality, price, delivery and service in respectively as follows:-

$$\text{➤ } 1.83/0.43 = 4.25$$

$$\text{➤ } 1.24/0.31 = 4.00$$

$$\text{➤ } 0.65/0.16 = 4.06$$

$$\text{➤ } 0.40/0.10 = \underline{4.00}$$

SUM 16.31

Next, averaged these values by summing them and dividing by the number of criteria we are comparing in this case 4 and the result will be $16.31/4$ which is 4.08. Once it is computed the average value, the consistency index (CI) is computed using the formula:-

$$\text{CI} = \frac{4.08 - n}{n - 1} \quad \text{Which is} \quad \frac{4.08 - 4}{4 - 1} = 0.08/3 = \underline{\underline{0.03}}$$

According to Bernard W. (2006), If $CI = 0$, then manufacturing industries would be a perfectly consistent decision maker. Since 0.03 is not perfectly consistent, the next question is the degree of inconsistency that is acceptable. An acceptable level of consistency is determined by comparing the consistency index(CI) to a random index (RI) which is the consistency index of a randomly generated pair wise comparison matrix as follows:-

The degree of consistency for the pair wise comparisons in the decision criteria matrix is determined by computing the ratio of CI to RI which is $CI/RI=0.03/0.90=0.03$. Therefore here the degree of consistency is satisfactory if $CI/RI < 0.10$ (Bernard W.,2006) , and in this case 3 percent is less than 10 percent and the under taken AHP results is meaningful.

4.2 Pair wise Comparison with Respect to Quality Sub criteria

The selected supplier selection sub criteria under quality are package strength, quality consistency and quality system. The respondents' average response analysis is computed in the under mentioned tables (i.e. table 10 to table 15) as follows. Among the various supplier selection sub criteria the preference scale for pair wise comparisons is mentioned on table 10.

Therefore in the under mentioned table a good performance on package strength, the criterion for the second row, is moderately preferred than quality consistency (shown by the value of 3), which is strongly preferred than quality system (shown by the values of 5). A good performance on quality consistency, the criterion for the third row, is equally to moderately preferred than quality system (shown by the value of 2). Similarly for fraction values for example, assuming that the pair-wise comparison of package strength to quality consistency is 3, or equivalently a 3 to 1 ratio, it follows that the pair-wise comparison of quality consistency to package strength is a 1 to 3 ratio, or $1/3$ and etc... . A value of 1 is assigned to the diagonal elements since package strength (row) is equally preferred to package strength (column) and etc....

Table 10 Pair-wise Comparison Matrix with Respect to Quality Sub criteria

S.N	Sub Criteria	Package Strength	Quality Consistency	Quality System
1	Package Strength	1	3	5
2	Quality Consistency	$1/3$	1	2
3	Quality System	$1/5$	$1/2$	1

The above table depicts that based on Saaty's scale, the average respondents' response implies that package strength is moderately preferred and strongly preferred than quality consistency and quality system in respectively. Using table 4 the researcher tried to follow an AHP analysis steps and the next step is summing up of each values in each column in the under mentioned table manner. Using table 10 the researcher tried to follow an AHP analysis steps and the next step is summing up of each values in each column in the under mentioned table manner.

Table 11 Pair-wise Comparison Matrix and Column Sums of the *Quality Sub criteria*

S.N	Sub Criteria	Package Strength	Quality Consistency	Quality System
1	Package Strength	1	3	5
2	Quality Consistency	1/3	1	2
3	Quality System	1/5	1/2	1
SUM		23/15	9/2	8

Once the column sums of the selected criteria computed, the next step is dividing each elements by its respected column sum value as per the under mentioned table detail.

Table 12 Division of Each Value in a Column by Its Corresponding Column Sum

S.N	Sub Criteria	Package Strength	Quality Consistency	Quality System
1	Package Strength	15/23	6/9	5/8
2	Quality Consistency	5/23	2/9	2/8
3	Quality System	3/23	1/9	1/8

Having the ratio of each value with column sum, the next step is converting all fraction numbers to the nearest two digit decimal number as follows:-

Table 13 Conversion of All Values to Decimal Numbers

S.N	Sub Criteria	Package Strength	Quality Consistency	Quality System
1	Package Strength	0.65	0.66	0.62
2	Quality Consistency	0.21	0.22	0.25
3	Quality System	0.14	0.12	0.13

Once all AHP values in decimal number form computed, the next step is computing the average value in each row as per the under mentioned table manner.

Table 14 Average Value of Each Row

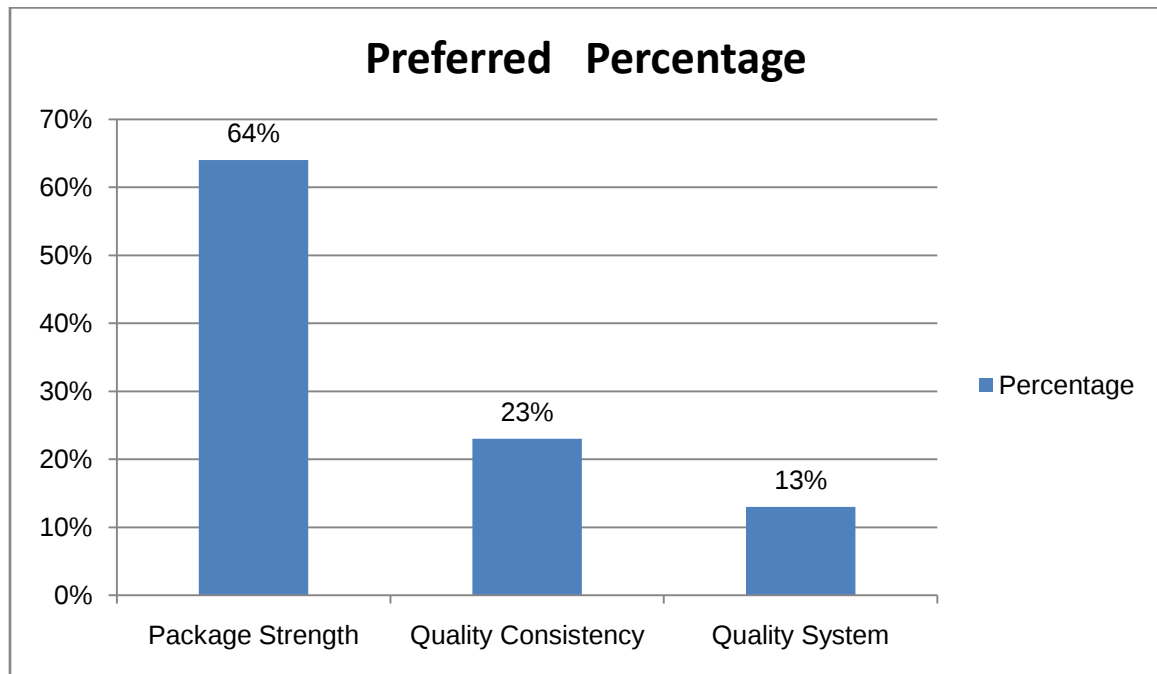
S.N	Sub Criteria	Package Strength	Quality Consistency	Quality System	Average Value
1	Package Strength	0.65	0.66	0.62	0.64
2	Quality Consistency	0.21	0.22	0.25	0.23
3	Quality System	0.14	0.12	0.13	0.13

Table 15 Priority Rank of Various Quality Sub criterion

S.N	Sub Criteria	Average Value	Priority Rank
1	Package Strength	0.64	1 st
2	Quality Consistency	0.23	2 nd
3	Quality System	0.13	3 rd

The average computed values for package strength, quality consistency and quality system are 0.64, 0.23 and 0.13 in respectively. Table 15 shows that package strength is the best supplier selection sub criterion followed by quality consistency and quality system.

Figure 4: Respondents Averagely Preferred Suggestion with Regards to Quality Sub criteria



As per the analytical hierarchy process which is a method for ranking decision alternatives and selecting the best one sub criteria when the decision maker has multiple sub criteria, on which to base the decision package strength, quality consistency and quality system has got 1st, 2nd and 3rd rank in respectively. This means while evaluating and selecting potential suppliers, food manufacturing companies could be intelligent to give 64 percent priority for package strength, 23 percent priority for quality consistency and 13 percent priority for quality system. This helps food manufacturers to procure quality carton box packaging and by this to deliver quality products as per their customers' preference so as to have a sustainable competitive advantage over its rivals and the like.

4.3 Pair wise Comparison with Respect to Price Sub criteria

The selected supplier selection sub criteria under price are competitive price, payment term, standard price and credit facility. The respondents' average response analysis is computed in the under mentioned tables (i.e. table 16 to table 21) as follows. Among the various supplier selection sub criteria the preference scale for pair wise comparisons is mentioned on table 16.

Therefore in the under mentioned table a good performance on competitive price , the criterion for the second row, is equally to moderately preferred than payment term and credit facility (shown by the value of 2), which is moderately preferred than standard price (shown by the values of 3). A good performance on standard price, the criterion for the fourth row, is equally to moderately preferred than payment term and credit facility (shown by the value of 2). Similarly for fraction values for example, assuming that the pair-wise comparison of competitive price to standard price is 3, or equivalently a 3 to 1 ratio, it follows that the pair-wise comparison of standard price to competitive price is a 1 to 3 ratio, or 1/3 and etc... . A value of 1 is assigned to the diagonal elements since competitive price (row) is equally preferred to competitive price (column) and etc....

Table 16 Pair-wise Comparison Matrix with Respect to *Price Sub criteria*

S.N	Sub Criteria	Competitive Price	Payment term	Standard Price	Credit Facility
1	Competitive Price	1	2	3	2
2	Payment term	1/2	1	1	1
3	Standard Price	1/3	2	1	2
4	Credit Facility	1/2	1	1/2	1

The above table depicts that based on Saaty's scale the average respondents' response implies that competitive price is equally to moderately preferred, moderately preferred and equally to moderately preferred than payment term , standard price and credit facility in respectively. Using table 16 the researcher tried to follow an AHP analysis steps and the next step is summing up of each values in each column in the under mentioned table manner.

Table 17 Pair-wise Comparison Matrix and Column Sums of Price Sub criteria

S.N	Sub Criteria	Competitive Price	Payment term	Standard Price	Credit Facility
1	Competitive Price	1	2	3	2
2	Payment term	1/2	1	1	1
3	Standard Price	1/3	2	1	2
4	Credit Facility	1/2	1	1/2	1
SUM		14/6	6	11/2	6

Once the column sums of the selected sub criteria computed, the next step is dividing each elements by its respected column sum value as per the under mentioned table detail.

Table 18 Division of Each Value in a Column by its Corresponding Column Sum

S.N	Sub Criteria	Competitive Price	Payment term	Standard Price	Credit Facility
1	Competitive Price	6/14	2/6	6/11	2/6
2	Payment term	3/14	1/6	2/11	1/6
3	Standard Price	2/14	2/6	2/11	2/6
4	Credit Facility	3/14	1/6	1/11	1/6

Having the ratio of each value with column sum, the next step is converting all fraction numbers to the nearest two digit decimal number as follows:-

Table 19 Conversion of All Values to Decimal Numbers

S.N	Sub Criteria	Competitive Price	Payment term	Standard Price	Credit Facility
1	Competitive Price	0.43	0.33	0.55	0.33
2	Payment term	0.21	0.17	0.18	0.17
3	Standard Price	0.15	0.33	0.18	0.33
4	Credit Facility	0.21	0.17	0.09	0.17

Once all AHP values in decimal number form computed, the next step is computing the average value in each row as per the under mentioned table manner.

Table 20 Average Value of Each Row

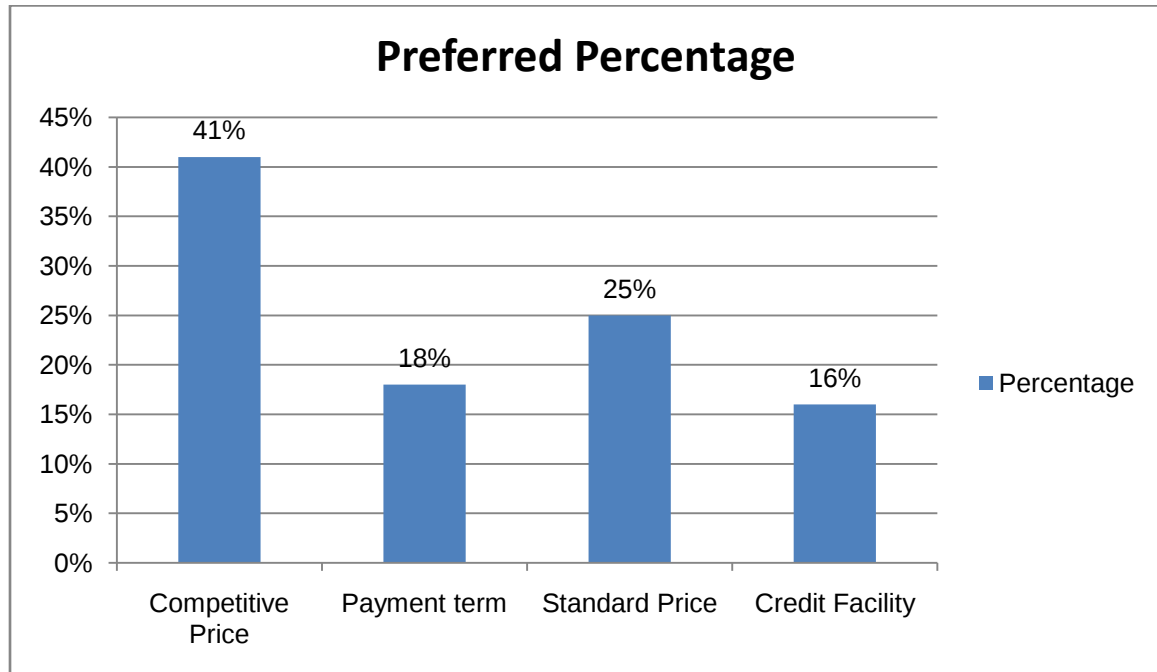
S. N	Sub Criteria	Competitive Price	Payment term	Standard Price	Credit Facility	Average Value
1	Competitive Price	0.43	0.33	0.55	0.33	0.41
2	Payment term	0.21	0.17	0.18	0.17	0.18
3	Standard Price	0.15	0.33	0.18	0.33	0.25
4	Credit Facility	0.21	0.17	0.09	0.17	0.16

Table 21 Priority Rank of Various Price Sub criterion

S.N	Sub Criteria	Average Value	Priority Rank
1	Competitive Price	0.41	1 st
2	Payment term	0.18	3 rd
3	Standard Price	0.25	2 nd
4	Credit Facility	0.16	4 th

The average computed values for competitive price, payment term, standard price and credit facility are 0.41, 0.18, 0.25 and 0.16 in respectively. Table 21 shows that competitive price is the best supplier selection sub criterion followed by standard price, payment term and credit facility.

Figure 5: Respondents Averagely Preferred Suggestion with Regards to Price Sub criteria



As per the analytical hierarchy process which is a method for ranking decision alternatives and selecting the best one sub criteria when the decision maker has multiple sub criteria, on which to base the decision competitive price, standard price, payment term and credit facility has got 1st, 2nd , 3rd and 4th rank in respectively. This means while evaluating and selecting potential suppliers, food manufacturing companies could be intelligent to give 41 percent priority for competitive price, 25 percent priority for standard price, 18 percent priority for payment term and 16 percent priority for credit facility. This helps food manufacturers to procure quality carton box packaging and by this to deliver quality products as per their customers` preference so as to have a sustainable competitive advantage over its rivals and the like.

4.4 Pair wise Comparison with Respect to Delivery Sub criteria

The selected supplier selection sub criteria under delivery are delivery speed, transportation facility and delivery commitment. The respondents` average response analysis is computed in the under mentioned tables (i.e. table22 to table 27) as follows. Among the various supplier selection sub criteria the preference scale for pair wise comparisons is mentioned on table 22.

Therefore in the under mentioned table a good performance on delivery speed, the criterion for the second row, is strongly preferred than transportation facility (shown by the value of 5), which is moderately preferred than delivery commitment (shown by the values of 3). A good performance on delivery commitment, the criterion for the fourth row, is moderately preferred than transportation facility (shown by the value of 3). Similarly for fraction values for example, assuming that the pair-wise comparison of delivery speed to delivery commitment is 3, or equivalently a 3 to 1 ratio, it follows that the pair-wise comparison of delivery commitment to delivery speed is a 1 to 3 ratio, or 1/3 and etc... . A value of 1 is assigned to the diagonal elements since delivery speed (row) is equally preferred to delivery speed (column) and etc....

Table 22 Pair-wise Comparison Matrix with Respect to *Delivery Sub criteria*

S.N	Sub Criteria	Delivery speed	Transportation facility	Delivery commitment
1	Delivery speed	1	5	3
2	Transportation facility	1/5	1	1/3
3	Delivery commitment	1/3	3	1

The above table depicts that based on Saaty's scale the average respondents' response implies that delivery speed is strongly preferred and moderately preferred than transportation facility and delivery commitment in respectively. Using table 22 the researcher tried to follow an AHP analysis steps and the next step is summing up of each values in each column in the under mentioned table manner.

Table 23 Pair-wise Comparison Matrix and Column Sums of *Delivery Sub criteria*

S.N	Sub Criteria	Delivery speed	Transportation facility	Delivery commitment
1	Delivery speed	1	5	3
2	Transportation facility	1/5	1	1/3
3	Delivery commitment	1/3	3	1
SUM		23/15	9	13/3

Once the column sums of the selected sub criteria computed, the next step is dividing each elements by its respected column sum value as per the under mentioned table detail.

Table 24 Division of Each Value in a Column by Its Corresponding Column Sum

S.N	Sub Criteria	Delivery speed	Transportation facility	Delivery commitment
1	Delivery speed	15/23	5/9	9/13
2	Transportation facility	3/23	1/9	1/13
3	Delivery commitment	5/23	3/9	3/13

Having the ratio of each value with column sum, the next step is converting all fraction numbers to the nearest two digit decimal number as follows:-

Table 25 Conversion of All Values to Decimal Numbers

S.N	Sub Criteria	Delivery speed	Transportation facility	Delivery commitment
1	Delivery speed	0.65	0.56	0.69
2	Transportation facility	0.13	0.11	0.08
3	Delivery commitment	0.22	0.33	0.23

Once we get all AHP values in decimal number form, the next step is computing the average value in each row as per the under mentioned table manner.

Table 26 Average Value of Each Row

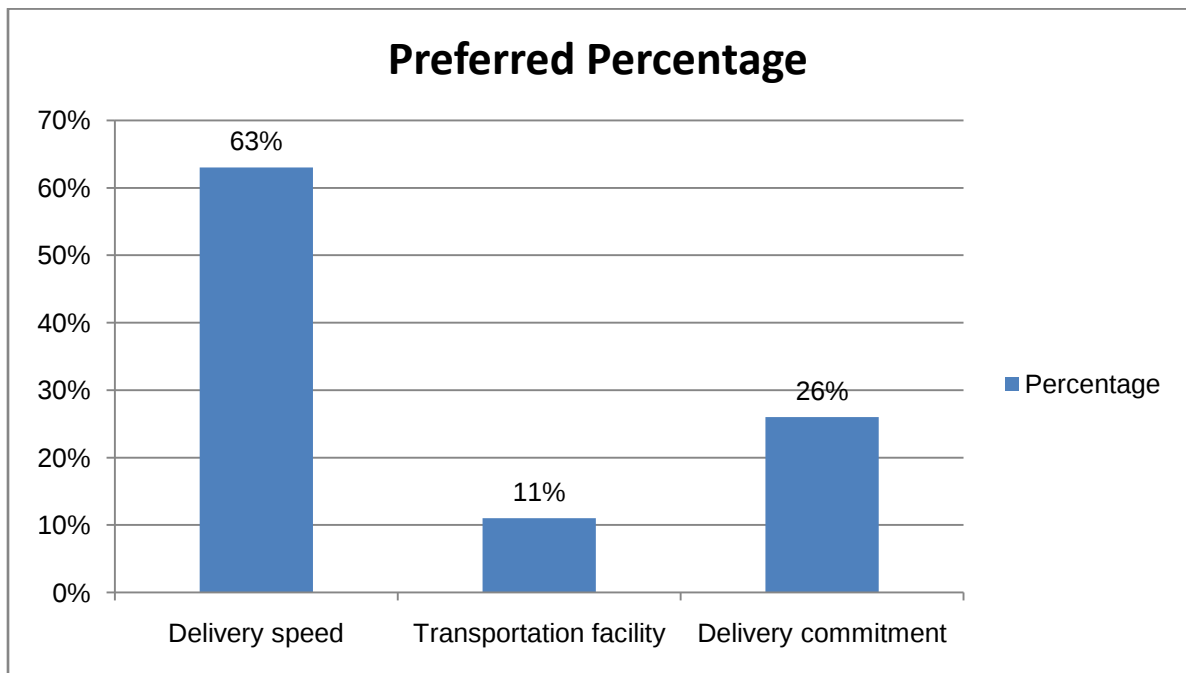
S.N	Sub Criteria	Delivery speed	Transportation facility	Delivery commitment	Average Value
1	Delivery speed	0.65	0.56	0.69	0.63
2	Transportation facility	0.13	0.11	0.08	0.11
3	Delivery commitment	0.22	0.33	0.23	0.26

Table 27 Priority Rank of Various Delivery Sub criterion

S.N	Sub Criteria	Average Value	Priority Rank
1	Delivery speed	0.63	1 st
2	Transportation facility	0.11	3 rd
3	Delivery commitment	0.26	2 nd

The average computed values for delivery speed, transportation facility and delivery commitment are 0.63, 0.11 and 0.26 in respectively. Table 27 shows that delivery speed is the best supplier selection sub criterion followed by delivery commitment and transportation facility.

Figure 6: Respondents Averagely Preferred Suggestion with Regards to Delivery Sub criteria



As per the analytical hierarchy process which is a method for ranking decision alternatives and selecting the best one sub criteria when the decision maker has multiple sub criteria, on which to base the decision delivery speed, delivery commitment and transportation facility has got 1st, 2nd and 3rd rank in respectively. This means while evaluating and selecting potential suppliers, food manufacturing companies could be intelligent to give 63 percent priority for delivery speed,

26 percent priority for delivery commitment and 11 percent priority for transportation facility. This helps food manufacturers to procure quality carton box packaging and by this to deliver quality products as per their customers` preference so as to have a sustainable competitive advantage over its rivals and the like.

4.5 Pair wise Comparison with Respect to Service Sub criteria

The selected supplier selection sub criteria under service are after sales service, technical support and ability to modify packaging. The respondents` average response analysis is computed in the under mentioned tables (i.e. table 28 to table 33) as follows. Among the various supplier selection sub criteria the preference scale for pair wise comparisons is mentioned on table 28.

Therefore in the under mentioned table a good performance on after sales service, the criterion for the second row, is equally to moderately preferred than technical support (shown by the value of 2). A good performance on ability to modify packaging , the criterion for the fourth row, is equally to moderately preferred than after sales service (shown by the value of 2). Similarly for fraction values for example, assuming that the pair-wise comparison of after sales service to technical support is 2, or equivalently a 2 to 1 ratio, it follows that the pair-wise comparison of technical support to after sales service is a 1 to 2 ratio, or 1/2 and etc... . A value of 1 is assigned to the diagonal elements since after sales service (row) is equally preferred to after sales service (column) and etc....

Table 28 Pair-wise Comparison Matrix with Respect to Service Sub criteria

S.N	Sub Criteria	After sales service	Technical Support	Ability to modify packaging
1	After sales service	1	2	1/2
2	Technical Support	1/2	1	1
3	Ability to modify packaging	2	1	1

The above table depicts that based on Saaty`s scale the average respondents` response implies that after sales service is equally to moderately preferred than technical support and ability to modify package is equally to moderately preferred than after sales service.

Using table 28 the researcher tried to follow an AHP analysis steps and the next step is summing up of each values in each column in the under mentioned table manner.

Table 29 Pair-wise Comparison Matrix and Column Sums of Service Sub criteria

S.N	Sub Criteria	After sales service	Technical Support	Ability to modify packaging
1	After sales service	1	2	1/2
2	Technical Support	1/2	1	1
3	Ability to modify packaging	2	1	1
SUM		7/2	4	5/2

Once we did the column sums of the selected sub criteria, the next step is dividing each elements by its respected column sum value as per the under mentioned table detail.

Table 30 Division of Each Value in a Column by Its Corresponding Column Sum

S.N	Sub Criteria	After sales service	Technical Support	Ability to modify packaging
1	After sales service	2/7	2/4	1/5
2	Technical Support	1/7	1/4	2/5
3	Ability to modify packaging	4/7	1/4	2/5

Having the ratio of each value with column sum, the next step is converting all fraction numbers to the nearest two digit decimal number as follows:-

Table 31 Conversion of All Values to Decimal Numbers

S.N	Sub Criteria	After sales service	Technical Support	Ability to modify packaging
1	After sales service	0.28	0.50	0.20
2	Technical Support	0.14	0.25	0.40
3	Ability to modify packaging	0.58	0.25	0.40

Once all AHP values in decimal number form computed, the next step is computing the average value in each row as per the under mentioned table manner.

Table 32 Average Value of Each Row

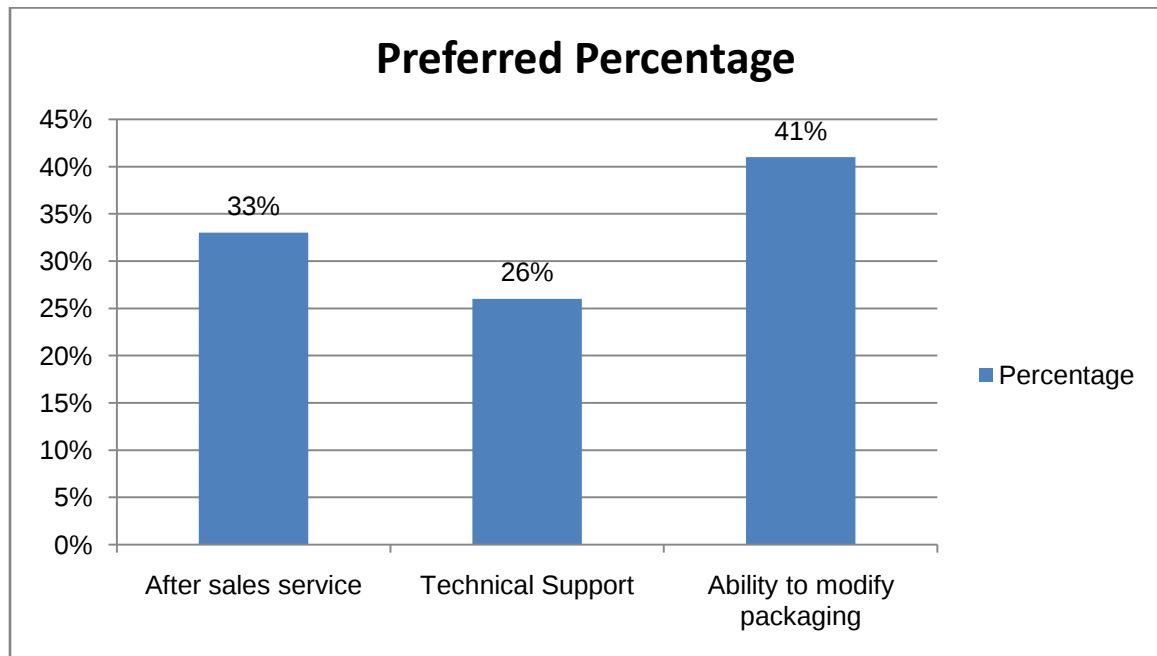
S.N	Sub Criteria	After sales service	Technical Support	Ability to modify	Average Value
1	After sales service	0.28	0.50	0.20	0.33
2	Technical Support	0.14	0.25	0.40	0.26
3	Ability to modify packaging	0.58	0.25	0.40	0.41

Table 33 Priority Rank of Various Service Sub criterion

S.N	Sub Criteria	Average Value	Priority Rank
1	After sales service	0.33	2 nd
2	Technical Support	0.26	3 rd
3	Ability to modify packaging	0.41	1 st

The average computed values for after sales service, technical support, and ability to modify packaging are 0.33, 0.26 and 0.41 in respectively. Table 33 shows that ability to modify packaging is the best supplier selection sub criterion followed by after sales service and technical support.

Figure 7: Respondents Averagely Preferred Suggestion with Regards to Service Sub criteria



As per the analytical hierarchy process which is a method for ranking decision alternatives and selecting the best one sub criteria when the decision maker has multiple sub criteria, on which to base the decision ability to modify packaging, after sales service and technical support has got 1st, 2nd and 3rd rank in respectively. This means while evaluating and selecting potential suppliers, food manufacturing companies could be intelligent to give 41 percent priority for ability to modify packaging, 33 percent priority for after sales service and 26 percent priority for technical support. This helps food manufacturers to procure quality carton box packaging and by this to deliver quality products as per their customers' preference so as to have a sustainable competitive advantage over its rivals and the like.

4.6 Pair wise Comparison of Four Local Suppliers

Tables 34-38 show the pair wise comparison matrix of four suppliers with respect to each criterion and priorities. This process is similar to the procedure used to create the criteria comparison matrix. For example, the purchasing and supply chain managers requested to compare each pair of suppliers with respect to quality, price, delivery and service. The priorities of the suppliers, for each criterion, derived employing the four-step procedure identified in the above mentioned tables.

As it is mentioned in chapter two, the four local selected carton box suppliers are Ethiopian Pulp & Paper (Supplier 1), Burayu Packaging and Printing Industry (Supplier 2), Minaye Packaging (Supplier 3) & Unlimited Packaging (Supplier 4) and its comparison computed accordingly as follows:-

Table 34 Comparison of Local Suppliers with Respect to Quality

Quality	Supplier 1	Supplier 2	Supplier 3	Supplier 4	Average Value	Priority Rank
Supplier 1	1	1/2	½	½	0.14	4th
Supplier 2	2	1	3	2	0.42	1st
Supplier 3	2	1/3	1	1	0.20	3rd
Supplier 4	2	1/2	1	1	0.24	2nd

Table 35 Comparison of Local Suppliers with Respect to Price

Price	Supplier 1	Supplier 2	Supplier 3	Supplier 4	Average Value	Priority Rank
Supplier 1	1	3	2	2	0.42	1st
Supplier 2	1/3	1	1	1	0.17	4th
Supplier 3	1/2	1	1	1	0.19	3rd
Supplier 4	1/2	1	1	1	0.22	2nd

Table 36 Comparison of Local Suppliers with Respect to Delivery

Delivery	Supplier 1	Supplier 2	Supplier 3	Supplier 4	Average Value	Priority Rank
Supplier 1	1	1/2	½	2	0.21	4th
Supplier 2	2	1	1	1	0.29	1st
Supplier 3	2	1	1	1	0.27	2nd
Supplier 4	1/2	1	1	1	0.23	3rd

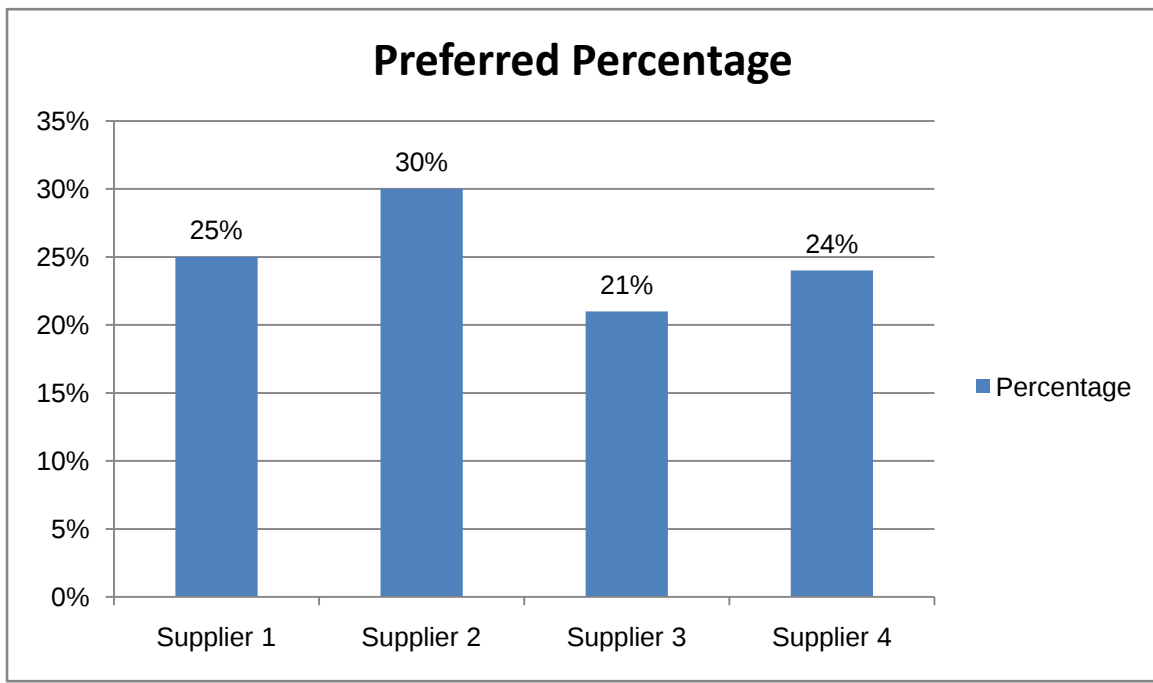
Table 37 Comparison of Local Suppliers with Respect to Service

Service	Supplier 1	Supplier 2	Supplier 3	Supplier 4	Average Value	Priority Rank
Supplier 1	1	1	2	1/2	0.26	2nd
Supplier 2	1	1	1	2	0.27	1st
Supplier 3	1/2	1	1	2	0.24	3rd
Supplier 4	2	1/2	½	1	0.23	4th

Table 38 Determination of Overall Priority

Priority	Quality (0.43)	Price (0.31)	Delivery (0.16)	Service (0.10)	OVERALL AVERAGE VALUE	Rank
Supplier 1	0.14	0.42	0.21	0.26	0.25	2nd
Supplier 2	0.42	0.17	0.29	0.27	0.30	1st
Supplier 3	0.20	0.19	0.27	0.24	0.21	4th
Supplier 4	0.24	0.22	0.23	0.23	0.24	3rd

Figure 8: Determination of Overall Priority with Regards to Local Suppliers



The final phase of the AHP analysis is summarized on table 38. To determine the overall priority, a simple weighted technique is used. For a given supplier four priorities are derived for each of the four evaluation criteria shown on tables 34-38. These four priorities are multiplied by the appropriate criteria priorities in satisfying the goal of the hierarchy shown on table 9, and the outputs of the four multiplications are summed together to determine the supplier score. Each supplier score is the estimated total benefits to be derived from selecting a particular supplier.

With respect to the overall priority scores of alternative suppliers Supplier 2 i.e Burayu Packaging and Printing Industry (30 percent) is most preferred carton box packaging supplier followed by supplier 1 i.e Ethiopian Pulp & Paper (25 percent), supplier 4 i.e Unlimited Packaging (24 percent) and supplier 3 i.e Minaye Packaging (21 percent) in respectively. Essentially, supplier 2 or Burayu Packaging and Printing Industry is judged to be the overall best.

Chapter Five

5. Summary of the findings, Conclusion and Recommendations

AHP is an important supplier selection approach because it supports decision makers in ranking potential suppliers based on the relative significance of the attributes (Saaty, 2010). Supplier selection process and evaluation represents one of the key activities that organizations must integrate into their core strategic decisions. Selecting and evaluating the right suppliers is the essential aspect of strategic purchasing and supply chain management that can affect manufacturing firms.

5.1 Summary of the findings

The following Summary of the findings can be raised from the respondents' suggestion on the survey made about carton box packaging supplier selection matrix for food and beverage manufacturing industries in Addis Ababa.

- i. Among the selected supplier selection criteria; quality is the best supplier selection criterion followed by price, delivery and service. While evaluating and selecting potential suppliers for food manufacturing companies' respondents averagely suggest using 43 percent priority for quality, 31 percent priority for price, 16 percent priority for delivery and the remaining 10 percent priority for service.
- ii. Among the selected quality sub criteria; package strength is the best supplier selection sub criterion followed by quality consistency and quality system which scores 64 percent, 23 percent and 13 percent in respectively.
- iii. Among the selected price sub criteria; competitive price is the best supplier selection sub criterion followed by standard price, payment term and credit facility which scores 41 percent, 25 percent, 18 percent and 16 percent in respectively.
- iv. Among the selected delivery sub criteria; delivery speed is the best supplier selection sub criterion followed by delivery commitment and transportation facility which scores 63 percent, 26 percent and 11 percent in respectively.

- v. Among the selected service sub criteria; ability to modify packaging is the best supplier selection sub criterion followed by after sales service and technical support which scores 41 percent percent, 33 percent and 26 percent in respectively.
- vi. With regards to quality among the existing well-known local carton box suppliers; Burayu packaging is the most preferred supplier followed by Unlimited packaging , Minaye packaging and Ethiopian pulp and paper who scores 42 percent, 24 percent, 20 percent and 14 percent in respectively.
- vii. With regards to price among the existing well-known local carton box suppliers ; Ethiopian pulp and paper is the most preferred supplier followed by Unlimited packaging , Minaye packaging and Burayu packaging who scores 42 percent, 22 percent, 19 percent and 17 percent in respectively.
- viii. With regards to delivery among the existing well-known local carton box suppliers; Burayu packaging is the best preferred supplier followed by Minaye packaging , Unlimited packaging and Ethiopian pulp and paper who scores 29 percent, 27 percent, 23 percent and 21 percent in respectively.
- ix. With regards to service among the existing well-known local carton box suppliers; Burayu packaging is the best preferred supplier followed by Ethiopian pulp and paper , Minaye packaging and Unlimited packaging who scores 27 percent, 26 percent , 24 percent and 23 percent in respectively.
- x. Regarding with the determination of overall priority with respect to all the above mentioned four criteria; Burayu packaging is the most preferred supplier followed by Ethiopian pulp and paper , Unlimited packaging and Minaye packaging who scores 30 percent , 25 percent, 24 percent and 21 percent in respectively.

5.2 Conclusion

The first contribution of the study was the identification of the weight priority result of each selected criteria and compute top weighted selection criteria so as compute the optimum mix of using important supplier selection criteria during supplier evaluation and selection process in food and beverage manufacturing industries in Addis Ababa. Here the criteria used were quality, price, delivery and service. This attainment covered the first and second specific objectives of the research.

The second contribution of the study was determining the overall priority among carton box suppliers by examining the weaknesses and strengths of the selected carton box suppliers as illustrated on table 38. This attainment covered the third specific objectives of the research.

The other contribution of the study was to understand the ranks given by the selected industries for few main domestic carton box suppliers with regards to some selected criteria. This attainment covered the other specific objectives of the research.

Above all the major contribution of the study was to recommend the importance of a multi criteria decision making approach for supplier evaluation and selection in order to solve supplier selection problems through developing supplier evaluation & selection model using AHP. This attainment covered the general objective of the research by developing a scientific model using AHP approach. The basis of vendor selection process is to integrate the main criteria that are considered to be important for the supplier selection in that specific industry where companies are already operating in order to sustain a competitive advantage and satisfy customers' preferences.

5.3 Recommendations

Based on the conclusions drawn above, some recommendations are forwarded on using AHP in the supplier selection process:-

- i. According to Rundth (2005) packaging is the silent salesman and here beverage and food manufacturing industries need to give a due attention during the purchasing of packaging materials for their products. This study and previous related studies showed that the most preferred criteria selected by the respondents is quality so that food and beverage manufacturing industries need to give a high emphasis for quality so as to save the overall implicit and explicit costs of companies.
- ii. Food and beverage manufacturing industries need to develop a long term business relationship with the most preferred suppliers in this case Burayu Packaging and Printing Industry &/ or with the next most preferred supplier which is Ethiopian Pulp and Paper .
- iii. So as to have a smooth flow of the inbound supply of packaging the researcher recommends food and beverage manufacturing industries to use a scientific method of

supplier selection method (say using AHP) than a haphazard or a trial and error form of supplier selection method .

- iv. As per the average respondents` response quality holds nearest to 50 percent of other supplier selection criteria. And it is a very decisive criteria which must be considered by buyers while must be considered by buyers while evaluation and select potential supplier.
- v. As per the average respondents` response packaging strength which is a sub criteria for quality holds 65 percent of other supplier selection quality sub criteria. And it is a very decisive sub criteria than others which must be considered by buyers while must be considered by buyers while evaluation and select potential supplier.
- vi. Among the selected carton box packaging suppliers Burayu Packaging and Printing Industry has scored a better result or rank in the eyes of the respondents with regards to quality ,delivery and service except price. Therefore for potential buyers considering only price refers loosing such kind of suppliers who satisfies more supplier selection criteria mix.

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APPENDIX 1

SURVEY QUESTIONNAIRE

Dear Sir/Madam

My name is **Birhanu Chane**. I am a prospective **Master of Art Student in Logistics & Supply Chain Management** at Addis Ababa University School of commerce.

I am writing to stimulate your EXPERT OPINION on the issue of carton box suppliers' evaluation and selection. Your opinion will be significantly invaluable to this research and you are invited to complete the attached survey questionnaire.

The aim of this questionnaire is to collect information and identify the degree of important of various carton box suppliers' evaluation and selection criteria in the eyes of your firm. This questionnaire leverages Analytical Hierarchy Process (AHP) to model supplier selection in your good office. You are hereby kindly requested to give weight for these criteria. **All of the data collected from your end will be used ONLY FOR THIS STUDY.**

Hoping to await your honest opinion and thank you very much for your cooperation and assistance in this research.

Researcher's Name : Birhanu Chane

Advisor's Name: Teklegiorgis Assefa (Asst.Prof.)

PAIRWISE COMPARISON QUESTIONNAIRE

Degree of relative importance of each criteria compared to the other

Instruction: - Please select the degree of relative importance/Preference of each criterion compared to each other according to the following scale:-

- (1) Equally important or preferred
- (3) Moderately important or preferred
- (5) Strongly important or preferred
- (7) Very strongly important or preferred
- (9) Extremely important or preferred or you can add any scale between 1 and 9 as per Saaty's scale below:-

Preference Level	Numeric Value
Equally preferred	1
Equally to moderately preferred	2
Moderately preferred	3
Moderately to strongly preferred	4
Strongly preferred	5
Strongly to very strongly preferred	6
Very strongly preferred	7
Very strongly to extremely preferred	8
Extremely preferred	9

Source: Saaty (2000)

Example:1 If you select the shaded No. 4 in the following question, it means “price” is moderately to strongly preferred than “quality”. Please refer the above table.

Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Price
---------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	-------

Example: 2 If you circle the shaded No. 5 in the following question, it means “Quality” is Strongly preferred than “Price”. Please refer the above table.

Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Price
---------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	-------

Similarly, please contribute your expert opinion and do the same for the under mentioned questions. You can circle the number you choose.

A. Description of each CRITERIA

Criteria	Definition
Quality	It refers to the ability of suppliers to meet the customers' required specifications consistently. This criterion has been measured on the basis of the importance of the following sub criteria: package strength, quality consistency, quality system (example
Price	The firm always requires the minimum price of the product to increase the profitability. The firm therefore must find a low-cost supply base where it can minimize manufacturing cost related to the production of the product. This criterion has been measured on the basis of the importance of the following sub criteria: competitive price, payment term, credit facility and standard price
Delivery	It refers to the ability of suppliers to follow the predefined delivery schedule. This criterion has been measured on the basis of the importance of the following sub criteria: delivery speed, transportation facility and delivery commitment.
Service Level	It refers to the performance of suppliers in providing holistic service to the manufacturers. This criterion has been measured on the basis of the importance of the following sub criteria: after sales service, technical support and ability to modify

B. Select the degree of relative importance of each CRITERIA compared to theOther

*1. Relative importance of **one** criteria with respect to the other three criteria*

Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Price
Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Delivery
Quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Service
Price	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Quality
Price	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Delivery
Price	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Service
Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Service

B. Select the degree of relative importance of each SUB CRITERIA with respect to to the other

1. *Relative importance of one QUALITY SUB CRITERIA with respect to the other two sub criteria*

package strength	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	quality consistency
package strength	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	quality system
quality	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	quality system

2. *Relative importance of one PRICE SUB CRITERIA with respect to the other three sub criteria*

competitive price	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	payment term
competitive price	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	credit facility
competitive price	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	standard price
payment term	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	credit facility
payment term	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	standard price
credit facility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	standard price

3. *Relative importance of one DELIVERY SUB CRITERIA with respect to the other two subcriteria*

delivery speed	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	transportation facility
delivery speed	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	delivery
transportation facility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	delivery commitment

4. *Relative importance of one SERVICE SUB CRITERIA with respect to the other two sub criteria*

after sales service	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	technical support
after sales service	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	ability to modify
technical support	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	ability to modify packaging

D. Prioritize Well Known Local Suppliers Evaluation in the eyes of your good office using main criteria

- ✚ Supplier 1 = Ethiopian Pulp & Paper
- ✚ Supplier 2 = Burayu Packaging and Printing Industry
- ✚ Supplier 3 = Minaye Packaging
- ✚ Supplier 4 = Unlimited Packaging

1. Please mark your preference of one supplier with the other supplier with respect to “**Quality**”

Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 2
Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 3
Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4
Supplier 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 3
Supplier 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4
Supplier 3	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4

2. Please mark your preference of one supplier with the other supplier with respect to “**Price**”

Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 2
Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 3
Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4
Supplier 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 3
Supplier 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4
Supplier 3	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4

3. Please mark your preference of one supplier with the other supplier with respect to “**Delivery**”

Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 2
Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 3
Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4
Supplier 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 3
Supplier 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4
Supplier 3	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4

4. Please mark your preference of one supplier with the other supplier with respect to “**Service**”

Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 2
Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 3
Supplier 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4
Supplier 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 3
Supplier 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4
Supplier 3	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Supplier 4

-THANK YOU VERY MUCH-