Supplier Selection in Service Industry Using Analytical Hierarchy Process

Sulkhiyai Saidbek

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Prof. Dr. Mustafa Tümer
Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Master of Science in Industrial Engineering.

Assoc. Prof. Dr. Gökhan Izbırak
Chair, Department of Industrial Engineering

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Industrial Engineering.

Asst. Prof. Dr. Hüseyin Güden
Supervisor

Examining Committee

1. Prof. Dr. Bella Vizvari _____

2. Asst. Prof. Dr. Sahand Daneshvar _____

3. Asst. Prof. Dr. Hüseyin Güden _____

ABSTRACT

Every production system including the tourism industry which creates services to customer satisfaction is directly part of supply chain must have its contractor and decisions about the appropriate suppliers. For hotels are a major issues of concern since its assumption will deploy an inclusive choice of scientific co-operation extended within a particular era. For as we all know that, every firm hugely depends on a reliable supplier for their products, therefore suppliers play vital role to make any organization reach the peak of cost efficient and profitable. Supplier selection (SS) has a great impact on integration of the Supply Chain Relationship (SCR), and the best supplier will greatly help to enterprises efficiency between supply chain (SC) partners and consequently enhance organizational performance. To the best of our knowledge, there are many studies regarding supplier selection for various industries, most of them are good production systems and only few are related to service industry. However, there is no study for hotel business.

In this study we are considering some significant factors to determine which of them is the most important to be accepted when making a selection for the right supplier in hotel business. Via evaluating the weight of each factor using Analytic Hierarchy Process (AHP), through Pair-wise Comparison Matrix's (PWCMs) of a given criteria and the weight of the numerical scale of judgment are used to represent the relative important among the Multiple-Criteria Decision Makings (MCDMs). For evaluating and selecting the best supplier in hotels was a realistic attempt by implementing a survey questionnaire which was sent to the top managers in various

hotels through a well-designed internet web-site which was used to justify the AHP judgment from the decision makers (DM) or experts.

For assigning the efficacy and accuracy of the identified criteria and their weights the real life application is applied to a hotel in Cyprus. The landscape and geography of Cyprus gives potential to run a hotel business, and therefore this part of touristic industry has succeed high degree of competitiveness. The facilitated and determined weights of criteria in real life may provide a privilege for hotels to analyze alternative suppliers and make the best decision.

The main contribution of this study is that utilize weight of the criteria is used to enhance the efficiency and flexibility of the supply network and selection process for continuous improvement of hotel business.

Keywords: Service systems, Supplier selection in hotel business, Multiples-Criteria Decision Makings (MCDMs), Analytic Hierarchy Process (AHP).

ÖZ

Müşteri memnuniyeti için servis sunan turizm sektörü de dahil tüm üretim sistemleri bir tedarik zincirinin parçasıdır ve uygun tedarikçileriyle ilgi karar vermelidir. Oteller için tedarikçi seçimi en önemli meselelerden biridir çünkü nasıl yapılacağı belli bir alanda kapsamlı bir bilimsel katılım gerektirir. Tüm sistemler büyük oranda tedarikçilerine bağlıdırlar ve bu sebeple tedarikçiler sistemin maliyeti ve etkinliğinde hayati rol oynarlar. Tedarikçi seçimi tedarik zincirindeki ilişkilerin kurulmasında büyük etkiye sahiptir. Doğru tedarikçi tahminleri, işletmelerin uygun tedarik zinciri ortakları bulmasına ve dolayısıyla kuruluşun performansını geliştirmesine yardımcı olur. Bir otel için yeni bir tedarikçi seçerken kararımızla ilgili tüm faktörleri (kriterleri) dikkate almalıyız. Bildiğimiz kadarıyla litaratürde çeşitli sektörler için tedarikçi seçimiyle ilgili çok sayıda çalışma vardır. Bnuların çoğu imalat sistemlerini ele alırken çok az bir kısmı servis sistemleriyle ilgilidir. Bununla birlikte, otel işletmeciliğinde tedarikçi seçimini ele alan bir çalışma yoktur.

Bu çalışmada otel işletmeciliğinde doğru tedarikçi seçimi için kullanılabilecek kriterleri ve içlerinden en önemlilerini belirledik. Analitik Hiyerarşi Proses (AHP) yontemi ile bu kriterlerin ağırlıkları belirlenirken kriterler arasındaki göreli ağırlıklara dayalı karşılaştırma matrislerini kullandık. Birçok otelin üst kademe yöneticilerine iyi hazırlanmış bir anketi internet ortamında uygulayarak AHP için gerekli karşılaştırma matrislerini oluşturduk ve böylece otel işletmeciliğinde tedarikçi seçimini için gerçekçi sonuçlar elde etmeyi amaçladık.

Belirlenen kriterlerin ve ağırlıkların etkinliğini ve doğruluğunu görebilmek için Kıbrısta bir otelde gerçek hayat uygulaması yaptık. Kıbrıs'ın manzarası ve coğrafyası turizm sektörü içerisinde otelciliğin kullanımı için bir potansiyel sunmaktadır. Dolayısıyla da bu alanda yüksek bir rekabet söz konusudur. Belirlenen kriterler ve ağırlıklar gerçek hayatta otellere tedarikçi seçeneklerini değerlendirmede ve en iyi seçimleri yapmada bir ayrıcalık verebilir.

Bu çalışmanın ana katkısı otel işletmeciliğinde sürekli iyileşme kapsamında tedarikçi seçimiyle ilgili esnek ve etkin criterleri ve ağırlıkları kullanmasıdır.

Anahtar kelimeler: Servis sistemleri, Otel işletmeciliğinde tedarikçi seçimi, Çok kriterli karar verme (ÇKKV), Analitik hiyerarşi Proses (AHP).

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Chapter 1

INTRODUCTION

In the search of appropriate new supplier is every production system's priority so as to update and upgrade the variety of their various product classification, which is very important since most products life-circle is very short about 1-2 years making their product to depreciate in value and the need for fresh models has often been developed, by adopting complete Renewed Material Process (RMP) as a part of new technology in respect that most touristic industry are historically labor-intensive sector, which aspects are expressed in term of complex pattern of demand for material and labor.

Presently most tourist hotel purchasing-function has spontaneously gained great significant in the supply chain (SC) network linking management, due to some factors within globalization economic recession has decreased the value added in supply and advanced increasing in scientific approach. Supplier selection is the systematic approach toward getting the best supplier which is capable to sort out the customers need within the actual worth of goods and service within a given price, quantities, and at the same time needed for the product to be delivered to the hotel. Supplier selection (SS) is a typical MCDM issue surrounding a lot of criteria that can be both tangible and intangible toward the efficient selection of supplier goes a long way to reduce huge risk in the total value of product given to the buyer at any point.

It is always very vital for any firm to run some analysis to help them to avoid some future lost and shortages, due to the kind of supplier they are dealing with and that is why there is need to ask some question within their location about the lapse of any supplier, before the conclude their decision with him or her in any term toward supplying their products, since the future of any organization lies on the present supplier that is supplying their product

Most touristic hotel covers activity aimed at choosing the best supplier for their resource within the time limit and also schedules to select the most feasible one. Which is capable of managing the hotels both internally and external resource in way goods and services are guided with the optimal idea that will promote smooth running of the business and innovating the daily activities of the touristic hotel so as to avoid waste, shortage and unnecessary cost occurring during production and transportation.

Most of the industries require quality technique in making a choice of good supplier selection, or enhance a sound delivering quality in production process so as to avoid wastage, poor quality of products, which will result to loss of value of goods and services offered by the touristic hotel to the general public who desperately need the best. An effective quality technique approach assessment toward supplier selection is carried out by teams composed of department managers, supervisor and engineers, whom totally key hourly into establishing an approach to measure performance in quality, productivity and schedule relative to the customer target objective.

Supplier must increase deliveries of production in order meet the desire of the customer who are in need of the product and service, that is why it is so important when we are looking for reliable suppliers it is always best to be sure of the business cycle you are operating and categorize of the business needs, knowing, what you really desire to implement a choice for a particular supplier.

The manager of the most touristic industry has to draw some evaluation measure in selecting the right supplier that can help to drive customer demand, meet regulatory standard and finally create a new brand reputation of quality product. But in most supply chain selecting the right supplier who can meet your customer's want for quality ingredients may attract some initial costs that will pay off over a period of time through consistent value or service.

But on this study we want to evaluate some supplier selection criteria critically be receiving some opinion from expertise in various hotel through a well-designed questionnaire which are guided by some point of view of identify and assess some few suppliers based on capabilities and compare pricing tap and with supplier assessment questionnaire can create a useful performance gaps discount their individual ideas and opinion on the case study of operation then assign an auditing frequency, since supplier can be grouped into level of importance and risk. The great concern on priority will help in picking the right supplier selection.

Every production system including the tourism industry which creates services to customer satisfaction is directly part of supply chain must have its contractor and decisions about the appropriate suppliers. For hotels are a major issues of concern since its assumption will deploy a wide range of scientific co-operation extended

within a period of time. When choosing a new supplier for hotel we must take into account all relevant factors (criteria) that have a positive influence on this decision.

In this study we search significant criteria for supplier selection in hotel business and determine their weights using Analytic Hierarchy Process (AHP). The Analytical Hierarchy Process (AHP) is a Multi-Decision Making Approaches (MDMAs) and technique generating arithmetic significances from a given independent ideas conveyed in term of Pair-Comparison Matrix (PCMs) of each weighted alternative can result to the ranking weight from the most prefer weight of each alternative (Liu and Hai, 2005) which involves several criteria with wide spread application in decision making issues (Yussuf and Hashmi, 2001). The AHP techniques approach is used to identify criteria toward assisting in resolving supplier selection issues in making maximum optimal supplier selection mixtures. Hence, applying AHP through pair-wise comparison matrix of the criteria and the weight of the numerical scale of judgment are used to represent the relative important among the Multiple-Criteria Decision Makings (MCDMs). In evaluating and selecting a supplier in hotels was a realistic attempt by implementing a survey questionnaire which was sent to the top managers in various hotels through a well-designed internet web-site which was used to justify the AHP judgment from the decision makers (DM) or experts.

In order to adjust how much realistic the determined criteria and their weights are, the found results are applied in a real life case, in Cyprus. Cyprus is a touristic island and hotel business is the most competitive field. Since, the geography and allocation of the island permits to run the hotel business, this industry became highly

challenging. Therefore, supplier selection finds its significance in the given island and has precise impact on hotel business' performance.

The main contribution of this study is that utilize weight of the criteria is used to enhance the efficiency and flexibility of the supply network and selection process for continuous improvement of hotel business.

Chapter 2

LITERATURE REVIEW

2.1 Supplier Selection Overview

Choosing the actual supplier will create a positive degree of efficiency in service industries since supplier has varied strength and weakness and care should be taken to ascertain an effectiveness in supplier selection process (Liu and Hai, 2005), it is very important that every decision concerning suppliers needed to be breaking down into ranking so as to measure the performance of different suppliers at every level of industries.

The significant idea that govern the degree of purchasing function is the ability of one to choose the right supplier for a particular items, which help to enhance and promote significant savings for the firm (Haq and Kannan, 2006). In the past decade it was clearly understood that various tactics have been suggested to select, monitor and evaluate potential suppliers by using a given multiples criteria idea, which techniques and methodologies has created a lot waves in the fields of operations research, decision analysis theory and artificial intelligence (Ho, Xu and Dey, 2010), but when will center our thought on the literature review of some Multi-Criteria Decision Making Approaches (MCDMAs) for evaluating supplier selection, then it is important view and understand some scholars ideas on the determining and analysis issues that are related to decision making approaches, through designing of models that can tackle problem on MCDMAs and such are: Data Envelopment Analysis

Model (DEAM), Multi-Objective Programming Model (MOPM), Analytic Hierarchy Process Model (AHPM), Case-Based Reasoning Model (CBRM), Fuzzy Logic Model(FLM), Genetic Algorithms Model (GAM) and Artificial Neural Networks Model (ANNM) (Chan and Chan, 2004). The used of applied AHP to evaluate some critical factors suppliers' selection (Levary, 2008). The main potential supplier of manufacturing firm had some disruption risks during assembly operation in relation to a particular characteristics and a proposed AHP was used to analysis the effects and solution (Talluri et al., 2008). Using mix AHP and goal programming in determining the presence of risk measures and product life cycles in supplier selection combining AHP and goal programming (Chen, Lin and Huang, 2006), fuzzy environment when fully utilizing an extended version of TOPSIS for solving and analyzing issues in supplier selection (Chen, 2000). Mainly in chain satisfaction, the issues in relation to suppliers cannot maintain the same conditions of supplying, provided that will consider some criteria like delivery condition, inventory level and market environments remain static (Liu and Hai, 2005), which will create enough chances to make the best selection of the most appropriate suppliers in the relation to quality control capacity of all potential suppliers which result to maximum satisfaction and profitable margin between the customer chain and industry chain (Yang, Wang and Li, 2009) of production process, hence resulting to better production and lower cost of goods and service in service industries.

In selecting the best suppliers can always be a key toward true procurement process (PP) and also representing a major route for any companies to reduce costs. The selection of fake supplier for a firm can also cause serious blow in the daily running functioning and business cost of production (Weber and Benton, 1991). The supplier

selection (SS) issues can be resolved using AHP. Since it involves a lot of several criteria which then are very important toward evaluating each of the supplier criterion affects the decision making method in align to weight equally the different criteria and then check which one has the highest magnitude of weight (Yahya and Kingsman, 1999).

When we fully observe in recent times, supplier selection (SS) has plays a vital role toward management, since it is known for its contemporary innovation toward achieving around up benefit on both on operational and quality strategic (Ahmed and Zairi, 2004), while in a virtual firm which main goal is to satisfy customer desire through an organized market sells, that also attract profit both internal and external concept and sourcing is the main ingredient that keep both buyers and suppliers closely, both are the major driving forces to generate a healthy competition among manufacturing firm (Porter, 1980). The process by which buyers create avenue to increasing quality of material and reducing all cost of products, (Trent R and Hand Field, 1998). In addition to the cost of analysis supplier selection which has all the chances to be qualify by the buyer, and there are several procedures to be taken in order to select the best supplier (Trent R, 1998). Through continuous evaluation of all factors or criteria that are directly involved in selecting supplier which is fully prepared to improve quality of customers satisfaction (Hou J and Su D, 2007). And basically quality of material stand out to be the most appropriate criteria when choosing a supplier, (Dickson W. 1966). The need of finding a reliable and trusted supplier is now becoming more competitive and challenging too, mainly because of the need to sustain the buyer's myriad request toward suppliers (Ohmsen D and Spiller R, 2006).

We have discovered many studies related to supplier selection in different industries such as, supplier selection in textile industry (Murat M.A. and Asli K., 2007), supplier selection in construction industry (Ph. Mai and H.N. Chengter, 2007), supplier selection in automobile industry (M.K. Sagar and D.Singh, 2012), supplier selection in food industry (J.L. Shen, Y.M. Liu and Y.L. Tzeng, 2012), supplier selection in medical device industry (P. Ghadimi and C. Heavey, 2014) etc.

The implication of this research is that most managers in industrial scale can fully utilize the result of the review to increase the quality of product that are offered to the market and decrease the production time of defect product, hence to find the best supplier.

2.2 Tourism Service Industry Overview

In the past decade, it is noticeable that tourism service industry has undergoes a lot of demand for improvement and restructured in resent time. As we can see, high competitive environment has created much space for innovation in business to service business context and this has gain a significant ground in the world's leading industries, resulting to growth in the variation of new facts in building sound technologies and the improvement of new marketable set-ups in services of tourist industries. Basically for Effective Tourism Supply Chain Management System (ETSCMS) to be implemented one of the strategies that tourism firms could imply to promote their sales efficiency and also give room to more profit for tourism sector.

In addition, there is always a need to reduce cost which most customer face in searching for nice room for accommodations and has become a serious problem that need to be evaluated both internally and externally, so as to be able give an

appropriate location for establishing hotel industry, which has now become one of the most pressing issues for most investors, and one of the way to overcome this issues on ground is to adopt selection of a facility location, which is an important strategic involving a long-term commitment of resources. Considering some certain influential factors such as building style, quality staffs, reputation and marketing strategic which directly affect the daily operation of hotel industries (Yang and Lee, 1997). For this reason, hotel location can't be measure as the only influential factor that can help to increase profitability, but will help to improve the convenience of most tourist visitor how are lodging in that particular hotel location, which is close to the major activity within the cities. Moreover, to enhance the level convenience of customer place to stay that will directly raise customer trustworthiness in the age of Customer-Based Service (CBS), thereby satisfying customer desires. A mathematical programming tool was designed to identify the location toward selection of retail stores and factories within a given region (Cheng and Li, 2001). But to analysis the effectiveness of Multi-Criteria Selection (MCS) of various restaurant in a particular region in Taipei (Tzeng, et al. 2002). According to AHP as a popular powerful tool initiated mainly to use in finding possible solution toward issues of location selection within an area (Aras, et al. 2004), has created more room to acquire the best location of wind reflection stationary point using AHP ideas (Barbarosoglu and Yazgac, (1997): Xia and Wu, 2007).

The Supplier Selection (SS) is the root of efficiency performance in any given touristic industries, since it help to promote sound tactical relationship in Tourism Supply Chain Management (TSCM), in respective of weather the tourism suppliers have excellent performance in discharging its service to the given buyer, which will

directly influence quality, cost and delivery of tourism products to the right destination. The greatest impact of TSCM efficiency is achieve when supplier are wisely selected to carry out service operation within a given location. When we reflect back, we can clearly see that many tangible model has be designed to tackle the issues surrounding TSCM in relation to select the best supplier over the past decade till present, and some of proposed model are: Fuzzy Comprehensive Evaluation (FCE), Comprehensive Grade Model (CGM), Grey Comprehensive Evaluations (GCEs) etc. Were all designed to handle cases on the trade industries, with little attention paid to the service sector of TSCM (Buhalis and Laws, 2001), But on the other hand a great highlight has been made on the importance of the supplier on tourism industry (Stabler and Sinclair, 1997). In this matter we have observed several studies considering selection of a supplier in service sector (Chan and Lau, 2007), (Douglas G.P., 2008), (W. Hsu, G. Shyu and P. Chen, 2014), (Hatice G. and Mehmet G., 2015).

2.3 AHP Method Overview

The Analytical Hierarchy Process (AHP.) is a Multi-Decision Making Approach's (MDMAs) and technique generating arithmetic significances from a given independent ideas conveyed in term of Pair-Comparison Matrix (PCMs) of each weighted alternative can result to the ranking weight from the most prefer weight of each alternative (Hai and Liu, 2005) which involves several criteria with wide spread application in decision making issues (Hashmi and Youssuf, 2001). The AHP techniques approach is used to identify criteria's toward assisting in resolving supplier selection issues in making maximum optimal supplier selection mixtures (Jing and Yu, 2004). The main objective of evaluation process in any Decision Making Process (DMP) is to reduce purchasing risk, optimize the purchasing values

(Handfield and Trent, 2005) MCDM approaches guide the decision expert toward solving a set of alternative and based on purchasing situation where criteria has different choice of importance and vary weight (Mininno and Dulmin, 2003). The numerical extension of Analytical Hierarchy Process in planning, selecting the most appropriate alternative, reestablished quote in resolving conflict by optimization (Vargas, 1990).

But considering literature review of previous researcher we can clearly see that the priority mean, of each factor in each level can be determined using a pair- wise comparison matrix in finding the relative important of each criteria and sub-criteria based on the 1-9 scale of Fundamental numbering (Saaty, 1980). The usefulness in constructing a ranking of alternative in discrete decision making issues based on seeing (Wachowicz and Tomasz, 2012) which involves reasonable negotiation of scales. Making a genius decision which involves recognizing the value of organization issues toward relative proportion in decision of management element (Tavakkoli- Moghaddem, Reza and Yazdani, 2012) The existence of judgment in important dispersion when evaluating useful principles in broad consensus (Kim, Needy and Vargas, 2016). When estimating the standard of pair-wise comparison judgment of relative significant of a given criteria and alternative in related matters (Bavadavan and Shima, 2013).

A lot of scholars made researches based on AHP I.M. Mahdi (Support System for Selecting the Proper-Project-Delivery-Method (PPDM) using AHP, 2005), Bhagwat R. and Sharma M.K. (The Performance Measurement of SCM using AHP, 2007), Theresa J.B. and Zabinsky Z.B. (A MCD-Model for Reverse-Logistics using AHP,

2010), Bahmani N., G.Javalgi and Blumburg H. (AHP-Application for Consumer-Problem, 2014), Taheri K., Francisco G. and Ezzat R. (Sinkhole-Susceptibility Mapping using AHP and magnitude-frequency relationships, 2015).

To analyze, identify, and determine which criteria was used in selection of supplier among several alternatives (Dickson, 1966) comprehensive categorize of supplier selections which concluded the quality, net cost and delivery were the most rank criteria (Cao, Zang and Lei, 2003) and after sorting the criteria's, price was selected as the most important criteria among all the ranked criterion (Osman, Thariri, 2003 and Dickson, 1966) The review of the most tangible supplier selection criteria were real cost, value and services granted in relation to industry (Zhao and Bross, 2004). Thus the average rate of cost decreasing in term of value is the mixture of different raw material will greatly have effect on the profit margin since technology, time, cost and quality are involved in the system of market (Huang and Lin, 2006).

As far as I can see, from the observation of literature review, there are plenty of studies referred to supplier selection in different industrial fields, yet very few in service industry. Unexpectedly, any study illustrating supplier selection for hotel business.

Chapter 3

THE PROBLEM DEFINITON

3.1 Issues Analysis and Solution Guide

The issues of supplier selection has eaten deep in global economic market resulting to some global economic crises, quality expectations, lack of customization toward total quality of product, high competitive pressure within the tourist has cause a thrive for supply managers to re-strategic the best decision to select and maintain core suppliers, since it's advisable to gainfully produce at a low cost, with high quality product, within a good measure in selecting of a competent group of suppliers.

In this study we want to determine the best criteria that will be used when choosing a new supplier for hotel and we know that most of this criteria's are quantitative and qualitative in nature of selection. But of resent, the tourist industry has re-established and industrial base with unlimited potential toward supplier selection performance productivity and quality improvement which will help to prevent the issues of global economics market such as lack of progress in hotel improvement quality, productivity, profit and competitive edge in service caused by lack of integrated action plan by supply chain management executives and manager who does not know what to do, how to do it or who should do it.

Supplier quality is becoming a vital business orientation practice since more industries are now aware of the danger of wrong supplier in terms of outsourcing, production chain, distribution, shipping sales. Aside from the result of wrong as a failure to comply with myriad of selection regulatory supplier or may lead to some issues like: litigation, added costs in production lines, harmful reputation among other issues, such as goods adulteration and misbranding. However, there is a great risk and benefit with the relationship between suppliers- customer chain.

With the view of implement supplier selection performance within the global touristic industries, where one can explore other non-traditional supplier, in relation to the structures, it is clearly seen that the issues is growing exponentially in complexity due to the large numbers of suppliers who have fully admitted in resent time has exerted pressure on every link in the supply chain. Then from our early definition of supplier selection in relation to touristic industries which we said it is the process of finding a supplier that will be able to meet or provide buyers with the actual quality materials or services at the actual quantities, actual time and at the actual price. In most business supplier relationship has been one of the major issues on ground. But of resent there are basically two type supplier selection issues, which are classified into

- The single source type
- The multiple source type

From the single sourcing type is the process where we have one supplier, which can be cater and satisfy all the buyer's need at a particular price and time, but the major issue on this types of sourcing is that the exist strong monopoly kind of business.

Since the supplier can increase the price of each goods on its own without considering the buyer market strategy. While in the multiple sourcing supplier's type, it means there are several suppliers on a particular requirement since it is clearly view that no supplier can actually satisfy all the buyers requirements and most managers want to split order level of quantity among several suppliers from various part of the world basically at this preferences (Meng J.G. and Heung S.H., 2005). Supplier selection has become an important issue to tackle of present because of the higher need from the buyers down to purchasing department, since the main objective of a supplier is to ensure low cost within the whole phase of SCM, meaning that best choice in selecting a supplier is the major key to procurement system and guide the hotels effectively in reducing purchasing risk, increasing the higher numbers of Just-in-Time (JIT) suppliers.

Going down to history, for many years now the traditional approach to selecting suppliers has basically centered on price, however, as of now most touristic industries are aware of the sole emphasis on a single criterion "price". For supplier selection is never efficient way to make a right choice but needed to look beyond wide range of multi-criteria analysis approach (MCAA), which now accommodate a lot of criteria as result of increasing environment, political crises, social ethic and the most crucial is the customer satisfaction. The ideals of incorporating other important criteria will make a lot of difference to an organization's system ability to provide the effective continuous improvement in customer's satisfaction.

The effective absorbing approach of multi-criteria supplier techniques has created. Flexibility in supply chain due to the diversity of touristic industries has created

room progress, thereby fostering competition among several alternative suppliers within the geo-political region. The maintenance of MCAA strategic view toward selecting the right supplier is so vital to the growth of any sector, since the major goal of any right supplier lies on reducing the purchasing risk, develop closeness, and also make best use of rendering quality to buyers and finally to create a long-lasting relationship between customers chain- supply chain management.

In this study our problem is to determine: (*i*) the criteria in supplier selection in hotel industry, (*ii*) the weights of those criteria in a respect to make the best decision and (*iii*) scores of the alternative suppliers.

Chapter 4

SOLUTION METHOD

4.1 Determining Supplier Selection Criteria (SSC)

But the Initial practice to take whenever one want to achieve success in any supplier rating measure, is to define the suitable criteria to be used for investigating the supplier selection and their important stated from the actual situation of the optimizing supplier selection base on the complexity of the system production industries.

During implementation of a Supplier Selection Decisions (SSDs), a set of evaluate criteria are properly analysis, in accordance to the compare potential sources of decider within the location and this process are always draw-out to see the level of customer satisfaction view point of the product (Gregory. 1986). Within the same frame some scholars made some critical statement that reliability of supplier is always measure by price as the most vital criteria for sourcing the weight of products (O'Shaughnessy and Lehmann, 1974). On the other hand, it was proposed that quality, and reliability of supplier to deliver those product with ease time is prime criteria for service industries (Shipley and Cameron, 1985). It was also stated that some time the supplier whom offer his product on best price to the consumers, do that on the contrary of not meeting up with time, but the majority of researcher draw their conclusion that the prime criteria such as quality product, price and service is the most vital criteria to measure the Performance Efficiency (PE) of reliable

supplier (O'Shaughnessy and Lehmann, 1974). Another renowned scholar on operation research work on the aspect of identifying several criteria, which every director can employed to meet purchasing power of various issues of supplier selection (Dickson, 1966). The company's competitive circumstances and its commercial strategies were used to define the main criteria for Suppliers evaluation (O'Brien and Ghodsypour, 1998).

In this paper it is examined that supplier selection and evaluation criteria were based on quoted into rank of six factors which are Factor-A (quality), Factor-B (cost), Factor-C (delivery), Factor-D (Service), Factor-E (flexibility), Factor-F (purchaser and supplier relationship) which each of these factors are subdivided three other sub-factors as illustrated in figure 4.1.1. This classification is to enable us carry pair-wise comparison between the given sub criteria's as accordance to the needs of the buyers which also lead to more precise platform for the expert (decision maker) to decide on supplier selection which will give us a good pictures of the supplier's performance through a well-designed web-site questionnaires implemented to ascertain several decisions from different managers and expertise in relation to tourism supply chain management as a guidelines for comparing supplier attributes using a 6-factor point rating and developed approach aggregation techniques for combining different sub factor group in preferences to the main objective of selecting the best choice of suppliers.

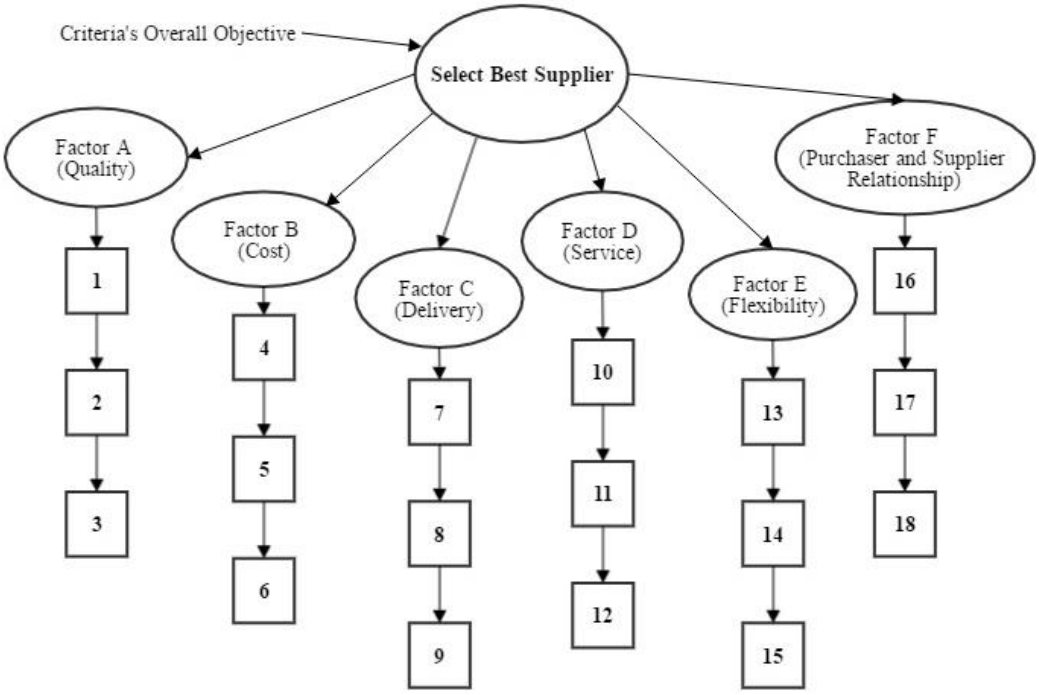

Figure 4.1. Illustrating Hierarchy of Criteria

From above illustration in Figure 4.1. we can see that there are a lot of criteria to be considered for efficiency of suppliers in service industry and appropriate supplier selection have to be choosing to improve the performance of supplier's since they play vital roles to make an organization cost profitable.

In this view we can understand that there are several criteria's to be considered but into facilitate the task we have grouped the given measures into six (6) main factors and three (3) sub-factors, and for a clear view they are explained in details as:

Factor-A (Quality)

Sub factor A1 product certified by an authorized organization i.e. product must reply to all customer requirements and standards of the market;

Sub factor A2 reliability i.e. product should be trustworthy and satisfy given measures;

Sub factor A3 defect rates i.e. defectiveness of a product;

Factor-B (Cost)

Sub factor B1 low price;

Sub factor B2 quantity discounts i.e. the more purchased quantity the more prices for product will be decreased;

Sub factor B3 transportation cost i.e. based on geographic areas transportation cost may differ;

Factor-C (Delivery)

Sub factor C1 on time and stable delivery;

Sub factor C2 good packaging;

Sub factor C3 order fulfillment lead time i.e. the average time from order placement to customer receipt;

Factor-D (Service)

Sub factor D1 ease of communication i.e. the ease to lead negotiation of a product;

Sub factor D2 production capability i.e. the ability of a company to respond to inquiries as much as they received;

Sub factor D3 warranty i.e. This is a documentary permission issues to customer or buyer from the producer ensuring to substitute any faulted product offer at particular time within a given period of location;

Factor-E (Flexibility)

Sub factor E1 mix-flexibility, this is the tendency to transformation the range of some products when required.

Sub factor E2 delivery-flexibility, this is act to re-join quickly to pressing delivery requests when require.

Sub factor E3 service -flexibility, this is the act to take modifications in service when is necessary;

Factor-F (Purchaser and supplier relationships)

Sub factor F1 reputation, the opinions of a community or public about given companies;

Sub factor F2 honesty, the quality to be responsible and truthful;

Sub factor F3 partnership, an arrangement in which two or more companies share the profits of a business.

From the picture of the American National Standard Institute (ANSI) and the related body of American society for Quality Suppliers Selection Control (ASQSSC) define quality in term of supplier selection as the total of feature and characteristics of services that bears on its ability to satisfy given need of customers within tourist industries. The view of supplier selection is made satisfying customers organization goals will not achieve success and to beat the competition means that there should be a good supplier which often exceeds customer expectation by providing product and services that delight and excite customers.

The focus of a reliable supplier selection will aim at continual increase in customers satisfaction at continuously lower cost which is integral part of high level selection

strategy that work horizontally across the tourist industries and department that involve both supply chain and customer chain.

4.2 Determining the Weights of the Criteria

4.2.1 Survey

The questionnaire and accompany cover letter were mailed to the top managers of various hotels from several countries, for establishing their adjustments of the identified criteria. For this purpose the well-known internet website is used to collect the results of the judgements. Respondents were asked to evaluate and assess the most critical factor with respect to another, which would help us to generate the valid appraising suppliers. Sample of sent questionnaire is given in appendix.

4.2.2 AHP Method

AHP disintegrate a large complex multiples criteria decision into simple alternatives to meet various objective. The AHP technique and method was proposed by great mathematician Thomas Saaty, 1980 which provide a mathematic power tool approach that can be used to tackle the issues of making decision when it comprise several multi-criteria objectives as a result of pair-wise comparisons matrix of some factors in relation to the importance of each criterion based on the weight evaluate means along with a numerical integer value number 1-9 scale as interpreted in table.

The knowledge of AHP approach toward decision making under multiplies criteria's is that it gives a calculated ranking of several factors by different opinions of expertise based on pair-wise comparison matrix of the main criteria's and sub criteria. For this point of view we can say that it is a robust way to draw conclusion using a mathematical transform experts' judgment in accordance to priority of one's choice in reference to the numerical results circumstances with respect to possible pair-wise comparison value among numerous expertise.

Supplier performance measure and evaluation is one of the multi-criteria decision making issues (MCDMI), which take a lot of conditions in the hierarchical framework of decision implement process, as the AHP decompose the various decision criteria issues into a hierarchy level of concise way so that each criteria can be analyzed independently to each other elements of hierarchy, in respect to quantitative and qualitative issues of classification by comparing them to each other two at a time, then the reality use of the judgments from all the element in accordance to the important of each underlying evaluation (Saaty,Thomas, 2008). The numerical priorities of each calculated decision alternatives. AHP model detail all possible way to evaluate every criterion to the respect of the design importance of the main goal accordance to achieve the correct supplier. It is important to score the performance measure of evaluation and selection of the right supplier which will give more definition to the right cost and quantity at the right time. The use of AHP model makes it easy to incorporate judgments conclusion on intangible quantitative main criteria in relation to tangible quantitative criteria factors. From the above analysis of the framework of AHP in Figure 4.1.2 we can clearly see that multiple-criteria decision making method is basically center on three fundamental principles:

- Structural nature of the model to be used
- Comparative judgment analysis of the different alternatives and criteria
- The synthesis of the priorities

The structural nature of the model been the first step help general complex multi-criteria decision issues: can be structured as a hierarchy which AHP can initially disintegrate the complicated criteria into different levels of hierarchy of interrelated evaluation of decision alternatives, since the different alternatives are defined in the

hierarchical structures known as the “family tree of criteria” but in general hierarchy has at least three level depending on the objective of the goal, criteria and sub-criteria, basically the major or overall goal of the issues is always on top, while the criteria itself lies in the middle and the sub-criteria also known as decision alternatives at the bottom of the tree (Nergis S and Huseyin B, 2011).

But in second step which lead to the direct comparison of the various criteria and alternatives, and immediately after disintegration of the criteria will result to construction, then prioritization level begins immediately at that spot in order to evaluate and determine the relative importance of the various criteria along each of the level of interaction. It is very important to know that the pair-wise judgmental comparison (PWJC) begins from the middle level (second) and end up at the bottom level of hierarchy.

Finally the late step, which help to synthesis the various priorities of each criteria based on the determined relative weight of each criteria, before running other performance analysis measure to find the consistency ratio of each level of criterion, giving aid to the best supplier.

As we all know that AHP model is one of the most useful and flexible tool used by most industrial directors in drawing out decision making process about the best supplier by setting out priorities in relation to both the tangible and non-tangible aspects of each decision needed to be considered. This is done by breaking and reducing the complex decisions a small to level of series of 1-1 pair wise comparisons (PCs). However, in many real –life cases the human being preference thinking ideas is always uncertain toward making the right decision, and for this

most decision experts (DEs) might be unable to assign the right or exact numerical values to the comparison analysis judgments (CAJ). In most cases, when sorting several suppliers the decision experts are usually not a particular supplier and his capabilities (Rakesh V and Saroj K, 2008). Supplier evaluation process of criteria is subjective to choice, which makes it more difficult for decision experts to express the strength of their preferences toward providing the exact numerical values for the comparison, which is one of the disadvantages of using AHP due to the uncertainty and vagueness in the decision process.

Benefit of AHP toward this paper

- Firstly, AHP help to determine which criterion is the most important among the different complex criteria's of supplier selection.

- Secondly, ones we able to determine the important of criteria then we can more forward to choose the best design in relation to the right supplier among possible multiple alternatives which can be compared with the various choices (preferences) of selecting suppliers in Cyprus as a general.

- Finally, we select the best supplier according to the highest ranking of analysis.

According to Saaty's 1986 verified that this intuition will be needed correct if only implies that a perfect consistent decision making has CT/RT<0.1 which mean that the generated irrational data for comparing the assign alternatives by the analysis to make pair-wise comparisons of elements of each level in relation to the result of activity at the next higher level in the hierarchy.

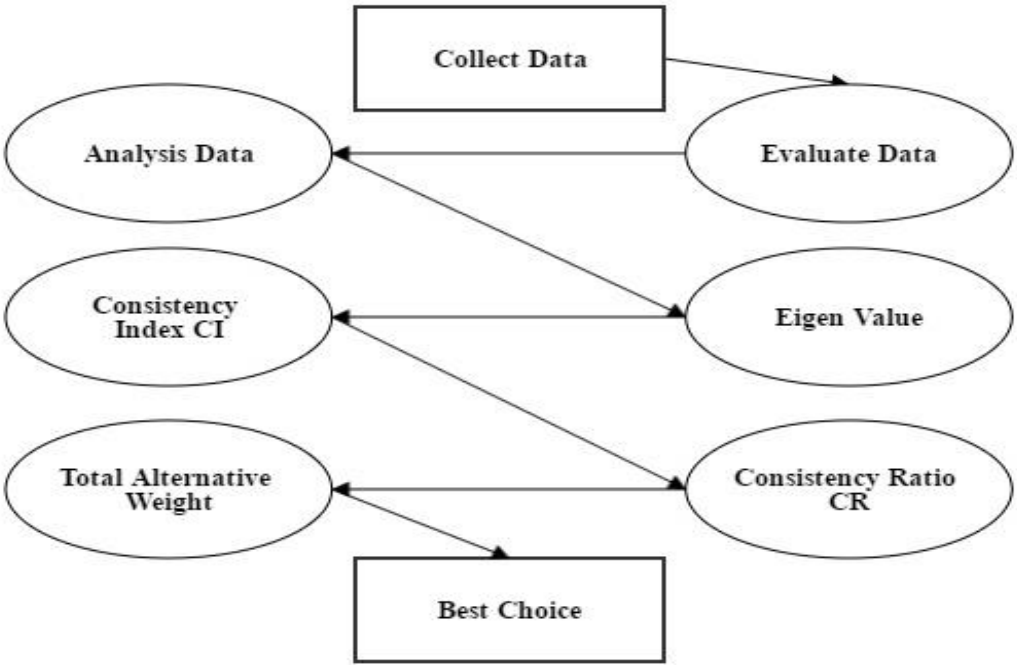

Figure 4.2. Framework of AHP

The main steps of the AHP can be summarized as follows:

Step 1. Setting up a hierarchy by defining the overall objective and research criterion (factors), where each of the factor of choosing the best option is broken down into sub-factors. The alternative suppliers are in the lowest level.

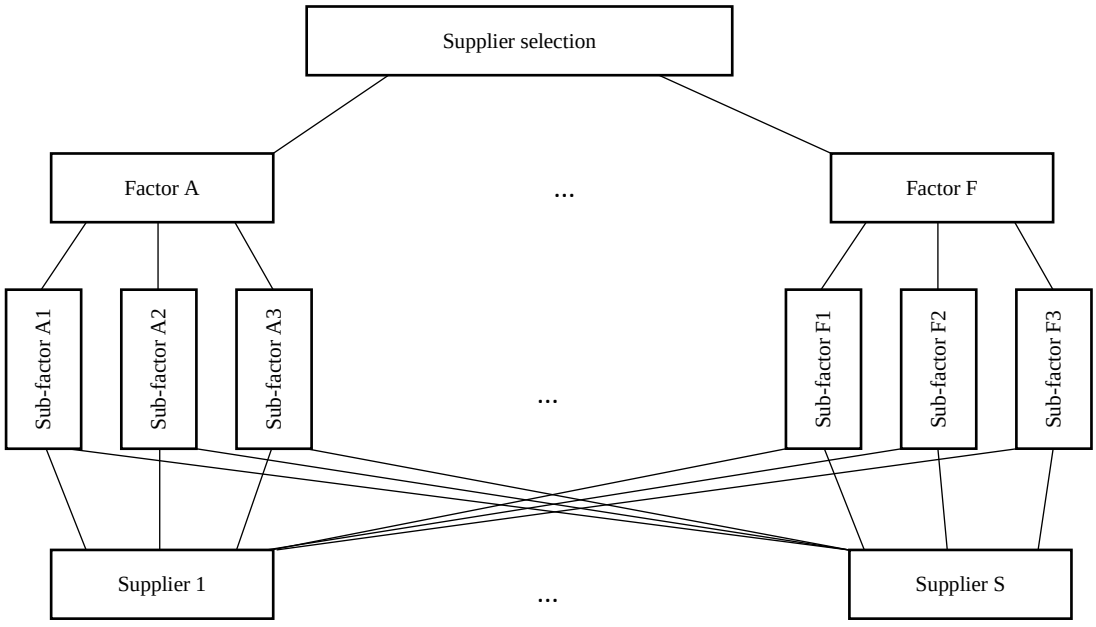

Figure 4.3. Hierarchy of AHP with given Suppliers

Step 2. Form the pairwise comparison matrices between the factors and between the sub-factors of each factor based on the judgements of experts. Let C^k be any of these comparison matrices filled out based on the k^{th} expert's judgments. Each entry c_{ij}^k of the matrix C^k represents the importance of the i^{th} criterion relative to the j^{th} criterion. In a comparison matrix c_{ii}^k is always 1 and $c_{ji}^k = 1/c_{ij}^k$. The relative importance between two criteria is defined according to a numerical scale 1 to 9, as shown in table 4.1.

Table 4.1. Fundamental Scale Table

Fundamental scale	Linguistic variable	Numerical number
1	Absolutely Unimportant	1/9
2	Strongly Unimportant	1/7
3	Fairly Unimportant	1/5
4	Weakly Unimportant	1/3
5	Equally Important	1
6	Weakly Important	3
7	Fairly Important	5
8	Strongly Important	7
9	Absolutely Important	9

Note that 1/8, 1/6, 1/4, 1/2, 2, 4, 6 and 8 can be used for soft judgments as compromise values.

Form the final comparison matrices based on the joint judgments of the experts. Let *C* be the final pairwise comparison matrix generated by using C^k matrices. The c_{ij} entry of C equals to the average of c_{ij}^k values. When the number of the experts is E then

$$c_{ij} = \frac{\sum_{k=1}^{E} c_{ij}^k}{E}$$

Step 3. Compute the relative weights of the criteria (factors) and sub-factors in order to achieve the target by the following sub-steps.

Step 3.i. Form the normalized pair-wise comparison matrix C^{norm} by using the comparison matrix C by dividing each element in every column by the sum of that column. I.e.,

$$c_{ij}^{norm} = \frac{c_{ij}}{\sum_{a=1}^{h} c_{aj}}$$

Step 3.ii. Compute the relative weights of factors (sub factors) by taking the averages of the rows of C^{norm}. Let W_f be the weight of factor (sub-factor) f.

$$W_f = \frac{\sum_{j=1}^{h} c_{fj}^{norm}}{h}$$

Here h is the number of the factors (sub-factors) compared in matrix C.

Step 4. Check the consistency of the comparison matrix C by the following operations. Let W be the vector of the weights of the factors (sub factors) found in Step 3.

Step 4.i. Actual weights (AW) of factors (sub factors)

$$AW=C\times W$$

Step 4.ii. Compute $E_f = \frac{AW_f}{W_f}$ for every factor *f*.

Step 4 .iii. $\lambda = \frac{\sum_{f=1}^{h} E_f}{h}$ and Consistency Index $CI = \frac{\lambda - h}{h-1}$

Then $CR = \frac{CI}{RI}$.

Where CR is a consistency ratio which illustrates the accuracy of the obtained results. RI is a random index which is the consistency index, i.e. when the entries of C are completely random. For a perfect consistent decision CRI<0.10 should be, otherwise significant inconsistency exists and the research is meaningless.

Table 4.2. The Value of the Random Index

Serial number	Number of criteria (h)	RI (random index)
1	2	0.000
2	3	0.580
3	4	0.900
4	5	1.120
5	6	1.240
6	7	1.320
7	8	1.410
8	9	1.450
9	10	1.510

4.3 Determining the Scores of the Alternative Suppliers

In the above section a part of the AHP is given for determining the weights of the factors and sub factors. In this section another part of the AHP method is presented for determining the scores of the alternative suppliers.

Step 5. Form comparison matrices between the alternate suppliers for each of the sub factors based on the judgments of the decision maker(s) about supplier selection in the considered hotel. Let CS^u be the comparison matrix between the suppliers for sub-factor u. Using CS^u perform step 2, 3, 4. Make the same computations for all CS^u matrices. If the results are inconsistent ask the decision makers to correct their comparisons. Otherwise go to Step 6.

Step 6. W vector found for comparison matrix CS^u shows the scores of the suppliers about the sub factor u. Let the score of supplier i (Sup^i) about sub factor u is $ScoreSup^i_u$. Let the sub factors of any factor J are SJ1, SJ2 and SJ3. Their weights found in Step 3 are w_{SJ1}, w_{SJ2} and w_{SJ3}. Then the score of Sup^i for factor J is computed by

$ScoreSup^i_J = w_{SJ1} \times ScoreSup^i_{SJ1} + w_{SJ2} \times ScoreSup^i_{SJ2} + w_{SJ3} \times ScoreSup^i_{SJ3}$.

Compute the scores of all suppliers about all of the factors.

Step 7. Let the weight of factor J found in Step 3 is w_J. Then the final score of supplier i is computed by

$ScoreSup^i = w_A \times ScoreSup^i_A + \ldots + w_F \times ScoreSup^i_F$.

The descending order of the suppliers in terms of their scores shows the order of the suppliers from the best one to the worst one according to this multi criteria evaluation.

Chapter 5

NUMERICAL RESULTS

5.1 Data Collection

Data collected applying questionnaire survey through internet-website by mailing the respondents in various hotels. There are comparison matrices containing explanations about the questionnaire goal, factors and sub-factors which have to be assessed, analyzed and compared. The questionnaire were dispensed to the top managers of the hotels. The comparison is made using fundamental scale which is presented on the table. The questionnaire was sent to 150 hotel top managers allocated all over the world, from this 62 responses were received.

Table 5.1. Pattern of Obtained Results

Data source	Number of mailed questionnaire	Number of responses
Top managers	150	62

5.2. Analysis and Computations of the Collected Data

Step 2. The received responses of experts through pair-wise comparison matrix is illustrated in the table 5.2.1, where the average point of joint judgments of experts is taken.

Table 5.2. Obtained Weight of Comparison Matrix of the Main Factors

Factors	**A**	**B**	**C**	**D**	**E**	**F**
A	1	8.8600	8.8500	8.3600	3.3500	0.7100
B	0.1129	1	8.2900	7.7400	8.9600	2.5600
C	0.1091	0.1206	1	0.6900	0.4500	0.5300
D	0.1196	0.1088	1.4493	1	0.2700	0.1800
E	0.2985	0.1116	2.2222	3.7037	1	0.2200
F	1.4085	0.3906	1.8868	5.5556	4.5454	1

Furthermore, the Comparison Matrices of sub-factors of the main factors are calculated.

Table 5.3. Obtained Weight of Comparison Matrix of Sub-factors of the Main Factor-A

	Sub factor A1	**Sub factor A2**	**Sub factor A3**
Sub factor A1	1	6.0300	0.3800
Sub factor A2	0.1658	1	1.1600
Sub factor A3	2.6316	0.8621	1

Table 5.4. Obtained Weight of Comparison Matrix of Sub-factors of the Main Factor-B

	Subfactor B1	**Subfactor B2**	**Subfactor B3**
Subfactor B1	1	5.9500	1.3400
Subfactor B2	0.1681	1	0.1800
Subfactor B3	0.7463	5.5556	1

Table 5.5. Obtained Weight of Comparison Matrix of Sub-factors of the Main Factor-C

	Subfactor C1	**Subfactor C2**	**Subfactor C3**
Subfactor C1	1	5.2800	1.2700
Subfactor C2	0.1893	1	0.1700
Subfactor C3	0.7874	5.8823	1

Table 5.6. Obtained Weight of Comparison Matrix of Sub-factors of the Main Factor-D

	Subfactor D1	**Subfactor D2**	**Subfactor D3**
Subfactor D1	1	1.2100	0.4400
Subfactor D2	0.8264	1	0.3100
Subfactor D3	2.2727	3.2258	1

Table 5.7. Obtained Weight of Comparison Matrix of Sub-factors of the Main Factor-E

	Sub-factor E1	**Sub-factor E2**	**Sub-factor E3**
Sub-factor E1	1	4.0100	0.3300
Sub-factor E2	0.2494	1	1.1700
Sub-factor E3	3.0303	0.8547	1

Table 5.8. Obtained Weight of Comparison Matrix of Sub-factors of the Main Factor-F

	Sub-factor F1	**Sub-factor F2**	**Sub-factor F3**
Sub-factor F1	1	2.2700	0.2600
Sub--factor F2	0.4405	1	2.1300
Sub-factor F3	3.8461	0.4694	1

After getting the Comparison Matrices, sum of the factors of each column is computed.

Table 5.9. Sum of Comparison Matrix of the Main Factors

	A	**B**	**C**	**D**	**E**	**F**
∑	**3.0484**	**10.5916**	**23.8482**	**28.3092**	**18.5754**	**5.2000**

Respectively, for sub-factors the sum of each column is derived.

Table 5.10. Sum of Comparison Matrix of Sub-factors of Factor-A

	Subfactor A1	**Subfactor A2**	**Subfactor A3**
∑	**3.7974**	**7.8920**	**2.5400**

Table 5.11. Sum of Comparison Matrix of Sub-factors of Factor-B

	Subfactor B1	**Subfactor B2**	**Subfactor B3**
∑	**1.9143**	**12.5055**	**2.5200**

Table 5.12. Sum of Comparison Matrix of Sub-factors of Factor-C

	Subfactor C1	**Subfactor C2**	**Subfactor C3**
∑	**1.9767**	**12.1623**	**2.4400**

Table 5.13. Sum of Comparison Matrix of Sub-factors of Factor-D

	Subfactor D1	**Subfactor D2**	**Subfactor D3**
∑	**4.0991**	**5.4358**	**1.7500**

Table 5.14. Sum of Comparison Matrix of Sub-factors of Factor-E

	Subfactor E1	**Subfactor E2**	**Subfactor E3**
∑	**4.2796**	**5.8647**	**2.500**

Table 5.15. Sum of Comparison Matrix of Sub-factors of Factor-F

	Subfactor F1	**Subfactor F2**	**Subfactor F3**
∑	**5.2866**	**3.7394**	**3.3900**

Step 3. Computing the Relative Weights of the criteria.

Step 3.i. Forming Normalized Matrices.

Table 5.16. Normalized Matrix of the Main Factors

Factors	**A**	**B**	**C**	**D**	**E**	**F**
A	0.3280	0.8365	0.3773	0.2933	0.1803	0.1365
B	0.0370	0.0944	0.3451	0.3179	0.4823	0.4923
C	0.0357	0.0113	0.0416	0.0242	0.0242	0.1019
D	0.0392	0.0102	0.0603	0.0351	0.0145	0.0346
E	0.0979	0.0105	0.0925	0.1299	0.0538	0.0423
F	0.4620	0.0368	0.0785	0.1949	0.2447	0.1923
∑	**1**	**1**	**1**	**1**	**1**	**1**

Table 5.17. Normalized Matrix of Sub-factors of the Factor-A.

	Subfactor A1	**Subfactor A2**	**Subfactor A3**
Subfactor A1	0.2633	0.7641	0.1496
Subfactor A2	0.0436	0.1267	0.4566
Subfactor A3	0.6929	0.1092	0.3937
∑	1	1	1

Table 5.18. Normalized Matrix of Sub-factors of the Factor-B.

	Subfactor B1	**Subfactor B2**	**Subfactor B3**
Subfactor B1	0.5223	0.4757	0.5317
Subfactor B2	0.0877	0.0799	0.0714
Subfactor B3	0.3898	0.4442	0.3968
∑	1	1	1

Table 5.19. Normalized Matrix of Sub-factors of the Factor-C.

	Subfactor C1	**Subfactor C2**	**Subfactor C3**
Subfactor C1	0.5058	0.4341	0.5204
Subfactor C2	0.0958	0.0822	0.0696
Subfactor C3	0.3983	0.4836	0.4098
∑	1	1	1

Table 5.20. Normalized Matrix of Sub-factors of the Factor-D.

	Subfactor D1	**Subfactor D2**	**Subfactor D3**
Subfactor D1	0.2439	0.2226	0.2514
Subfactor D2	0.2016	0.1839	0.1771
Subfactor D3	0.5544	0.5934	0.5714
∑	1	1	1

Table 5.21. Normalized Matrix of Sub-factors of the Factor-E.

	Subfactor E1	**Subfactor E2**	**Subfactor E3**
Subfactor E1	0.2336	0.6837	0.1320
Subfactor E2	0.0582	0.1705	0.4680
Subfactor E3	0.7081	0.1457	0.4000
∑	1	1	1

Table 5.22. Normalized Matrix of Sub-factors of the Factor-F.

	Subfactor F1	**Subfactor F2**	**Subfactor F3**
Subfactor F1	0.1891	0.6070	0.0767
Subfactor F2	0.0833	0.2674	0.6283
Subfactor F3	0.7275	0.1255	0.2949
∑	1	1	1

Step 3.ii. After obtaining normalized matrices, we calculate the relative weight of factors and sub-factors of each row.

Table 5.23.The Relative Weight of the Main Factors.

	A	**B**	**C**	**D**	**E**	**F**
W_f	0.3589	0.2952	0.0400	0.0324	0.0714	0.2018

Table 5.24. The Relative Weight of Sub-factors of the Factor-A.

	Subfactor A1	**Subfactor A2**	**Subfactor A3**
W_f	0.3923	0.2090	0.3986

Table 5.25. The Relative Weight of Sub-factors of the Factor-B.

	Subfactor B1	**Subfactor B2**	**Subfactor B3**
W_f	0.5099	0.0797	0.4103

Table 5.26. The Relative Weight of Sub-factors of the Factor-C.

	Subfactor C1	**Subfactor C2**	**Subfactor C3**
W_f	0.4868	0.0825	0.4306

Table 5.27. The Relative Weight of Sub-factors of the Factor-D.

	Subfactor D1	**Subfactor D2**	**Subfactor D3**
W_f	0.2393	0.1875	0.5731

Table 5.28. The Relative Weight of Sub-factors of the Factor-E.

	Subfactor E1	**Subfactor E2**	**Subfactor E3**
W_f	0.3498	0.2322	0.4179

Table 5.29. The Relative Weight of Sub-factors of the Factor-F.

	Subfactor F1	**Subfactor F2**	**Subfactor F3**
W_f	0.2909	0.3263	0.3826

Step 4. Checking the consistency of the comparison matrix C.

Step 4.i. Determining Actual Weights (AW) of factors (sub factors)

Table 5.30. The Actual Weight of the Main Factors.

	A	**B**	**C**	**D**	**E**	**F**
AW	3.9538	2.7311	0.2214	0.3081	0.0443	0.2864

Table 5.31.The Actual Weight of Sub-factors of the Factor-A.

	Subfactor A1	**Subfactor A2**	**Subfactor A3**
AW	1.8042	0.4333	1.0491

Table 5.32. The Actual Weight of Sub-factors of the Factor-B.

	Subfactor B1	**Subfactor B2**	**Subfactor B3**
AW	1.5342	0.4237	0.3062

Table 5.33.The Actual Weight of Sub-factors of the Factor-C.

	Subfactor C1	**Subfactor C2**	**Subfactor C3**
AW	1.4696	0.4462	0.3391

Table 5.34.The Actual Weight of Sub-factors of the Factor-D.

	Subfactor D1	**Subfactor D2**	**Subfactor D3**
AW	0.7184	0.7281	1.3025

Table 5.35.The Actual Weight of Sub-factors of the Factor-E.

	Subfactor E1	**Subfactor E2**	**Subfactor E3**
AW	1.4191	0.4758	1.2664

Table 5.36.The Actual Weight of Sub-factors of the Factor-F.

	Subfactor F1	**Subfactor F2**	**Subfactor F3**
AW	1.1313	0.5264	1.4718

Step 4.ii .Computing the Sum of the Actual Weight (AW) of Factors and sub-factors

Table 5.37. Sum of the Actual Weight of Factors and Sub-factors

	E_f
Main Factors	37.1907
Subfactors of Factor A	9.3033
Subfactors of Factor B	9.0689
Subfactors of Factor C	9.2108
Subfactors of Factor D	9.1565
Subfactors of Factor E	9.1359
Subfactors of Factor F	9.3474

Step 4.iii. In order to be accurate in our solutions, the consistency is checked. The condition for consistency is CR<0.1.

For the main Factors λ=6.1984 CI=0.0396 CR=0.03

For sub-factors of Factor A λ=3.1011 CI=0.0505 CR=0.08

For sub-factors of Factor B λ= 3.0229 CI=0.0115 CR=0.02

For sub-factors of Factor C λ=3.0703 CI=0.0351 CR=0.06

For sub-factors of Factor D λ= 3.0522 CI=0.0263 CR=0.04

For sub-factors of Factor E λ= 3.0453 CI=0.0226 CR=0.03

For sub-factors of Factor F λ= 3.1158 CI=0.0579 CR=0.09

From the derived results we can say that the consistency condition is satisfied, since all CR<0.1 and the research is meaningful.

Eventually, from the Obtained Weights we have final Bar Charts

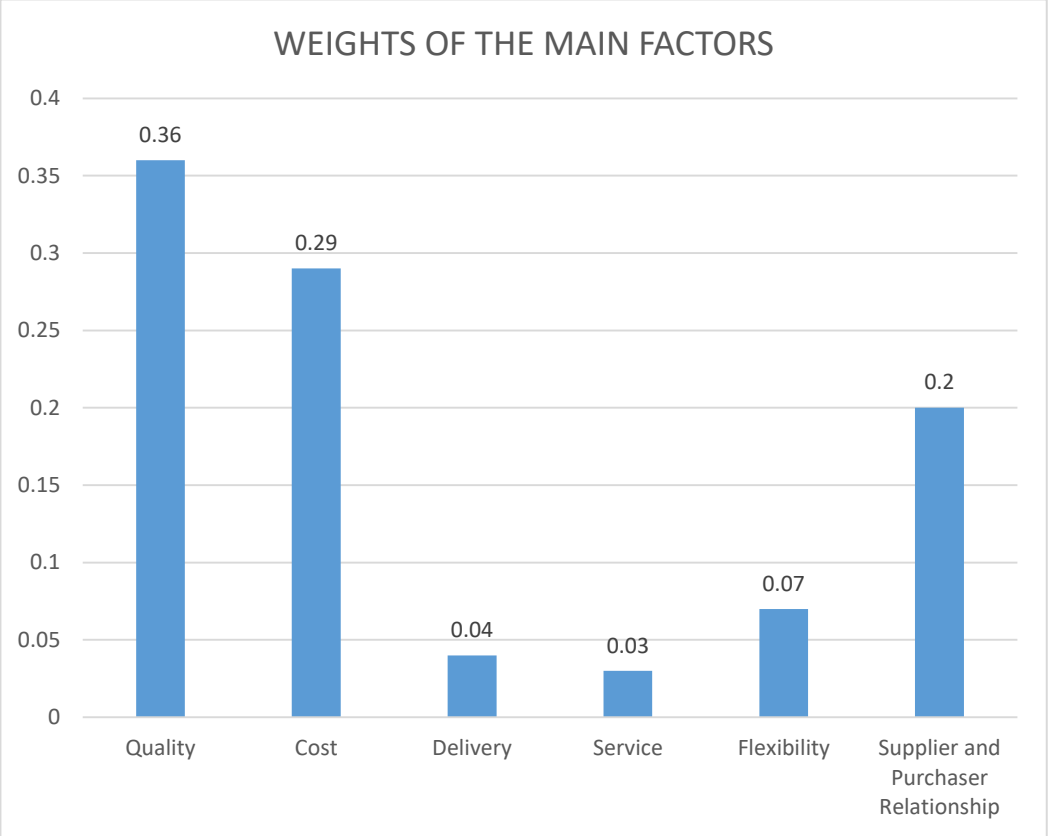

Figure 5.1. Relative Weight of the Main Factors Bar Chart

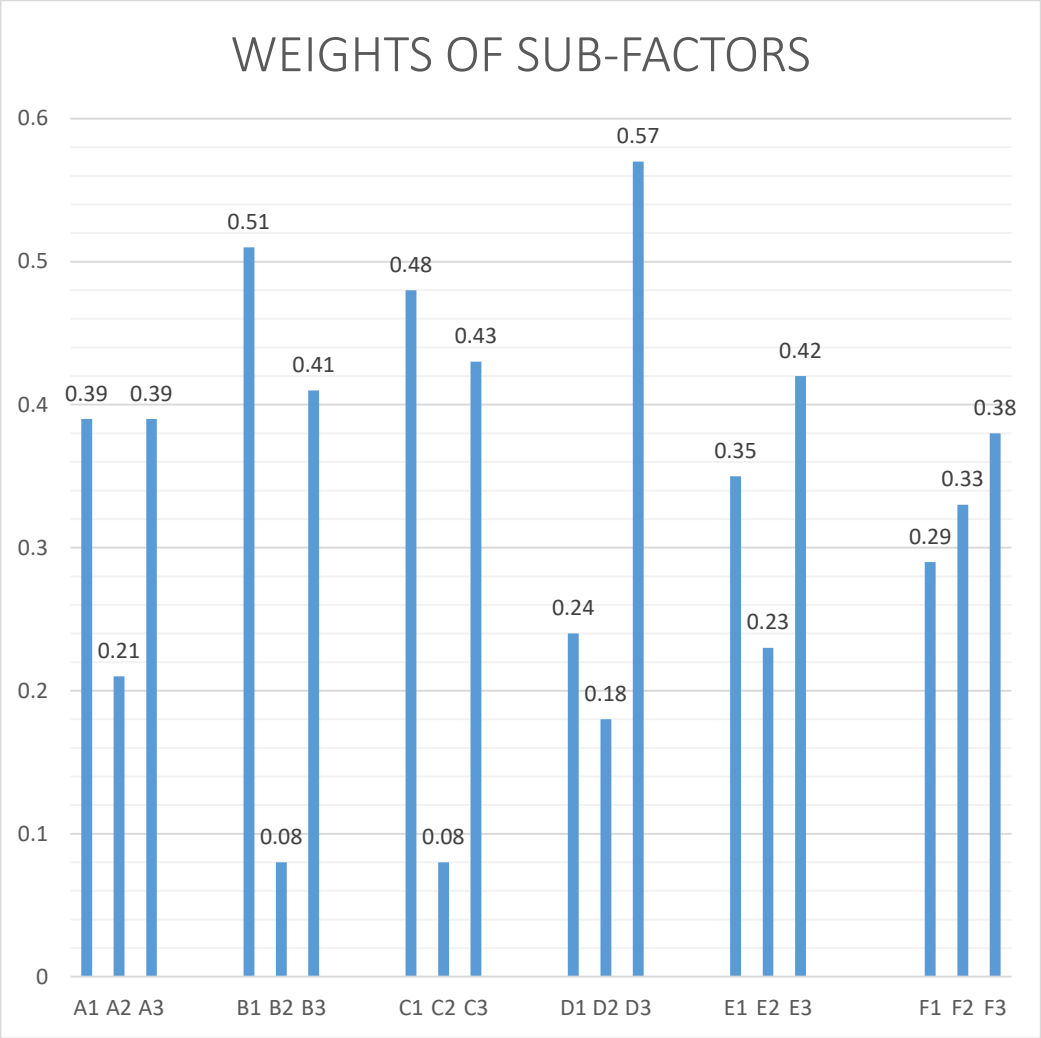

Figure 5.2. Relative Weight of Sub-factors of the Main Factors Bar Chart

Chapter 6

REAL-LIFE CASE

Cyprus achieved its independence from the United Kingdom in 1960. Northern Cyprus is a semi-presidential and democratic republic, with beautiful and wild nature. Economy of the country is based on service sector, such as trade and tourism, more accurately on hotel business. Hotel business is considered as a driving and flourishing sector. Since 2012 the number of tourists has increased particularly and it lead to the increase and development of the hotel business. There is a numerous hotels with entertainment facilities around the island, which attracts tourists from all over the world. The territory of the island is known as untouched and unspoiled land with enormous compelling beaches and mountains. Therefore, a huge investment is made on hotel business, for its contribution to raising the economy of the country.

For our real life case we choose Evolve Park hotel, which is allocated in Famagusta city of Northern Cyprus. Evolve Park was established in 2008. This hotel is regarded as one of the successful and leading hotels in the city. Its unique architecture and design attracts views and provides 151 rooms for 250 people. There is a café-restaurant in the first floor of the building, procuring delicious meals and different beverages. Hotel also provides indoor swimming pool, with heating technology. There is market-shop, which has all daily necessities. A laundry is available for more convenient service. There is a fitness center which is appointed with the latest technological sport equipment. Operating personnel is hold with the owners, top

manager of the hotel, accounting, manager of the cleaning personnel and its workers, manager of the café-restaurant and its working staff, reception personnel, chef and kitchen staff. Hotel ensures with high level of service 24/7.

In this section another part of the AHP method is presented for determining the scores of the alternative suppliers.

Step 5. The received response of Top Manager of the Evolve Park Hotel through pair-wise comparison matrices are illustrated in the tables below.

Table 6.1. Derived score for suppliers of sub-factor A1 of the main Factor-A

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	8.000	8.000	9.000
Supplier 2	0.125	1	3.000	6.000
Supplier 3	0.125	0.333	1	2.000
Supplier 4	0.111	0.167	0.500	1

Table 6.2. Derived score for suppliers of sub-factor A2 of the main Factor-A

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	5.000	9.000	7.000
Supplier 2	0.200	1	4.000	2.000
Supplier 3	0.111	0.250	1	2.000
Supplier 4	0.143	0.500	0.500	1

Table 6.3. Derived score for suppliers of sub-factor A3 of the main Factor-A

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	4.000	6.000	6.000
Supplier 2	0.250	1	2.000	8.000
Supplier 3	0.167	0.500	1	2.000
Supplier 4	0.167	0.125	0.500	1

Table 6.4. Derived score for suppliers of sub-factor B1 of the main Factor-B

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	9.000	8.000	7.000
Supplier 2	0.111	1	2.000	3.000
Supplier 3	0.125	0.500	1	3.000
Supplier 4	0.143	0.333	0.333	1

Table 6.5. Derived score for suppliers of sub-factor B2 of the main Factor-B

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	9.000	8.000	7.000
Supplier 2	0.111	1	2.000	3.000
Supplier 3	0.125	0.500	1	3.000
Supplier 4	0.143	0.333	0.333	1

Table 6.6. Derived score for suppliers of sub-factor B3 of the main Factor-B

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	9.000	9.000	9.000
Supplier 2	0.111	1	1	2.000
Supplier 3	0.111	1.000	1.000	4.000
Supplier 4	0.111	0.500	0.250	1

Table 6.7. Derived score for suppliers of sub-factor C1 of the main Factor-C

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	8.000	8.000	7.000
Supplier 2	0.125	1	3.000	3.000
Supplier 3	0.125	0.333	1	2.000
Supplier 4	0.143	0.333	0.500	1

Table 6.8. Derived score for suppliers of sub-factor C2 of the main Factor-C

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	6.000	6.000	9.000
Supplier 2	0.167	1	3.000	3.000
Supplier 3	0.167	0.333	1	4.000
Supplier 4	0.111	0.333	0.250	1

Table 6.9. Derived score for suppliers of sub-factor C3 of the main Factor-C

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	5.000	8.000	9.000
Supplier 2	0.200	1	4.000	7.000
Supplier 3	0.125	0.250	1	2.000
Supplier 4	0.111	0.143	0.500	1

Table 6.10. Derived score for suppliers of sub-factor D1 of the main Factor-D

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	9.000	7.000	9.000
Supplier 2	0.111	1	2.000	5.000
Supplier 3	0.143	0.500	1	2.000
Supplier 4	0.111	0.200	0.500	1

Table 6.11. Derived score for suppliers of sub-factor D2 of the main Factor-D

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	6.000	9.000	9.000
Supplier 2	0.167	1	2.000	5.000
Supplier 3	0.111	0.500	1	2.000
Supplier 4	0.111	0.200	0.500	1

Table 6.12. Derived score for suppliers of sub-factor D3 of the main Factor-D

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	7.000	7.000	8.000
Supplier 2	0.143	1	4.000	5.000
Supplier 3	0.143	0.250	1	1.000
Supplier 4	0.125	0.200	1.000	1

Table 6.13. Derived score for suppliers of sub-factor E1 of the main Factor-E

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	5.000	6.000	7.000
Supplier 2	0.200	1	5.000	3.000
Supplier 3	0.167	0.200	1	2.000
Supplier 4	0.143	0.333	0.500	1

Table 6.14. Derived score for suppliers of sub-factor E2 of the main Factor-E

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	5.000	7.000	8.000
Supplier 2	0.200	1	4.000	6.000
Supplier 3	0.143	0.250	1	3.000
Supplier 4	0.125	0.167	0.333	1

Table 6.15. Derived score for suppliers of sub-factor E3 of the main Factor-E

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	7.000	7.000	6.000
Supplier 2	0.143	1	4.000	4.000
Supplier 3	0.143	0.250	1	1.000
Supplier 4	0.167	0.250	1	1

Table 6.16. Derived score for suppliers of sub-factor F1 of the main Factor-F

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	5.000	5.000	5.000
Supplier 2	0.200	1	2.000	5.000
Supplier 3	0.200	0.500	1	3.000
Supplier 4	0.200	0.200	0.333	1

Table 6.17. Derived score for suppliers of sub-factor F2 of the main Factor-F

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	5.000	4.000	6.000
Supplier 2	0.200	1	3.000	3.000
Supplier 3	0.250	0.333	1	3.000
Supplier 4	0.167	0.333	0.333	1

Table 6.18. Derived score for suppliers of sub-factor F3 of the main Factor-F

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Supplier 1	1	6.000	6.000	6.000
Supplier 2	0.167	1	3.000	5.000
Supplier 3	0.167	0.333	1	2.000
Supplier 4	0.167	0.200	0.500	1

Following, the sum score of suppliers of each column is calculated.

Table 6.19. Sum score of sub-factors of the main Factor-A

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
∑ sub-factor A1	1.361	9.500	12.500	18.000
∑ sub-factor A2	1.454	6.750	14.500	12.000
∑ sub-factor A3	1.583	5.625	9.500	17.000

Table 6.20. Sum score of sub-factors of the main Factor-B

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
∑ sub-factor B1	1.379	10.833	11.333	14.000
∑ sub-factor B2	1.379	10.583	14.000	12.000
∑ sub-factor B3	1.333	11.500	11.250	16.000

Table 6.21. Sum score of sub-factors of the main Factor-C

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
∑ sub-factor C1	1.393	9.667	12.500	13.000
∑ sub-factor C2	1.444	7.667	10.250	17.000
∑ sub-factor C3	1.436	6.393	13.500	19.000

Table 6.22. Sum score of sub-factors of the main Factor-D

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
∑ sub-factor D1	1.365	10.700	10.500	17.000
∑ sub-factor D2	1.389	7.700	12.500	17.000
∑ sub-factor D3	1.411	8.450	13.000	15.000

Table 6.23. Sum score of sub-factors of the main Factor-E

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
∑ sub-factor E1	1.509	6.533	12.500	13.000
∑ sub-factor E2	1.468	6.417	12.333	18.000
∑ sub-factor E3	1.452	8.500	13.000	12.000

Table 6.24. Sum score of sub-factors of the main Factor-F

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
∑ sub-factor F1	1.600	6.700	8.333	14.000
∑ sub-factor F2	1.617	6.667	8.333	13.000
∑ sub-factor F3	1.500	7.533	10.500	14.000

Step 3. Computing Relative Scores of suppliers.

Step 3.i. Forming the Normalized Matrices. Note that the sum of each column should be equal to one.

Table 6.25. Normalized Matrix of sub-factor A1 of the main Factor-A

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.7347	0.8421	0.6400	0.5000	2.7168
Supplier 2	0.0918	0.1053	0.2400	0.3333	0.7704
Supplier 3	0.0918	0.0351	0.0800	0.1111	0.3180
Supplier 4	0.0816	0.0175	0.0400	0.0556	0.1947
	1	1	1	1	

Table 6.26. Normalized Matrix of sub-factor A2 of the main Factor-A

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6878	0.7407	0.6207	0.5833	2.6325
Supplier 2	0.1375	0.1481	0.2759	0.1667	0.7282
Supplier 3	0.0764	0.0370	0.0689	0.1667	0.3491
Supplier 4	0.0982	0.0741	0.0345	0.0833	0.2901
	1	1	1	1	

Table 6.27. Normalized Matrix of sub-factor A3 of the main Factor-A

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6316	0.7111	0.6316	0.3529	2.3272
Supplier 2	0.1579	0.1778	0.2105	0.4706	1.0168
Supplier 3	0.1053	0.0889	0.1053	0.1176	0.4171
Supplier 4	0.1053	0.0222	0.0526	0.0588	0.2389
	1	1	1	1	

Table 6.28. Normalized Matrix of sub-factor B1 of the main Factor-B

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.72518	0.83077	0.70588	0.5	2.76183
Supplier 2	0.08058	0.09231	0.17647	0.21429	0.56364
Supplier 3	0.09065	0.04615	0.08824	0.21429	0.43932
Supplier 4	0.1036	0.03077	0.02941	0.07143	0.23521
	1	1	1	1	

Table 6.29. Normalized Matrix of sub-factor B2 of the main Factor-B

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.72518	0.85039	0.57143	0.58333	2.73034
Supplier 2	0.08058	0.09449	0.28571	0.25	0.71078
Supplier 3	0.09065	0.02362	0.07143	0.08333	0.26903
Supplier 4	0.1036	0.0315	0.07143	0.08333	0.28986
	1	1	1	1	

Table 6.30. Normalized Matrix of sub-factor B3 of the main Factor-B

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.7500	0.7826	0.8000	0.5625	2.8951
Supplier 2	0.0833	0.0869	0.0889	0.1250	0.3842
Supplier 3	0.0833	0.0869	0.0889	0.2500	0.5092
Supplier 4	0.0833	0.0435	0.0222	0.0625	0.2115
	1	1	1	1	

Table 6.31. Normalized Matrix of sub-factor C1 of the main Factor-C

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.7179	0.8276	0.6400	0.5385	2.7240
Supplier 2	0.0897	0.1034	0.2400	0.2308	0.6639
Supplier 3	0.0897	0.0345	0.0800	0.1538	0.3581
Supplier 4	0.1026	0.0345	0.0400	0.0767	0.2539
	1	1	1	1	

Table 6.32. Normalized Matrix of sub-factor C2 of the main Factor-C

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6923	0.7826	0.5854	0.5294	2.5896
Supplier 2	0.1154	0.1304	0.2927	0.1765	0.7149
Supplier 3	0.1154	0.0435	0.0976	0.2353	0.4917
Supplier 4	0.0769	0.0435	0.0244	0.0588	0.2036
	1	1	1	1	

Table 6.33. Normalized Matrix of sub-factor C3 of the main Factor-C

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6963	0.7821	0.5926	0.4737	2.5447
Supplier 2	0.1393	0.1564	0.2963	0.3684	0.9604
Supplier 3	0.0870	0.0391	0.0741	0.1053	0.3055
Supplier 4	0.0774	0.0224	0.0370	0.0526	0.1894
	1	1	1	1	

Table 6.34. Normalized Matrix of sub-factor D1 of the main Factor-D

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.7326	0.8411	0.6667	0.5294	2.7698
Supplier 2	0.0814	0.0935	0.1905	0.2941	0.6594
Supplier 3	0.1046	0.0467	0.0952	0.1176	0.3643
Supplier 4	0.0814	0.0187	0.0476	0.0588	0.2065
	1	1	1	1	

Table 6.35. Normalized Matrix of sub-factor D2 of the main Factor-D

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.7200	0.7792	0.7200	0.5294	2.7486
Supplier 2	0.1200	0.1299	0.1600	0.2941	0.7039
Supplier 3	0.0800	0.0649	0.0800	0.1176	0.3426
Supplier 4	0.0800	0.0259	0.0400	0.0588	0.2048
	1	1	1	1	

Table 6.36. Normalized Matrix of sub-factor D3 of the main Factor-D

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.7089	0.8284	0.5385	0.5333	2.6091
Supplier 2	0.1013	0.1183	0.3077	0.3333	0.8606
Supplier 3	0.1013	0.0296	0.0769	0.0667	0.2744
Supplier 4	0.0886	0.0237	0.0769	0.0667	0.2559
	1	1	1	1	

Table 6.37. Normalized Matrix of sub-factor E1 of the main Factor-E

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6625	0.7653	0.4800	0.5385	2.4462
Supplier 2	0.1325	0.1531	0.4000	0.2308	0.9163
Supplier 3	0.1104	0.0306	0.0800	0.1538	0.3749
Supplier 4	0.0946	0.0510	0.0400	0.0769	0.2626
	1	1	1	1	

Table 6.38. Normalized Matrix of sub-factor E2 of the main Factor-E

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6813	0.7792	0.5676	0.4444	2.4725
Supplier 2	0.1363	0.1558	0.3243	0.3333	0.9497
Supplier 3	0.0973	0.0389	0.0811	0.1667	0.3840
Supplier 4	0.0852	0.0259	0.0270	0.0556	0.1937
	1	1	1	1	

Table 6.39. Normalized Matrix of sub-factor E3 of the main Factor-E

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6885	0.8235	0.5385	0.5000	2.5505
Supplier 2	0.0984	0.1176	0.3077	0.3333	0.8570
Supplier 3	0.0984	0.0294	0.0769	0.0833	0.2880
Supplier 4	0.1147	0.0294	0.0769	0.0833	0.3044
	1	1	1	1	

Table 6.40. Normalized Matrix of sub-factor F1 of the main Factor-F

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6250	0.7463	0.6000	0.3571	2.3284
Supplier 2	0.1250	0.1492	0.2400	0.3571	0.8714
Supplier 3	0.1250	0.0746	0.1200	0.2143	0.5339
Supplier 4	0.1250	0.0298	0.0400	0.0714	0.2663
	1	1	1	1	

Table 6.41. Normalized Matrix of sub-factor F2 of the main Factor-F

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6186	0.7500	0.4800	0.4615	2.3101
Supplier 2	0.1237	0.1500	0.3600	0.2308	0.8645
Supplier 3	0.1546	0.0500	0.1200	0.2308	0.5554
Supplier 4	0.1031	0.0500	0.0400	0.0769	0.2700
	1	1	1	1	

Table 6.42. Normalized Matrix of sub-factor F3 of the main Factor-F

	Supplier 1	Supplier 2	Supplier 3	Supplier 4	∑
Supplier 1	0.6667	0.7965	0.5714	0.4286	2.4631
Supplier 2	0.1111	0.1327	0.2857	0.3571	0.8867
Supplier 3	0.1111	0.0442	0.0952	0.1429	0.3934
Supplier 4	0.1111	0.0265	0.0476	0.0714	0.2567
	1	1	1	1	

Step 3.ii. After obtaining normalized matrices, we calculate the relative scores of suppliers of sub-factors.

Table 6.43.The Relative Score of suppliers of sub-factors of the Factor-A.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Si of sub A1	0.6792	0.1926	0.0795	0.048
Si of sub A2	0.6581	0.1821	0.0873	0.0725
Si of sub A3	0.5818	0.2542	0.1043	0.0597

Table 6.44.The Relative Score of suppliers of sub-factors of the Factor-B.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Si of sub B1	0.6905	0.1409	0.1098	0.0588
Si of sub B2	0.6826	0.1777	0.0673	0.0725
Si of sub B3	0.7238	0.0960	0.1273	0.0529

Table 6.45.The Relative Score of suppliers of sub-factors of the Factor-C.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Si of sub C1	0.6810	0.1659	0.0895	0.0635
Si of sub C2	0.6474	0.1787	0.1229	0.0509
Si of sub C3	0.6362	0.2401	0.0764	0.0474

Table 6.46.The Relative Score of suppliers of sub-factors of the Factor-D.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Si of sub D1	0.6924	0.1649	0.0911	0.0516
Si of sub D2	0.6872	0.1760	0.0856	0.0512
Si of sub D3	0.6523	0.2152	0.0686	0.0639

Table 6.47.The Relative Score of suppliers of sub-factors of the Factor-E.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Si of sub E1	0.6116	0.2291	0.0937	0.0656
Si of sub E2	0.6181	0.2374	0.0960	0.0484
Si of sub E3	0.6376	0.2143	0.0720	0.0761

Table 6.48.The Relative Score of suppliers of sub-factors of the Factor-F.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Si of sub F1	0.5821	0.2178	0.1335	0.0666
Si of sub F2	0.5775	0.2161	0.1388	0.0675
Si of sub F3	0.6158	0.2217	0.0984	0.0642

Step 4. Checking the consistency

Step 4.i. Obtaining Actual Scores

Table 6.49.The Actual Score of suppliers of sub-factors of the Factor-A.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Sa of sub A1	3.2943	0.8081	0.3259	0.1960
Sa of sub A2	2.8616	0.8078	0.3509	0.3012
Sa of sub A3	2.5826	1.0861	0.4478	0.2406

Table 6.50.The Actual Score of suppliers of sub-factors of the Factor-B.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Sa of sub B1	3.2489	0.6137	0.4430	0.2410
Sa of sub B2	3.3271	0.7399	0.2695	0.2965
Sa of sub B3	3.2098	0.4095	0.5153	0.2132

Table 6.51.The Actual Score of suppliers of sub-factors of the Factor-C.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Sa of sub C1	3.1695	0.7101	0.3569	0.2609
Sa of sub C2	2.9156	0.8081	0.4940	0.2132
Sa of sub C3	2.8738	1.0042	0.3106	0.1905

Table 6.52.The Actual Score of suppliers of sub-factors of the Factor-D.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Sa of sub D1	3.2784	0.6821	0.3757	0.2071
Sa of sub D2	2.9747	0.7178	0.3524	0.2056
Sa of sub D3	3.1504	0.9026	0.2795	0.2571

Table 6.53.The Actual Score of suppliers of sub-factors of the Factor-E.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Sa of sub E1	2.7788	1.0169	0.3727	0.2762
Sa of sub E2	2.8648	1.0357	0.3889	0.1973
Sa of sub E3	3.0981	0.8978	0.2928	0.3079

Table 6.54.The Actual Score of suppliers of sub-factors of the Factor-F.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Sa of sub F1	2.6716	0.9341	0.5585	0.2711
Sa of sub F2	2.6186	0.9507	0.5578	0.2821
Sa of sub F3	2.9211	0.9403	0.4032	0.2603

Step 4.ii. Computing E_{fh}

E_{f1}=17.1720, E_{f2}=16.9598, E_{f3}=17.0342, E_{f4}=17.1930, E_{f5}=17.1363, E_{f6}=16.7773

E_{f7}=17.0286,E_{f8}=17.2308, E_{f9}=16.7909, E_{f10}=17.0078, E_{f11}=16.5373, E_{f12}=17.1194

E_{f13}=17.1682, E_{f14}=17.1212, E_{f15}=17.1612, E_{f16}=17.1334,E_{f17}=17.1289, E_{f18}=17.1412

Step 4.iii. Computing λ and CI.

Table 6.55. Consistency table

λ	CI	CR
4.29	0.096	0.10
4.24	0.080	0.08
4.26	0.086	0.09
4.29	0.096	0.10
4.28	0.093	0.10
4.19	0.063	0.07
4.26	0.086	0.09
4.30	0.100	0.10
4.19	0.063	0.07
4.25	0.083	0.09
4.13	0.043	0.05
4.27	0.090	0.10
4.29	0.096	0.10
4.28	0.093	0.10
4.29	0.096	0.10
4.28	0.093	0.10
4.28	0.093	0.10
4.28	0.093	0.10

Step 6. Computing the scores of all suppliers

Table 6.56. The final score for suppliers of sub-factors of the main factors

	Sub-factors of Factor A	Sub-factors of Factor B	Sub-factors of Factor C	Sub-factors of Factor D	Sub-factors of Factor E	Sub-factors of Factor F
Supplier 1	9.89291	7.37687	6.93351	8.62469	9.23024	8.70031
Supplier 2	2.94744	1.38042	1.74479	2.18836	3.07295	2.94116
Supplier 3	1.20999	0.95158	0.85038	0.89061	1.08483	1.51902
Supplier 4	0.73657	0.56064	0.54310	0.63338	0.87587	0.83830

Step 7. Computing the final score of the suppliers.

Table 6.57. The final score of suppliers

Supplier 1	0.64807
Supplier 2	0.18917
Supplier 3	0.10277
Supplier 4	0.05999

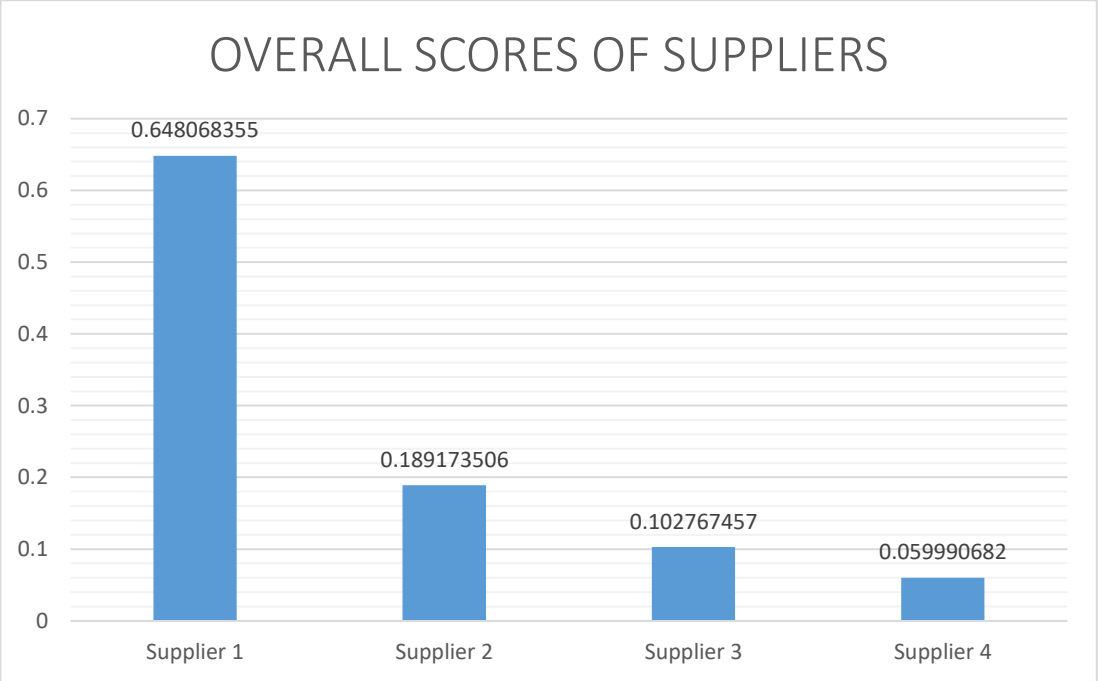

Figure 6.1. Overall Score of Suppliers

Chapter 7

CONCLUSION

An attempt has been made in this study to evaluate and identify the most significant criteria, immensely contributing on hotel business success and improvement, more widely developing the Service Industry performance. As a matter of fact our observation was clearly show that price stand out to be outstanding extensively adjusted criteria. In contrast, from the above evaluation the best adopted criteria with a great Performance Efficiency of Suppliers (PESs) is quality (Q) as number one (1), and the next was price (P), then service (S), delivery (D), etc. Correspondingly this ensures that some limitation occurs within the price limit, may be due to customary way of treatment customers are not substantial to drive the spirit of hostility between producer (supplier) and customer (buyer). The customary price-based style cannot 100% guarantee that chosen supplier is efficient in performance when compared with the align customer-service oriented approach toward the given criteria such as: quality (Q), flexibility (F), delivery (D) and others when fully consider in this study.

There are so many approaches proposed as a means to arrest the issues surrounding supplier selection and the most incorporated one is AHP model, which we involved to measure and determine the most important criteria and their weights. In real life the actual percentage increase in mean of supplier evaluated factors, depend mainly on the business-business priorities. Therefore, in case if mean-weighted values are poorly designated individually across the supply chain, then the chosen supplier may

not justify and provide hotel's necessities. A hierarchical criteria framework concluding both the tangible and intangible criteria was been constructed. Hotels exhibit various purchasing behavior with various conditions, which define each level of supplier selection (SS) and evaluation. With this intention the main contribution of this study is to display a step-wise technique on how to define each level criteria and their weights.

In addition to the real life case-study, which was purely investigated directly by applying our proposed approach in Evolve Park Hotel (EPH) right here in Famagusta, and we were able to designed a standard relationship which exist between the supplier-buyer in partnership level, are structured systematically and each sub-criteria for supplier selection (SS) clearly determined. And create a large room for decider to be able see the fortes and feebleness of each alternate suppliers through proper cross checking with other suitable criteria and sub-criteria. For the purpose of reducing the number of comparisons and the regarded computational effort, the most important criteria are elaborated. Utilization the fundamental ranking measure for allocating the various weights of each criteria will helps the decider to reduce time consuming pair-wise comparison (PWC) judgements. The practical employment declared the feasibility of the study. The application of the multi-criteria analysis enhances the possibilities of selecting the best supplier. The Service Industry requires simple but effective decision-making approach, such as attributed in this study. The implemented method may aid to improve supplier selection strategy, will forward to cost descent, shortening the time consumption quality and operation performance.

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APPENDIX

Applied Questionnaire

I Sulkhiyai Saidbek a master degree student of Industrial Engineering Department of Eastern Mediterranean University would like your evaluaton with respect to my thesis stated "Supplier selection in service industry using Analitical Hierarchy Process method".

In this paper we propose to define the weights of the factors specifying the efficiency of suppliers in service industry.

Appropriate supplier selection will improve the performance. Every business organization largely depends on the suppliers and therefore suppliers play vital roles to make an organization cost profitable. This is a crucial issue that connects both managerial and operational viewpoints because a correct decision considerably benefits an organization. In this matter we sincerely ask your opinion and fill the following pair-wise comparison matrices according to your own judgement as an expert in service industry field.

In order to facilitate the task we have grouped the given measures into six main factors and three subfactors under each criteria.

Factor-A (Quality)

Sub factor A1 product certified by an authorized organization i.e. product must reply to all customer requirements and standards of the market;

Sub factor A2 reliability i.e. product should be trustworthy and satisfy given measures;

Sub factor A3 defect rates i.e. defectiveness of a product;

Factor-B (Cost)

Sub factor B1 low price;

Sub factor B2 quantity discounts i.e. the more purchased quantity the more prices for product will be decreased;

Sub factor B3 transportation cost i.e. based on geographic areas transportation cost may differ;

Factor-C (Delivery)

Sub factor C1 on time and stable delivery;

Sub factor C2 good packaging;

Sub factor C3 order fulfillment lead time i.e. the average time from order placement to customer receipt;

Factor-D (Service)

Sub factor D1 ease of communication i.e. the ease to lead negotiation of a product;

Sub factor D2 production capability i.e. the ability of a company to respond to inquiries as much as they received;

Sub factor D3 warranty i.e. This is a documentary permission issues to customer or buyer from the producer ensuring to substitute any faulted product offer at particular time within a given period of location;

Factor-E (Flexibility)

Sub factor E1 mix-flexibility, this is the tendency to transformation the range of some products when required.

Sub factor E2 delivery-flexibility, this is act to re-join quickly to pressing delivery requests when require.

Sub factor E3 service -flexibility, this is the act to take modifications in service when is necessary;

Factor-F (Purchaser and supplier relationships)

Sub factor F1 reputation, the opinions of a community or public about given companies;

Sub factor F2 honesty, the quality to be responsible and truthful;

Sub factor F3 partnership, an arrangement in which two or more companies share the profits of a business.

In the pair-wise comparison matrices the ratios between the weights of compared pairs of factors (in this paper the factor A until factor F) are shown. The cell (*i*,*j*) of the comparison matrix shows the ratio *wi*/*wj* where *wi* is the weight of factor *i* and *wj* is the weight of factor *j*. The list of the linguistic variables and corresponding ratios are given below:

Fundamental Scale	**Linguistic variable**	Ratio
1	Absolutely Unimportant (AU)	1/9
2	Strongly Unimportant (SU)	1/7
3	Fairly Unimportant (FU)	1/5
4	Weakly Unimportant (WU)	1/3
5	Equally Important (EI)	1
6	Weakly Important (WI)	3
7	Fairly Important (FI)	5
8	Strongly Important (SI)	7
9	Absolutely Important (AI)	9

In the comparison matrices please use the above linguistic variables. In order to make it clearer let's give an example:

The comparison matrix between factor A and factor B is:

	factor A	***factor B***
factor A	5	**?**
factor B	-	5

Let's assume that in your answer you stated that factor A is Fairly Important (FI) than factor B.

	factor A	***factor B***
factor A	5	**7**
factor B	-	5

Let's assume that in your answer you stated that factor A is Weakly Unimportant (WU) than factor B.Considering the corresponding ratio your answer means that the ratio WfactorA/ WfactorB is 5. I.e., factor A is 5 times more important than factor B, but using fundamental scale it means that factor A is 7 times fairly important than factor B.

	factor A	***factor B***
factor A	5	**4**
factor B	-	5

Considering the corresponding ratio your answer means that the ratio WfactorB/ WfactorA is 3. I.e., factor B is 3 times more important than factor A. ***("Factor A is Weakly Unimportant than factor B" means "factor B is Weakly Important than***

facator A"), but using fundamental scale it means that factor A is 4 times weakly unimportant than factor B.

And, considering the above explanations, please fill the following pair-wise comparison matrices according to your own judgments.

- **Supplier selection in service industry using Analitical Hierarchy Process method**

- 1 Comparison matrix between factor A and other factors: Please fill the cells.

	Factor B	Factor C	Factor D	Factor E	Factor F
Factor A					

- 2 Comparison matrix between factor B and other factors: Please fill the cells.

	Factor C	Factor D	Factor E	Factor F
Factor B				

- 3 Comparison matrix between factor C and other factors: Please fill the cells.

	Factor D	Factor E	Factor F
Factor C			

- 4 Comparison matrix between factor D and other factors: Please fill the cells.

	Factor E	Factor F
Factor D		

- 5 Comparison matrix between factor E and factor F: Please fill the cells.

	Factor F
Factor E	

- 1.1 Comparison matrix between the subfactors in factor A: Please fill the cells.

	subfactor 2	subfactor 3
subfactor 1		

- 1.2 Comparison matrix between the subfactors in factor A: Please fill the cells.

	subfactor 3
subfactor 2	

- 2.1 Comparison matrix between the subfactors in factor B: Please fill the cells.

	subfactor 5	subfactor 6
subfactor 4		

- 2.2 Comparison matrix between the subfactors in factor B: Please fill the cells.

	subfactor 6
subfactor 5	

- 3.1 Comparison matrix between the subfactors in factor C: Please fill the cells.

	subfactor 8	subfactor 9
subfactor 7		

- 3.2 Comparison matrix between the subfactors in factor C: Please fill the cells.

	subfactor 9
subfactor 8	

- 4.1 Comparison matrix between the subfactors in factor D: Please fill the cells.

	subfactor 11	subfactor 12
subfactor 10		

- 4.2 Comparison matrix between the subfactors in factor D: Please fill the cells.

	subfactor 12
subfactor 11	

- 5.1 Comparison matrix between the subfactors in factor E: Please fill the cells.

	subfactor 14	subfactor 15
subfactor 13		

- 5.2 Comparison matrix between the subfactors in factor E: Please fill the cells.

	subfactor 15
subfactor 14	

- 6.1 Comparison matrix between the subfactors in factor F: Please fill the cells.

	subfactor 17	subfactor 18
subfactor 16		

- 6.2 Comparison matrix between the subfactors in factor F: Please fill the cells.

	subfactor 18
subfactor 17	

- Submit