Selection of a Logistics Service Provider Based on Analytic Hierarchy Process (AHP) Approach

A case study of Swedish Coffee Manufacturer — Gevalia

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March, 2014

Student Thesis, Bachelor, 15 HE
Industrial Engineering and Management
Bachelor Program in Industrial Management and Logistics

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ACKNOWLEDGEMENTS

First we would like to thank our supervisor, Muhammad Abid, for his consistent encouragement and patient guidance in this thesis. Then, we would like to thank Robin von Haartman, who inspired us to explore this topic in his course named Strategies and Principles for Effective Logistics. Particularly, we would be grateful to the manager in the interview who assisted us in collecting important data and offered his abundant logistics knowledge. Moreover, we would also very much like to express our genuine thanks to our examiner, Claes Åkerman, for his illuminating and patient instruction.

Finally, we would like to thank the department of Industrial Development, IT, and Land Management at University of Gävle, for the support and course arrangement. We really appreciate all teachers and classmates in the University of Gävle, for the professional teaching and patient helping.

Gävle, March, 2014
Heshan Ye, Jiading Wu
ABSTRACT

Logistics outsourcing has been applied in practices by enterprises for decades, but its efficiency is always restricted because logistics service providers (LSPs) often only have a single function such as delivery or warehousing. In the last few years, LSPs have upgraded their capabilities to support some other logistics services including value-added services, materials management, information-related services etc. The purpose of this thesis is to identify the differences between self-built logistics system and outsourcing logistics system by using the Strengths Weaknesses Opportunities Threats (SWOT) strategic analysis; and figure out how to apply the Analytic Hierarchy Process (AHP) to make an appropriate selection among LSPs that based on the single-case study of Gevalia. Both quantitative and qualitative methods have been used in this study, authors expect to describe and explore the application of AHP approach regarding to the case company which implements outsourcing logistics system. Accordingly, it could be a good idea for case company to implement the mixed mode of self-built and outsourcing logistics system after using the SWOT strategic analysis. In addition, the production and logistics manager of case company emphasized that the five selection criteria including “compatibility”, “delivery performance”, “location”, “management” and “cost” should be considered as a priority among other different criterion when he selected a LSP. As a result, it will be efficient and effective for us to simulate a best decision for those industrial manufacturing enterprises to achieve a path regarding to the selection of the best logistics partner that based on the significant AHP approach.

Keywords: Analytic Hierarchy Process (AHP), Gevalia, Logistics Service Providers (LSPs), Selection, Outsourcing Logistics
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<tr>
<td>AHP</td>
<td>Analytic Hierarchy Process</td>
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<td>ANP</td>
<td>Analytic Network Process</td>
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<td>CI</td>
<td>Consistency Index</td>
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<td>CR</td>
<td>Consistency Ratio</td>
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<td>CPT</td>
<td>Compatibility of a Provider</td>
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<td>CST</td>
<td>Cost Performance of a Provider</td>
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<td>DEA</td>
<td>Data Envelopment Analysis</td>
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<td>FP</td>
<td>Financial Performance</td>
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<td>JIT</td>
<td>Just-In-Time Management</td>
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<td>LSP(s)</td>
<td>Logistics Service Provider(s)</td>
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<td>LTR</td>
<td>Long-term Relationship between User and Provider</td>
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<td>OP</td>
<td>Operational Performance</td>
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<td>QLT</td>
<td>Quality in Management of a Provider</td>
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<td>RI</td>
<td>Standard Ratio Index</td>
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<td>RM</td>
<td>Risk Management</td>
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<td>RFI</td>
<td>Request for Information</td>
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<td>RFP</td>
<td>Request for Proposal</td>
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<td>RPT</td>
<td>Reputation of a Provider</td>
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<td>SC</td>
<td>Supply Chain</td>
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<td>SCM</td>
<td>Supply Chain Management</td>
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<td>SWOT</td>
<td>Strengths Weaknesses Opportunities Threats Analysis</td>
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<tr>
<td>TMS</td>
<td>Transportation Management System</td>
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<tr>
<td>ZOGP</td>
<td>Zero-One Goal-Programming Model</td>
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<td>SO</td>
<td>Perspective in Strengths within Opportunities to Analyze</td>
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1. INTRODUCTION

1.1 BACKGROUND

With the rapid development of business involving the growth of customers, many firms have realized that it is necessary to establish efficient, effective, and relevant product or service solutions to satisfy the vary requirements with supply chain partners (Bowerxsox et al, 2000). Particularly, problems related to logistics operations of a company have gradually become the “bottle-neck” in doing business. In some specific situations, the single self-built logistics system including functions like simple delivery or warehousing is unable to meet the changeable needs of distribution in the market.

Gol and Catay (2007) have emphasized that it requires companies to collaborate with the expertise and synergy of external supply chain partners closely to achieve the success within the significant capital investment and complex organizational structure together. Jharkharia and Shankar (2007) highlighted that outsourcing logistics operation brings the professional expertise and experience to the companies; therefore, it would be helpful to concentrate on the core of business, cost reduction, supply chain partnerships, in improving customer service level, efficient operation etc. For this reason, many firms have already cooperated with logistics service providers (LSPs) as their outsourcing logistics functions to enhance their competitive advantages from a long-term consideration. Andersson and Norrman (2002) found out that there was an especial business-to-business relationship between logistics providers and their users in the entire supply chain. The users would not only play a critical stakeholder to receive benefits, on the other hand, the quality of these logistics providers would also influence on their users directly in supply chain.

In recent years, most LSPs have upgraded their capabilities to provide multiple-functions including the value-added services, materials management and information-related services to achieve long-term cooperation with their users (Jayaram and Tan,
Halldorsson and Skjoett (2004) have highlighted that LSPs construct the specific relationships with both material suppliers and third-party logistics (3PL), assisting their customers to integrate logistics, information and business processes throughout the whole supply chain. Moreover, Boyson et al. (1999) also pointed out that most 3PLs could offer two or more functions that integrate to the logistics operations at the same time instead of only offering a single function. The functions of logistics operations offered by 3PLs can be summarized, such as inventory management, transportation, distribution, tracking and tracing through using IT technology, secondary installation of products etc. Accordingly, it is necessary for companies to identify and confirm what functions they need exactly from the LSPs in the areas of outsourcing logistics. Several researchers have discussed about the performance of logistics outsourcing (Razzaque and Sheng, 1998; Andersson and Norrman, 2002; Lynch, 2000), however, the selection criteria for a provider did not being concerned too much. Tam and Tummala (2001) have emphasized that the Analytic Hierarchy Process (AHP) approach can be regarded as one of the widely used methods to solve a multi-criteria decision-making issues. Without a useful approach, it could be a tough task for the companies to select a proper logistics provider which offers a good performance of logistics outsourcing operations to meet their requirements. Therefore, understanding the process of AHP approach in the process of selecting a LSP could help those companies (LSPs’ clients) to recognize the “Comprehensive Ability” of different logistics companies in a scientific way.

1.2 PURPOSE

The purpose of this thesis is to identify the differences between self-built logistics system and outsourcing logistics system by using the Strengths-Weaknesses-Opportunities-Threats (SWOT) strategies analysis; and figure out how to apply the Analytic Hierarchy Process (AHP) to make an appropriate selection among LSPs that based on the single-case study of Gevalia. In order to achieve this purpose, two critical research questions have been formulated which are as follows:
1. What are the features of self-built logistics and outsourcing logistics?

2. How to make a decision of selecting a LSP based on the AHP approach?

1.3 OUTLINES

This thesis is organized as follows:

1) The first chapter is a general introduction of this study;
2) The second chapter is concentrating on what research methods have been used;
3) The third chapter is the basis of theoretical framework for doing this study;
4) The fourth chapter is the finding part of the empirical case study of Gevalia;
5) The fifth chapter is the analysis/discussion of analyzing two research questions;
6) The sixth chapter is the conclusion that concludes the overall study in this thesis.

![Diagram of Research Outlines]

**FIGURE 1 -** Description of this Research Outlines (Source: by authors)
2. METHODOLOGY

The empirical study of this thesis mainly focused on an overall perspective of the study through identifying what logistics mode of case company used and exploring what selection criteria should be considered as a priority when company selects a LSP and how to finish the process of this selection that based on the AHP approach. As mentioned in the background, the development of LPSs has a rapid growth in nowadays. LSPs can provide a set of professional logistics activities to support their clients (users in supply chain). Yin (2003) has stated that the case study can help researchers to know the detailed description of a phenomenon within its perspective. In this thesis, authors have reviewed relevant literatures that related to the methodology of AHP-based model which can help to figure out how to make the best selection scientifically between the two potential LSPs.

After identifying the research purpose and questions in this thesis, authors started to select the case company patiently. In particular, authors finally decided to explore the famous coffee manufacturer in Sweden — Gevalia, which implements outsourcing logistics operations in their business and locates in the city of Gävle. Meanwhile, authors recognized the practical situation of the specific case company, and believed that this case study has been made to best suitable studying. The case company has been selected because of its representativeness of outsourcing a logistics company in the real industrial project. Moreover, all related data within the case study has been analyzed with both qualitative research strategy and quantitative research strategy in this thesis. In this section, authors have reviewed some methodologies including quantitative and qualitative research strategies, deductive and inductive research approaches, literature review, case selection, data collection and research quality. In the analysis/discussion part, the AHP-based model is required to deal with valid judgments that based on the mathematical method of comparison matrix in order to achieve the best selection of a LSP. In doing so, authors decided to practice the quantitative method to express the
actual features of logistics operations for the case company. Thereafter, authors also collected the secondary data that involved some relevant literatures, related information and fundamental resources from the databases of the University of Gävle on the Internet. In order to satisfy the purpose of this thesis, authors not only reviewed relevant literatures to obtain the specific knowledge about the process of AHP-based model that helps to understand “what to do” and “how to do”, but also interviewed the production and logistics manager of the specific case company (Gevalia). After a few times e-mail contact with the manager of the case company, we finally got the permission of 1 hour face-to-face interview at Gevelia. After that, authors still continued to keep contacting with the manager by the e-mail in order to confirm the selection criteria in the process of AHP-based model that selects a LSP in this study. Eventually, authors collected the valuable primary data and individual valid judgments for each selection criterion from the manager which can be regarded as a decider in the case company and explored how to deduce a best selection of a LSP that based on the AHP approach.

2.1 QUANTITATIVE AND QUALITATIVE METHODS

In this thesis, authors have used both quantitative and qualitative methods to satisfy the research objectives and analyzed the research questions. Biggam (2011) has stated that it is a common phenomenon to answer the mix of quantitative and qualitative question in every day. Moreover, it cannot equate research strategic with quantitative research or qualitative research. At the same time, he also illustrated that quantitative research or qualitative research should depend on a combination of the research strategic, individual research objectives and data collection techniques. Moreover, researchers can deeply discuss the complexity of a special phenomenon, then verify and describe its important relationships by applying the qualitative approach. On the other hand, researchers also can apply the quantitative approach to finish the statement for statistical analysis, then to find out the reasons and finally provide some predictions for the future plan (Thompson and Walker, 1998). Furthermore, Biggam (2011) also pointed that the quantitative research is quite different from the qualitative research.
and both of them cannot be displaced by each other.

According to Clissett (2008), he compared the differences between quantitative and qualitative research. Especially, he explained that quantitative research focuses on formal objective and systematic process for getting quantifiable information about the world. Therefore, it mainly presents in numerical form and analyzes through the use of statistics that aims at describing and testing cause and effect relationships. Biggam (2011) has claimed that quantitative approach referred to the research that is concerned with quantities and measurements. And quantitative involved calculating to figure out the specific problems related to answer the “how” questions. In this thesis, authors focused on how to select a LSP for companies by applying the AHP-based model that needs to deal with some quantity data.

On the other hand, qualitative research focuses on seeking to explain human behaviors in terms of reasons that people behave the way they do. Thus, it mainly uses human speech or the wiring as data for analyzing. As a result, it will lead to certain actions in a research thesis through uncovering the understandings and motives. Moreover, Walliman (2005) has explained that the qualitative method was evolved to describe and analysis qualities, attributes and make distinctions. According to Yin (2011), qualitative research method tries to answer the “why” questions through illustrating the special phenomenon. Creswell (1998) also has stated that the qualitative method is an inquiry process of perceiving to explore the problems in human or society basing on distinct traditional method of inquiries. Cavnava et.al (2000) have defined that qualitative methods were used in the range of an interpretive paradigm. In qualitative research, data collection could concern more about the depth of data and not use the statistical applications. Thus, qualitative method will get results as a qualitative understanding when researchers analyze the potential reasons and motivations. And qualitative is linked to in-depth exploratory studies that related to answer the “why” questions. In this thesis, authors analyzed that why case company would like to outsource their logistics operations to LSPs.
2.2 DEDUCTIVE AND INDUCTIVE APPROACHES

Walliman (2005) stated that arguments are traditionally divided into two different types including “deductive” and “inductive”. Every argument containing its premises could provide some grounds for the truths of its conclusion; however, only the premises of a deductive argument would provide conclusive grounds. Moreover, deductive arguments must be either ‘valid’ or ‘invalid’. That is said to be valid when its premises are true; it will provide conclusive grounds for its conclusions. On the other hand, both premises and conclusions are logically related to this rule that the premises could not be valid if the conclusions are invalid. Comparing to a deductive argument, the inductive one involves the claim that its premises only provide some support for the conclusion, but not provide conclusive grounds for its truth. Particularly, inductive arguments can be neither ‘valid’ nor ‘invalid’. Therefore, the stronger of support by its premises would lead to more likely that the conclusions will tend to be true. All in all, both deductive and inductive arguments can be regarded as seeking the truth from opposite directions. Furthermore, Walliman (2006) emphasized the difference between the deductive and the inductive, therefore, the deductive thinking is going from the general to the specific, while the inductive thinking is going from the specific to the general.

In this thesis, deductive approach is more suitable to do the research about the selection of a LSP that based on the AHP approach. Deductive approach is used to test a theory (Walliman, 2006), and it could draw a specific true conclusion according to the general knowledge about AHP approach. Thus, authors used the deductive research approach to explore how AHP approach helps case company to finish the best decision in the process step by step.

2.3 LITERATURE REVIEW

Croom (2009) has stated that the literature review is a conventional method to do the
empirical research. It can certainly help to study existing work in the field with insight. In the beginning of this thesis, literature review has given preliminary notions about topics, methods, sources of evidences for emerging study to our research. Therefore, it is necessary to find out some literatures that concerned with our research objectives and try to interpret and evaluate them carefully. Even more, literature review should present the studies of others in a clear, interesting and progressive manner and provide evidence of in-depth critical evaluation (Murray and Hughes, 2008).

Scientific articles used for the theoretical research were found from the University of Gävle’s databases (i.e. Emerald, Google, Scholar, IEEE Xplore and Science Direct). In order to find out relevant subject related articles, keywords like “supply chain management (SCM)”, “selection of logistics service providers”, “Analytic Hierarchy Process (AHP)”, “self-built logistics”, “logistics outsourcing” and “third-party logistics (3PL)” were used to be more effective and efficient during the findings phase. At this juncture, high cited articles were preferred to underline the reliability of the given information. In the second step, high cited articles with relevant information based on the abstract, introduction, and conclusion were saved and grouped together in groups such as “supply chain”, “logistics service providers in general”, “outsourcing logistics”, “self-built logistics”, and “successful/risk factors of outsourcing logistics”. Finally, these related articles were read carefully and patiently by authors.

2.4 A SINGLE CASE STUDY

Biggam (2011) has stated that case study is very popular with student, because it is easier to focus on their research on one organization or part of an organization. Consequently, case study could be an appropriate method to do both social science and life science researches. In this thesis, authors regarded the case study as the main research strategy. A case study in general is used when investigating individuals, groups, events or organizations to understand and explain these actions. Schramm (1971) has mentioned that the case study tries to illuminate a decision or set of decisions: how they
were implemented, why they were taken, and what resulted. Yin (2003) has defined that the case study as: “A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.” Thereafter, case study can be seen to suitable for analyzing how to select a LSP that based on AHP approach for the study of a single-case enterprise in this thesis.

Yin (2003) has defined three types of case studies: exploratory, descriptive and explanatory. The details about three types of case studies have been concluded as follows: an exploratory case study mainly concerns on defining the questions and providing some hypotheses of subsequent study (not necessarily contain a case study), somehow even involving determining the feasibility of the expected process of the specific research problem; a descriptive case study presents a complete description of a special phenomenon within its context; an explanatory case study comprises data bearing on cause-effect relationships-explaining how the events happened. After understanding the differences among the three types of case studies, authors decided to focus on the combination of “explanatory” and “descriptive” in this thesis. In quantitative analysis, the factors theory is one of the most common types of explanatory theories which conducts the analysis and accounts for such complexities as the interactions among the independent variables. Moreover, the explanatory theory also can be called as “how” and “why” theory which is suitable for designing and doing explanatory case studies. Yin (2012) claimed that explanatory theory can solve the complex and multivariate problems in the case studies. Therefore, descriptive case studies can offer rich and revealing insights into the social world of a particular case. Yin (2012) also has pointed out that the successful descriptions in case studies should mediate between trying to describe “everything” and to be too sparse.

In addition, case study also can be divided into two main types of study, including a single-case study and multiple-case study (i.e. at least two cases). Yin (2008) has claimed that a single-case study design can be eminently justifiable under certain
conditions: (1) a critical test of existing theory; or (2) a rare or unique circumstance; or (3) a representative or typical case; or (4) where the case serves a revelatory; or (5) a longitudinal purpose. Moreover, Yin (2008) stated that multiple-case studies have to follow a replication, not a sampling logic, and an investigator must choose each case carefully. In this thesis, authors preferred to use the single-case study that caused it could focus on specific research objectives with less extensive resource and time. In general, a single-case study can help authors to concentrate on how to use the AHP approach to select a proper LSP. Accordingly, the topic of selecting a LSP for the specific case is suitable to use a single-case study. Furthermore, authors could practice a single-case study that explores the case enterprise deeply and comprehensively which based on the research questions in this thesis.

Case selection based on the criteria if it is a revelatory case, where the investigator has an opportunity to observe and analyze a phenomenon so far inaccessible to scientific investigation (Yin, 2003). In this thesis, it has provided a revelatory case for those companies which prefer to implement outsourcing logistics operations to select a LSP that based on the AHP approach. The case enterprise in a single-case study has already gained a well developing in the areas of coffee marketplace in Sweden, and it implements outsourcing logistics operations to enhance their logistics performance in the entire supply chain management and improve their business activities. Therefore, it is very significant to apply a single-case study to do the research so that we can focus on the “how” and “why” questions and thus explore how to solve them in this thesis.

2.5 DATA COLLECTION

Once deciding to use a single-case study, it is necessary to understand how to collect data properly in this section. Some methods of collecting data have been concluded by Biggam (2011), those methods are classified into five key parts, such as practicing a variety of techniques sampling in statistics areas, gathering some secondary data, making especially interviews, capturing data from the specific questionnaires and
forming an observation etc. Moreover, he also suggested that using more than one technique would lead to “triangulate results” in the research. Particularly, it will get a range of perspectives (quite useful in qualitative research) and achieve a more rounded picture through using different sources. In order to satisfy the specific case study research in this thesis, authors collected both quantitative and qualitative data that related to the research objectives through reviewing the information from official website of case enterprise, and gathering the selection criteria and valid judgments from the interview with the production and logistics manager of case enterprise. In particular, data collection is a very significant step to continue doing the research in this thesis.

2.5.1 Qualitative Data

In general, case study can be regarded as a qualitative research. In this thesis, the empirical information was collected by the interview with the production and logistics manager of Gevalia. Particularly, the manager can represent a decider in the case company to select a LSP in the logistics apartment. There are two main reasons for us to interview him: firstly, the manager has been worked in logistics field for more than 20 years that he has rich experience of handling with the issues about logistics outsourcing; secondly, he would like to accept our interview because he was really interested about the topic of this thesis and expected to discuss the process of selection with us. According to the face-to-face interview, we captured much useful primary information from the manager which could help us to better fulfill the process of selecting a provider that based on the AHP approach. A good case study interview not only needs that the interviewers follow the route of their inquiries, but also simultaneously put the friendly questions in the interview (Yin, 2008). According to the specific interview, there is only one person which has interviewed by authors. However, the production and logistics manager could represent a decider to make a selection of choosing a provider in the case company. Due to the reason of time limited in the interview, authors have to discuss the comprehensive performance of logistics system
in the case company and confirm the selection criteria and judgments that based on the AHP approach by e-mail after the face-to-face interview. Obviously, it would save time for both interviewer and interviewee to achieve the research purpose. Consequently, authors asked him some questions about the material flows and logistics activities in Gevalia. After identifying the logistics system of the case company and comparing the different factors about the selection criteria in selecting a provider for the case company, as a result, it would enough satisfy the requirements of comprehensive methodology of AHP-based model to explore how to achieve the best decision of a LSP in outsourcing logistics activities.

2.5.2 Quantitative Data

Quantitative research is explaining phenomena by collecting numerical data that are analyzed by using mathematically based methods (Aliaga and Gunderson, 2000). This study is going to analyze how to make a selection of a LSP based on the AHP approach. Therefore, according to the requirements of the comprehensive method of AHP-based model, it has to collect some quantitative data about the judgments of each selection criterion in the process of AHP approach. First of all, the statistical data we needed in the AHP approach was collected through the specific interview and e-mail. Those quantitative data was mainly collected by the interview of the manager of case enterprise because he is the decider in case company and has rich experience in the logistics field so that he can ensure the selection criteria and give his valid judgments in the process of AHP approach in this thesis. As mentioned in collecting qualitative data before, the manager has already emphasized that he would focus on these five critical selection criteria including “compatibility”, “delivery performance”, “location”, “management” and “cost”. Based on these selection criteria, it also required to compare the importance between each two criterion and make an accurate judgment for them in the comparison matrix. Moreover, the production and logistics manager of Gevalia finished the initial step for preparing the AHP approach to analyze the process of
selecting a provider. Through reviewing the related literatures about the process of AHP approach, authors have done the calculation to make a comparison about the “Comprehensive Ability” between two LSPs based on a regular AHP-based model. The quantitative data we have used in AHP-based model is clearly stated in the section of analysis/discussion.

### 2.6 RESEARCH QUALITY

According to Biggam (2011), he has claimed that it is necessary to construct validity and reliability in the research. Therefore, it should explain that why the research is valid empirical research and why it can be reliable. In order to follow the validity and reliability of research in the case enterprise study, authors would strictly keep controlling the research strategic, data collection techniques, data analysis techniques. In this thesis, research should observe the following standards: (1) Ensuring the information of case enterprise can be regarded as formal resources from the official website; (2) Properly collecting data that included empirical interview, strategic development report, and some external resources; (3) Tracking the evidences of the case enterprise study can be acceptable in the whole research. Therefore, it also should understand about the definition of both “validity” and “reliability”.

#### 2.6.1 Validity

Valid research is acceptable to the research community (Biggam, 2011). It means that all the research activities containing research strategies, data collection techniques and data analysis techniques are considered appropriate to the research. In other words, implementing the research approaches and techniques should suite to each of steps in the whole research. In this thesis, all research activities are based on the research validity. All activities in this thesis included in selecting the research strategy of a single-cases study, reviewing relevant scientific literatures, collecting quantitative and qualitative database on lecture, interviewing with the production and logistics manager
of case enterprise and collecting secondary-data from the official web-site can ensure the research validity with reasonable explanations.

2.6.2 Reliability

In addition, the concept of reliability is different from validity. Reliable research is about whether the research can be trusted or not (Biggam, 2011). Particularly, the research is valid but not reliable that means researchers have implemented all research activities appropriately but lacked trustworthy evidences to support the research. In this thesis, authors firstly reviewed lots of literatures related to the research topic, and referred to relevant articles about how to select LSP s among well-known researchers in order to ensure the reliability of research direction. Secondly, collecting primary data from the interview, thus the interview could provide a deeper understanding about the current logistics situations about case enterprise; and secondary data form the case enterprise’s official web-site that is reliable to use. According to the reliable information, authors proposed the AHP approach to select a LSP for case company.
3. THEORETICAL FRAMEWORK

3.1 SUPPLY CHAIN MANAGEMENT

Christopher (2011) has pointed out that the supply chain (SC) is a network that connects interdependent organizations and works together to control, manage and improve the flow of materials and information from suppliers and final customers. SC is not only a simple logistics chain or information chain, but also is a value-added chain for the business partners. In particular, SC could connect with both suppliers on upstream and customers on downstream in a whole supply chain. Consequently, firms can get benefits from the value-added chain. The key points in SC for companies aim at keeping a good balance between suppliers and final customers. According to Christopher (2011), supply chain management (SCM) can be defined as: management of relationships between upstream and downstream suppliers and customers. Particularly, the purpose in this concept of SCM aims at delivering superior customers value with fewer costs. Kaufman (1997) believed that the core of SCM is the satisfaction of customers. So in some points of view, the goal of SCM is keeping the harmonious relationships to achieve the sustainable development in business activities. These activities included getting along with suppliers, manufacturers, warehouses, distribution centers and retailers. As a result, organizations can achieve a profitable outcome from all entities in the whole SC.

Besides that, there are two driven forces of SCM development, including external pressures and potential benefits. Stanley et.al, (2010) have noted that the development of technology and increased customers satisfaction, gaining lower costs, and the competitive relationships among the enterprises are the main external pressures, and the potential benefits that include adding values to customers, controlling the inventory turnover, and reducing the costs through the upstream to the downstream of SC. Therefore, it can help to satisfy customers’ specific needs in a short time if the SCM can keep closely touch with their suppliers. Kaufman (1997) has claimed that SCM
aims to remove “communications barriers and eliminate redundancies” through coordinating, monitoring and controlling the processes in SC.

Moreover, logistics is a type of global wide business and also plays a major role in enhancing organizational competitiveness through improving the ability to deal with information and material flows along the SC (Sarkis, 2008). Logistics management has become a very popular management system in the global business, which has been defined by Mears-Young & Jackson (1997):

“The process of planning, implementing and controlling the efficient, cost-effective flow and storage of raw materials, in-process inventory, finished goods, and related information from point-of-origin to point-of-consumption for the purpose of conforming to customer requirements.”

Waters (2003) has defined the logistics management as a business plan framework for the management of material, service, information and fund flows. In order to adapt the logistics management in today’s business environment, companies have to handle the information in increasingly complex construction, communication and control system. It was also described by Christopher (2011) that logistics management can be regarded as a framework in order to seek to create a single plan for the products flow and information through the entire business. Generally, logistics activities include inventory management, warehousing operations, consolidation and packaging, transportation and logistics information systems. Successful logistics operations would not only enable companies to reach in the rapid and changeable market with delivery of competitive products, but also reduce the total cost of these products while simultaneously improving the customer satisfaction (Waters, 2003). Meanwhile, logistics management studies have focused on outsourcing, supplier development, managing inventory and other strategies for containing and reducing shipping cost.
3.2 SELF-BUILT LOGISTICS SYSTEM

According to Chiu (1995), the self-built logistics system could help enterprises to reduce distribution costs of product, because the one-time investment costs of the self-built logistics system is large. Thus, order quantity can be fully released, and the product distribution costs in the short term may be relatively lower. Figure 2 shows the operational process of traditional self-built logistics.

**FIGURE 2** - Flow Chart of Traditional Self-built Logistics System (Source: Chiu, 1995)

Suppliers support materials to the manufacturer with distribution logistics and purchasing logistics. The manufacturer delivers finished goods to the distribution center by production logistics. Then, the distribution center distributes finished goods among retailers or send to customers directly. From the perspective of benefits, Frazzon et al. (2010) have stated that self-built logistics system could help companies to shorten deliver time and to improve distribution quality. In the own logistics system, enterprises can pick up finished goods from their own warehouse to distribute them at the earliest time after receiving the customers’ orders. At the same time, managers can pay more attention to improve the quality of delivery to strive for the trust of customers.
Accordingly, this could be the main features of self-built logistics system. Mason et al. (2003) provided a theory about integrating warehouse management systems (WMS) and transportation management systems (TMS) and believed that it can take advantage of spare resources in the self-built logistics system to offer paid services for other companies. Many companies would rather cooperate with self-built logistics enterprises than 3PL temporarily because of the large one-time investments for self-built logistics system. Huang et al. (2001) held the same view that the self-built logistics always has been invested a lot in establishing logistics system that relied on the advanced IT technologies. Except meeting its own demands in the logistics operations, it also provides relevant services in SCM to other enterprises in the whole value-added chain. Enterprises can promote a new business and protect their brand that depended on their own logistics system. In addition, self-built logistics system can be useful to inspire purchasing and to enhance the stickiness of customers.

In order to resolve the problem such as information distortion, delay and waste of inventory, the lean logistics is put forward by some authors. According to King and Lenox (2001), they stated that the logistics system that combines with the lean thinking, can be deemed as a lean logistics, which means that the suppliers could provide comprehensive logistics services with proper price in the right place to satisfy the demands of the final customers at right time. In many traditional manufacturing industries, their self-built logistics systems are mostly lean logistics. Martínez and Moyano (2013) have made a literature review of lean management and they have concluded some features of lean logistics in the traditional self-built logistics system: information-based, integrated system, decreasing costs, raising efficiency, accurate, fast and customer demands oriented. Comparing to the lean logistics system, Just-In-Time (JIT) would like to focus on the inventory management. However, the lean logistics system concerns on the process of manufacturing and the operations management. JIT is a system and the concept of JIT has gradually seen as wide acceptance by the business and manufacturing communities (Iijima et al., 1996).
3.3 DEVELOPMENT OF LOGISTICS OUTSOURCING

“Outsourcing is the transfer of activities and processes previously conducted internally to an external party.” (Ellram and Billington, 2001)

Outsourcing logistics could be deemed as a kind of logistics activity that let the external LSPs help their users to handle the comprehensive logistics operations. The logistics activity depends on the specific services in the contract between the organizations and LSPs. Many organizations would rather select a third-party logistics company as their logistics partner in their business operations (Razzaque and Sheng, 1998). Hertz and Alfredsson (2003) have noted that there are a lot of contributions in implementing outsourcing logistics. Outsourcing logistics can help companies to concentrate on their core business and reduction of cost. In addition, LSPs could improve the quality of services and operations for their clients (users). LSPs also try to develop relationships in the whole SC so that users can take this opportunity to restructure companies and get a successful performance. Langley et al. (2003) have indicated that storage, outbound and inbound transportation are the most common activities in the simple outsourcing logistics activities. So in the near future, LSPs may provide comprehensive services which involve the business-to-business (B2B) relationships. This means that outsourcing logistics also could promote the development of businesses within a SC perspective. Andersson and Normman (2002) have emphasized that the users of LSPs could become critical stakeholders. The quality of LSPs’ services can directly influence on their clients’ business operations in the entire SC.

The general rule is that LSPs firstly sign up a long-term contract with their customers and then provide external logistics functions for them. This specific pattern can be regarded as a situation of “win-win” relationships (Hertz and Alfredsson, 2003). Jharkharia and Shankar (2007) have claimed that LSPs would like to build both vertical and horizontal relationship with their partners in the entire SC. Particularly, there is a list about the simple definition of LSPs (see Figure 3) that included from first-party
logistics (1PL) to fourth-party logistics (4PL).

**FIGURE 3** - Logistics Provider Pyramid (Source: by authors)

Explanation of different types of logistics service providers which are as follows:

- First-party logistics (1PL) service providers can only offer simple logistics activities including inbound and outbound transportation, e.g. a truck owner;
- Second-party logistics (2PL) service providers can provide both simple transportation and an extra service of warehousing;
- Third-party logistics (3PL) service providers can take care of most logistics needs, own and manage the warehouse activities and trucking operations within a contract;
- Fourth-party logistics (4PL) service providers can be regarded as a consultancy that tailors the logistics network and contracts other companies for certain tasks.
3.3.1 Third-party Logistics (3PL)

“Third-party logistics (3PL) service providers are firms that offer a range of logistics activities for their consumers.” (Christopher, 2011)

Bask (2001) has stated that the overall trend in logistics outsourcing is moving in two directions: increase in the number of buyers of logistics services, and increase in the extent of usages of logistics services. The most common way to face this trend is outsourcing logistics by 3PL. According to Boumole (2003), third-party logistics (3PL) can be regarded as the outsourcing or contract logistics. In addition, 3PL is widely defined as the utilization of an external firm to perform all or parts of another firm’s logistics operations. Meanwhile, Ye (2005) has claimed that outsourcing 3PL would enable manufacture enterprises to outsource its non-core products or operations to professional logistics companies, as a result, enterprises could focus on its core competencies. Moreover, Marasco (2007) concluded that 3PL is a kind of inter-organizational relationship between users and providers and the functions can cover the whole logistics process or partial activities, including information management, warehousing, value-added services, tracking and tracing and so on. Service providers also build relationships with the interfaces of the SC and the purpose is high effectiveness and efficiency, no matter in the short-term or long-term relationship (Bask, 2001). Marasco (2007) has indicated that there are four identified issues which need to pay attention immediately: the first issue is to increase operation rate of e-commerce technology; the second issue is the development of 3PL business culture; the third one is the complex behaviors of customers and providers; the fourth issue is a requirement of deeper research concerns which gathers processes and philosophies within outsourcing logistics operations. According to Bask (2001), 3PL is susceptible to the changes of strategies, processes and structure in the SC. The development of information and communication technology also improved the performance of logistics outsourcing activities. 3PL could communicate with customers directly via easy-to-use information channels and also achieve many benefits that based on the contract within
a long-term cooperation, as well as from the innovation ability and knowledge sharing with customers in the entire SC.

3.4 METHODS FOR SELECTION OF A LOGISTICS SERVICE PROVIDER

Many researchers have conducted their studies to select the suitable logistics partner in the outsourcing logistics process for companies. Therefore, they also provided their suggestions on how to select a LSP that based on the logistics outsourcing. Min and Joo (2006) highlighted that using the method of Data Envelopment Analysis (DEA) can be helpful to measure and benchmark the operational efficiency of a LSP. After that, Zhou et al. (2008) suggested using DEA to measure the competitiveness of the ten leading 3PL providers in China. In addition, Gol and Catay (2007) have applied AHP-based model to make an appropriate selection of a proper global LSP in the Turkish Automotive Company. Similarly, Jharkharia and Shankar (2007) proposed the Analytic Network Process (ANP) approach for the process in the selection of an appropriate 3PL provider. Moreover, Meade and Sarkis (2002) also have claimed that the ANP approach can be applied to choose a proper 3PL in their study. Furthermore, Andersson and Norrman (2002) provided an effective plan to make a selection of a LSP that is according to these 8 key points: (1) define the service; (2) understand the volume bought; (3) simplify and standardize; (4) market survey; (5) request for information; (6) request for proposal; (7) negotiations; (8) contracting. Although companies can recognize these key points to continue implementing their process of selection, there is no doubt that the final selection of a logistic partner for companies cannot simply regarded as an easy task after finishing the initial screening of providers. Thereafter, more and more organizations would like to use some similar approaches to make a final selection of a provider. Consequently, the importance of systematic development in the selection process is gradually growing. Particularly, identifying the selection criterion becomes an important part in choosing a logistics outsourcing provider.
3.4.1 Problems Related to Selection of a Logistics Service Provider

The selection of a LSP can be viewed as a complex multi-criteria decision-making problem because the availability of quantitative, qualitative and multiple criteria have to be considered in the decision process (Percin, 2009). Moreover, the better selection of a LSP for a company could better match the requirements at the both internal and external operations which followed the initial goal and selection criteria (Bhatnagar et.al, 1999). Sink and Langley (1997) have emphasized that the process of sound decision-making from internal stakeholders in a company cannot be ignored when company selects a logistic provider. These suggestions are deemed as critical comments that directly influence on the final selection. However, some problems that relate to the selection should be carefully considered by those companies which would like to outsource their logistics operations to a LSP. Jharkharia and Shankar (2007) have highlighted that the logistics manager of companies may encounter some specific problems during the period of making a selection of a LSP. Therefore, companies have to pay attention to these specific problems and solve them effectively before they finally decide to outsource a LSP. Thus, these problems are commonly happening at the process of making a final selection. Therefore, organizations which prefer to outsource logistics operations ought to identify these specific problems clearly. In other words, these specific problems should be highly paid attentions by organizations once practicing the program of making a final decision. Accordingly, it is quite significant for organizations to recognize these problems before doing a selection. Thereafter, organizations could avoid such a list of problems and finally finish a best decision in the outsourcing logistics operations.

Briefly, some specific problems have been concluded as follows:

- Due to lack of in-depth and professional logistics knowledge staffs to manage the logistics operations in a company, organizations would like to execute outsourcing logistics activities. Meanwhile, it can be a tough task for such an organization to
make an appropriate selection of a LSP;

- At the step of initial screening of LSPs, a few LSPs might offer unrealistic information that referred to their ability by themselves. Based on this reason, these LSPs cannot meet the requirements to organizations, as a result, it will finally lead to a bad selection of a LSP for the organizations;

- Directly comparing to request for proposal (RFP) from various LSPs can be regarded as a tough task to run, organization should carefully analyze each proposal and get an initial selection among these providers;

- Difficult to compare some subjective criteria such as the reputation of one company, employee satisfaction level etc., thereafter, this process will influence on making a valid judgment for decision makers;

- In some special situations, the LSPs cannot provide realistic services and activities in range of outsourcing logistics operations to their users, that is to say the LSPs did not satisfy the expectations of users;

- Although considering about these specific problems as above, it still takes the company almost a few months in the process of making the selection of an appropriate LSP. Organizations should be careful to decide their selection.

3.5 ANALYTIC NETWORK PROCESS (ANP)

Analytical Network Process (ANP) approach is a method which deals with the complex decision by utilizing a systemic multi-attribute analytical technique (Saaty, 1996). Especially, the ANP approach allows organizations to model within complex and dynamic environments in the selection process. Azhar and Leting (1993) claimed that ANP contains an evaluation of a multi-attribute, multi-year decision process that applied to an equipment replacement decision. Hamalainen and Seppalainen (1986) also emphasized that ANP approach can be regarded as a more general evaluation approach or system-with-feedback approach, at the same time, may be used to assess a dynamic multi-directional relationship among decision attributes. Zaim et al. (2012) agreed that the ANP method would rather consider about much more relative selection
criteria including tangible or intangible, objective or subjective etc. and better draw a comprehensive decision. They also highlighted that it is significance to ensure the selection criteria and alternatives before building the ANP-based model in order to gain consistent and reliable decisions. Moreover, the ANP method can analyze different types of relationships systematically through adding some useful factors such as feedbacks, inter-dependences and interactions into the decision-making program. Lee and Kim (2000) applied ANP method within a Zero-One Goal-Programming (ZOGP) model to provide a selection methodology that reflected inter-dependencies among evaluation criteria. Sarkis (2002) has used the systemic ANP model to analyze various projects, technological selections or business decision alternatives. Momoh and Zhu (1998) presented an application of AHP and found that the ANP method can enhance the selection of generating power units for appropriate price allocation in a competitive power industry. The ANP method aims at evaluating alternatives, then it could help organizations to become agiler by improving the selection processes effectively (Meade and Presley, 2002).

In addition, Jharkharia and Shankar (2007) stated that ANP-based model can help decision makers to capture inter-dependencies among decision attributes and lead to a more systematic analysis for the final decision. The ANP-based model can effectively deal with the high level of complex problem during the process of making a selection of a provider by companies. According to the comprehensive ANP-based model from Jharkharia and Shankar (2007), when companies decide to outsource a logistics provider, these four determinants including compatibility (CPT), cost (CST), quality (QLT) and reputation (RPT) require companies to consider firstly. Under the level of four determinants, companies still have to concern on other four standard dimensions that aim at measuring the performance of four determinants as mentioned above. These four standard dimensions containing of long-term relationship (LTR), operational performance (OP), financial performance (FP) and risk management (RM) could help companies to focus on more detailed about the performance of providers from different perspectives. Through identifying these selection criteria that related to choose a proper
provider, it is important for companies to construct a complex ANP-based model. Nevertheless, the ANP-based model is quite useful for organizations to finish the selection process in outsourcing logistics operations. Thereafter, the ANP method can provide more generalized model to make an appropriate decision without making any assumptions about the independence elements. More details about the illustration of comprehensive ANP-based model were shown as follows (see Figure 4).

**FIGURE 4** - ANP-based Model for the Selection of a Logistics Service Provider
(Source: Jharkharia and Shankar, 2007)
3.6 ANALYTIC HIERARCHY PROCESS (AHP)

Saaty (1980) has created the Analytic Hierarchy Process (AHP) approach, and he believed that the AHP approach can be helpful to solve many problems which relate to make an appropriate decision. For instance, Saaty (1980) used the AHP approach to analyze which school was better for his son to go. Even more, the AHP method was also utilized to make a plan of transportation system for the Sudan government. According to Saaty (1994), there are some advantages about the AHP approach as following points: firstly, it helps to decompose a complex problem into a reliable hierarchic structure that contains criteria and alternatives to determine the best choice; secondly, it can make valuable judgments from decision makers to determine the weights of the elements; thirdly, it uses an appropriate consistency ratio (CR) to validate the consistency of the decision-making process.

Particularly, the AHP method is widely used to handle such a simple multi-criteria decision-making problem. Due to the nature of complexity in the ANP approach, it is a better way to utilize the AHP approach to deal with the selection of a LSP in this study. Many researchers have stressed that the AHP approach can be applied to track multi-attributes decision problems in real situations. Chan and Chan (2004) have applied the AHP-based model to develop the selection of a supplier that based on the quality management system principles. Jharkharia and Shankar (2007) stated that the AHP method is widely used by companies which can effectively and efficiently help to deal with the multi-criteria decision-making problem. Zaim et al. (2012) have also dealt with the decision-making problem that based on a hierarchical structure. Thereafter, the AHP method can help organizations to figure out the critical aspect of the specific problems about the final selection clearly and effectively. More importantly, the AHP method is used in many different areas such as economics and planning, energy policy, project selection and forecasting (Petroni Alberto, 2000).

The AHP method provides a framework to consider about multiple criteria including
intuitive, rational, qualitative and quantitative aspects. At the beginning of using the AHP method, it is necessary for decision makers to finish ratio scale priorities or weights to compare the different selection criterion. Following to do that, the AHP method not only assists decision makers to construct complexity and exercise judgment, but also lets them to consider about both objective and subjective elements in the decision process comprehensively. Obviously, this can be explained why choosing AHP method as the decision support model for solving the problem related to select a LSP. Meanwhile, it also requires a logical and rational control for the final decisions because the problems involve many intangible factors. Especially, the AHP method contains both upper level and lower level criteria, the upper level of the hierarchy is represented as the primary goal, as well as the lower level of hierarchy is represented as all of the possible alternatives. Thereafter, comparing to the value between each two selection criteria is an important step to evaluate the final selection in the AHP-based model. The AHP method focuses on constructing a comparison matrix that expresses the relative value in different levels of influenced elements. Therefore, there is a basic principle that involves different standards (e.g. judgments from number of 1-9). Decision makers should make a comparative between each two selection criteria and provide an importance judgment that presented in the scale in the matrix. For instance, if the selection criterion A is more important than selection criterion B, the decision makers can rate the judgment of A as 5. Meanwhile, on the other hand, criterion B can be rated as 1/5. There is a common scale (Saaty, 1980) for marking the judgments of selection criteria (see Figure 5).
FIGURE 5 - Fundamental Scale for Pair-wise Comparisons (Source: Saaty, 1980)

<table>
<thead>
<tr>
<th>Intensity of importance</th>
<th>Definition</th>
<th>Explanation</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Equal importance</td>
<td>Two factors contribute equally to the objective.</td>
</tr>
<tr>
<td>3</td>
<td>Somewhat more important</td>
<td>Experience and judgment slightly favor one over the other.</td>
</tr>
<tr>
<td>5</td>
<td>Much more important</td>
<td>Experience and judgment strongly favor one over the other.</td>
</tr>
<tr>
<td>7</td>
<td>Very much more important</td>
<td>Experience and judgment very strongly favor one over the other. Its importance is demonstrated in practice.</td>
</tr>
<tr>
<td>9</td>
<td>Absolutely more important</td>
<td>The evidence favoring one over the other is of the highest possible validity.</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>Intermediate values</td>
<td>When compromise is needed.</td>
</tr>
</tbody>
</table>

After gathering the judgment of each selection criterion, it is necessary to practice the process of calculation and to get the result of Eigen-vector for each selection criterion. Especially, the list of relative weights, importance, or value can represent as the Eigen-vector of these selection criteria. Tam and Tummala (2001) proposed four critical steps to implement the AHP method in making a final decision: (1) structuring the problem purpose; (2) collecting data; (3) weight normalization; and (4) synthesizing solutions.

Briefly, the key ideas in the AHP approach are as follows:

(1) Define the criteria for making a decision in the multi-level structure model that is similar like a hierarchy tree involving of objectives. At the upper level of the tree is a statement of the “primary goal” of the decision. After that, there are some attributes that associate with the decision problems at the lower level of the tree. If necessary, these attributes can be broken down into more detailed until all essential criteria for making the final decision have been specified. Then, the alternatives can be added to the last level of hierarchy model that are below each of the attributes at
the lower level of tree;

(2) Use the pair-wise comparison matrix by comparing criteria/objectives on the basis of importance or alternatives on the basis of preference for each two criteria in a group. This process aims at determining weights and ratings of the influenced elements so that decision makers can just concentrate on any two criteria/objectives at each time. As a result, weights or ratings are derived from the valid judgments by decision makers can be shown verbally, numerically or graphically. Especially, decision makers that have enough knowledge and experience should focus on marking the specific judgments. If not doing so, inappropriate weights or ratings will impact to the quality of final decision directly;

(3) Calculate the Eigen-vector for each pair-wise criteria, it is important to measure the preference rating to achieve the overall objectives for each alternative that is according to the specific judgments. Thereafter, compare with each Eigen-vector of selection criterion which comes from different levels in the pair-wise comparison matrix and sort the results of Eigen-vector step by step into a list;

(4) Identify the final Eigen-vector for criteria at different levels in the AHP-based model, the higher relative weights or ratings mean as more important than the others. Finally, the synthesis of judgments can be reflected a Comprehensive Ability” of the hierarchy model. Consequently, make the best decision based on the final results.

3.6.1 Process for Selection of a Logistics Service Provider Based on AHP

According to the methodology from Jharkharia and Shankar (2007), they have designed 9 steps to make a final selection of a LSP. At the same time, the proposed methodology would follow the evaluation of alternative providers in 2 ways: (1) initial screening the logistics providers; (2) making a final decision of selecting a logistics company that
based on ANP approach. Actually, it is easy to implement the first way but the final selection of the alternative logistics providers is a difficult task to finish. In this thesis, considering about the nature of complexity in ANP approach, authors would rather explore how to utilize the AHP approach to make a final selection of a LSP for the case company. Accordingly, authors reviewed these 9 important steps to establish a framework in the selection process that described as follows:

- Developing a team of competitive managers relevant to logistics knowledge;
- Ensuring the specific objectives for service and distribution;
- Developing a functional specifications;
- Identifying and screening the alternative logistics providers;
- Developing the request for information (RFI);
- Developing the request for proposal (RFP);
- Evaluating the responses of request for proposal (RFP);
- Flied visits and inspection;
- Final selection and agreement for services.

At first, the members in a competitive team who should have rich knowledge and experience to handle the logistics activities, including all functional areas such as finance, manufacturing, marketing, sales and logistics. According to their professional opinions, it can make a good starting for the selection of a logistics provider.

After that, organizations have to identify and confirm their objectives and expectations in outsourcing their logistics operations clearly. Jharkaria and Shankar (2007) claimed that an accurate description of service requirements would help the organization to ensure fewer surprises and achieve the actual need of assumptions. Organizations should figure out how to shorten the gap between what they expect to achieve and what they actually gain from a logistics provider through outsourcing logistics operations within a service contract.
In addition, organizations should identify other potential providers around themselves in the marketplace when they decided to outsource their logistics operations. Therefore, those providers also should be suitable to the requirements of user companies. Organizations can make an initial screening of the providers by adopting some methods as following: (1) communicating with the prospective providers directly; (2) gathering logistics information from professional logistics platform, media, and newspaper and business magazines; (3) attending the relevant logistics conferences to seek for an appropriate provider. Especially, the factors such as reputation, revenues, growth pattern, location, product range handled etc. also might play an important part at this step of initial screening.

Next step, organizations should send a request for information (RFI) to those potential logistics providers, aims at reviewing some basic information from the providers and evaluating their willingness to collaborate with the user companies within an outsourcing logistics contract. Then, organizations have to design the request for proposal (RFP) including both quantitative and qualitative information and sent it to each potential provider. As a result, the responses could be helpful for user companies to compare the importance of each factor that based on AHP approach. Consequently, the user companies should begin evaluating the responses to the request for proposal (RFP) and keep obtaining an actual logistics needs for providers.

It is very important for organizations to make a field visit and inspection with the potential providers before doing the final selection. In this step, organizations could evaluate thoroughly about the logistics equipment and the performance of employees, aims at understanding their actual ability. In addition, organizations also can try to discuss and exchange suggestions with the customers of the providers.

After preparing these important steps, organizations can mainly use AHP approach to make a final selection of a logistics provider. At the same time, a formal contract is an essential guarantee for user companies to maintain long-term business relationship with
their providers. Thereafter, organizations should identify the scope of services in the content of a contract clearly so that the providers can offer relevant logistics activities to satisfy the actual requirements of user companies.

### 3.6.2 Criteria for Selection of a Logistics Service Provider Based on AHP

Organizations have to consider about multiple criteria when they select a logistics service provider. Selection criteria are related to support the process of selecting providers that based on Analytic Hierarchy Process (AHP). Gol and Catay (2007) stated that the AHP approach has been widely applied to decision problems in these areas including the economics and planning, energy policy, material handling and purchasing, project selection, vendor selection and budget allocation. According to the AHP-based model from Gol and Catay (2007), it mainly provided a decision hierarchy model about a selection of logistics provider. The decision hierarchy model was considered with five main parts, including the “general company considerations”, “capabilities”, “quality”, “client relationship”, and “labor relations”. Besides that, Jharkharia and Shankar (2007) have explored that how to apply ANP approach to help companies to select a logistics provider. Comparing to the method of AHP, the ANP approach allows the inclusion of all the relevant criteria containing with tangible or intangible, objective or subjective etc., then arriving at the best decision for users. In their research, they have defined four main determinants at the beginning for a selection of a logistics provider, the determinants which included of “compatibility”, “cost”, “quality”, and “reputation”. Meanwhile, Sarkis (1998) has claimed that ANP approach can be used in decisions related to energy policy planning, production design, and equipment requirement. In addition, the selection criteria should be clearly identified and evaluated by using curves, ratings, and step functions with respect to each criterion. In this thesis, authors have reviewed much selection criteria and finally decided to focus on these ten important selection criteria in the process of a screening a logistics provider. Details of the selection criteria are provided as follows (see Table 1).
<table>
<thead>
<tr>
<th>Table 1 Selection Criteria</th>
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<tbody>
<tr>
<td><strong>Compatibility</strong></td>
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<tr>
<td><strong>Cost</strong></td>
</tr>
<tr>
<td><strong>Management</strong></td>
</tr>
<tr>
<td><strong>Reputation</strong></td>
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<tr>
<td><strong>Location</strong></td>
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<tr>
<td><strong>Storage capability</strong></td>
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<tr>
<td><strong>Delivery performance</strong></td>
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</table>
### Financial performance

The logistics provider which has a sound financial performance could ensure the continuity of services and regular upgrading of the equipment in the logistics operations (Andersson and Norrman, 2002; Boyson et al., 1999; Gattorna and Walters, 1996).

### Long-term relationships

Referring to include shared risks and rewards, ensure cooperation between the user and the provider. It also helps in controlling the opportunistic behavior of providers (Lynch, 2000; Boyson et al., 1999; Maltz, 1999; Stank and Daugherty, 1997).

### IT-capability

IT-capability refers the computer systems used for tracking, tracing, and confirmation. It could reduce uncertainties and improve the inventory level when outsource the provider which owns the advanced IT capabilities. It is not necessary for companies to invest in advanced IT capability by themselves if under such a situation. Thereafter, they can just keep tracking of goods and raw materials with the assist from provider through applying the advanced IT system (Andersson and Norrman, 2002; Boyson et al., 1999).

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### 3.7. SWOT ANALYSIS

SWOT is an acronym which stands for strengths, weaknesses, opportunities, and threats. The SWOT analysis can be used for a product, organization or person (Monavari et al., 2007). Harvard Business School Professor Andrews put forward this theory in 1971. Today, it is used as the most extensive analysis tool in the strategic management field. According to Zhang (2008), the SWOT analysis can be regarded as an analytical work of the opportunities and threats existing in the external environment, as well as the strengths and weaknesses existing in the internal environment. Most managers apply the SWOT matrix to identify and formulate strategies for their companies. Weihrich (1982) has provided a framework that gives some suggestions by matching key internal and external factors.
4. EMPIRICAL STUDY

4.1 GEVALIA INTRODUCTION

Gevalia has been doing business in Gävle for 159 years. This brand was founded in 1853 by Victor Theodor Engwall. Nowadays, Gevalia is the largest coffee roaster maker in Scandinavia because people in this area have the highest coffee consumption rate around the world. In 1971, Gevalia was acquired by General Foods and gradually became one of the top three most famous coffee brands in the world. According to the report (GEVALIA, 2012), Gevalia provides over 40 different varieties of coffee and tea in the market. In order to purchase the best quality of coffee beans in the world, the purchasing staffs have investigated in many regions that are abundant in coffee, such as Brazil, Colombia and Ethiopia etc. Gevalia always focuses on the quality of their productions. Therefore, the processes of selecting, grinding, roasting and final packaging are strictly controlled by Gevalia. The reason why they put the headquarters in Gävle is that the main customers of Gevalia locate at many big cities in the south of Sweden (GEVALIA, 2012). Particularly, Gevalia has a high requirement of coffee quantity, and it operates a rigid production cycle process every week (see Figure 6). In addition, Gevalia would also summarize the shortages of the production cycle process and send out its feedbacks to other business units on Friday in each week. Moreover, Gevalia uses the advanced management systems including the “Systems Application and Products in Data Processing (SAP)” and “Material Requirement Planning (MRP)” to send the short-term/long-term plan and orders to their business partners in the entire supply chain (see Figure 7).
4.2 LOGISTICS SERVICE PROVIDERS OF GEVALIA

According to the interview with the production and logistics manager of Gevalia, he mentioned that the 3PL company named FLB Logistics is the main LSP in Gevalia’s
outsourcing logistics operations. Gevalia has been outsourcing its external warehousing to FLB Logistics since 2009. The manager explained some details about how FLB Logistics supports to their logistics system. FLB Logistics, which founded at Gävle since 1987, offers industrial logistics including material supply, finished foods handling, and value-added services for Gevalia that will enable to reduce both lead time and costs in supply chain. Before outsourcing the logistics operations, Gevalia only used their own warehouse and vehicles in their self-built logistics system so that it could better control the processes of logistics operations in their businesses. However, Gevalia has not enough space to store their finished goods by itself, and it has to pay more attention to the simple self-built logistics system every day. With the increasing pressure of inventory in Gevalia’s owned warehouse, it began seeking for ways and eventually decided to outsource logistics operations to a logistics service company. Gevalia has been outsourcing their external warehousing to FLB Logistics for four years. FLB Logistics provides the professional logistics activities for Gevalia that include receiving materials, optimizing storage, ordering packaging and managing inventory. According to the material flow of Gevalia (see Figure 8), FLB Logistics helps Gevalia to receive the packing material from one supplier at the beginning of the supply chain at first. Secondly, FLB Logistics sends the packing materials to the manufacturing factory of Gevalia. Meanwhile, FLB Logistics also stores half accounts of packing materials in their warehouse from Gevalia to satisfy the flexible manufacturing. In addition, Mondelēz International, an American multinational confectionery company, which is responsible for marketing to sell the finished goods for Gevalia. The finished goods will be delivered to Mondelēz International by Gevalia. Especially, FLB Logistics would also provide its warehouse to store finished goods from Mondelēz International if the inventory in Mondelēz International is under the high pressure condition.
Furthermore, the manager explained why they selected FLB Logistics as their logistics provider. For Gevalia, one of the most important reasons is “space”. In recent years within high quantity of sale involving to Gevalia’s products in the marketplace, the old self-built logistics system of Gevalia can no longer to satisfy the current situation. There is a lack of space and effective logistics operations to handle the packing materials and finished goods in Gevalia. Consequently, Gevalia found out that FLB Logistics can provide abundant logistics knowledge and enough space of the warehouse for their logistics operations. After that, Gevalia could focus on their core competence in their businesses and reduce the cost of logistics operations by themselves with the assistance of FLB Logistics. Thereafter, the manager indicated that the delivery performance of one logistics provider is another important factor when he considers about making a final decision of a LSP, because he believed that it could reduce the lead time for Gevalia with the help of high efficiency delivery performance.

The “compatibility” between Gevalia and the LSP also is a significant consideration, simply saying, the scale of LSP should be matched with the development of the user in the whole logistics system. Otherwise, it will lead to a bad cooperation that relates to both provider and user because the LSP cannot effectively support to its clients at all.
Obviously, the factor of “compatibility” should be regarded as important selection criteria during the process of making a decision. In addition, when we asked if there was any other potential LSPs can be selected by Gevalia in the area of Gävle, the manager of Gevalia informed us that Gevalia considered selecting the enterprise named as Sören Thyr AB as their logistics operation partner at four years ago. Sören Thyr AB, which is a professional 3PL company that locates at Gävle. Moreover, he emphasized that Sören Thyr AB also can provide good logistics service for Gevalia. That is to say, Sören Thyr AB is one of the potential logistics providers for Gevalia to select in the areas of outsourcing logistics marketplace at Gävle.

Based on the interview with the manager, he has evaluated the ten important selection criteria in the process of selecting a LSP. These ten selection criteria including “compatibility”, “cost”, “management”, “reputation”, “location”, “storage capability”, “delivery performance”, “financial performance”, “long-term relationships” and “IT-capability” were summarized by authors after reviewing many literatures about selection criteria, and the manager agreed that these ten selection criteria are worthy of consideration. Therefore, he clearly explained to us that he would like to consider five important criteria among these ten selection criteria when he considered a LSP at the beginning of selection process. As an important decider in the logistics department of Gevalia, the manager has concluded that he would carefully concentrate on these five criteria including “compatibility”, “cost”, “management”, “delivery performance” and “location”. Depended on his abundant experience in logistics operation, he thought that these five selection criteria can evaluate the performance of a LSP effectively.

The compatibility of a provider should be suitable to the development of their users. Then, an excellent LSP can ensure their “Comprehensive Ability” to cooperate with their users, achieving to the common objectives together in the businesses. Needless to say, every decider has to consider about the cost in their business activities. The motivation of Gevalia decided to collaborate with a LSP is to enhance their competitive advantage and reduce their total costs in the whole supply chain. Besides that, Gevalia
can get abundant logistics knowledge and advanced technology from a LSP and focus on their core competence in their businesses. The ability of management in providing good internal service can be regarded as a plus point for providers. Consequently, it facilitates a stable management structure and deals with specific logistics problems for users. There is no doubt that the ability of delivery performance by a logistics service provider is reflected by these standards such as speed, safe and reliability to satisfy their clients. Companies require their logistics provider to delivery items to the destination on time and ensure the quality of loading and unloading the items. As a result, it could improve the reputation for the users through offering good logistics service by a LSP. Furthermore, the location of LSPs is a quite important factor because it can reduce the transportation time effectively if the location of LSP is near to Gevalia.

Actually, it is necessary to require logistics manager to ensure sets of criteria when the company expects to start selecting an appropriate LSP. Once confirming the selection criteria in the process of making a decision, it is necessary to provide the specific judgments between two different selection criteria in a group that bases on AHP approach. Particularly, the task of making judgments for each two selection criteria (pair-wise comparison) is the most difficult step in AHP-based model. Professional logistics experience could increase the valid of judgments, and offer reliable data in this study. More details about the valid judgments of five selection criteria that based on the production and logistics manager of Gevalia will be discussed later.

4.3 SWOT INFORMATION GATHERED FROM CASE STUDY

Through studying up existing knowledge and interviewing with the manager of the case company, we summarized the features of the two different logistics modes by Strengths-Weaknesses-Opportunities-Threats (SWOT) matrix. Two SWOT matrixes are utilized in self-built logistics system and outsourcing logistics system (see Figure 9, Figure 10).
### FIGURE 9 - SWOT Matrix of Self-built Logistics System (Source: by authors)

<table>
<thead>
<tr>
<th><strong>Strengths</strong></th>
<th><strong>Weaknesses</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. High brand awareness</td>
<td>1. High management cost</td>
</tr>
<tr>
<td>2. Higher delivery speed</td>
<td>2. Weaken an enterprise’s core business</td>
</tr>
<tr>
<td>3. Easier to grasp information</td>
<td></td>
</tr>
<tr>
<td>4. Less negotiations</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Opportunities</strong></th>
<th><strong>Threats</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Good for long-term development</td>
<td>1. High management risk</td>
</tr>
<tr>
<td>2. Enhance customers’ experience</td>
<td>2. Intense competitive pressures</td>
</tr>
</tbody>
</table>

### FIGURE 10 - SWOT Matrix of Outsourcing Logistics (Source: by authors)

<table>
<thead>
<tr>
<th><strong>Strengths</strong></th>
<th><strong>Weaknesses</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Strategic focus on core competence</td>
<td>1. Increased transaction costs</td>
</tr>
<tr>
<td>2. Low labour costs</td>
<td></td>
</tr>
<tr>
<td>3. Reduced bureaucracy</td>
<td></td>
</tr>
<tr>
<td>4. Strategic flexibility</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Opportunities</strong></th>
<th><strong>Threats</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Access to new competences</td>
<td>1. Risk of supplier opportunism</td>
</tr>
<tr>
<td>2. Possibility of value adding relations</td>
<td>2. Reduced scope of learning logistics and innovation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Weaknesses</strong></th>
<th><strong>Strengths</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Increased transaction costs</td>
<td>1. Strategic focus on core competence</td>
</tr>
<tr>
<td>2. Weaken an enterprise’s core business</td>
<td>2. Low labour costs</td>
</tr>
<tr>
<td>3. Reduced bureaucracy</td>
<td>3. Strategic flexibility</td>
</tr>
<tr>
<td>4. Strategic flexibility</td>
<td>4. Risk of supplier opportunism</td>
</tr>
</tbody>
</table>

1. High management risk
2. Intense competitive pressures
1. Risk of supplier opportunism
2. Reduced scope of learning logistics and innovation
4.3.1 Features of Self-built Logistics System

Brand awareness is about brand identity in consumers’ memory. The higher brand awareness could bring a good brand recognition and recall performances. Obviously, it is an advantage in the self-built logistics mode because it could reflect the degree of professionalism and technical strength of one company. Another advantage is the centralized administration and supervision in self-built logistics mode, so operational information can be well controlled by managers. In the meanwhile, self-built logistics could bring higher delivery speed because of its integrated system (Frazzon et al., 2010). Especially, it is not necessary to rely on other LSPs for those companies which have self-built logistics system. These companies can solve relevant logistics issues by themselves. Consequently, there are less negotiations that related to other logistics companies in their business activities.

Self-built logistics companies could build their own distribution centers and logistics system. For this reason, the management of cost would be higher, and the investments of self-built logistics companies would be mostly used for hiring some specialized staffs in the logistics areas. Accordingly, this might cause distractions and weaken their core businesses. In addition, there are some opportunities for self-built logistics system. In the process of building their own logistics system, they can accumulate a lot of experiences. Therefore, it could make the logistics performance better and better under owing a self-built logistics system and be beneficial for the long-term development. Meanwhile, the final customers would not only enjoy the products in a good delivery performance, but also get benefits from the delivery channels. In addition, the threats are obvious in self-built logistics companies. Because of the complexity of self-built logistics systems, they have to face several management risks and competitive pressures.

4.3.2 Features of Outsourcing Logistics System

A company decides to hire LSPs in order to focus on their core businesses and then
enhance its core competitiveness. It would not only save effort but also reduce labor costs (Alfredsson, 2003). Outsourcing can indirectly reduce bureaucracy because it creates many chances to discuss businesses and understand each other. So when compared with self-built logistics system, outsourcing logistics would have a strategic flexibility because companies can adjust their business structures easily by outsourcing. But the weakness is that more cooperation would bring increasing transaction costs. It increases the economic exchanges and complexity in a company’s operations.

One of the opportunities for outsourcing logistics is accessing to new competences. Cooperation could give the company new ability, or after outsourcing, the company can use conserved energy to develop new competences and value adding relations. The threat of suppliers’ opportunism is common. Suppliers would sometimes ask for a price premium over normal to guard themselves against their opportunistic behaviors. And the scope of learning logistics knowledge and innovation would be reduced because companies do not need to worry about logistics management as much as in the past.

4.4 VALID JUDGMENTS OF FIVE SELECTION CRITERIA

Nowadays, outsourcing logistics operations can not only be deemed as a single function in logistics activities such as simple transportation or warehousing. With the rapid development of outsourcing the logistics service, LSPs now can offer a variety of comprehensive services that include inventory management, fleet management, and supply chain management etc. The trend of LSPs has now become more professional and multi-functions than before. Particularly, the process of selecting a LSP can be seen as an important project when a company decides to outsource its logistics operations to other logistics company in their whole business activities. For this reason, these companies should realize what a LSP can be responsible for in the part of outsourcing logistics operations. Commonly, outsourcing logistics activities in a company can be parts of all logistics functions, and also can be the entire logistics functions for their clients. Hertz and Alfredsson (2003) have highlighted that “outsourcing logistics
operation can help organizations to concentrate their core competencies, cost reduction, improvement of services and efficient operations, development of whole supply chain partnerships, restructuring of companies and successful performance by using contract logistics.”

In the process of selecting a LSP, it is necessary to get the judgments in the comparison matrix by comparing each two selection criteria. After identifying the multi selection criteria, marking the specific judgments could be seen as a task that cannot be ignored to continue exploring how to make a selection based on AHP approach. Due to the authors’ lack of reality work experience in logistics, it is impossible to finish marking the appropriate judgments regarding to the five selection criteria. Thus, these judgments should be followed to a logistics manager which has professional logistics knowledge and empirical work experience in an actual company. As mentioned before, the logistics manager of Gevalia has emphasized that he would focus on five selection criteria including “compatibility”, “cost”, “management”, “delivery performance” and “location”.

After introducing the AHP method to the logistics manager of Gevalia during the period of the interview, the manager agreed that AHP method can be applied to make a selection of a LSP. With the help from the manager, he marked the specific judgments between two selection criteria in a group and compared the five selection criteria between two different providers. Moreover, he informed us that it really needs to identify which selection criteria would be considered as more important than another. Based on the comparison matrix of five selection criteria, he mentioned that he would like to consider the “capability” of LSPs firstly in the current marketplace at the first step of initial screening. It can say that the ability of one provider is an important indicator for users to evaluate effectively. Moreover, he also stated that the “location” of logistics service providers will directly impact on the selection for users. In his suggestions, it is better to select the providers which located from company with a reasonable distance and enabled to delivery items efficiently to its final customers. In
addition, company would concentrate on the quality of “management” that relates to the performance of internal operations by providers. The selection criterion of “management” refers to the ability of managing the logistics activities in the warehouse. Therefore, it would improve the capability for providers and support their users. Undoubtedly, many companies would rather select a LSP which is responsible for comprehensive logistics activities within lower “cost” in their outsourcing logistics operations. However, the logistics manager of Gevalia highlighted that he would not firstly consider about the factor of “cost” in the five selection criteria, because he clearly knew that the average price of outsourcing a LSP at Gävle is almost the same. Thus, the integral level involving the “Comprehensive Ability” of a LSP depends on satisfying to the actual needs from users and keeping an acceptable price in the contract logistics. Eventually, companies prefer to form a long-term partnership with their logistics provider, achieving to “win-win” business strategic pattern. The manager of Gevalia has utilized his professional logistics experience in real industry to provide his valid judgments on the five selection criteria in a pair-wise comparison matrix in the section of analysis/discussion.
5. ANALYSIS/DISCUSSION

5.1 SWOT STRATEGIES OF SELF-BUILT & OUTSOURCING LOGISTICS

In order to identify which logistics mode is more suitable to Gevalia, we used SWOT approach to summarize the strengths, weaknesses, opportunities and threats in the two logistics modes. And then we can use those two SWOT matrix (see Figure 9 and Figure 10) to identify and formulate the SWOT strategies. After analyzing SWOT matrix, we suggested some strategies for different logistics modes (see Figure 11 and Figure 12).

Four SWOT strategies which are as follows: SO strategy: pursue opportunities that are a good fit to the company’s strengths; WO strategy: overcome weaknesses to pursue opportunities; ST strategy: identify some ways that firms can use its strengths to reduce its vulnerability to external threats; WT strategy: establish a defensive plan to prevent the firm’s weaknesses from making it highly susceptible to external threats.

<table>
<thead>
<tr>
<th>SO strategy</th>
<th>ST strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Take the opportunities of developing self-bi</td>
<td>1. Strengthen the survey and research work</td>
</tr>
<tr>
<td>l built logistics system</td>
<td>2. Risk management</td>
</tr>
<tr>
<td>2. Cultivate customer loyalty</td>
<td>3. Create an open market, break the monopoly</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WO strategy</th>
<th>WT strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Focus on personnel training</td>
<td>1. Strengthen the information management</td>
</tr>
<tr>
<td>2. Evaluate the impact of SC development</td>
<td>2. Master the key technologies</td>
</tr>
</tbody>
</table>

**FIGURE 11 - SWOT Strategies of Self-built Logistics System (Source: by authors)**
SO strategy
1. Focus on core business
2. Strengthen both the communication and cooperation

ST strategy
1. Strengthen the survey and research work
2. Encourage the independent research and development

WO strategy
1. Promote financial performance
2. Improve operational process

WT strategy
1. With the help of government and legal system

FIGURE 12 - SWOT Strategies of Outsourcing Logistics (Source: by authors)

5.1.1 Strategies for Self-built Logistics System

SO strategy for self-built logistics is taking the opportunities of developing its own logistics system because we need to pursue opportunities to expand our advantages in this strategy. In details, companies could invest more resources to enhance the functions in the self-built logistics system. For instance, deciding to phase in latest logistics techniques or to build more distribution centers. It is also important to formulate relevant customer strategies to cultivate customer loyalty because customer experience is also self-built logistics’ advantage. Self-built logistics companies could use ST strategy to reduce the impact of threats. First they should strengthen the survey and research work and try their best to create an open market, break the monopoly. This will help to achieve healthy competition and reduce competitive pressures. Second they should be prudent to deal with all kinds of risk. Professional risk management is necessary for self-built logistics system.
WO strategy needs companies to overcome weaknesses to pursue opportunities. So self-built logistics companies should focus on personnel training. It is helpful to raise the efficiency of staff quality promotion and enhance core competencies. Evaluating the impact of SC development is also important. If companies could have a good understand in every link of SC, it is useful to reduce the high costs in self-built system. WT strategy needs companies to prevent weaknesses from making susceptible to threats. Self-built logistics companies need to strengthen the information management. This may facilitate accurate marketing analysis and be better for companies to seize market changes to reduce costs. Mastering the key technologies could guarantee companies’ competitiveness and reduce pressures.

5.1.2 Strategies for Outsourcing Logistics System

Outsourcing logistics’ advantage is strategic flexibility. Thus, SO strategy should focus on promoting core business because they can get more energy and resources to improve competitiveness. At the same time, they can also take advantage of the flexibility to achieve much more cooperation and to increase the possibility of getting new abilities in their businesses. As for ST strategy, companies which have outsourced logistics should also strengthen the survey and research work like self-built logistics. It is still very important work. But they can also encourage independent research if they had enough resources because they have got in touch with many collaborators and had a plan to use the new technique to enhance competitiveness.

WO strategy needs companies which have outsourced logistics to promote financial performance because of the increasing transaction costs. And other companies will assess your financial performance before they collaborate with you. In the meanwhile, companies should try to improve operational process to reduce the cost. WT strategy needs companies to get the help from government and legal system because economy and suppliers’ opportunistic behaviors are not easy to control. Furthermore, the action
of implementing relevant laws to monitor these activities is necessary.

Especially, if Gevalia wants to get advantages and avoid those drawbacks at the same time, the mixed use of two different logistics modes for Gevalia would be a good idea. Through the case study, we knew that Gevalia insists on keeping their own warehouse, at the meanwhile, they are implementing logistics outsourcing with FLB Logistics. Therefore, such a strategy has brought a lot of benefits to company. Consequently, Gevalia’ logistics cost can reduced and their competitiveness also has been improved.

5.2 THE SELECTION OF A LOGISTICS SERVICE PROVIDER THAT BASED ON AHP APPROACH

As mentioned in the section of empirical study, Gevalia has selected FLB Logistics as a business partner in their outsourcing logistics operations. In addition, the logistics manager also indicated that there was another potential LSP named Sören Thyr AB for them to select at the beginning of the selection. Furthermore, authors expect to explore how Gevalia to make such a decision of selecting a LSP that based on AHP approach. In this section, firstly authors would use AHP approach to build a simple model to analyze how Gevalia to finish such a selection of a LSP between two different logistics companies. According to information from the production and logistics manager of Gevalia, it stated that Gevalia can make a decision of choosing a LSP between the FLB Logistics and the Sören Thyr AB in 2009 at Gävle. Moreover, the manager emphasized that he has distinguished the actual ability from different considerations between these two 3PL companies when Gevalia decided to outsource its logistics function to a logistics company.

In the section of empirical study before, it highlighted that there are five important selection criteria that can be regarded as evaluation standards for Gevalia to estimate the performance of one logistics provider. Based on five selection criteria including
“compatibility”, “cost”, “management”, “delivery performance” and “location”, the logistics manager has compared each two selection criteria in one group and marked valid judgments on them that depends on his logistics experience in Gevalia. According to the results of the comparison from the manager, “compatibility” is the most important factor to consider at first. Secondly, it is necessary to identify the ability of “management” in the logistics operations of the provider. Thirdly, the importance of “cost” is almost equal to the criterion of “delivery performance”. Finally, the element of “location” can be focused on by Gevalia at last among these five selection criteria. Thereafter, the manager has to mark judgments on these five selection criteria including “compatibility”, “cost”, “management”, “delivery performance” and “location” between the FLB Logistics and the Sören Thyr AB. From different perspectives to consider about the actual ability of a LSP, it concluded that the “compatibility” of FLB Logistics is better than Sören Thyr AB for Gevalia. Moreover, the “management” in the business operations of FLB Logistics is more effective than Sören Thyr AB. In addition, these three selection criteria including “cost”, “delivery performance” and “location” between the FLB Logistics and the Sören Thyr AB are the same judgment.

In this study, the AHP approach will lead to a reasonable decision for the case company in making a comprehensive selection of a LSP. According to the answers from the production and logistics manager of Gevalia, authors built a simple model that based on AHP approach to explore how Gevalia to select a proper logistics company step by step. In this study, AHP model has been simulated that is according to the basis of the literature review about how to apply AHP approach in reality and practical information at the area of logistics from the specific interview with the production and logistics manager of Gevalia. Particularly, the five selection criteria and specific judgments from the manager of Gevalia are the core elements to build the AHP-based model to analyze how to finish the final selection.

As mentioned earlier, the section of the theoretical framework has introduced the two similar methods for decision making that includes of AHP and ANP. However, it seems
appropriately to use AHP approach to make a final selection of a LSP. Actually, the ANP-based model mainly analyzes more systematic problem and also has to consider a net structure including various levels of selection criteria, as well as each selection criterion has relationship with others inside the net structure. For this reason, the ANP method seems like a complex and difficult way for authors to make a practical analysis in this study. Based on our specific case study of Gevalia, the ANP approach can better satisfy to analyze how to make a selection, even more easily to deal with the problems that related to the hierarchy structure including a few selection criteria in this study. After reviewing to the selection criteria and specific judgments from the logistics manager of Gevalia, authors started to determine the five selection criteria (“compatibility”, “cost”, “management”, “delivery performance” and “location”) in the AHP-based model to analyze the selection of a LSP. In the AHP-based model, authors have classified the various selection criteria of decision-making into three levels of categories. According to the basis study from Tam and Tummala (2001), authors would follow these four critical steps to deduce the process of selecting a LSP in a simple AHP-based model:

(1) Define the five main selection criteria (depended on the managerial logistics experience) as those influence factors for making a decision in the multi-levels (hierarchy) structure model. Firstly, at the upper level of the multi-level structure, “Selection of a Logistics Service Provider” is the primary goal in AHP-based model. Later, there are five attributes including “compatibility”, “cost”, “management”, “delivery performance” and “location” at the middle level of structure in AHP-based model for deciders to consider. Moreover, set two different options as alternatives for case company to choose at the third level. The two providers named as “FLB Logistics” and “Sören Thyr AB” can be regarded as alternatives. The simple AHP-based model containing three hierarchical categories was shown in Figure 13.
(2) Based on the information from the production and logistics manager of Gevalia, he has clearly mentioned that Gevalia decided to use outsourcing logistics operations at beginning because there was not enough space to store the items (including packing materials and finished goods) in Gevalia. For this reason, the logistics apartment of Gevalia expected to find out a proper LSP which could provide the high efficiency of warehouse and other relevant logistics service for Gevalia. Meanwhile, it is better to seek for a provider which is suitable to meet the specific requirements of Gevalia. That is to say, the influence factor of “compatibility” is the most important indicator among the five selection criteria. Moreover, Gevalia also considered about the “delivery performance” that logistics companies could provide an effective and efficient outsourcing logistics activities. Next, the selection criterion of “location” means that the distance between Gevalia and its logistics
provider. Thereafter, the shorter distance would lead to the result of saving-time transportation for Gevalia. A good “management” of the LSP can efficiently support the business strategy for Gevalia. As a result, it will bring more benefits in businesses to Gevalia. Nevertheless, as a manufacturer, the factor of “cost” has to be considered carefully that specially involves such an important project. Moreover, Gevalia would like to reduce the “cost” and concentrate on their core competency after outsourcing a high efficiency logistics company. Thereafter, authors created the pair-wise comparison matrix for each two selection criteria, and the production and logistics manager of Gevalia helped us to finish marking these valid judgments and to fulfill them into the matrix (see Table 2).

- **Table 2** Judgments of Five Selection Criteria in Pair-wise Comparison Matrix

<table>
<thead>
<tr>
<th>Selection Criteria</th>
<th>Compatibility</th>
<th>Cost</th>
<th>Management</th>
<th>Delivery Performance</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cost</td>
<td>1/5</td>
<td>1</td>
<td>1</td>
<td>1/3</td>
<td>1/5</td>
</tr>
<tr>
<td>Management</td>
<td>1/7</td>
<td>1</td>
<td>1</td>
<td>1/5</td>
<td>1/2</td>
</tr>
<tr>
<td>Delivery Performance</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Location</td>
<td>1/2</td>
<td>5</td>
<td>2</td>
<td>1/2</td>
<td>1</td>
</tr>
</tbody>
</table>

In addition, we should still continue to compare the five selection criteria between two different logistics companies. In order to achieve this comparison matrix, it is very necessary to understand the details and “Comprehensive Ability” about the
two specific 3PL companies. Certainly, authors have not enough experience in comparing the capacity of the two potential providers. Therefore, this task has to require the managerial person in the logistics areas to give a hand to us in this study. Based on the interview with the manager of Gevalia, he mentioned that Gevalia has two selection including “FLB Logistics” and “Sören Thyr AB” when decided to outsource its logistics operations to a logistics company at 2008. At that time, the manager has investigated these two logistics companies and recognized the differences between them. Furthermore, the production and logistics manager of Gevalia has enough experience and knowledge to compare the “Comprehensive Ability” of two different providers according to the five selection criteria that he has highlighted in the interview. Thereafter, he marked the judgments with specific number in the comparison matrix through comparing to each criterion between “FLB Logistics” and “Sören Thyr AB”. As a result, the manager of Gevalia has illustrated the details between them in Table 3.

- **Table 3** Judgments of Five Selection Criteria in Pair-wise Comparison Matrix between Two Logistics Service Providers

<table>
<thead>
<tr>
<th>Compatibility</th>
<th>FLB Logistics</th>
<th>Sören Thyr AB</th>
</tr>
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<tbody>
<tr>
<td>FLB Logistics</td>
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<td>7</td>
</tr>
<tr>
<td>Sören Thyr AB</td>
<td>1/7</td>
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<table>
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<tr>
<th>Cost</th>
<th>FLB Logistics</th>
<th>Sören Thyr AB</th>
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<tbody>
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<td>FLB Logistics</td>
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<td>1</td>
</tr>
<tr>
<td>Sören Thyr AB</td>
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<table>
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<tr>
<th>Management</th>
<th>FLB Logistics</th>
<th>Sören Thyr AB</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLB Logistics</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Sören Thyr AB</td>
<td>1/3</td>
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</tr>
</tbody>
</table>
(3) Calculate the Eigen-vector for “Five Selection Criteria in Pair-wise Comparison Matrix” and “Five Selection Criteria in Pair-wise Comparison Matrix between Two Logistics Service Providers”, then we can measure the preference rating about them. In this section, the calculation should be followed to the specific mathematical formula. Firstly, we have to calculate the “λ”, then the formula is “A*ω = λmax*ω”, “ω” is an Eigen-vector and “λ” is an Eigen-value. Secondly, we should concentrate on some important indicators like the “Consistency Index (CI)” which should obey to the formula as “(λmax - n)/(n - 1)”, and the “n” means the number of level in comparison matrix. “Consistency Ratio (CR)” also is a useful indicator that can be calculated as this formula: the “Consistency Index (CI)” is divided by the “Standard Ratio Index (RI)” that can be corresponded random matrix. Particularly, the specific ratio of “Standard Ratio Index (RI)” can be seen in the Figure 14. Saaty (1980) has concluded that if the result of “CR” is less than 0.1, which means that the set of judgments can be sure as consistent and reliable. Otherwise, these judgments in the comparison might not be trustable to measure the preference rating and lead to an incorrect result in the comparison matrix. Results of “Eigen-vector”, “λ”, “CI” and “CR” between the two major pair-wise comparison matrix are shown as following context (details about the calculation can be seen in APPENDIX Ⅰ).
• Eigen-vector of “compatibility”, “cost”, “management”, “delivery performance” and “location” =\((0.3606, 0.0689, 0.0666, 0.3090, 0.1949)^T\), \(\lambda_{\text{max}}=5.0006\), CI=0.00015, CR=0.000134 < 0.1;

• Eigen-vector of “Compatibility” between FLB Logistics and Sören Thyr AB =\((0.875, 0.125)^T\), \(\lambda_{\text{max}}=2\), CI=0, CR=0 < 0.1;

• Eigen-vector of “Cost” between FLB Logistics and Sören Thyr AB =\((0.5, 0.5)^T\), \(\lambda_{\text{max}}=2\), CI=0, CR=0 < 0.1;

• Eigen-vector of “Management” between FLB Logistics and Sören Thyr AB =\((0.75, 0.25)^T\), \(\lambda_{\text{max}}=2\), CI=0, CR=0 < 0.1;

• Eigen-vector of “Delivery Performance” between FLB Logistics and Sören Thyr AB =\((0.5, 0.5)^T\), \(\lambda_{\text{max}}=2\), CI=0, CR=0 < 0.1;

• Eigen-vector of “Location” between FLB Logistics and Sören Thyr AB =\((0.5, 0.5)^T\), \(\lambda_{\text{max}}=2\), CI=0, CR=0 < 0.1.

(4) Finally, each result of Eigen-vector that related to attributes and alternatives has been marked as footnotes into the AHP-based model. Then, we can easily analyze the correct information and finish a best selection between these two potential LSPs according to these important Eigen-vectors (see Figure 15).
According to Figure 15, the “Comprehensive Ability” of two LSPs can be calculated as follows:

- FlB Logistics (Comprehensive Ability)
  \[= 0.3606 \times 0.8750 + 0.068 \times 0.5 + 0.0666 \times 0.75 + 0.3090 \times 0.5 + 0.1949 \times 0.5 = 0.6519;\]

- Sören Thyr AB (Comprehensive Ability)
  \[= 0.3606 \times 0.125 + 0.0689 \times 0.5 + 0.0666 \times 0.25 + 0.3090 \times 0.5 + 0.1949 \times 0.5 = 0.3481.\]

The standard in the AHP-based model should be followed to such a principle that is the higher result of Eigen-vector of the selection criterion should be regarded as the more important one in the process of selecting to a LSP. According to the AHP-based model in this study, we aimed at achieving a better selection between the two alternatives of logistics companies. That is to say, we have to compare the “Comprehensive Ability”
between these two providers. As mentioned above, the result of final calculation has been shown as follows: FLB Logistics (0.6519) > Sören Thyr AB (0.3481), based on the specific answer, we can surely prove that the “Comprehensive Ability” of FLB Logistics is better than Sören Thyr AB. For this reason, we can know that the AHP approach can be applied to analyze how to select a LSP in the area of real industry. Therefore, Gevalia would rather select the proper logistics company which could be more suitable to assist the development of their owned logistics operations effectively. However, the AHP-based model in this study seems like quite simple that involves only five selection criteria for the decider to consider when he started to make a final decision among the two potential LSPs. Furthermore, company can also follow this hierarchy structure to build a higher level of AHP-based model through adding other selection criteria or considering more other alternatives of logistics companies. After comparing to each selection criterion and different alternatives that based on the specific selection criteria, it could better draw a reasonable and acceptable decision for the case company. In short, the AHP-based model can be deemed as a significant method to make the best decision that can meet the actual requirements of the industrial company.
6. CONCLUSION

To date, the concept of logistics has increasingly become more and more important in the business operations for companies. For this reason, it forces many companies to focus on their core competency and outsource their transportation and other relevant logistics activities to LSPs. At the same time, the development of LPSs also has grown rapidly in the outsourcing logistics marketplace. In particular, the better performance of a LPS would lead to a successful logistics management in doing the business for companies. However, the performance of each LSP is different, and it is necessary to evaluate the “Comprehensive Ability” of LSPs. Consequently, the task of making a proper selection of a LSP plays a significant role in outsourcing logistics operations.

At the very beginning of this study, authors firstly compared the differences between the self-built logistics system and the outsourcing logistics system; therefore, to recognize the performance of these two types of logistics system. After using SWOT strategic analysis, we identified that each logistics system has its own advantages and shortcomings. Companies should implement the appropriate adaptation of logistics system that depend on their own situations, and authors found that the mixed mode of both self-built and outsourcing logistics system can be a good idea for case company. Furthermore, companies also have to consider about their logistics partner in business — LSPs. Consequently, it is very necessary to pay more attentions on how to select an appropriate LSP as an outsourcing logistics partner for companies. Thus, authors have applied the AHP approach to analyze how to finish the best selection and to build a logical AHP-based model that depended on the primary data from the interview with the manager of the case company. According to the findings of the empirical study, the manager of Gevalia as a decider in his company and stated that he would concern on five selection criteria including “compatibility”, “cost”, “management”, “delivery performance” and “location” when he selects a LSP.
In addition, he mentioned that Gevalia has two logistics companies to choose when his company decided to implement outsourcing logistics operations, these two logistics companies are named “FLB Logistics” and “Sören Thyr AB”. Moreover, authors expect to illustrate the process of selecting the LSP based on AHP approach for the case company in this study. Furthermore, we proved the final result that the performance of “FLB Logistics” is absolute better than “Sören Thyr AB” and this result is also matched with the real condition for Gevalia. Obviously, the AHP approach can satisfy to the requirements in the process of selecting a proper LSP. Even more, the better performance of a LSP will address the actual needs to its clients effectively (users).

6.1 LIMITATION OF THIS RESEARCH

The AHP approach that involves both qualitative and quantitative analysis could make the research seen more reliable. However, some limitations still exist in this study. Before we built the AHP-based model, we required to confirm what selection criteria should be considered at first and to identify the specific valid judgments for these selection criteria. Accordingly, some deciders in company might finish this step of the selection process depending on his/her subjective perspective view. Especially, it will lead to not reliable results in this study. For this reason, the selection process of a LSP should depend on the decider which has enough logistics experience and knowledge in the field of real industry. Otherwise, some unavoidable bias from the deciders would directly influence on the final result in the AHP approach. Moreover, the calculation of pair-wise comparison matrix is a time-consuming and complex process, it is very necessary to observe each step patiently to achieve the accurate calculation. Particularly, it will also lead to a wrong result in the AHP-based model at the end if the result of calculation stated as inconsistent (CR > 0.1) in the pair-wise comparison matrix. Without a doubt, every research method has its own limitations. Therefore, we can identify them effectively and avoid making such a list of mistakes. The AHP approach still is a useful application for companies to make an appropriate choice from many different levels of LSPs.
6.2 FURTHER STUDIES

In this thesis, the single-case study is used to explore how to select a LSP that based on the AHP approach. Thus, further studies can be generated to analyze the selection process through involving more different selection criteria and other potential providers, and considering other influenced elements in the AHP-based model. With the rapid trend of outsourcing logistics activities, this specific research related to the AHP approach could provide an indicator to guide logistics managers to make a decision in selecting a better LSP efficiently. A good LSP could improve the logistics functions effectively and enhance the competitive advantages for their clients, on the other hand, their clients (organizations or entities) could focus on their core competiveness to gain more benefits in the business marketplace.
7. REFERENCES


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8. APPENDIX

8.1 APPENDIX I - CALCULATION OF EIGEN-VECTOR, λMAX, CI AND RI

※ Table 2 Judgments of Five Selection Criteria in the Pair-wise Comparison Matrix

(Source: from Jan Norman, the production and logistics manager of Gevalia)

<table>
<thead>
<tr>
<th>Selection Criteria</th>
<th>Compatibility</th>
<th>Cost</th>
<th>Management</th>
<th>Delivery Performance</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility</td>
<td>1</td>
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<td>7</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cost</td>
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<td>1</td>
<td>1/3</td>
<td>1/5</td>
</tr>
<tr>
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<td>1/7</td>
<td>1</td>
<td>1</td>
<td>1/5</td>
<td>1/2</td>
</tr>
<tr>
<td>Delivery Performance</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Location</td>
<td>1/2</td>
<td>5</td>
<td>2</td>
<td>1/2</td>
<td>1</td>
</tr>
</tbody>
</table>

Step 1: Adding each judgment together in each rank of the matrix, then each judgment is divided by the total summed result of each rank;

Step 2: After finishing the step 1 for each judgment of each rank, adding again for each after-judgment together in each row, and getting a total importance value table;

Step 3: Repeating the step 1 again, the results are summed together and used for normalizing the Eigen-vector elements (sum of all Eigen-vector is equal to 1).

For example, the total summed result of first rank is 1+1/5+1/7+1+1/2=199/70, after that, we calculate the first judgment of “Compatibility” is that 1 divided by 199/70, as a result, it is equal to 70/199 ≈ 0.3518, following this regulation, we finally get all the results of each after-judgment in the matrix.
After that, adding these after-judgments from together in each row, for example, the important value of “Compatibility”: 0.3518+0.3333+0.4375+0.3297+0.3509=1.8032. Therefore, we can calculate the important value of these five selection criteria.

Later, repeating the step 1, for instance, the total summed result of important value is 1.8032+0.3446+0.3331+1.5449+0.9744=5.0002, we calculate the Eigen-vector of “Compatibility”, it is equal to important value of “Compatibility”=1.8032 divided by total important value=5.0002, as a result, we can get the Eigen-vector of “Compatibility” is 0.3606. Thus, the other criterion also should follow this regulation.
Because $A\omega = \lambda_{\text{max}}\omega$,

$A\omega = (1.8032, 0.3446, 0.3331, 1.5449, 0.9744)$,

$\omega = (0.3603, 0.0689, 0.0666, 0.3090, 0.1949)$, then $\lambda_{\text{max}}$

$= 1/5*(1.8032/0.3603+0.3446/0.0689+0.3331/0.0666+1.5449/0.3090+0.9744/0.1949)$,

finally, $\lambda_{\text{max}}=5.0006$;

In addition, because $\text{CI} = (\lambda_{\text{max}} - n)/(n - 1)$, then

$\text{CI}=5.0006-5/5-1=0.00015$,

Because $\text{CR} = \text{CI}/\text{RI}$, RI (5) =1.12, then

$\text{CR}=0.00015/1.12=0.000134<0.1$;

Eigen-vector of “compatibility”, “cost”, “management”, “delivery performance” and
“location” =$(0.3606, 0.0689, 0.0666, 0.3090, 0.1949)^T$, $\lambda_{\text{max}}=5.0006$, CI=0.00015,

CR=0.000134<0.1.
8.2 APPENDIX II - INTERVIEW QUESTIONS

Information about the interview:

Interview time: 10:00AM — 11:00AM, Nov 28th, 2013;
Interview location: Gevalia reception at Gävle;
Interviewee: Jan Norman;
Position of interviewee: Production and logistics manager;
Working time for Gevalia: 20 years (since 1994);
Daily job: Run the plan of production, and manage the logistics activities;

Interview questions:

Q1. What are the advantages and disadvantages of self-built logistics system in Gevilia?

Q2. When did Gevalia start to use outsourcing logistics system and why? What are the advantages and disadvantages of outsourcing logistics system?

Q3. Which five factors do you think are the most important when you decide to select a logistics service provider?

Q4. Could you finish the “Pair-wise Comparison Matrix” for these five factors?

Q5. Is there any other logistics service provider for Gevalia to select in Gävle?

Q6. Could you compare these five important factors between the potential provider and FLB Logistics?

Q7. How to evaluate the performance of logistics service providers for Gevalia?

Q8. What factors should be considered when evaluating the logistics performance? (Emergency services, Order fulfillment, ERP system etc.)