ABSTRACT

ULUSKAN, MERYEM. Insights into the Role of Quality in Sourcing Decisions in the Textile and Apparel Industry. (Under the direction of Dr. A. Blanton Godfrey and Dr. Jeffrey A. Joines).

Companies have been forced by increasing global competition to pursue international sourcing strategies that emphasize lower prices and delivery performance. Consequently they are focused on identification of opportunities to improve quality or gain efficiencies on a worldwide or regional basis. Global sourcing requires additional skills and knowledge to deal with international suppliers, logistics, communication, the political environment, and other issues. As a result, companies that have failed to pursue successful sourcing strategies have struggled to survive.

This study conducted a detailed technical survey and complementary personal interviews to provide an in-depth understanding of sourcing decisions of US textile and apparel companies. This research is primarily focused on sourcing decisions of US textile and apparel companies with an emphasis on quality, and includes significant contributions to the literature not only in terms of the new approaches to view the related subject but also in terms of the statistical applications to analyze the data. The factors of sourcing decisions of US companies are analyzed from very different perspectives. The factors originating from the buyer side such as different company types and marketing strategies, the factors resulting from suppliers side such as the issues encountered during sourcing efforts from different regions of the world are all investigated. This exploratory study provides an insight into the current state of the supplier quality and the role of quality in sourcing decisions of US companies including reshore/relocation. It also provides a broad comparison of quality issues arising from domestic and international suppliers. Moreover, it identifies the most effective

quality improvement strategies and their impact on sourcing decisions. It also determines to what extent the buyer companies provide support to their suppliers, and it examines the challenges and barriers encountered during supplier improvement efforts including implementation of quality practices in suppliers.

The analyses revealed that cost is the main driver for larger companies as well as retailers and private brands as opposed to manufacturer companies in their sourcing decisions. In addition, different marketing strategies, especially pursuing made-in-USA, speed-to-market, and green/sustainable strategies have considerable impact on reshoring decisions of US companies. Companies that are cost oriented tend to switch their suppliers. Moreover, detailed world maps are provided to depict the intensity of the issues that are encountered during sourcing from different regions. Product quality and supply chain quality are found as the most important factors in outsourcing decisions of all buyer companies, whereas, indirect qualities are less important in their outsourcing decisions.

The analyses also revealed that overall international supplier quality is worse as compared to those of domestic suppliers while the larger differences exist in management and process qualities. However, it is shown that these worse quality conditions, starting with product quality, can be improved significantly by the means of implementing Lean and Six Sigma within international suppliers while TQM and ISO implementations are not as effective. In addition to these findings, this study shows US companies provide quality and technical help to their suppliers in order to improve their quality instead of bearing supplier switching costs. On the other hand, it is found that time cost and expense to visit suppliers, information exchange, and management style all raise higher barriers for providing help to international suppliers compared to domestic ones.

Insights into the Role of Quality in Sourcing Decisions in the Textile and Apparel Industry

by
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BIOGRAPHY

Meryem Uluskan was born in Turkey in 1984. She received her double major Bachelor of Science Degrees in Textile Engineering and Management Engineering from Istanbul Technical University in 2008. During her undergraduate years, after learning fluent Italian, she attended Politecnico di Torino University in 2006 as an exchange student. In 2008 she started her Master's study as a Research Assistant in North Carolina State University. She earned her Master of Science degree in Textile & Apparel, Technology & Management from the College of Textiles with a minor in Statistics in 2010. During the Master's program, Meryem worked as a Process Development Intern at CHF/USAID-Haiti on a project funded by US government to develop Haiti's textile industry. Upon graduation, Meryem immediately enrolled in the Textile Technology Management PhD program with a minor in Business Administration at the College of Textiles. Meryem's major research areas are Six Sigma applications, quality improvements, supply chain management and reshoring. She is interested in international business with a focus in the supply-chain and quality areas.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1
Introduction

In the late 1970s, previously unrivalled US companies and manufacturing sites started to face considerable global competition that led to loss of market share. In order to regain and retain their competitive advantage, US companies implemented improvement programs that had originated in the United States and had been especially successful in Japan. These "improvement programs" include mainly TQM (Total Quality Management, called Total Quality Control or TQC in Japan), Lean (based on the Toyota Production System) and Six Sigma Quality. In the past few decades, both the economic press and academic journals have published articles describing successful efforts of these programs within companies.

On the other hand, off-shoring had also been one of the common strategies applied by companies to create and maintain a sustainable competitive advantage (Ferdows, 1997). Several decades ago, US companies, particularly those on the West Coast, started shifting high-volume manufacturing to Hong Kong, Singapore, and the Philippines for similar reasons - lower wages, fewer government regulations, and far less stringent environmental regulations. Meanwhile, other manufacturers moved assembly and manufacturing operations to Mexico to meet the demand in the US and world markets. Many companies found the lowest cost manufacturing operations in either China or India. Initially, US manufacturers outsourced specific parts and components of products to offshore suppliers. Afterwards, they outsourced whole product lines to offshore suppliers, and, ultimately, they built their own manufacturing facilities in China when the Chinese government changed the policies to allow private ownership of companies and foreign investment.

One of the main factors in outsourcing decisions has been the cost. For years, companies have seen off-shoring as a means of saving money. Low labor costs in developing countries have provided companies with the opportunity to find a cheaper workforce. These cost-saving strategies of off-shoring have been under reconsideration since labor costs are only one part of the overall cost and, ultimately, profit. Other features like shorter lead times, higher quality, on time deliveries, and other supply chain management costs also have an effect. Because a chain is only as strong as its weakest link, when suppliers fail to meet the requirements of the buyers, or when the international conditions start to change, the search for new sources – reshore and relocation - begins. It was observed that after reconsidering their outsourcing strategies, a number of companies have increased their manufacturing in the US, and moved some of their manufacturing from offshore to the US (re-shoring). Also, many companies have changed the location of their international suppliers (relocation) owing to several factors. Re-shoring or relocating as a key strategic decision has recently been accelerated by various companies. More recently, academics have begun to study on re-shoring / relocation (Holz, 2009; Kinkel & Maloca, 2009; Leibl *et al.,* 2011; Bishop *et al*., 2011, Kinkel, 2012; Ellram, 2013).

Academic literature in the area of supplier selection, supplier quality and sourcing has been primarily focused on sectors other than the textile and apparel industry. Literature on supplier selection has only limited studies that examine the actual state of suppliers' quality levels, and analytical quality comparisons can rarely be found for different groups of suppliers. Previous research that has focused on supplier quality does not go beyond the case studies conducted with a limited number of companies and fails to provide a general picture

of the industry as a whole. Previous studies are mainly focused on supplier selection criteria in theory and very limited research has been focused on analytically investigating the actual quality issues arising from suppliers within the textile and apparel industry. This research primarily investigates the supplier quality issues within the textile and apparel industry. It provides a general picture by the means of detailed surveys from various types of companies within the same industry. It goes beyond the traditional case-study type of research and provides quantitative results by means of a detailed and technical survey.

In the literature, the research that combines sourcing efforts and quality is also limited. Furthermore, this type of study does rarely exist within the context of the textile and apparel industry. The research into quality initiative implementations is mainly focused on the quality implementation within the company itself. Research that looks at the quality implementations in suppliers, and views the quality initiatives in suppliers as a factor of sourcing decision of buyer companies does not exist. From this point of view, in addition to looking at the impact of these implementations within the company, this research looked at the impacts of quality implementations within the US companies' suppliers. This research combines sourcing decisions of buyer companies with quality initiative implementations in suppliers by the means of quantitative data from the textile and apparel industry. This research is primarily focused on *Reshore* and *Relocation* decisions of the US buyer companies which can be regarded as the most important sourcing decisions. Since reshoring is a fairly new phenomenon, the academic research that has been focused on this area is also limited, and much of the time, the research on reshoring does not go beyond defining the term *reshoring*. So, this research can be regarded as the "second phase" of studies about

reshoring. In this research, conclusions are made based on reshore and relocation efforts within the US textile and apparel industry, i.e., reshore is now accepted as an intermediate tool to explain various new notions and structures. Therefore, this research has a noteworthy contribution to the reshore and relocation literature by reconsidering reshoring/relocation efforts within the US textile and apparel industry with a focus on quality.

This research is primarily focused on sourcing decisions of US textile and apparel companies with a specific emphasis on quality. One of the main goals of this research is to analyze the factors of sourcing decisions of US buyer companies from different perspectives. This research was aimed to identify the factors originating from the buyers side such as different company types and marketing strategies, and the factors resulting from the suppliers side such as the issues encountered during sourcing efforts from different regions of the world. This exploratory study was also aimed at providing an insight into the current state of supplier quality and the role of quality in sourcing decisions of US companies including reshore/relocation. It is intended to provide a broad comparison of quality issues arising from domestic and international suppliers. Moreover, the purpose of this research includes identification of the most effective quality improvement strategies and their impact on sourcing decisions. It is also aimed to determine to what extent the buyer companies provide support to their suppliers, and, ultimately, to examine the challenges and barriers encountered during supplier improvement efforts including implementation of quality practices in suppliers. Moreover, it also aims to determine the important quality practices and the individual quality dimensions that influence a company performance.

To achieve these goals, Chapter 2 outlines all the current research on the subject and demonstrates the lack of knowledge with regard to sourcing decisions and quality for the textile and apparel industry. Chapter 3 develops a specific set of research questions as well as describes the research methodology utilized to gather data to answer those questions. Finally, Chapter 4 analyzes and addresses each of the main research question and sub-questions while Chapter 5 gives conclusions and points to future work that can be further carried out.

Chapter 2
Literature Review

2.1 Globalization

Due to growing international business and investment, innovative technologies and important developments in information technology, industry consolidation, emergence of large amount of multinational companies, and the need for increased productivity and capacity, long distances between countries and continents appears to be shorter and the world now seems to be smaller. This phenomenon, called globalization, describes the process of international interaction and integration among people, companies, and governments of different countries (Friedman, 2005; Senft, 2014). Most countries and companies in today's world do not limit themselves within their geographical borders and are involved in international relations. The world is again metaphorically claimed to be flat to emphasize that all of the international competitors are provided with equal opportunities to succeed in global market (Friedman, 2005)

2.1.1 Manufacturing and Sourcing Decisions

As far as competitiveness is concerned, globalization leads to increased competition which has forced many companies to source internationally to remain competitive, and companies that have failed to pursue successful sourcing strategies have struggled to survive. Sourcing strategies that companies follow can be classified in two main categories, namely, *in-sourcing* where manufacturing takes place in company owned plants and involves proprietary manufacturing activities conducted either domestically or internationally, and *outsourcing*

which implies purchasing products either from domestic or international suppliers (Antras and Helpman, 2004; Schniederjans et al, 2005; Duening and Click, 2005). Both alternatives may be implemented separately or concurrently depending on the industry dynamics and companies' strategic decisions.

2.1.2 Domestic vs. Global Sourcing

When a company chooses to source its raw materials or final products, the question of sourcing either domestically or internationally arises. *Domestic sourcing* or *onshore sourcing* refers to sourcing from suppliers that are located in the same country of the buyer company (Lewin et al., 2009). Some considerable advantages of domestic sourcing are the possibility of ordering smaller quantities, prompt handling of orders that require fast response, and a better reaction to fluctuating numbers of incoming orders (Arnolds, 2010). Moreover, the relatively short distance between domestic supplier and the buyer company may offer logistical advantages by eliminating complex logistics processes and transportation distances while offering shorter lead times. Additionally, domestic sourcing can eliminate risks that might arise during global sourcing. These risks may include fluctuation of currency, labor rates and energy prices, supply chain control risk due to logistics problems, political risks, port closures, and risks due to cultural differences.

On the other hand, *global sourcing* or *offshoring* implies that the trade between the supplier and the customer takes place at the international level (Peng, 2006; Golini and Kalchschmidt, 2011). This means that the source and the destination of products are located in different countries and the products have to cross borders on their way from the supplier to

the customer. Offshoring refers to the process of sourcing and coordinating tasks and business functions beyond national borders. Offshoring may include both in-house (captive, or International in-sourcing) and, global outsourcing activities (Lewin et al., 2009). However, increasingly, the term *offshoring* is used for global outsourcing activities, that is, manufacturing outside the boundaries of the firm. Today's competitive markets and low cost opportunities offered by international sourcing push majority of the companies towards global sourcing which brings focus on identification of opportunities to improve quality, lower prices, delivery performance or gain efficiencies on a worldwide or regional basis (Frahm, 2003; Wisner et al., 2005; Cagliano et al., 2008). Global sourcing requires additional skills and knowledge to deal with international suppliers, logistics, communication, political environment, and other issues (Kotabe and Helsen, 2004; Wisner et al., 2005). Despite the big phenomenon of globalization, some successful companies that do not consider global outsourcing can still be found, such as the sport clothing manufacturer Trigema whose production is still in Germany (Senft, 2014). However, many companies have maintained their competitive position owing to their global outsourcing strategies and many of them take the advantages of lower costs achieved through outsourcing some of their manufacturing processes and services to developing countries, such as China, India, Pakistan, and Bangladesh.

Successful global sourcing, however, does not simply imply the goal of sourcing products cheaply abroad, but it can be considered to be a kind of strategic weapon to keep the company viable in the long term. Therefore, managing global sourcing to achieve competitive advantage depends on three key factors: price, quality and delivery time.

Considering price and delivery time, it can be said that low labor costs in developing countries, coupled with transportation services provided by reliable logistics partners, lower transportation costs, and global information and communication systems that make all regions of world easily accessible have offered companies cost and time opportunities (Nash-Hoff, 2011; Senft, 2014). Moreover, better access to raw materials, higher quality products, higher productivity and capacity as well as higher technology in global sourcing partners can provide the buyer companies with the flexibility for growing market demands (Nassimbeni, 2006; Golini and Kalchschmidt, 2011). Also, taxation or currency advantages owing to international agreements are among important factors in global sourcing. Many global companies successfully take the advantage of these opportunities and optimize their cost structure and product base. Nike is an example company who has a successful global sourcing strategy where it subcontracts most of its manufacturing to independent producers in Thailand, Indonesia, Cambodia, and Vietnam (Antras and Helpman, 2004).

2.1.3 Reshore and Relocation vs. Non-Reshore and Non-Relocation

Driven by the aspect of fierce competition and the potential opportunities, companies sometimes set forth on their global sourcing journey without considering all key variables. They make the decision to outsource internationally too quickly, or on the basis of labor cost only, and therefore, they can overlook other costs and the risks that might occur during their global sourcing efforts. Poor quality, wrong quantities, inflexibility, fluctuation of exchange rates, scarcity of raw materials, poor capacity, longer lead times and time-to-market, communication issues, hidden supply chain management costs, higher energy prices and

intellectual property risks are among possible problems that a company might encounter during its global sourcing efforts (Holweg, 2011; Fishman, 2012; Culp, 2012; Williamson, 2012; Clarke, 2012; Riley and Vance, 2012, Lampon and Lago-Penas, 2013; Senft, 2014). Due to these potential problems, it is not unusual that, after some time, companies begin to consider and even look for ways to domestically source or manufacture a portion or all of their products and needs. This phenomenon is commonly referred to as *reshoring* and defined as *moving manufacturing back to the country of its parent company* in the academic literature (Holz,2009; Kinkel and Maloca, 2009; Leibll et al., 2011; Bishop et al., 2011, Kinkel, 2012; Ellram, 2013). Reshoring and reasons of reshoring will be further explained in Section 2. However, even when companies decide to reshore their sourcing, the assets, products or manufacturing infrastructure might already have been used for other purposes or might not even exist in the country anymore.

All of the above mentioned strategies regarding global or domestic sourcing, of course, involve tradeoffs. While trying to prevent some undesirable situations such as bad qualities or high costs of the current suppliers, companies inevitably suffer from the switching costs directly caused by reshoring and relocation itself. In order to prevent incurring costs of shifting between different supplier selection strategies, companies should focus on better supplier selection either domestically or internationally in advance for their sourcing activities. As far as supplier selection is concerned, when all of the complicated notions and features such as quality, innovation and technological performance, as well as, development cycles and costs are combined together, the potential or current suppliers cannot be fully classified as positive or negative for these two geographically different sourcing

strategies. Other details and specific criteria for supplier selection are further discussed in Section 3.

2.1.4 Geographical Location Selection

Global outsourcing strategies can be further classified in itself with respect to the characteristics of different regions and countries. There are obvious differences in performance and procurement practices in different regions of the world (Ruamsook et al., 2007). Countries differ and so their attractiveness in terms of being potential locations for global sourcing does also differ for different types of needs. The buyer company should then identify the pros and cons of sourcing from suppliers that are located in low-cost countries vs. developed countries. As a general perception, companies that source from developed countries often take advantage of higher productivity, better quality, and a superior technical performance due to better know-how, while these advantages mostly do not stand out in developing countries for the sake of low costs (Morschett, 2010; Senft, 2014). However, it is necessary to specify here that even low-cost countries might have regions and suppliers that have excellent know-how and specialization skills. China is a good example for this case. In the textile and apparel industry, China is significantly skillful in manufacturing sophisticated products. Other advantages in sourcing from China cited in the literature are the country's long experience in manufacturing in textiles and apparel, its accuracy and its ability to pick up skills, and improve quality in a fast pace. Still, long lead time and the lack of English language proficiency among Chinese workers are pointed out as disadvantages of sourcing from China (Fang, 2010).

With regard to the advantages of sourcing from developed countries, in addition to the access to better quality, and superior technical performance, certain risks can also be reduced due to higher intellectual property protection, better political stability, lower rates of criminality, better built infrastructure and better performance continuity (Morschett, 2010; Senft, 2014).

On the other hand, *low cost country sourcing* refers to the process of procuring products, parts and services from suppliers in countries with lower labor and materials costs (Carter, 2008). "Low cost countries and geographies" have become opportunity destinations for buyer companies based in developed countries. Low cost countries attract companies, such as apparel manufacturers, with lower labor rates, low costs for material, availability of certain skills, subsidies, tax benefits and fewer regulations (Fang, 2010; Senft, 2014). However, because the conditions in these countries are often not well-predictable, sourcing from these countries involves higher risks, such as government corruption, political stability, and security of intellectual property (Carter, 2008). In order to describe the risks due to sourcing from various countries, many types of country indexes have been introduced. Global Competitiveness Index (World Economic Forum), Index of Economic Freedom (The Heritage Foundation), Country credit rankings (Standard & Poor's / Moody's / Fitch), Corruption Perceptions Index (Transparency International) are some example of indexes which can be used in selecting a specific country for outsourcing (Senft, 2014).

As far as the selection of geographical scope of a sourcing strategy is concerned, the size of the buyer company may influence the selection between domestic and global sourcing

or low-cost and developed countries. The use of worldwide available resources is easier for large multinational companies compared to smaller companies. A large company can more easily afford the expenses for global sourcing (Senft, 2014). Thus, the supplier selection behaviors of large companies can significantly differ from those of small-sized companies.

In addition to make or buy, domestic or international sourcing, low cost or developed country, and reshoring and relocation decisions, companies should also choose between part vs. modular sourcing, single or multiple sourcing, changing supplier or regular supplier, supplier switching, supplier base reduction, centralization or decentralization, and sourcing implementation (e.g. company only, joint venture, alliance or service provider) (Seshadri, 2005; Wisner, et al., 2005; Kausik, 2012; Senft, 2014).

Companies with different backgrounds and from different countries or regions have different operation strategies. As an example, US companies have different sourcing and location preferences compared to European and Japanese companies (Kakabadse and Kakabadse, 2002; Junyan, 2010). As a result, all these sourcing decisions depend on the company, its characteristics and its strategy. Therefore, the competitive strategy (cost leadership vs. quality leadership), the production and inventory strategy (e.g. just in time), outsourcing orientation (e.g. international or domestic), and the configuration of the other value-added activities (such as research and development etc.) will all have an impact on the determination of appropriate sourcing strategies (Morschet, 2010).

2.2 Re-Shoring

In recent decades, off-shoring – also referred as *international* or *global sourcing* - has been one of the common strategies applied by firms to create and maintain a sustainable competitive advantage (Ferdows, 1997). For years, companies have regarded off-shoring as a means of saving money. Labor costs in developing countries have offered companies the opportunity to find a cheaper workforce. Lower labor costs, few or no environmental regulations, less government regulation on building construction and operations, lower taxes and global "free trade" mentality are among the main reasons why US companies have off-shored their manufacturing (Nash-Hoff, 2011). These types of cost-saving measures have been proved beneficial to manufacturing and business services. This section explains how these measures have changed in time, which ultimately created hesitation about the advantages of offshoring activities.

Several decades ago, US companies, particularly those on the West Coast, started shifting high-volume manufacturing to Hong Kong, Singapore, and the Philippines for the same reasons - lower wages, fewer government regulations, and far less stringent environmental regulations. Meanwhile, other manufacturers moved assembly and manufacturing operations to Mexico to meet the demand in the US and world markets. Many companies found the lowest cost manufacturing operations in either China or India. Initially, US manufacturers outsourced specific parts and components of products with offshore suppliers. Afterwards, they outsourced whole product lines to offshore suppliers, and, ultimately, they built their own manufacturing facilities in China when the Chinese

government changed the policies to allow private ownership of companies and foreign investment (Nash-Hoff, 2011).

Previously, countries like China and India provided companies with low-cost labor, materials, and even real estate. Sending manufacturing activities from the US to these locations appeared to be a straightforward decision. Currently, many of these manufacturers are realizing that offshore manufacturing or business services may not be as cost-effective as initially considered owing to all hidden costs.

The current trending topic in global supply chains is whether and where manufacturing is moving, expanding, or contracting across the world. The global economic risk, political environments in foreign countries, security issues, and the social media are playing a more prominent role in these decisions. Many companies are rethinking their sourcing strategies from some different perspectives. The benefits of off-shoring and out-sourcing strategies are being critically questioned. Consequently, the off-shoring trend – which began in the late 1970s – may see a reversal (Larsen et al, 2013). Many companies are considering bringing manufacturing back home from their current international locations.

These events which are defined as moving manufacturing back to the country of its parent company are generally described by terms such as “re-shoring”, “back-shoring”, “on-shoring” and “in-shoring”(Gray et al., 2013, Ellram, 2013).These terms have become increasingly common in the economic press (The Economist, 2013) and in white papers by consulting firms (see, among others, Graebel, 2012). More recently, the topic has also

attracted academic attention (Holz, 2009; Kinkel & Maloca, 2009; Leibl *et al.,* 2011; Bishop *et al*., 2011, Kinkel, 2012; Ellram, 2013).

The first academic definition of such events is put forward by Holz (2009) who defines reshoring as "the geographic relocation of a functional, value creating operation from a location abroad back to the domestic country of the company." Holz (2009) also defined the term *relocation* as "a matter of making a geographical decision for a company". Kinkel and Maloca (2009) describe back-shoring as the "re-concentration of parts of production from own foreign locations as well as from foreign suppliers to the domestic production site of the company." "In-shoring" is another term used in academic literature, yet it has not been standardized. Skipper (2006) uses it to refer to the opposite of off-shoring activities where Holz (2009) states that in Anglo-American language the term *in-shoring* "basically describes an inward investment of foreign companies to the domestic country". To provide other definitions of reshoring, Kinkel (2012) explains reshoring as the re-concentration of the company's "production capacities, trying to exploit the benefits of higher capacity utilization and a superior relation of variable costs to fix at their existing locations". More recently, Ellram (2013) defines *reshoring* as "moving manufacturing back to the country of its parent company", while Gray et al. (2013) describe re-shoring as bringing manufacturing back home to the parent company's country. According to Gray et al. (2013) the term "re-shoring" mainly deals with the location of manufacturing activities being performed, and is independent of who is performing the manufacturing activities.

2.2.1 Re-shoring - A Location Decision

As stated previously, *re-shoring* is defined as moving manufacturing back to the home country of its parent company and reshoring decisions are basically location decisions (Ellram, 2013; Gray et al., 2013). In previous research four different classifications for re-shoring efforts are proposed which are based on the ownership of manufacturing activities before and after the re-shoring (Gray et al., 2013). These classifications are: *in house reshoring* which takes place when a company relocates its manufacturing activities that have previously been performed in wholly owned offshore facilities back to wholly owned US-based facilities; *re-shoring for outsourcing* which happens when a company relocates its manufacturing activities from wholly owned offshore facilities back to US-based suppliers; *re-shoring for in-sourcing* which involves relocating manufacturing activities from offshore suppliers back to wholly owned US-based facilities; and finally, *outsourced re-shoring* which takes place when a company relocates its manufacturing activities from offshore suppliers back to US-based suppliers (Gray et al., 2013). As an example, GE engaged in *in-house-re-shoring*, when it re-shored its appliance manufacturing from company-owned manufacturing plants in China back to its own plants in the US to meet US demand, whereas US-based Vaniman Manufacturing engaged in *outsourced re-shoring*, when the company decided to no longer purchase sheet metal fabrication from an offshore supplier and shifted its sourcing to a local supplier to meet demand in the US (Gray et al., 2013).

2.2.2 Current Re-Shoring Activities

In 2011, for the first time in over a decade, American manufacturers added and created jobs in the US (Hagerty, 2011). On December 2012, Apple announced that one of its existing Mac lines would be manufactured exclusively in the United States starting in 2013 (Polidoro, 2012). Apple is one of many US manufacturing companies that have decided to bring manufacturing back home. Companies have begun bringing back jobs from offshore countries or have decided not to send them overseas at all. General Electric (GE) also announced a $1 billion investment to bring back the manufacturing of appliances from China to the US (Crooks, 2012). In addition to large companies like GE and Apple, various other companies that take part in re-shoring activities include NCR, Coleman, Ford, Sleek Audio, Peerless and Outdoor Greatroom Company (Sirkin et al., 2011). Recently, Walmart (2013) also announced its plans to increase sourcing from domestic / US suppliers by $50 billion by 2023.

Recent surveys conducted on re-shoring revealed that about 38% of companies think that a direct competitor has re-shored (Tate et al., 2012) and 14% definitely plan to re-shore (Hagerty, 2012). The MIT Re-shoring Survey (2012) which was distributed to members of the MIT Forum for Supply Chain Innovation and members of the Supply Chain Digest community, revealed that 33.6% of the respondents are "considering" bringing manufacturing back to the US while 15.3% of US companies stated that they are "definitively" planning to re-shore their manufacturing activities (Hagerty, 2012).

2.2.3 Drivers Behind Re-shoring

A number of factors have been suggested as factors in re-shoring and relocation decisions and they include the following ones:

The rising cost of labor in low-cost countries is causing many companies to rethink their current sourcing location (Anon, 2012; Fishman, 2012). As Lampon and Lago-Penas (2013) state in their research on the automotive industry, the search for lower labor costs is found to be one of the main factors determining relocation. For instance, in dollars, wages in China are five times more what they were in 2000 - and they are expected to keep rising 18 percent a year. However, hourly wages alone do not tell the complete story when deciding where to locate a manufacturing plant or supply chain. For instance, in the case of China, higher labor costs alone are not enough to prompt companies to leave. The country has the world's best supply chains of components for different industries and its infrastructure works well. Companies have also already invested heavily in being there. Moreover, as Groom and Powley (2014) explain in their paper, although wages have been rising in low cost countries, still a large gap remains. Manufacturing costs per hour in Western Europe or in the US are about 15 times higher compared to China.

Similar to the labor costs, *quality concerns* are now becoming more important in sourcing decisions. A survey conducted by The EEF (Engineering Employers Federation UK) revealed that re-shoring decisions of the companies in UK are driven by quality, not the costs. According to the survey results, 35 % of the companies surveyed in the UK stated that the main reason for their reshoring efforts was to improve the quality of the products and

components. Quality improvement was followed by certainty and speed of delivery and the reduction of transportation costs. The risk of supply chain disruption was cited by 23%. According to the survey, only 16% of the participants cited that the increase in labor costs in off-shore manufacturing countries was a significant factor. China was the main area from which companies were re-shoring, followed by Eastern Europe. The main barriers cited to doing more manufacturing in the UK were high energy costs and skills shortages.

Along with quality concerns, *quality control* also plays a role in why companies may choose to re-shore / relocate. Overseeing quality control is harder when the plant is half a world away, and language and cultural barriers exist between the expatriates and the workforce. This difficulty is getting more severe when a *revolving door syndrome* exists, when expatriates cannot complete their tours of duty, or when short-term assignments provide too little time to encourage effective management relationships (Fishman, 2012).

The search for *production concentration and specialization* in order to obtain economies of scale and improved productivity are found to be one of the main factors determining reshoring and relocation in the sector. These processes (i.e. reshoring and relocation) are facilitated by the operational flexibility of the multinational firms that dominate the sector which allows them to transfer resources internationally. US labor productivity has continued its long march upward, meaning that labor costs have become a smaller and smaller proportion of the total cost of finished goods. You simply can't save much money chasing wages anymore (Fishman, 2012). Lean supply chains, technological requirements for production processes and the need for integration of production plants in the

institutional environment are also factors of reshoring and relocation (Lampon and Lago-Penas, 2013). Owing to *the rising fuel and transportation costs* companies are now rethinking their global supply chain (Behar & Venables, 2010; Fishman, 2012). Oil prices are three times what they were in 2000. The rising cost of oil has impacted shipping costs for cargo traveling via air or sea. This increase in fuel costs has caused steamship companies and airlines to reduce or eliminate less profitable routes which can cause costly delays (Fishman, 2012).

In addition to these, *longer lead times and time to market* are causing many companies to rethink their current sourcing location**s.** Overseas manufacturing facilities have longer lead times, and it can be a barrier for companies to being innovative and flexible to bring products to market in a timely fashion. When lead times are long, companies may struggle with getting their products into the hands of consumers quickly. This problem is especially troublesome today, as economic uncertainty across the globe has forced many companies to lower inventories to decrease their risk (Fishman, 2012). Moreover, companies that operate overseas facilities or have product manufactured elsewhere have to account for duties and customs charges and time delays as these items clear ports of entry (Graebel, 2012).

Distance, time zone differences, and communication issues create obstacles for supplier ability to fast response, quickly modify products or customize an order based on customer requests (Graebel, 2012). The need for shorter response time and leaner supply chain associated with locating manufacturing closer to the end customer or consumer are

frequently cited as re-shoring factors (Williamson, 2012). Perception of quicker recovery in the case of supply chain disruption is higher for the suppliers that are located at least in the same region (Fishman, 2012; Williamson, 2012).

Direct costs, such as labor costs, transportation costs, of supply chain are being outweighed by the *hidden supply chain management costs*. As mentioned previously, the labor cost-based assessment of off-shore manufacturing can be short-sighted. Unanticipated "hidden" costs can defeat and exceed the expected savings from inexpensive foreign labor over time in various ways. These *hidden costs* are the costs that are not related to the actual supply chain operation, but impact on the wider business environment, such as currency fluctuations, changing energy cost, and changes in the political climate or regulatory framework. Harry Moser (2013) stated "about 60 percent of the companies that off-shored manufacturing didn't really do the math. They looked only at the labor rate - they didn't look at the hidden costs. "Usually, these costs are difficult to predict, and will incur on an irregular basis, such as costs resulting from additional travelling expenses required to coordinate the relationship with the suppliers (Holweg, 2011). Another important factor of hidden cost is the potential increase in labor costs (i.e. changes in the economic environment of the supplying country). Labor costs can change quickly and substantially. Labor cost savings also may be partly offset by the risks of labor unrest and increasingly restrictive labor laws. As a result, Moser (2013) stated that about a quarter of what's made outside the US could be more profitably made at home.

In addition to hidden costs, *overall risks within global supply chains* are also causing many companies to reconsider their current sourcing locations. These risks include business continuity and creditworthiness of suppliers, currency risk (real and anticipated volatility in currency), product and service instability of the suppliers, supply chain integrity, political risks and a number of other operational risks (Culp, 2012). One commonly mentioned risk among companies for relocation is increasing theft of intellectual property when dealing in global regions (Clarke, 2012; Riley & Vance, 2012). Additionally, foreign manufacturing operations can open companies to the risk of counterfeiting and intellectual property concerns. There is a potential cost associated with losing intellectual property rights and providing technological support to suppliers located in different countries because these foreign suppliers may use this knowledge to supply competitors and/or move up the value chain to compete with their past customers (Holweg, 2011).

Moreover, natural events such as earthquakes and floods - for example the recent Japanese earthquake and tsunami, the floods in Thailand and the ash clouds caused by the Icelandic volcano - have demonstrated how far the consequences of such risks can extend. The Japanese earthquake, for instance, severely affected global electronics manufacturing and caused extended business disruptions for the automotive industry. The Thai flooding created significant shortages in the hard disk drive market that generated millions of dollars of losses for well-known electronics manufacturers (Culp, 2012).

Furthermore, similar to overall cost considerations, *energy prices* are now becoming more important in sourcing decisions. Energy prices are higher in low cost countries. This

causes off-shoring companies to reconsider their overall cost equation. For instance, the natural-gas boom in the US has dramatically lowered the cost for running a plant in the US. Natural gas currently costs four times as much in Asia as it does in the US.

Ultimately, one of the main factors in relocation decisions is *high employee turnover and absenteeism rate* in low cost countries. Employee turnover in some countries can be particularly high, which in turn directly leads to additional costs of recruiting new workers and indirectly to wage increases to maintain current staff (Dep. of Com., 2014). One frequently cited factor driving wage increase in low cost countries is the difficulty to retain employees, especially skilled workers. This difficulty forces these companies to increase wages to retain workers and reduce turnover. A study by Pena (2000) found that turnover affected the efficiency of manufacturing operations. According to the study, even when the costs of replacing workers are low, high turnover rates can result in considerable direct expenses for companies, as well as indirect costs in terms of reduced product quality, reduced productivity, and increased overtime costs. Pena's study (2000) indicates that turnover rate in Mexico is at its lowest rate in automobile (2 years) and electronics (9 months), while it is much higher in textile (3 months) and chemical (2 months) companies. Employee turnover rates are also high in other low cost countries such as China. 2011 turnover rates in Hong Kong and Singapore are close to 10%, while it is ranging from 11% to 40% in China. In 2013, the average salary in China is increased by 8.5% and companies have witnessed a turnaround rate of 14.3 (Serfaty, 2014). As a result, as the national average salary grows, the turnover rates slow down.

2.3 The Role of Supplier Selection and Supplier Quality

As it is mentioned previously, when a company makes a decision to outsource its raw materials or final products either domestically or internationally, it searches for the best suppliers and partners based on a set of criteria. The goal of supplier selection is to determine suppliers that can deliver products and services at the right price along with acceptable levels of quality (Lockstrom, 2007). Suppliers constitute a critical role in the business success of a company by providing both intermediate materials which are inputs to the company's product offerings, and directly final products (Modi and Mabert, 2007). The superior performance of sourcing efforts is achieved via successful supplier selection and regular performance evaluation of existing suppliers.

Supplier selection is a multi-criteria problem that involves both qualitative and quantitative factors. During this pre-procurement process the goal is to understand a supplier's suitability towards the organization's sourcing needs and strategy (Kausik, 2012). Supplier evaluation and selection is one of the most important phases in the purchasing process that involves evaluation of many inter-correlated factors during the decision-making process (Braglia and Petroni 2000; Zang et al., 2012; Senft, 2014,). Supplier selection studies can be grouped into two major categories: *supplier selection criteria* (Sharland, 2003; De Boer et al., 2001) and *supplier selection decision models* (Sarkis and Talluri, 2002; Muralidharan, 2002; de Boer and van der Wegen, 2003; Talluri and Narasimhan, 2005). In supplier selection decision models, some mathematical models (e.g. Analytical Hierarchy Process, Linear Programming, and Dynamic Programming) use a set of criteria to optimize the actual selection of the suppliers, while supplier selection criteria only utilize the criteria

to rank the suppliers for selection. For the purpose of this research we mainly focus on the supplier selection criteria to determine the quality elements for suppliers.

In the literature, some researchers divided supplier selection and evaluation into two groups, namely; *Organizational Factors* and *Strategic Performance Factors* or *Competition Factors* (Sarkis and Talluri, 2002; Bai and Sarkis, 2010; Chen, 2011), whereas others simply mention main categories namely: *quality*, *delivery*, *technology*, *management*, *relationship*, and *cost* (Talluri and Narasimhan, 2005; Wisner et al., 2005; Huang and Keshar, 2007; Kuo et al., 2010; Avila et al., 2012; Amindoust et al., 2012; Ghadimi and Heavey, 2014).

Organizational factors mainly comprise organization and management of the supplier, relationship ability, and technology and process capability, whereas, *strategic performance metrics* include cost, quality, time, delivery, flexibility and innovativeness (Chan, 2003; Bai and Sarkis, 2010). Experience, technical capability, capacity, quality system certification, geographical location, financial stability, communication capability, service, order system and cycle time, raw material procurement, reliability, and attitude are additional criteria cited in the literature (Wisner, et al., 2005; Rajesh and Malliga, 2013). More recent studies also include *environment* and *corporate social responsibility* factors within these groups (Huang and Keshar, 2007; Kuo et al., 2010; Bai and Sarkis, 2010; Amindoust et al., 2012; Ghadimi and Heavey, 2014). These social dimensions comprise pollution prevention, environmental management system, health and safety of the employees, safety audit and assessment, as well as, employee practices such as training and security practices.

As far as the *strategic performance metrics* are concerned, various *quality* and *delivery* related attributes have been found in the papers. The *quality* related attributes include: product quality, continuous improvement programs such as ISO, Lean, Six Sigma or Total Quality Management, documentation and internal audit, control capability (incoming material, document, process and inventory control), rejections, and warranty and claim policies (see Table 2-1 for details). Additionally, *delivery* related attributes include; on-time delivery, distance, delivery delays, delivery reliability, sample delivery time, delivery compliance, and delivery performance (see Table 2-1 for details).

On the other hand, when *organizational factors* is of concern, the attributes included in the literature are: management stability and financial ability, reputation and position in the industry, organization and management, communication openness, willingness, and collaborative potential, trust, data sharing and information technology capability, innovativeness, research and development, design and improvement capability, technological and process capability, capacity, ethical standards, accident records and safety training (see Table 2-1 for details).

Considering the academic work conducted on supplier selection, Dickson's (1966) work has been used as a reference for many researches. The participants ranked, according to their importance, 23 different criteria mainly affect the supplier selection decision-making process. According to his study, the most significant criteria were the *quality of the product*, *on time delivery*, *performance history* of the supplier and the warranty policy used by the supplier.

According to Ho et al. (2010)'s study which looked at 75 papers written between 2000 and 2008 regarding supplier selection, product quality was the most cited selection criterion at 87% followed by delivery and price/cost at 82% and 80% respectively. Based on their findings, it was revealed that price/cost is not the most widely adopted criterion. Therefore, it can be concluded that the traditional single criterion approach based on lowest cost is no longer supportive and robust enough in contemporary supply management (Ho et al., 2010).

After reviewing the literature, for the purpose of this study, two new concepts have been created for determining supplier quality and performance: *Received Quality* and *Indirect Quality*. *Received quality* refers to *Supply Chain Quality*, *Product Quality* and *Product Quality based Factors*. These are the *direct quality* factors that are directly passed from suppliers to the buyer company. In other words, these are the quality of products and services directly received by the US companies. On the other hand, *Indirect Quality* concept is created to refer to suppliers' *Management*, *Workforce* and *Process Quality*. These are the quality factors that are internal to the supplier and the US companies may not even be concerned or aware of their presence. However, at the end, these indirect qualities inevitably will be reflected on the received quality. Six *received* and *indirect quality* factors including sub quality factors have been created and shown Table 2-1.

Table 2-1: Supplier Quality Determinants
(Uluskan, 2014)

	Supplier Quality Factor	Main Criteria (Sub Quality Factors)
RECEIVED QUALITY	Supply Chain Quality of Supplier	Fill Rate
		Delivery Time
		On Time Delivery Rate
		% Of Perfect Orders and Delivery Performance
		Accurate and Precise Information Sharing
		Fast Response To Requests
	Product Quality of Supplier	Product Quality
		Product Appearance
		Meet Specifications
	Product Quality Based Factors	Distributor/Retailer Rejection Rates
		End Customer Returns
		Returns and Warranties (also after sales services)
		Inspection and Training Costs
INDIRECT QUALITY	Management Quality of Supplier	Overall Management of Supplier
		Communication and Cooperation Ability
		Documentation and Self Inspection (Audit)
		Quality Management Systems and Practices
	Workforce Quality of Supplier	Training (Human Resources Management, Personnel)
		Skills and Experience
		Productivity
	Process (Manufacturing) Quality of Supplier	Design and Development Capability
		Ability to Modify Products
		Process Technology and Level of Automation
		Work Safety

Table 2-2 shows the research related to supply chain quality of supplier. As it can be seen from the table, lead time, on time delivery of goods, delivery reliability, perfect order rate, responsiveness and flexibility are among the critical supply chain quality features.

Table 2-2: Supply Chain Quality Criteria

Supplier Quality Factor	Main Criteria	Sub Criteria	References
Supply Chain Quality of Supplier	Fill Rate	Fill Rate	Kuo et al.,2010; Chen and Huang,2007; Huang and Keshar,2007; Ho et al.,2010; Parthiban et al.,2012
	Delivery Time	Lead Time (delivery)	Kuo et al., 2010; Punniyamoorthy et al.,2011; Chen and Huang,2007; Ho et al.,2010; Huang and Keshar,2007; Gunasekaran et al.,2004; Chen,2011; Parthiban,2012; Talluri and Narasimhan, 2005 (Delivery), Senft, 2014
		Cycle Time (total build, package, installation, sourced/in-process cycle time)	Wisner et al, 2005; Huang and Keshar,2007
		Geographical Location	Punniyamoorthy et al.,2011; Ho et al.,2010
	On Time Delivery Rate	On Time Delivery of Goods	Parthiban et al.,2012; Gunasekaran et al.,2004; Chen, 2011; Huang and Keshar,2007; Kim and Boo,2010; Amin et al.,2011; Ho et al.,2010
		Delivery Reliability	Bai and Sarkis, 2010; Parthiban et al., 2012; Gunasekaran et al., 2004; Punniyamoorthy et al., 2012; Ho et al., 2010, Wisner et al., 2005
	% Of Perfect Orders and Delivery Performance	Delivery Performance	Ho et al.,2010; Kuo et al.,2010
		% Of Perfect Orders	Punnitamoorty,2011; Ho et al.,2010; Geng and Hu, 2012; Huang and Keshar, 2007; Ghadimi and Heavey, 2014
	Accurate and Precise Information Sharing	Information Sharing	Gunasekaran et al., 2004; Bai and Sarkis, 2010; Kuo et al., 2010
		Information Technology Infrastructure	Chen and Huang, 2007; Shore and Venkatachalam, 2003
		Delivery Documents' Effectiveness (invoice, shipping docs etc.)	Gunasekaran et al., 2004; Huang and Keshar, 2007; Ho et al.,2010
		Order Entry (order system)	Bai and Sarkis, 2010; Gunasekaran et al., 2004; Wisner et al., 2005
	Fast Response To Requests	Responsiveness	Keskin et al., 2010; Bai and Sarkis, 2010; Kuo et al., 2012; Chen and Huang, 2007; Chen, 2011; Kim and Boo, 2010; Punniyamoorthy et al., 2011
		Flexibility (to changes, volume, time etc.)	Huang and Keshar, 2007; Chen and Huang, 2007; Chen, 2011; Gunasekaran et al., 2004; Bai and Sarkis, 2010, Senft, 2014

Table 2-3 shows the research related to product quality of supplier. As it can be seen, actual product quality, rejection rates, after sales services and warranty policies are critical features.

Table 2-3: Product Quality Criteria

	Main Criteria	Sub Criteria	References
Product Quality of Supplier	Product Quality (also mentioned as defect free), Conformance		Wisner et al, 2005; Parthiban et al., 2012; Bai and Sarkis, 2010; Gunasekaran et al., 2004; Punniyamoorthy et al., 2011; Amin et al., 2011; Chen and Huang, 2007; Ho et al., 2010; Geng and Hu, 2012; Huang and Keshar, 2007; Kim and Boo, 2010; Talluri and Narasimhan, 2005, Senft, 2014
	Rejections, Returns and Warranties (also after sales services)	Rejection Rate (also returns)	Kuo et al, 2010; Punniyamoorthy et al., 2011; Ho et al., 2010; Chen, 2011; Huang and Keshar, 2007
		Warranties and Claim Policies (after sales services)	Bai and Sarkis, 2010; Avila et al., 2012; Kuo et al., 2010; Punniyamoorthy et al., 2011; Ho et al., 2010; Chen, 2011, Huang and Keshar, 2007; Ghadimi and Heavey, 2014; Kim and Boo, 2010
	Inspection and Training Costs		Avila et al., 2012; others general costs

Table 2-4 shows the research related to management quality of supplier. Organization and management, management attitude for future such as strategic aspects and fit, communication openness, willingness and collaborative potential, trust, control capability (for incoming material, document, and process) and process improvement programs or methods are critical features within the management quality.

Table 2-4: Management Quality Criteria

	Main Criteria	Sub Criteria	References
Management Quality of Supplier	Overall Management of Supplier	Financial Ability and Management Stability	Gunasekaran et al., 2004; Shore and Venkatachalam, 2003; Huang and Keshar, 2007
		Reputation and Position in the Industry	Bai and Sarkis, 2010; Punniyamoorthy et al., 2011; Chen and Huang, 2007; Kim and Boo, 2010
		Management Attitude for Future - Strategic Aspects, Strategic Fit and Compatibility	Bai and Sarkis, 2010; Gunasekaran et al., 2004; Avila et al., 2012; Huang and Keshar, 2007
		Management Commitment to Quality	Kuo et al., 2010; Ho et al., 2010
		Organization and Management	Keskin et al., 2010; Chen and Huang, 2007; Punniyamoorthy et al., 2011; Chen, 2011; Talluri and Narasimhan, 2005, Senft, 2014
	Communication and Cooperation Ability	Long Term Relationship (amount of past business done)	Bai and Sarkis, 2010; Punniyamoorthy et al., 2011; Kim and Boo, 2010
		Communication Openness, Willingness, and Collaborative Potential	Bai and Sarkis, 2010; Gunasekaran et al., 2004; Avila et al., 2012; Kuo et al., 2010; Shore and Venkatachalam, 2003; Kim and Boo, 2010; Chen, 2011, Chen and Huang, 2007; Wisner et al., 2005
		Trust (e.g. mutual trust and impression of supplier in personal contacts)	Bai and Sarkis, 2010; Punniyamoorthy et al., 2011; Kim and Boo, 2010; Amin et al., 2011; Johnston, 2003
		Cultural Similarities	Avila et al., 2012; Huang and Keshar, 2007
		Location, Language (understanding ability)	Wisner et al., 2005; Geng and Hu, 2012; Avila et al., 2012; Amin et al., 2011
		Data Sharing Potential and IT Capability	Punniyamoorthy et al., 2011; Shore and Venkatachalam, 2003; Huang and Keshar, 2007; Chen and Huang, 2007
	Documentation and Self Inspection (Audit)	Control Capability (Incoming material, document, process, and inventory control) and Internal Audit	Ho et al., 2010; Huang and Keshar, 2007; Ghadimi and Heavey, 2014; Talluri and Narasimhan, 2005
		Documentation (booking in procedures)	Gunasekaran et al., 2004; Ho, 2010; Talluri and Narasimhan, 2005
	Quality Management Systems and Practices	Process Improvement / Quality Assurance Methodology (Six Sigma, TQM etc.)	Gunasekaran et al., 2004; Ho et al., 2010; Avila et al., 2012; Kuo et al., 2010; Punniyamoorthy et al., 2011; Shore and Venkatachalam, 2003; Huang and Keshar, 2007; Talluri and Narasimhan, 2005
		Quality System Certification (ISO, quality awards)	Punniyamoorthy et al., 2011; Ho et al., 2010; Huang and Keshar, 2007

Table 2-5 shows the research related to workforce quality of supplier. As it can be seen training, skills and experience of the employees as well as their productivity are important features within this category.

Table 2-5: Workforce Quality Criteria

	Main Criteria	Sub Criteria	References
Workforce Quality of Supplier	Training (Human Resources Management, Personnel)		Parthiban et al., 2012; Bai and Sarkis, 2010; Gunasekaran et al., 2004; Avila et al., 2012; Punniyamoorthy et al., 2011; Ho et al., 2010; Ghadimi and Heavey, 2014
	Skills and Experience		Punniyamoorthy et al., 2011; Geng and Hu, 2012
	Productivity		Parthiban et al., 2012; Gunasekaran et al., 2004; Avila et al., 2012; Huang and Keshar, 2007

Ultimately, Table 2-6 shows the research related to process (manufacturing) quality of supplier. As it can be observed that the critical features in process quality are; research and development, development speed, design and improvement capability, technological and process capability, compatibility (machine capability etc.), capacity and capacity utilization, ethical standards and safety.

Table 2-6: Process Quality Criteria

	Main Criteria	Sub Criteria	References
Process Quality of Supplier	Design and Development Capability and Ability to Modify Products	Innovativeness	Avila et al., 2012; Punniyamoorthy et al., 2011
		Research and Development and Speed in Development	Bai and Sarkis, 2010; Punniyamoorthy et al., 2011; Huang and Keshar, 2007; Geng and Hu, 2012; Talluri and Narasimhan, 2005, Senft, 2014
		Design and Improvement Capability	Bai and Sarkis, 2010; Punniyamoorthy et al., 2011; Huang and Keshar, 2007; Geng and Hu, 2012; Gunasekaran et al., 2004; Kuo et al., 2010; Kim and Boo, 2010; Talluri and Narasimhan, 2005
		Product Offering (range of products etc.)	Avila et al., 2012; Punniyamoorthy et al., 2011
	Process Technology and Level of Automation	Current Technological and Process Capability and Compatibility (machine capability etc.)	Parthiban et al., 2012; Keskin et al., 2010; Bai and Sarkis, 2010; Punniyamoorthy et al., 2011; Chen, 2011; Shore and Venkatachalam, 2003; Huang and Keshar, 2007; Wisner et al., 2005; Ghadimi and Heavey, 2014; Kim and Boo, 2010; Talluri and Narasimhan, 2005, Senft, 2014
		Future Manufacturing Facilities / Process Capabilities	Bai and Sarkis, 2010; Gunasekaran et al., 2004; Punniyamoorthy et al., 2011
		Capacity and Capacity Utilization	Gunasekaran et al., 2004; Wisner et al., 2005; Punniyamoorthy et al., 2011; Keskin et al., 2010; Huang and Keshar, 2007
		Production Scheduling Systems and Planning Process Cycle Time	Shore and Venkatachalam, 2003; Huang and Keshar, 2007
	Work Safety	Ethical Standards	Punniyamoorthy et al., 2011; Kuo et al., 2010; Huang and Keshar, 2007; Ghadimi and Heavey, 2014
		Incident/Accident Records	Punniyamoorthy et al., 2011; Huang and Keshar, 2007
		Safety Training	Huang and Keshar, 2007; Ghadimi and Heavey, 2014
		Safety Audits	Huang and Keshar, 2007; Ghadimi and Heavey, 2014

2.4 The Role of Quality Programs Implementation In Suppliers

Based on the fact that globalization leads to fierce competition and raises the bar by increasing expectations from each individual company, just like the buyer companies, suppliers also need to maintain or improve their status in the global marketplace to be able to remain in business. They are under pressure to ensure that their products and services continue to meet or exceed acceptable thresholds set by their customers. Either with the support of their supply chain partners and global buyer companies or just internal efforts, suppliers need to make commitment to continuous improvement.

In the previous section, it is in detail shown that quality related attributes ranging from product quality to service and shipment quality are highly demanded during supplier selection. Moreover, in order to deliver these desired quality attributes, established appropriate *quality management systems* such as supplier quality certification, continuous improvement program, Six Sigma program or Total Quality Management program, and quality assurance program are also commonly demanded by buyer companies (Gunasekaran et al., 2004; Avila et al., 2012; Kuo, 2010; Huang and Keshar, 2007; Kuo, 2010; Punniyamoorthy et al., 2012; Shore and Venkatachalam, 2003). Therefore, in order to improve quality, it is imperative for suppliers to implement some form of Quality Management (QM) system and practices within their facilities.

2.4.1 Quality Management Practices and Systems

Quality management (QM) has been recognized as a comprehensive management paradigm for enhancing organizational performance and competitiveness (Mellat-Parast and Digman,

2007). Previous researchers proposed a categorization of QM practices as either infrastructure or core practices (Flynn et al., 1995; Ho et al., 2010; Sousa and Voss, 2002). These studies indicate that significant positive relationships exist between the infrastructure QM practices and core QM practices. Laohavichien (2011) supported this categorization and divided QM practices into two groups: Infrastructure QM including leadership, management support, supplier management, customer focus, human resources, organization cooperation and Core QM including process management, statistical process control and design quality management. According to prior studies core QM practices serve as intermediary practices within the relationship of infrastructure QM practices and quality performance (Flynn et al., 1995; Rahman and Bullock, 2005). Moreover, Flynn et al. (1995) have proven that the infrastructure QM practices do not directly affect quality performance; strictly speaking, they support the implementation of core QM practices, which directly affect quality performance.

Since quality management practices are important, an extensive literature review has been carried out to select appropriate QM practices for this study. Research into quality management, and TQM, ISO and Lean Six Sigma practices has identified many critical success factors that affect an organization's performance and success.

Table 2-7 presents the QM practices from the QM and performance studies on ISO, TQM, Lean, and Six Sigma or mix of these, and also from TQM, Lean and Six Sigma critical success factors (CSFs) literature. Synthesis of QM practices obtained from the literature led us to develop the following five main categories for QM practices: Top Management Support (Leadership); Customer Relationship; Employee Relations (Human Resource Management),

Process Management and Six Sigma Role Structure. The detailed items used in this study for each QM categories can be seen in Table 2-8.

Table 2-7: Quality Management Practices

Quality Management Practice	*Sub Practice*	*References from studies about QM, TQM, ISO, and Lean Six Sigma*
Top Management Support		Kaynak, 2003; Zu et al., 2010; ISO 9000 Series QM Principles; Gotzamani and Tsiotras, 2001; Almeida and Frias, 2012; Moriones et al., 2011; Jaafreh, 2013; Tari et al., 2007; Kanapathy, 2008; Karuppusami, 2006; Kim et al., 2012; Lakhal,2006; Lam, 2011; Laohavichien, 2011, Najeh and Kara-Zaitri, 2007; Mellahi and Eyuboglu, 2001; Lorente and Costa, 2000; Habidin, 2012; Cheung, 2010, Phan et al., 2011; Ramos, 2007; Sadikoglu, 2010; Saez et al.,2011; Sila-Ebrajimpour,2005; Su, 2008; Yusuf and Gunesekaran,2007; Antony-Banuleas,2002; Johnson-Swisher, 2003; Snee, 2011
Customer Relationship		Zu et al., 2010; Chong, 2004; ; Gotzamani and Tsiotras, 2001; Almeida and Frias, 2012; Moriones et al., 2011; Jaafreh, 2013; Tari et al., 2007; Kanapathy, 2008; Karuppusami, 2006; Kim et al., 2012; Lakhal,2006; Lam, 2011; Laohavichien, 2011, Najeh and Kara-Zaitri, 2007; Lorente and Costa, 2000;Habidin, 2012; Cheung, 2010, Phan et al., 2011; Ramos, 2007; Sadikoglu, 2010; Saez et al.,2011; Sila-Ebrajimpour,2005; Su et al., 2008; Yusuf and Gunesekaran,2007
	Linking Six Sigma to Customers	Antony-Banuleas,2002; Johnson-Swisher, 2003; Snee, 2011
Employee Relations		Kaynak, 2003; Zu et al., 2010; Gotzamani and Tsiotras, 2001; Almeida and Frias, 2012; Moriones et al., 2011; Jaafreh, 2013; Tari et al., 2007; Karuppusami, 2006; Kim et al., 2012; Lam, 2011; Laohavichien, 2011; Mellahi and Eyuboglu, 2001; Najeh and Kara-Zaitri, 2007; Lorente and Costa, 2000; Habidin, 2012; Sadikoglu, 2010; Saez et al.,2011; Sila-Ebrajimpour,2005
	Employee Involvement	Kanapathy, 2008; Lakhal, 2006; Cheung, 2010; Ramos, 2007; Su et al., 2008; Yusuf and Gunasekaran, 2007; Phan et al., 2011
	Effective Communication Between Employees and Management	Najeh and Kara-Zaitri, 2007; Yusuf and Gunesekaran,2007
	Linking Six Sigma to Human Resources	Antony-Banuleas,2002; Johnson-Swisher, 2003; Snee, 2011
Process Management		Kaynak, 2003; Zu et al., 2010; Baird et al., 2011; Gotzamani and Tsiotras, 2001; Almeida and Frias, 2012; Moriones et al., 2011; Jaafreh, 2013; Tari et al., 2007; Kanapathy, 2008; Karuppusami, 2006; Kim et al., 2012; Laohavichien, 2011; Phan et al., 2011; Ramos, 2007; Sadikoglu, 2010; Saez et al., 2011; Sila-Ebrajimpour,2005; Su et al., 2008
Lean Six Sigma Role Structure		Zu et al., 2010; Tari et al., 2007; Karuppusami, 2006; Lakhal,2006; Laohavichien, 2011; Najeh and Kara-Zaitri, 2007; Lorente and Costa, 2000; Habidin, 2012; Phan et al., 2011; Ramos, 2007; Sadikoglu, 2010; Su et al., 2008; Yusuf and Gunesekaran,2007; Antony-Banuleas,2002; Johnson-Swisher, 2003; Snee, 2011

Table 2-8: Quality Management Items

Quality Management Item	
Top Management 1 (TM1)	Top Management supports long-term quality improvement process.
Top Management 2 (TM2)	Top Management regularly reviews quality issues in meetings.
Top Management 3 (TM3)	Top Management considers improvement as a way to increase profits.
Customer Relationship Management 1 (CRM1)	We have a clear definition of customer requirements.
Customer Relationship Management 2 (CRM2)	Our company uses customer requirements as the basis of quality.
Customer Relationship Management 3 (CRM3)	Our company attains customer feedback on quality and delivery performance.
Employee Relations 1 (ER1)	Our employees are responsible for quality.
Employee Relations 2 (ER2)	Our employees are provided with the feedback on their quality performance.
Employee Relations 3 (ER3)	Our employees are encouraged to participate in quality decisions.
Process Management 1 (PM1)	Preventive actions are more important than corrective ones during processes.
Process Management 2 (PM2)	We have standardized processes and instructions in place.
Process Management 3 (PM3)	We have clean and well-organized facilities.
Six Sigma Role Structure 1 (SS1)	We have black/green belt role structure (or equivalent structure) for continuous improvement in our company.
Six Sigma Role Structure 2 (SS2)	The roles and responsibilities of quality improvement teams are clearly identified in our company.
Six Sigma Role Structure 3 (SS3)	Our company uses a structured approach (such as DMAIC) to manage quality improvement activities.

These quality management practices seen in Table 2.7 are the practices implemented within quality management systems which include certifications such as ISO (International Organization for Standardization) as well as quality initiatives such as Total Quality Management (TQM), Lean and Six Sigma. ISO certification is required by the customers in some areas where certain standards need to be met such as the medical products area. If the certification is not required by the customer as in the ISO case, then the question of "whether or not to implement an improvement program and if implemented which one to choose" arises for supplier companies. The consideration of implementing a quality program is not only because the buyer companies request the implementation, but also the advantages provided by these programs if implemented properly. The implementation of each of these programs has their own advantages.

The ISO 9000 Series of Standards are internationally recognized quality management system (Kanapathy, 2008). There are eight quality management principles on which standards of the ISO 9000 series are based. These principles are: customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making, mutually beneficial supplier relationships (ISO, 2012). Since 1987, when the ISO 9000 series of standards was first published, an incredible number of papers that highlight both positive and negative effect of the implementation of the ISO 9000 standards on organizational performance have been published (Dick et al, 2008;Marin, 2011; Starke et al, 2012; Psomas et al, 2013).

On the other hand, *Total Quality Management* (TQM), a well-known quality management approach since the late 1970s, can be defined as a management philosophy that strives for continuous improvement in all functions of an organization (Zu et al., 2010). An extensive amount of research has been conducted on TQM practices and their impact on organizational performance. These studies have described both successful and unsuccessful efforts of implementing TQM (Sousa and Voss, 2002; Kaynak, 2003; Joiner, 2006; Corredor and Goni, 2010).

Treading in the steps of TQM, *Six Sigma* is a more recent approach to quality management (Su et al., 2006; Kim et al., 2012). The basic Six Sigma concepts were developed at Motorola in the 1980s recognizing many new tools and methods they had added to TQM and has been defined as a disciplined and organized approach for improving product and strategic process quality that relies on statistical methods and the scientific method

(Schroeder et al. 2005). After some leading companies such as General Electric, Honeywell, Sony, and Caterpillar have adopted Six Sigma, the continuous improvement program has gained wide acceptance as a way to increase organizational performance (Lee and Choi, 2006; Mellat-Parastand Digman 2011; Hilton and Sohal, 2012). Six Sigma improvement projects follow a structured method that includes five steps: Define, Measure, Analyze, Improve, and Control (DMAIC). A variant of this method used in design-oriented processes is Define, Measure, Analyze, Design, and Verify (DMADV). There is a vast amount of literature that has documented substantial cost savings and other benefits from Six Sigma program adoptions (Pande et al., 2000; Harry and Schroeder, 2000). These benefits of Six Sigma adoption include positive impact on employee satisfaction, return on assets, and sales growth, enhanced organizational performance primarily through efficient employee deployment (Sunder, 2013; Swink, 2012; Shafer, 2012) Moreover, from the stand point of environmental and social responsibility, the performance of the Pollution Prevention program (projects conducted between 1995-2007) increased after the implementation of the Six Sigma program and the pollution is prevented more in the countries where the implementation of Six Sigma is more expressive than in the countries with less expressive Six Sigma implementation (Calia, 2009).

In addition to ISO standards, and TQM and Six Sigma approaches, *Lean* is another popular management philosophy that strives for elimination of waste and non-value added processes. Lean can be defined as: "an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability" (Shah and Ward, 2007). The origin of lean manufacturing was

established at Toyota Motor Corporation during 1970s, under the name of the Toyota Production System (TPS) and included just-in-time (JIT) manufacturing (Taj, 2008). Numerous studies support that Lean practices have helped organizations improve their operations performance in terms of quality, inventory minimization, delivery, productivity, and cost reduction (Nawanir et al., 2013; Fullerton and Wempe, 2009; Chong et al., 2001; Hallgren and Olhager, 2009). Not surprisingly, in addition to improvements in operations performance, Lean practices have positive impact on business performance in terms of profitability, sales, and customer satisfaction (Fullerton and Wempe, 2009; Kannan and Tan, 2005; Green and Inman, 2007; Nawanir et al., 2013). Lean manufacturing was introduced to US companies through the seminal book by Womack, Jones and Roos, *The machine that Changed the World,* 1990.

More recently, Lean or Lean Principles has been combined with Six Sigma Quality and is often simply referred as Lean Six Sigma as a means to improve organizational performance. Lean Six Sigma is the latest generation of improvement approaches and many companies have experienced superior performance and customer satisfaction, efficient results in sale forecasts, effectiveness and efficiency of sales force as well as decreased inventory costs through successful Lean Six Sigma implementation (Motwani et al., 2004; Antony and Banuelas, 2002; Sharma, 2003; Marti, 2005; Hesselschwerdt, 2006; Gabor, 2001). Moreover, Lean Six Sigma is seen as a business strategy and methodology that increases process performance resulting in enhanced customer satisfaction and improved bottom-line results (Snee, 2011).

Several authors have discussed that improvement approaches are fads and Lean basically is a repackaged version of the Toyota Production System and just-in-time (JIT), Six Sigma is the new version of TQC and TQM, and that both are derivatives of the Toyota Production System (Dahlgaard and Dahlgaard-Park,2006). (The methods are pioneered since the early 1920s by AT&T and described in detail in the Western Electric Quality Control Handbook and six editions of Juran's Quality Handbook). However, recent research suggests that improvement approaches are not short-lived trend or fashion, but they are the steps along the way in an evolution of business improvement methodology (Schroeder, 2008; Snee, 2011). Snee (2011) states that "Each improvement approach builds on previous approaches adopting the effective aspects of previous approaches and adding new concepts, methods and tools to remove limitations that have been identified." Therefore, each improvement approach introduces new and distinct concepts as well as practices into quality management (Schroeder, 2008).

In conclusion, quality program implementations not only improve the product, service, and shipment quality but also help reduce overall costs. As far as implementation of these quality programs in suppliers is concerned, if the supplier is large enough as a company, as it is the case for specialty products' manufacturers who have all the know-how and technical capability, it is very likely that they already have a quality improvement program in place. However, suppliers are often small or medium size organizations for which quality improvement implementations, such as Lean Six Sigma, appear to be too sophisticated. If this is the case, companies should support at least their critical suppliers for training and implementation of such programs. Companies can initiate and implement a

project in suppliers, support deployment of current and future projects, or demand their suppliers comply with one of the improvement programs. The last one depends on the company's influence over the supplier and the supplier may be motivated to undertake the quality improvement initiative in order to keep them in business.

2.4.2 Company Involvement in Supporting Domestic and International Suppliers

Because companies are "only as good as their suppliers" (Goran Lande, Sony Ericsson, 2010), in managing quality, focus on supplier behavior and process improvement is essential. Global sourcing strategy requires a close coordination among R&D, manufacturing, and marketing activities across national boundaries (Kotabe, 2004). There is growing recognition of the importance of inter-organizational relationships as a source of competitive advantage and value creation. Various research have argued that primary motivation for constructing and strengthening buyer–supplier relationships is that these relationship efforts will lead to superior operational performance outcomes and/or competitive advantage for both parties (Day, 2000; Krause et al., 2007; Autry, 2010). One tangible form of inter-organizational exchange that falls under the supply chain management research is a practice called *supplier development* (Krause et al., 2007). Supplier development has been defined as any activity initiated and undertaken by a buyer organization to improve the performance or capabilities of its suppliers with the purpose to attain the short and long-term objectives of the buyer organization (Krause et al., 1998). Supplier development may include a variety of activities such as goal setting, supplier evaluation, performance measurement, working directly with suppliers through training, and other related activities (Handfield, 2000; Krause et al., 2007).

Supplier development is an important strategy since it involves actions ranging from *low/indirect involvement* activities such as supplier evaluation and information sharing to much more sophisticated and resource demanding *direct involvement* activities such as buyer commitment, shared values, investing in manufacturing equipment, shared asset investments, and training of supplier employees (Krause et al., 2007; Vagadia, 2012; Modi and Mabert, 2007; Sanchez-Rodriguez et al., 2005).

In the case of *direct involvement* (also called *internalized* or *higher involvement* supplier development), the buyer company plays an active role and dedicates human and/or capital resources to a specific supplier by providing more personal, face-to-face interactions with their suppliers (Krause et al, 2000; Krause et al, 2007; Wagner, 2011; Arroyo-Lopez et al., 2012). In addition to providing capital resources, direct supplier development involves knowledge and qualifications transfer into the supplier's organization (Moran, 2005; Lawson et al., 2006). Examples of such activities include on-site consultation, education and training programs, a dedicated supplier development team, temporary employee transfer, and inviting supplier's employees (Krause et al, 2000).

Contrary to direct supplier development, in the case of *indirect involvement*, which is also called as *externalized* or *lower involvement* supplier development, the buyer company commits no or limited resources to a specific supplier (Krause et al, 2000; Wagner, 2011; Arroyo-Lopez et al., 2012). This approach deals with the communication approach of the buyer company and is done through assessment of suppliers, communication of these assessment results as well as performance goals with suppliers, gradually increasing

suppliers' performance goals, and promising future business based on goal achievement (Krause et al, 2000; Prahinski and Benton, 2004).

Recognizing the long-term and strategic benefits of supplier development, companies today are increasingly implementing supplier development programs. For example, Toyota has provided its suppliers located in the US with the assistance in building up lean manufacturing capabilities through problem solving teams of Toyota's Operations Management Consulting Division in Japan and the Toyota Supplier Support Center in the United States. These organizational capabilities benefited both the suppliers and Toyota in the long run (Dyer and Hatch, 2006). John Deere's Enterprise Supply Management group has implemented a program, called *Achieving Excellence*, to improve suppliers' just-in-time capabilities (Modi and Mabert,2007; Wagner, 2011). Suppliers achieved remarkable reductions in cycle time as a result of working with John Deere's supplier development teams (Golden, 1999). Honda, on the other hand, has implemented the BP *Best Practice, Best Process, and Best Performance* supplier development program to assist its suppliers in implementing the Kaizen philosophy for continuous improvement and organizational change (Sako, 2004). Moreover, Otis Elevator's supplier development program is regarded as a core activity for supply management (Modi and Mabert, 2007). Eaton Corporation has undertaken supplier development activities which involve working closely with its key suppliers to achieve improvements in process control, quality system, product quality, delivery performance, supply chain effectiveness, lead time, and productivity, as well as, supply chain optimization and cost reduction. Development teams of Eaton Group communicate and train the suppliers on Lean and/or Six Sigma programs (Eaton, 2013). Similarly, Cummins Inc.

initiated a Supplier Six Sigma program which is primarily intended for their suppliers which have been identified as critical for each business unit of the company. Reduced costs, improved quality and improved delivery are the expected and realized benefits from supplier Six Sigma projects in Cummins Inc. (Cummins, 2010). These last two examples place an emphasis on selection of *critical suppliers* who present the best opportunity for improvement and the greatest potential for supplier development program, as well as an emphasis on *management involvement* and *active participation* from both parties during the implementation.

In addition to manufacturing companies, retailers also initiated supplier development programs. For example, Wal-Mart established a supplier development team and a series of strategies to promote close collaboration and joint business planning with its suppliers. These efforts led to significant improvement in customer awareness of brands, successful key item launches, and increased sales (Hahn, 2005). On the other hand, textile and apparel companies mainly focus on Global Compliance and have related programs and audits which involve health and safety issues as well as environmental concerns (e.g. VF Corporation Global Compliance Framework) (VF Corporation, 2011).

In line with the extensive implementations in the industry, supplier development activities and programs also attracted growing attention from academicians. Previous research on supplier development have investigated the buyer companies' supplier development activities as a way to create a capable supplier base and to leverage the benefit of supply management (Robinson and Malhotra, 2005; Yeung, 2008; Zsidisin and Ellram,

2003), the process of supplier development and the possible improvements in operational and organizational outcomes (Day, 2000; Krajewski and Ritzman, 2004; Krause et al., 2007; Carr and Kaynak, 2007; Li et al., 2007; Modi and Mabert, 2007; Autry, 2010; Arroyo-Lopez et al., 2012), "direct" and "indirect involvement" of buyer companies (Modi and Mabert, 2007; Krause et al., 2007), the life-cycle of the buyer– supplier relationship (Wagner, 2011), the influence of perceived value, switching costs and relationship quality (satisfaction, trust and affective commitment) on relationship strength (Barry et al, 2008), the greater need for information sharing with the suppliers (Kocabasoglu and Suresh, 2006), the impact of supply chain integration and socialization to achieve improved supplier communication and operational performance (Cousins and Menguc, 2006), supplier development and even the role of the buyer on supplier-supplier relationships, and how the buyer and supplier–supplier relationships affect supplier performance (Wu, 2010).

During all these supplier development efforts, however, some pitfalls and challenges may occur. Although these pitfalls can arise from both buyer and supplier, previous research shows that majority of the pitfalls (eg. six out of ten) fall into the "supplier-specific" category (Handfield et al., 2000). Failure to implement improvements stems mainly from the suppliers' lack of commitment or lack of technical or human resources (Handfield et al, 2000). Suppliers are sometimes unwilling to accept help in the form of supplier development. The resistance of unsupportive managers occurs maybe because they are too proud, or they do not see the value in improving quality or delivery performance, or they do not recognize they have a problem. Supplier management and as a result their employees may not be fully committed to the effort because they are remain unconvinced that development will benefit

their organization. Therefore, management attitudes must be monitored and addressed continually as they significantly affect the success of a supplier-development effort (Handfield, 2000).

In addition to unwillingness, as far as global sourcing as opposed to domestic sourcing is concerned, problems may also arise from the cultural and language barriers which are addressed as important features in the supplier selection (Huang and Keshar, 2007; Amin et al., 2011; Avila et al., 2012; Geng and Hu, 2012). In domestic sourcing, partners in the same country share common knowledge about cultural and legal structures, facilitating contract enforcement. Such conditions facilitate trust formation (Koh et al., 2012). Moreover, communication openness, willingness and collaborative potential of the supplier as well as its data sharing and information technology capability can determine potential problems during supplier development efforts. These features are also among the important features in supplier selection (Bai and Sarkis, 2010; Gunasekaran et al., 2004; Avila et al., 2012; Kuo, 2010; Shore and Venkatachalam, 2003; Kim and Boo, 2010; Chen, 2011, Chen and Huang, 2007; Wisner et al., 2005).

Moreover, the length and intensity of the relationship with the suppliers is important in supplier development efforts. It is less likely to encounter problems or unwillingness from the supplier side, if there is a prior history of cooperation between companies (Krause, 2007; Wagner, 2011). Besides, it is recommended that buyer companies should consider indirect supplier development (e.g., supplier assessment, evaluation, or feedback) in the very early stages of the buyer– supplier relationship life-cycle, and then gradually move in to direct

development activities (e.g., training, consulting, or staff transfer). On the contrary, in declining buyer– supplier relationships, it is suggested that the buyer company should gradually move from direct to indirect development activities (Wagner, 2011). These life-cycle approaches can be used to facilitate the implementation of supplier development activities and help remove the potential problems.

The potential pitfalls that are used in this study are summarized in Table 2-9. Some challenges are added based on the supplier selection literature and initial interviews with the companies.

Table 2-9: Challenges in Supplier Improvement Efforts

Challenges in Supplier Improvement Efforts	**References**
Management Style in Suppliers, Lack of Supplier Commitment (due to unfair sharing of benefits, uncertainty or unclear goals)	Forker, 1999; Handfield, 2000, Wagner, 2009, Arroyo-Lopez et al., 2012
Communication and Language Barriers, and Cultural Difference	Koh et al,, 2012; Huang and Keshar, 2007; Amin et al., 2011; Avila et al., 2012; Geng and Hu, 2012
Information Exchange Problems with Suppliers	Bai and Sarkis, 2010; Gunasekaran et al., 2004; Avila et al., 2012; Kuo, 2010; Shore and Venkatachalam, 2003; Kim and Boo, 2010; Chen, 2011, Chen and Huang, 2007; Wisner et al., 2005
Time, Cost and Expense to Visit Suppliers and Supplier Training Costs	Holweg, 2011; Avila et al., 2012
Lack of Awareness in Quality Management Methods (Lean, Six Sigma etc.)	Gunasekaran et al., 2004; Ho, 2010; Avila et al., 2012; Kuo, 2010; Punniyamoorthy et al., 2011; Shore and Venkatachalam, 2003; Huang and Keshar, 2007; Talluri and Narasimhan, 2005
Employee Reluctance to Participate in Quality Implementations	Punniyamoorthy et al., 2011; Ho, 2010; Huang and Keshar, 2007

In addition to supplier development programs and quality management systems implementation in suppliers, some important principles which may also help organizations to reduce the chances of outsourcing failing are: building commitment and mutual dependence, open communication channels (within and between organizations), alignment of goals and objectives both within the buyer as well as supplier, using the concept of *consensus building*, building individual and institutional trust to enable parties to perform services as prescribed in the contract, managing effective collaboration and knowledge sharing between both parties, creating appropriate group interaction, implementing effective controls which enable monitoring of performance, facilitate guiding supplier behavior and positively influence the development of trust (Vagadia, 2012).

Chapter 3
Research Methodology

This study provides an in-depth understanding of sourcing decisions of US textile and apparel companies with an emphasis on quality, identifies the differences in supplier quality, explains the issues encountered during sourcing from different regions of the world and identifies the role of quality practices in sourcing decisions. It provides an insight into the current state of the supplier quality and the role that these qualities play in sourcing decisions including reshore/relocation decision. It also provides a broad comparison of quality issues arising from domestic and international suppliers. Moreover, it identifies the most effective quality improvement strategy for the suppliers and their impact on sourcing decisions of buyers. It determines the rate of support that the buyer companies provide to their suppliers, and identifies the challenges encountered during these efforts.

3.1 Research Aim and Objectives

In order to meet the goals of the research, the following concise research aim and two objectives have been developed.

Research Aim: To investigate the impact quality and quality programs (quality improvement strategies) has on sourcing decisions within the textile value chain.

Research Objective 1: To identify the factors that impact sourcing decisions

a. To identify any differences based on size of company, type of company (e.g., manufacturer, retailer), marketing strategy (Made-in-USA, green/sustainable, etc.) associated with the buyer's side.
b. To explain the issues in suppliers with respect to the different regions of the world.

c. To analyze the dimensions of quality that most influence sourcing decisions due to the supplier quality.

d. To explain the differences in quality performance between international and domestic suppliers due to supplier quality.

Research Objective 2: To determine the impact of quality process improvement strategies on sourcing decisions and on organizational performance

a. To identify the most effective quality improvement strategies in suppliers and their impact on sourcing decisions of US buyer companies

b. To identify how involved US companies are in supporting their international and domestic suppliers and how it impacts quality.

c. To identify the challenges and barriers of implementing process improvement strategies in suppliers or providing help to suppliers on this subject.

d. To determine the strength of the relationships of the quality dimensions that most influence the performance of the organization

In order to achieve these two objectives, the main construct will be the analytical analysis of the results from our surveys coupled with our interviews and secondary data collection from literature as seen in Figure 3-1. A rigorous literature review was conducted for secondary data collection and construct development to be used in the research. The methodology used in this research is a qualitative and quantitative study through the surveys and the interviews across textile and apparel manufacturers and retail organizations in the United States. In order to develop a better understanding of the current state of sourcing efforts, such as re-shoring/relocation, of US textile and apparel companies, and to identify the

importance of supplier quality, our data were collected between January-May 2014 via an electronic survey and personal interviews. The interviews were used to determine insights about quality management programs and sourcing efforts of companies actively participating in the global textile marketplace.

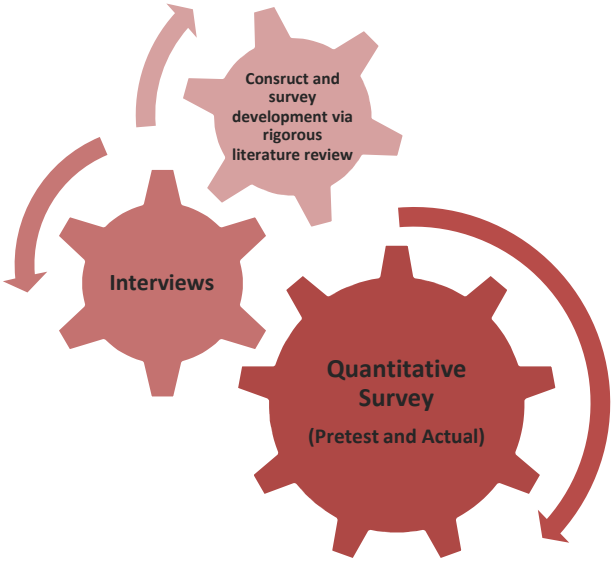


Figure 3-1: Basic Methodology Used for This Research

Concurrently, the survey was conducted to identify the outsourcing reasons, the differences in sourcing decisions for different companies, differences between international and domestic suppliers' quality, the role of quality program implementation in suppliers in sourcing decisions, the company involvement in supplier development, the impact of quality management practices on organizational performance, and the challenges of quality implementations. Previous research suggests that using a survey design provides a systematic way to obtain information and to make claims about the population using the sample results

(Hair et al., 2006; Creswell, 2009). Moreover, conducting surveys is relatively inexpensive and effective tool to gain access to a large group of respondents with a rapid turnaround in data collection.

3.2 Target Population and Survey Procedure:

The participants were selected from US textile and apparel companies (including fiber, yarn, fabric, apparel manufacturers as well as private brands and retailers). The participants were in either senior management positions or within the quality department or supply chain department. Respondents with senior level positions within their companies were preferred so they would be knowledgeable about the company processes overall. Finding respondents who were familiar with the implementation of quality initiatives in their companies, knowledgeable about both their company's sourcing and performance was a challenge during our data collection period.

3.2.1 Pretest, Interview Process and Preliminary Data Collection:

A face-to-face or telephone interview scheduled with the participants. The interview process took anywhere from 60-90 minutes depending on the participant. There were 25 participants in this interview process. The feedbacks that were attained from initial interviews were used to construct and modify the items within the survey, and then the insights attained from subsequent interviews which are conducted concurrently with the survey are used as complimentary intuitions and conclusions for the survey questions.

For a pre-test, the survey was conducted with five respondents that were not included in the survey. Our test sample was similar to our actual sample. Each of the pre-test

respondents was asked to review the survey in terms of wording, time to complete, etc. After the pre-test was completed some of the main parts of the survey were consolidated, and some of the sub parts and measures were eliminated. A few minor changes were also made in wording to clarify some questions.

3.2.2 Survey Procedure:

A dynamic smart-selective survey seen in Appendix A was prepared to identify the outsourcing reasons, the differences in sourcing decisions for different companies, differences between international and domestic suppliers' quality, the role of quality program implementation in suppliers in sourcing decisions, the company involvement in supplier development, the impact of quality management practices on organizational performance, and the challenges of quality implementations. The survey had two main parts. The first part consists of questions regarding sourcing reasons, efforts and supplier quality while the second part consists of quality program implementation and quality practices efforts both in buyer and supplier companies. These parts were also consisted of different block of questions. The first part mainly consists of blocks of questions related with company profile, outsourcing reasons, general issues in different regions, reshore/relocation reasons for the companies who reshored versus not, and supplier quality issues in domestic versus international sourcing. On the other hand, the second part consists of blocks related to quality initiative efforts of the buyer company, supplier development efforts regarding quality initiative implementations, challenges regarding supplier development efforts, and effects of

these efforts on sourcing decisions. The survey was able to provide each company with different types and levels of questions according to the incoming answers.

The survey was administered via the Qualtrics™ Survey Software. Five hundred participants were emailed the survey which resulted in 166 partial completions and 75 full completions. The partial completions were possible due to not finishing the entire survey or only finished parts they had direct knowledge of the operations but are included in the analysis on the sections where they were completed. The detailed flow of the survey is given in Figure 3-2 and the actual survey is given in Appendix A. The analyses were mainly conducted using SAS JMP™ software and IBM® AMOS Program.

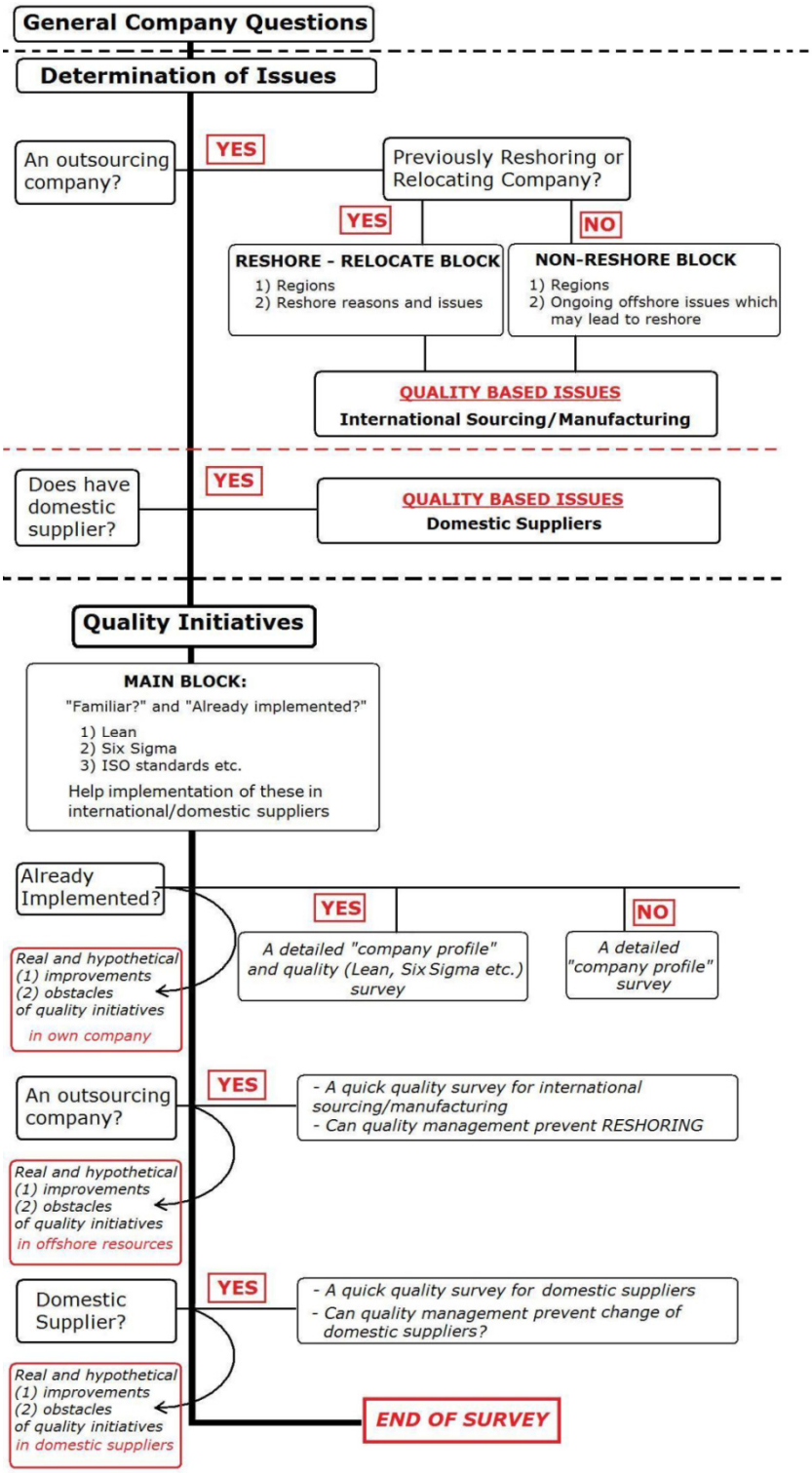


Figure 3-2: Survey Flow

3.2.3 Company Demographics:

Initially, the participant companies are asked about their basic operations and specific areas of operations. The company size was measured by the number of full-time employees and the annual revenue ($ million). In addition, companies were asked to identify their marketing strategy (low cost, high quality, made-in-US, high innovation etc.). In the second part, participants were also asked about existence of quality implementation (such as Lean, Six Sigma, ISO, TQM) within their companies and within their domestic and international suppliers.

3.3 Factors that Influence Outsourcing and Re-Shoring/Relocating Decisions:

The respondents were asked about the factors that influenced their offshore sourcing decisions (i.e. reasons for outsourcing) (Table 3-1) as well as, the issues associated with each of their offshore manufacturing regions (Table 3-2). The respondents were also asked about the factors that affect their decisions to re-shore/relocate their manufacturing as seen in Table 3-3. And specifically, quality categories which will be provided in the next section in detail are asked to respondents if they are a factor of their sourcing decisions (Table 3-4).

Table 3-1: Sourcing Decision Items - Reasons for Outsourcing

Factors That Influence Sourcing Decisions (Reasons for Outsourcing)
Unit price
Labor costs in the country
Energy Costs in the country
Raw material costs in the country
Raw material availability
Proximity to source of raw or intermediate materials
Mass production capability

Table 3-2: Issues That Are Encountered During Sourcing Efforts

1. Cost Issues
2. Quality Issues
3. Delivery Issues
4. Unavailability of factors
5. Overall Risk
6. Other (Environmental issues, Intellectual Property protection etc.)

Table 3-3: Reshore-Relocation Decision Items

Factors That Influence Reshore/Relocation Decisions (Scale Items)
Increase in unit price
Increase in labor costs in the country
Increase in energy costs in the country
Increase in raw material costs
Increase in shipment costs
Problems in availability of raw materials
Low process technology
Communication and cooperation problems with the suppliers
Political and economic instability/risk in the country
Problems in intellectual property protection
Nonconformance incidents and works safety

Table 3-4: Quality Issues in Reshoring and Relocation Decisions

Issues in product quality of supplier
Issues in supply chain quality of supplier
Issues in management quality of supplier
Issues in workforce quality of supplier
Issues in process quality of supplier

3.4 Supplier Quality Measures for Sourcing:

After reviewing the literature, for the purpose of this study, two new concepts have been created for determining supplier quality and performance: *Received Quality* and *Indirect Quality*. Received quality refers to Supply Chain Quality, Product Quality and Product Quality based Factors (see chapter 2 for details). These are the direct quality factors that are directly passed from suppliers to the US buyer company. In other words, these are the quality of products and services directly received by the US companies. On the other hand, Indirect Quality concept is created to refer to suppliers' Management, Workforce and Process Quality. These are the quality factors that are internal to the supplier and the US companies may not even be concerned or aware of their presence. However, at the end, these indirect qualities inevitably will be reflected on the received quality. Six received and indirect quality factors including sub quality factors have been created and shown in Table 3-5.

Table 3-5: Supplier Quality Determinants – Quality Measures for Sourcing

	Supplier Quality Factor	Sub Criteria (Scale Items)
RECEIVED QUALITY	**Supply Chain Quality of Supplier**	Fill Rate
		Delivery Time
		On Time Delivery Rate
		% Of Perfect Orders and Delivery Performance
		Accurate and Precise Information Sharing
		Fast Response To Requests
	Product Quality of Supplier	Product Quality
		Product Appearance
		Meet Specifications
	Product Quality Based Factors	Distributor/Retailer Rejection Rates
		End Customer Returns
		Returns and Warranties (also after sales services)
		Inspection and Training Costs
INDIRECT QUALITY	**Management Quality of Supplier**	Overall Management of Supplier
		Communication and Cooperation Ability
		Documentation and Self Inspection (Audit)
		Quality Management Systems and Practices
	Workforce Quality of Supplier	Training (Human Resources Management, Personnel)
		Skills and Experience
		Productivity
	Process (Manufacturing) Quality of Supplier	Design and Development Capability
		Ability to Modify Products
		Process Technology and Level of Automation
		Work Safety

In order to determine the quality differences between international and domestic suppliers, we asked respondents about quality issues arising from their domestic suppliers (US suppliers) and international suppliers. These issues are rated on a Likert scale from 1 being *very problematic* to 7 being *no problems at all*. Our study favored the use of a 7 point scale over a 5 point scale, because, as the number of scaling points decreases, the amount of information lost increases (Russell and Bobko, 1992; McClelland and Judd, 1993).

3.5 Quality Practices Measures:

Research into quality management, and TQM, ISO and Lean Six Sigma practices has identified many critical success factors that affect an organization's performance and success. Table 3-6presents the QM practices from the QM and performance studies on ISO, TQM, Lean, and Six Sigma or mix of these, and also from the literature of TQM, Lean and Six Sigma critical success factors (CSFs). Synthesis of QM practices from the literature led to the creation of the following five main categories for QM practices: Top Management Support (Leadership); Customer Relationship; Employee Relations (Human Resource Management), Process Management and Six Sigma Role Structure. Quality Management items under each category are provided in detail in Table 3-8.

Table 3-6: Quality Management Practices

Top Management Support
Customer Relationship
Employee Relations
Process Management
Lean Six Sigma Role Structure

Table 3-7: Quality Management Items

Quality Management Item	Description
Top Management 1 (TM1)	Top Management supports long-term quality improvement process.
Top Management 2 (TM2)	Top Management regularly reviews quality issues in meetings.
Top Management 3 (TM3)	Top Management considers improvement as a way to increase profits.
Customer Relationship Management 1 (CRM1)	We have a clear definition of customer requirements.
Customer Relationship Management 2 (CRM2)	Our company uses customer requirements as the basis of quality.
Customer Relationship Management 3 (CRM3)	Our company attains customer feedback on quality and delivery performance.
Employee Relations 1 (ER1)	Our employees are responsible for quality.
Employee Relations 2 (ER2)	Our employees are provided with the feedback on their quality performance.
Employee Relations 3 (ER3)	Our employees are encouraged to participate in quality decisions.
Process Management 1 (PM1)	Preventive actions are more important than corrective ones during processes.
Process Management 2 (PM2)	We have standardized processes and instructions in place.
Process Management 3 (PM3)	We have clean and well-organized facilities.
Six Sigma Role Structure 1 (SS1)	We have black/green belt role structure (or equivalent structure) for continuous improvement in our company.
Six Sigma Role Structure 2 (SS2)	The roles and responsibilities of quality improvement teams are clearly identified in our company.
Six Sigma Role Structure 3 (SS3)	Our company uses a structured approach (such as DMAIC) to manage quality improvement activities.

3.6 Organizational Performance Measures:

Research into organizational performance measurement has revealed that the success of organizational activities should be adequately assessed by multiple measures of performance. Prior studies indicate that better performance assessment can be achieved via tracking not

only financial performance measures such as operating income, sales growth and sales revenue, but also non-financial ones as well (Ittner and Larcker, 2003). Based on the organizational performance literature (Kaplan and Norton, 1992; Kaynak, 2003; Camarero, 2007; Sila and Ebrahimpour, 2007; Rusjan and Alic, 2010; Sadikoglu and Zehir, 2010; Phan et al., 2011; Lam et al., 2011; Marr 2012), we suggest six items for organizational performance and these items can be seen in Table 3-8.

Table 3-8: Organizational Performance Items

Organizational Performance Items	
Performance 1 (P1)	Net Profit Margin (Profit Per Product)
Performance 2 (P2)	Order Fulfillment Cycle Time
Performance 3 (P3)	Full and On Time Delivery Rate
Performance 4 (P4)	Defect Rate
Performance 5 (P5)	Product Quality
Performance 6 (P6)	Employee Performance

The respondents are asked to evaluate the improvement rate of these performance measures in their companies from one being *significant improvement* to seven being *no / insignificant improvement* after the implementation of a quality practice.

3.7 Challenge Measures in Supplier Development

Research into supplier quality and development has revealed that there can be many pitfalls from suppliers' side during the improvement and development efforts (see Chapter 2). Depending on the literature on supplier selection and development, in Table 3-9, we suggest the challenge measures that can be encountered during improvement efforts of buyer

companies. For this group, a seven point Likert-type scale is being used with one being *very challenging* and seven representing *not a challenge*.

Table 3-9: Challenges in Supplier Improvement Efforts

Management Style in Suppliers, Lack of Supplier Commitment (due to unfair sharing of benefits, uncertainty or unclear goals)
Communication and Language Barriers, and Cultural Difference
Information Exchange Problems with Suppliers
Time, Cost and Expense to Visit Suppliers and Supplier Training Costs
Lack of Awareness in Quality Management Methods (Lean, Six Sigma etc.)
Employee Reluctance to Participate in Quality Implementations

The Likert type scales used for all items under different factors in this study are summarized in Table 3-10:

Table 3-10: Main Constructs and Their Corresponding Likert-Scales Used in This Study

MAIN CONSTRUCTS USED IN THIS STUDY	Likert Scale
Sourcing Decision Items	1-Very Influential to 7-Least Influential
Re-shore/Relocation Decision Items	1-Very Influential to 7-Least Influential
Supplier Quality Complaint Items	1- Very Problematic to 7-No Problems At All
Quality Practices Items	1- Strongly Agree to 7- Strongly Disagree
Organizational Performance Items	1-Significant Improvement to 7- No Improvement
Challenge Items In Supplier Development	1- Very Challenging, 7- Not A Challenge
Yes / No Questions	-

Chapter 4
Analysis and Results

The previous chapter outlined the research aim of determining the impact that quality and quality programs (quality improvement strategies) have on sourcing decisions within the textile value chain as well as the research methodology using a survey instrument. The data analysis was performed on the extensive survey conducted to identify the outsourcing reasons, the differences in sourcing decisions for different companies, suppliers' quality as well as quality initiatives and their impact on the sourcing decisions. The survey was administered via the Qualtrics™ Survey Software. Five hundred participants were emailed the survey. This resulted in 166 partial completions and 75 full completions. The partial completions were due to not finishing the entire survey or only answering questions where the respondent had direct knowledge of the operations, and the answers are included in the analysis on the sections where they were completed. The participants were mainly involved in sourcing activities for their company. The analyses were mainly conducted using SAS JMP™ software and IBM® AMOS Program. The results of these analyses are also supported and reinforced by the qualitative data attained from 25 personal interviews. The following two research objectives will be answered through the analysis of the survey results.

Research Objective 1: To define the factors that impact sourcing decisions (with emphasis on quality).

Research Objective 2: To determine the impact of quality process improvement strategies on sourcing decisions and on organizational performance.

As shown in Chapter 3, each of these two questions has multiple sub questions that will be used to address these main questions.

4.1 Research Question 1-A – Factors Due to the Buyer Side

To help answer the first question about the factors that impact sourcing decisions, Research Question 1-a will identify the differences in sourcing decisions based on size of company, type of company (e.g., manufacturer, retailer, etc.), marketing strategy (made-in-USA, niche market), etc. During the identification of the factors that impact sourcing decisions, the reasons for outsourcing (unit price, mass production capability, labor costs, raw material availability, proximity to raw materials as well as energy raw materials and energy costs in the country) will be used as an intermediate tool.

Since there are several reasons for outsourcing, the number of reasons for outsourcing will be reduced by the means of exploratory factor, and these reduced factors will be used in further analysis to answer this sub-question. Principal component analysis followed by varimax rotation was used to analyze the seven items for *Reasons for Outsourcing* in this study. PCA is considered to be a variant of factor analysis (Kim and Mueller, 1984), so it can be used as the first step of exploratory factor analysis. The varimax rotation is the preferred method because it is an orthogonal rotation, which means that the rotated components are uncorrelated, in other words, the underlying factors are independent (Lehman et al., 2013; Field, 2005). Also, this rotation is commonly used in social sciences (Lehman et al., 2013).

To help ensure the validity of using factor analysis on the outsourcing data, Barlett's test of sphericity is used to test the hypothesis of whether or not the correlation matrix involving these seven variables is an identity matrix. For this analysis, the hypothesis is

rejected (i.e., p-value < 0.001) which means the factor analysis performed is feasible from the perspective of Bartlett's test. Also, the sampling adequacy in relation to the number of variables is examined by the Kaiser-Meyer-Olkin test (KMO) (Child, 2006). Since the KMO test is 0.825 for the outsourcing data which is very large (i.e., greater than 0.5), the KMO also supports using factor analysis.

The output of the PCA suggests using the first two factors whose eigenvalues are above one as seen in Table 4.1, which is also demonstrated by the Scree plot in Figure 4-1.In accordance with the Kaiser's rule of retaining factors, the factors with eigenvalues larger than one should be accepted as the number of factors. The Scree plot is a graphic aid intended to help deciding where the *trivial* dimensions begin (Child, 2006).The Kaiser rule of opting for two dimensions in our case is fairly supported by the Scree plot (i.e. Cattell's criterion for retaining the factors that lie above the elbow of the plot). As a result, the first two factors with eigenvalues of 3.9672 and 1.1594 were retained.

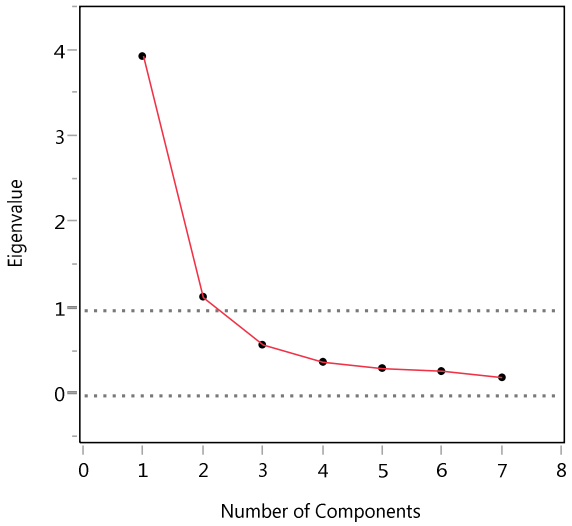


Figure 4-1: Scree Plot for Two Factors

Table 4-1: Eigenvalues for Sourcing Reasons

Number	Eigenvalue
1	3.9672
2	1.1594
3	0.6063
4	0.4073
5	0.3304
6	0.3018
7	0.2275

The proportion of variance captured by the first factor is almost 57%, while, the second factor explains 16% variance. Therefore, the total variance explained by these two factors is 73%. Table 4-2 shows the factor loadings for each of the seven outsourcing reasons.

Table 4-2: Factor loadings for all Sourcing Reasons items - based on principal component analysis with varimax rotation

	Factor 1	Factor 2
Unit Price	0.89	
Mass production capability	0.82	
Labor Costs in the Country	0.80	
Raw Material Availability		0.89
Proximity to the source of raw or intermediate materials		0.75
Raw Material Costs in the Country		0.65
Energy Costs in the Country		0.65

Cronbach's alpha which ranges from zero to one is used to evaluate the reliability of the constructs that are attained from exploratory factor analysis (EFA) (Cronbach, 1951). As the correlations between items under the same factors increase, the Cronbach's alpha will increase, which indicates a higher reliability (Hair *et al.*, 1995). Although there are numerous

studies suggesting that the alpha values around 0.60 (Hair et al., 1995; Boyer and Pagell, 2000) or even 0.55 (Van de Ven and Ferry, 1979) are acceptable, constructs with alpha values less than 0.7 were intended to be eliminated from the analysis (Nunnally, 1978).Table 4-3 represents the two factors attained from the exploratory factor analysis as well as their relevant reliability coefficients. Because it can be seen that Cronbach's alphas of the factors are sufficiently high, none of the seven items were deleted from the factors.

Table 4-3: Cronbach's Alpha Values for Sourcing Items

Items (grouped as in Factors)	Cronbach's Alpha
FACTOR 1- Primary Cost Unit Price, Labor costs, Mass Production Capability	0.8386
FACTOR 2 – Secondary Cost Raw Material Costs, Energy Costs, Raw Material Availability, Proximity to the Source of Raw or Intermediate Materials	0.8949

After the determination of factors by the means of the exploratory factor analysis and the reliability tests, the two factors can generally describe either primary costs or secondary costs. Because the items "Unit Price" and "Labor Costs" are primarily important in governing the general cost of outsourcing, factor one will be categorized as "Primary Cost". The second factor will be categorized as "Secondary Cost" since it contains items that are not often considered as primary by companies.

After the factor structures (i.e., that is the items associated with each factor) have been identified, each respondent's answers have to be converted into a single value for analysis. One very common method is to just average the observed values of the items within

the factor which does not take into account if certain items are more important. Therefore, instead of just simply averaging, the eigenvector with the highest eigenvalue is obtained for each factor by the means of PCA. This eigenvector which provides us with the weights associated with each item within the factor will be used to compute the projection values of the observations (Truxillo, 2005; Suhr, 2005) to the most important principle component of the factor. Therefore, within a single factor, before summation of the values of the items, each item must be weighted according to their importance within the corresponding factor. Table 4-4 and Table 4-5 provide the eigenvectors (i.e., the weights for each item) of the most important principal components for each of our two factors respectively.

Table 4-4: Weights for Items in Factor 1

Item	Weight
Unit Price	0.58832
Labor Costs in the Country	0.56104
Mass production capability	0.58233

Table 4-5: Weights for Items in Factor 2

Item	Weight
Energy Costs in the Country	0.51521
Raw Material Costs in the Country	0.52350
Raw Material Availability	0.45314
Proximity to the source of raw or intermediate materials	0.50515

The value for each factor for each respondent will be determined by the following equation:

$$Factor\ Value = X_1 w_1 + X_2 w_2 + \cdots + X_n w_n$$

where;

$$X_i = observed\ value\ of\ the\ i^{th} item\ within\ the\ factor$$

$$w_i = weight\ (corresponding\ component\ of\ the\ eigenvector) of\ the\ i^{th} item$$

$$n = number\ of\ items\ in\ the\ specified\ factor$$

Now because the factors and their values have been determined, the differences between various types of companies with respect to reasons for sourcing will be explored. The analysis on size of the companies was performed using both the number of employees working at each company and the annual revenue of the company. The cut off points for the company sizes were determined after a review on company size through governmental websites and academic literature. In terms of employee number, small companies were defined to have less than or equal to 100 employees while medium companies ranged from 101 to 1000 employees and large companies are defined to have over 1000 employees. With regard to annual revenue, small companies were defined as those that have annual revenue less than $50 million, medium companies between $50 million and $1billion in revenue and large companies with annual revenue greater than $1 billion (Pagel and Halperin, 1999; "Statistics about Business Size (including Small Business) from the U.S. Census Bureau", 2008; "Small Business Size Standards, US Small Business Administration", 2012).

To test for differences, ANOVA was performed to see if the groups were the same. If the underlying conditions (i.e., each group is normally distributed and independent along with equal variance among groups) were not met, the non-parametric equivalent Kruskal-Wallis test which calculates a test statistic by using the ranks rather than original observations was used (Hollender et al., 2013).If either of these tests indicated a difference among the means or ranks, the appropriate multiple comparison tests were conducted to determine which groups were actually different either using the Tukey Kramer multiple means test for the parametric data and the Steel-Dwass test for the non-parametric data.

4.1.1 Size of Company based on Annual Revenue

Does the size of the company based on annual revenue dictate how the company is oriented towards the primary or secondary cost factors? Two hypotheses for two cost factors will be tested to determine if there is a difference in terms of different-sized companies with regard to these two cost factors.

4.1.1.1 Primary Cost Factors by Size of Company

The first hypothesis that is tested is that the companies of different sizes (i.e., small, medium, and large) by revenue will differ in the level of their alignments to the primary cost factor

H_0: "Small = Medium = Large" The importance of the Primary Cost factor by small, medium, and large companies based on revenue are all same.

H_1: At least one of the company groups differs from the others.

To test the validity of this hypothesis, ANOVA using the Kruskal-Wallis test and then multiple comparison test using Steel-Dwass tests were used. The nonparametric equivalent of

one-way ANOVA was used for this analysis owing to the reason that some of the groups have less than 30 samples and slightly deviate from normal. Nonparametric statistical methods offer a valuable alternative option if there exists an uncertainty about fulfilling the requirements of normality for some of the classes within the data (Paulson, 2008). As a result, in order to stay confident, Kruskal-Wallis tests are engaged, and also in addition to the means, the comparisons are made by the help of the medians and the overall distributions of different classes.

Figure 4-2 shows the box plots of the three groups which display the medians which are represented by the horizontal line within the box. From the plot, there seems to be a difference between large and small companies. The box plot is developed by John Tukey (a.k.a. box and whisker diagram) and is a standardized way of displaying the distribution of a data based on a five number summary: minimum, first quartile, median, third quartile, and maximum. The median divides the data into two halves. To divide the data into quarters, the medians of these two halves must be found. These three points – the median of all distribution and the medians of the two halves are called as *quartiles*, because they divide the entire data set into quarters. In the simplest box plot, the central rectangle spans from the first quartile to the third quartile. Therefore the central rectangle contains 50% of the entire data set. The *whiskers* above and below the box show the locations of the minimum and maximum. Varying-width box plots illustrate the size of each group by making the width of the box proportional to the size of the group. A popular convention is to make the box width proportional to the square root of the size of the group (McGill et al., 1978). Note that lower numbers along y-axis means that the costs are more important in accordance with the original

Likert scale in which one meant "extremely important" and seven meant "not important at all".

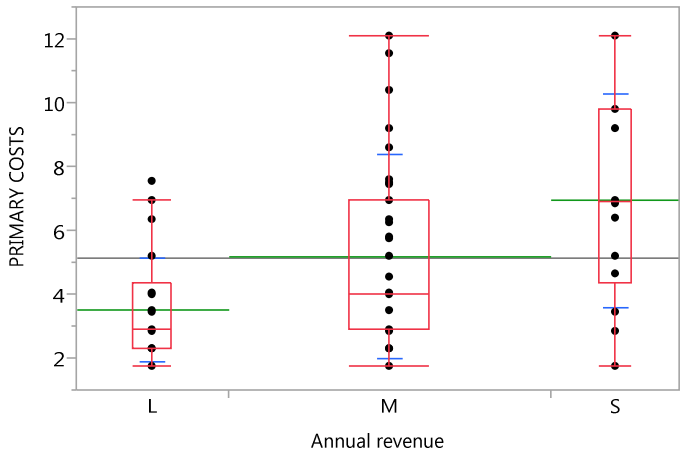


Figure 4-2: Means and Box Plots for Three Groups-
Small, Medium and Large

Even though the graphical representation indicates a difference between the different sizes of companies in terms of the importance of the cost, the hypothesis needs to be tested to determine if a statistical difference exists. Owing to the results of Kruskal-Wallis test (i.e., χ^2 = 12.9647, p= 0.0015), the null hypothesis is rejected and there is only a 0.15% chance of making a wrong decision. Therefore, at least one of the groups is statistically different with regard to the primary cost factor.

After the examination of box plots and attaining a significant Kruskal-Wallis test result, the multiple comparison test using Steel-Dwass test which is a non-parametric equivalent of Tukey-Kramer parametric test was ran as seen in Table 4-6. The test revealed that there are strongly significant differences (i.e., p value= 0.0018) with regard to the

primary cost factor between large and small companies (i.e., there is only a 0.18% chance these groups are the same). The test reveals that there is again strong but less significant difference between large and medium companies (i.e., p value= 0.0482).

Table 4-6: Results of Steel-Dwass Test

Level	- Level	Score Mean Difference	Z	p-Value	Lower CL	Upper CL
S	L	13.8461	3.4219	0.0018*	1.1799	5.7441
M	L	12.8014	2.2897	0.0482*	0.0000	2.2654
S	M	11.7727	2.0887	0.0921	-0.0153	4.0576

Finally, it can be concluded that primary costs are more influential for large companies' outsourcing decisions compared with small and medium-sized companies with regard to revenue. In other words, large companies by annual revenue are more primary cost oriented in their outsourcing decisions. Note that this does not mean cost is not important to small groups. One conjecture of why this difference occurs is that larger companies have many more opportunities that help focusing on reducing costs whereas smaller companies are more limited in their choices (i.e., establishing new partners, risk associated with new suppliers, etc.).

4.1.1.2 Secondary Cost Factors by Size of Company based on Annual Revenue

The second hypothesis that is tested claims that the companies of different sizes will also differ in the level of their alignment to the second factor (i.e., secondary costs).

H_0: Small = Medium = Large; The importance of the Secondary Cost factor by small, medium, and large companies based on revenue are all same.

H_1: At least one of the company groups differs from others.

To test this hypothesis the Kruskal-Wallis test was used again as the data did not meet the parametric conditions. The test results (i.e., χ^2= 20.2984, p-value < 0.0001) states that at least one group is different. The differences between the different sizes of companies can be seen graphically in Table 4-3.

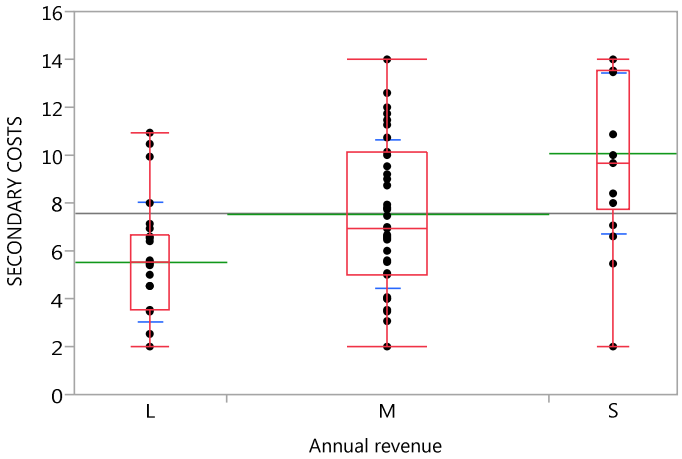


Figure 4-3: Means and Box Plots for 3 Groups-
Small, Medium and Large

Since the data is non-parametric, the Steel-Dwass test results as seen in Table 4-7 demonstrates that there is very strong statistical differences (i.e., p-value < 0.0001) between large and small companies (i.e., less than 0.01% chance the groups are the same) with regard to the views of secondary cost. There is also a difference between large and medium-sized companies (i.e., p-value= 0.0105) unlike the primary costs, there is a strong statistical difference between medium and small-sized companies (i.e., p-value = 0.0216) with regard to the importance of secondary costs.

Table 4-7: Table: Results of Steel-Dwass Test

Level	- Level	Score Mean Difference	Z	p-Value	Lower CL	Upper CL
S	L	17.1188	4.2269	<.0001*	2.7403	7.3054
S	M	16.3545	2.8988	0.0105*	0.5855	4.6162
M	L	14.8688	2.6561	0.0216*	0.1424	3.9940

Similarly, as a conclusion, secondary-costs seem to be more influential in large companies' outsourcing decisions as compared to small and medium-sized companies. Larger companies in terms of revenue give more importance to the secondary costs for the similar reasons stated for the primary costs.

4.1.2 Size of Company based on Number of Employees.

The previous section looked at the differences in terms of company size based on total revenue. Does the size of the company based on number of employees dictate how the company is oriented towards the primary and secondary cost factors? A similar analysis will follow for the company size by employee number. The number of companies in small, medium and large groups both by annual revenue and employee number are given in Table 4-8.

Table 4-8: The number of companies in small, medium and large groups both by annual revenue and employee number

Group	By Annual Revenue	By Employee Number
Small	22	15
Medium	55	46
Large	26	42

4.1.2.1 Primary Cost Factors by Size of Company

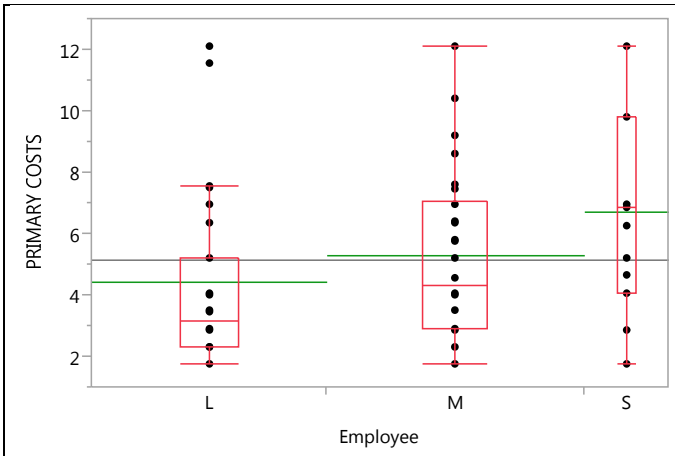
Therefore, the first hypothesis that is tested claims that the companies of different sizes (i.e., small, medium, and large) by number of employee will differ in their alignment to the primary cost factor.

H_0: "Small = Medium = Large" The importance of the Primary Cost factor by small, medium, and large companies based on number of employees are all same

H_1: At least one of the company groups differs from others.

The result of Kruskal-Wallis test (i.e., (χ^2= 8.2705, p-value = 0.0160) determined that importance of the primary cost factor significantly differs for different types of companies as seen in Figure 4-4. The comparison using the Steel-Dwass method shows that there are significant differences in secondary cost importance between large and small-sized companies (i.e., p-value = 0.0234) as well as between large and medium-sized companies (i.e., p-value= 0.0267). Therefore in conclusion, it can be seen that the primary costs are more influential in large companies' outsourcing decisions compared to small and medium-

sized companies based on the number of employees for the similar reasons stated in Section 4.1.1.



Kruskal-Wallis

$\chi^2 = 8.2705$,
p= 0.0160

Post hoc test using Steel-Dwass

Level	- Level	Score Mean Difference	Z	p-Value	Lower CL	Upper CL
M	L	12.3436	2.2673	0.0234*	0.0000	1.7316
S	L	11.0381	2.2162	0.0267*	0.4851	4.5309

Figure 4-4: Primary Cost Factor Analysis by Size of Company based on Number of Employees

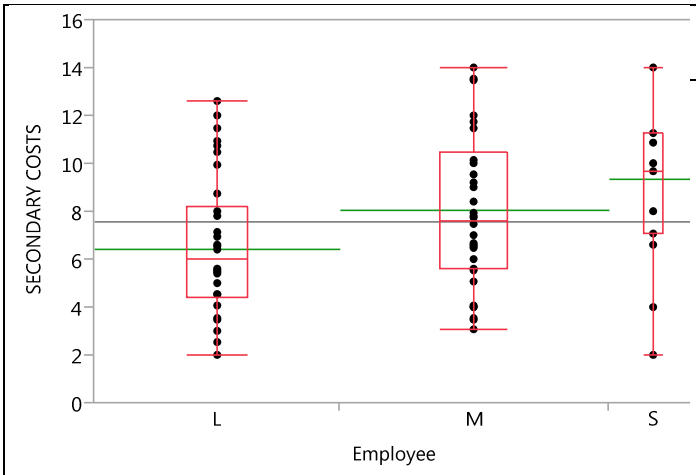
4.1.2.2 Secondary Cost Factors by Size of Company based on Number of Employees

Again, the second hypothesis that is tested claims that the companies of different sizes with regard to the number of employees will also differ in their alignment with regard to the secondary cost factor.

H_0: Small = Medium = Large; The importance of the Secondary Cost factor by small, medium, and large companies based on number of employees are all same.

H_1: At least one of the company groups differs from others.

In the validation of this hypothesis, the result of Kruskal-Wallis test (i.e., χ^2= 9.6456, p-value = 0.0080) determines that the null hypothesis will be rejected, and so that the size of company influences the way the company views the secondary costs. Using the Steel-Dwass test reveals that there are significant differences in the secondary cost view between large and small-sized companies (i.e., p-value = 0.0193) and less strongly between large and medium-sized companies as seen in Figure 4-5. The same analysis can be concluded that secondary costs are more influential in large companies' outsourcing decisions compared to small companies.



Kruskal-Wallis

χ^2 = 9.6456,
p= 0.0080

Post hoc test using Steel-Dwass

Level	- Level	Score Mean Difference	Z	p-Value	Lower CL	Upper CL
S	L	13.4357	2.6940	0.0193*	0.5051	5.6519
M	L	12.2298	2.2436	0.0641	-0.0349	3.4019
S	M	7.6913	1.4577	0.3114	-1.3310	3.9940

Figure 4-5: Secondary Cost Factor Analysis by Size of Company Based on Number of Employees

When it is looked at the differences between different sizes of companies either based on revenue or number of employees, it can be observed that the results are the same. To briefly state again, because of a larger bulk of opportunities such as better possibilities to order shipments from all over the world, the large companies by annual revenue and number of employees are more cost-oriented in their outsourcing decisions compared to medium and small-sized companies. Again, it does not mean that small companies view costs as not important, but the larger companies have more opportunities owing to their size in finding new suppliers and sources. And, within the framework of sourcing decisions, in the next sections, it will be showed that cost orientedness is more frequent among the companies who changed their international suppliers.

4.1.3 Type of Company Based on Company's Operations

In the previous two sections, the size of the company was analyzed to determine if a difference exists among the different size of companies. In this section, the question is whether different types of companies in terms of operation (i.e., manufacturer, retailer, and private brand) are differently oriented towards the primary and secondary cost factors. The hypothesis that is tested states that companies with different operation types will differ in their alignment to the primary cost factor.

H_0: (Manufacturer = Retailer = Private Brand). The importance of the Primary Cost factor by Manufacturers, Retailers and Private Brands are the same.

H_1: At least one of the company operation types differs from others.

As seen in Figure 4-6, differences in the means and medians suggest that there are differences in the way that different types of companies in terms of operations view the

primary costs. To test the validity of this hypothesis, the Kruskal-Wallis test was used because some of the group distributions deviate from normality. Kruskal-Wallis test results (i.e., $\chi^2 = 11.0593$, p= 0.0009) state that the null hypothesis will be rejected.

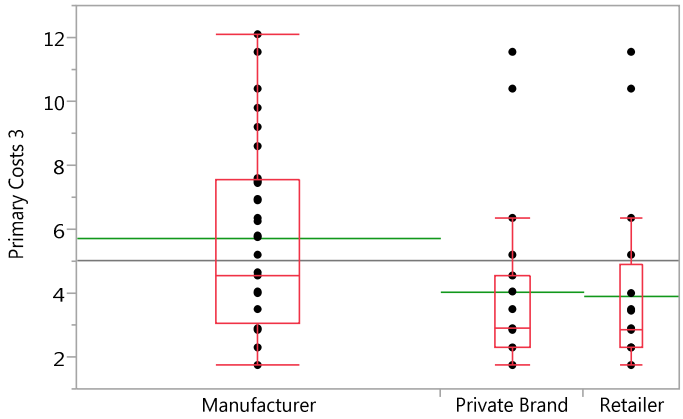


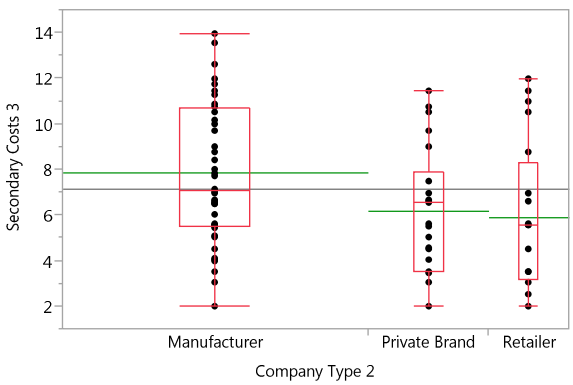
Figure 4-6: Means and Box Plots for Three Groups

Since there is at least one company type that is different, the multiple comparison Steel-Dwass method was used to determine which groups are different as seen in Table 4-9. As the table states, there are significant differences between manufacturers and retailers (i.e., p-value = 0.0123) as well as between manufacturers and private brands (i.e., p-value= 0.0124). There is only a 1.2% chance that these groups are really equal. As can be seen, there is no difference between the retailer and private brand which can be attributed that many retailers also have private brands.

Table 4-9: Steel-Dwass test results

Level	- Level	Score Mean Difference	Z	p-Value	Lower CL	Upper CL
Retailer	Private Brand	-2.5833	-0.6162	0.8112	-1.1646	0.6249
Private Brand	Manufacturer	-18.8289	-2.8446	0.0124*	-2.7839	-0.0212
Retailer	Manufacturer	-19.8947	-2.8454	0.0123*	-2.9083	-0.0272

Same conclusion can be made for the test on the secondary costs according to the results of the same analysis provided in Figure 4-7.



Kruskal-Wallis

$\chi^2 = 11.0593$,
p= 0.0009

Post hoc test using Steel-Dwass

Level	- Level	Std Err Dif	Z	p-Value	Lower CL	Upper CL
Retailer	Private Brand	4.2009	-0.4364	0.6625	-2.0590	1.4918
Private Brand	Manufacturer	6.6266	-2.1924	0.0283*	-3.1130	-0.0354
Retailer	Manufacturer	6.9987	-2.2605	0.0238*	-3.5745	-0.3068

Figure 4-7: Secondary Cost Orientedness vs. Type of Company in terms of Operations Analysis Results

Finally, we can conclude that primary and secondary costs are more influential in outsourcing decisions for both retailers and private brands as compared to manufacturers. In other words, retailers and private brands are more concerned with both primary and secondary cost factors in their outsourcing decisions.

4.1.4 Different Outsourcing Decisions Analysis

It has been shown that larger companies as well as retailers and private brands tend to view cost as being more important. In this section, our hypothesis states that the importance of how a company is oriented towards the primary and secondary cost factors would differ for two different types of companies in terms of outsourcing decision (i.e., companies which have changed their international suppliers versus companies which have not changed their international suppliers).Again, the first hypothesis claims that companies who have changed their international suppliers versus who have not changed differ in terms of giving importance to the primary cost.

H_0: (Change=No Change) The importance of the Primary Cost factor for companies which changed their international suppliers versus companies which did not change their international suppliers are the same.

H_1: The rate/importance of these two groups differs.

After observing the means and medians from Figure 4-8there seems to be significant differences between two company categories of different sourcing decisions. To test the validity of this hypothesis, Wilcoxon test was used because one of the group distributions slightly deviates from normal. The result of Wilcoxon test (i.e., χ^2 = 11.0593, p= 0.0009) reveals that the null hypothesis will be rejected. Since a lower number means that the factor

is more important, it can be observed that the companies that have changed their international suppliers consider costs are more important compared to those who did not.

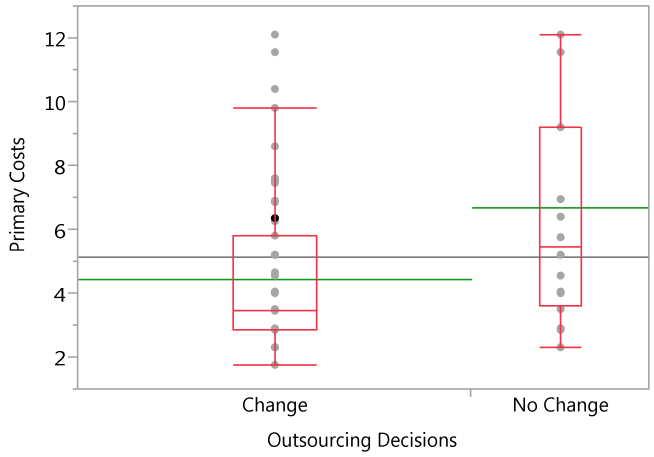


Figure 4-8: Box plots for Primary Cost Alignment with Companies who changed versus those who did not Change International Suppliers

As can be seen in Figure 4-9 the same conclusion with respect to the secondary costs can be made.

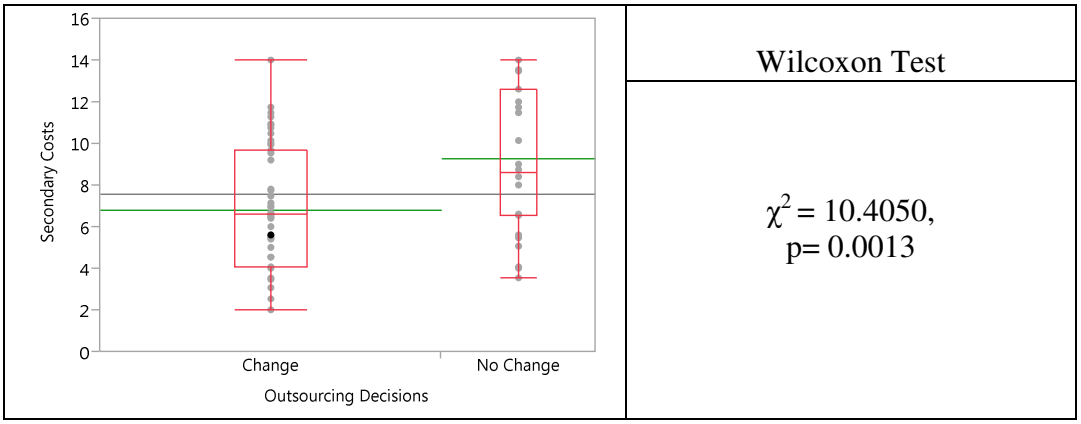


Figure 4-9: Secondary Cost Analysis Results with Companies who changed versus those who did not Change International Suppliers

Here, it is found noteworthy to mention that the results in this section can be reinforced by our findings in Section 4.2. With regard to the various cost issues associated with suppliers around the globe which will be analyzed in Section 4.2, the world issue maps in Figure 4-10 present cost issues from suppliers around the globe from the perspective of the US companies. Regions with numbers closer to one have the largest issues. (The details of the percentage calculations can be found in Section 4.2). It can be seen that the US companies who changed their international suppliers have higher rate of cost issues (i.e. primary and secondary costs) with regard to the suppliers they left. However, from the perspective of the US companies who did not change their international suppliers, the world does not possess any real significant cost issues. Even though it is the same world, the companies who do not reshore/relocate view the world differently (i.e., have fewer cost issues).

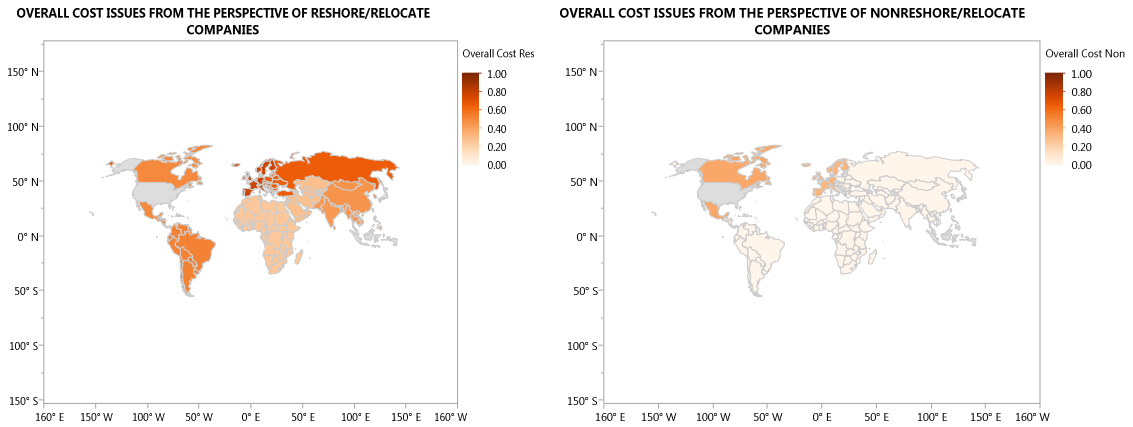


Figure 4-10: Overall Cost Issues from the Perspective of Reshore/Relocate Companies vs. Non-Reshore / Relocate Companies

4.1.5 Effects of Marketing Strategies on Sourcing Decisions

The company size and type of company in terms of operation have been shown to have an effect on sourcing decisions. The next question to answer is: do a company's marketing strategies play a role in their sourcing decisions? To achieve this goal, the companies were asked whether or not they pursue the following marketing strategies provided in Table 4-10:

Table 4-10: Marketing Strategies Followed by US Buyer Companies

Marketing Strategies		
low cost	high automation	high technology
high quality	"Made-in-US"	speed-to-market
niche marketing	mass production	high innovation
high research and development	green/sustainable	other

Figure 4-11 depicts the percentages of the US companies who have changed their international suppliers back to the US (i.e., reshored their manufacturing or supplier) given each particular marketing strategy. From the figure, the 'Made-in-USA' strategy has the highest percentage rate of reshoring activities (i.e., 70% of the 30). In other words, the US buyer companies who follow the 'Made-in-USA' as the marketing strategy tend to reshore more, compared to companies with other marketing strategies. This result is very reasonable because this strategy is one of the popular strategies followed by US companies to promote the reshoring activities. As an example, Wal-Mart announced a US manufacturing

commitment in January 2013: “It will buy an additional $50 billion in US products in 10 years in an effort to grow US manufacturing and encourage the creation of US jobs”.

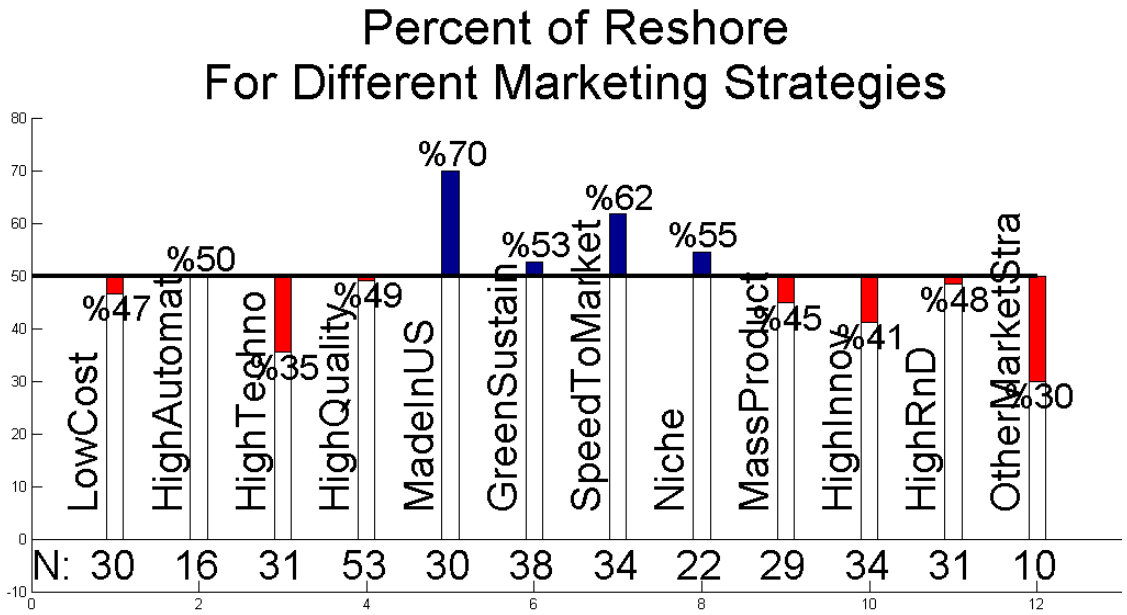


Figure 4-11: Percentage of Reshoring for Companies with Different Marketing Strategies

From Figure 4-11, the ‘Made-in-USA’ strategy is followed by ‘Speed-to-Market’, ‘Niche’ and ‘Green/Sustainable’ marketing strategies with high tendencies for reshoring activities. If ‘Speed-to-market’ is critical in companies’ competitiveness, they will look for closer suppliers in terms of location to decrease the longer lead times encountered during outsourcing from certain overseas suppliers. On the other hand, ‘Niche’ marketing calls for stable product quality, and as a result, stable relationships and close collaboration with suppliers. The attributes of niche specialization and customized manufacturing are challenging the strengths of those economies which are dependent on economies of scale,

with highly concentrated on specializing in large-scale manufacturing, such as China. Considering these situations, capability for small-size niche manufacturing coupled with close collaboration opportunities provided by domestic suppliers might be the main reasons behind reshoring activities of companies that pursue 'Niche' marketing strategy.

These findings here can be validated by proportion testing (i.e., the means of adjusted Wald tests) shown in Figure 4-11 through Figure 4-14, where the probability of reshore given Made-In-USA strategy is significantly higher compared to the probability of reshore given non Made-In-USA strategies, as an example whereas, it is not possible to make this type of conclusion based on High Quality as marketing strategy. When we look at significance of the difference of the probabilities of reshore given a marketing strategy exists versus not, we can see that there are significant differences in the case of made-in-USA, green/sustainable, and speed-to-market strategies.

Table 4-11: Wald Test for Made-in-USA Marketing Strategy

Description	Proportion Difference	Lower 95%	Upper 95%
P(Reshore | Made-in-USA)-P(Reshore | No Made-in-USA)	0.238701	0.04631	0.414296
Adjusted Wald Test			**Prob**
P(Reshore|Made-in-USA)-P(Reshore|No Made-in-USA) ≥ 0			0.0071*

Table 4-12: Wald Test for Green/Sustainable Marketing Strategy

Description	Proportion Difference	Lower 95%	Upper 95%
P(Reshore|Green/Sustainable)-P(Reshore|No Green/Sustainable)	0.166667	-0.02302	0.343023
Adjusted Wald Test			**Prob**
P(Reshore|Green/Sustainable)-P(Reshore|No Green/Sustainable) ≥ 0			0.0433*

Table 4-13: Wald Test for Green/Sustainable Marketing Strategy

Description	Proportion Difference	Lower 95%	Upper 95%
P(Reshore|No Speed-to-Market)-P(Reshore|Speed-to-Market)	-0.18087	-0.35484	0.008684
Adjusted Wald Test			**Prob**
P(Reshore|No Speed-to-Market)-P(Reshore|Speed-to-Market) ≤ 0			0.0310*

Table 4-14: Wald Test for High Quality Marketing Strategy

Description	Proportion Difference	Lower 95%	Upper 95%
P(Reshore|High Quality)-P(Reshore|No High Quality)	-0.02383	-0.27505	0.204879
Adjusted Wald Test			**Prob**
P(Reshore|High Quality)-P(Reshore|No High Quality) ≥ 0			0.6128
P(Reshore|High Quality)-P(Reshore|No High Quality) ≤ 0			0.3872
P(Reshore|High Quality)-P(Reshore|No High Quality) = 0			0.7744

4.1.6 Final Remark

It has been shown that large companies tend to be more cost oriented compared to smaller ones as well as private brands and retailers as compared to manufacturers. Additionally, in the pursuit of lower costs, cost oriented companies have more of a tendency to change their international suppliers compared to other companies. In other words, the alignment to primary and secondary costs leads to reshoring and relocating of international suppliers by these companies.

One conjecture is that small and medium sized companies do not possess the resources and international sophistication of large companies. Smaller companies may not have the capital to take the risk of rebuilding the supply chain. Therefore, smaller companies tend to create more stable relations with their existing suppliers and don't seek continuously

for cheaper prices. When it is considered that strategic sourcing involves the entire business processes, functions and capabilities, cost is not usually a primary decision-making factor, as it is usually the case for smaller companies. On the other hand, large companies have more abundant resources – at least in comparison to smaller companies, and can seek better prices for a certain quality and service level without suffering the painful tradeoff between cost and quality owing to their larger volume demands. In other words, they can find better prices without facing any quality reduction and any unfavorable tradeoffs. Therefore, cost is generally a primary decision-making factor in their sourcing decisions. If necessary, they can bear the supplier shifting costs and create new supply chains more easily. In addition, large companies have the ability to continually monitor which products are available under which conditions (in terms of quality, price, quantity, and supply times) not just from one country or location but from many. Furthermore, large companies prefer to contract with major logistics companies that give them discounts for larger volumes. Conversely, smaller companies award their contracts to smaller service providers because of their smaller volumes. Because large companies have the negotiating power, they tend to impose transport costs and risks on the vendor or can mitigate these costs owing to their volumes. Large companies have the standing in global sourcing markets to impose all-inclusive contracts on their suppliers which the costs and risks of delivery are entirely borne by the supplier. On the other hand, because smaller companies have less negotiating power, they may have to burden the main transportation costs. Therefore, large companies can mitigate their risks where small companies shoulder it if something goes awry.

As a conclusion, costs are more influential in large companies' outsourcing decisions as compared to medium and small size companies. And companies that change their international suppliers tend be more cost oriented. In other words, primary and secondary cost factors tend to be the reason companiesare willing and ready to change their international suppliers.Therefore, the company size leads to be more aligned (i.e., important) with primary costs (unit price etc.) and secondary costs (energy costs etc.). Being primary and secondary cost oriented leads to companies to make reshoring and relocation decisions.

4.2 Research Question 1.B – Factors Due To Supplier Side

The previous section addressed the research question which is about the factors from the buyer side. Research Question 1.b. will be used to explain the issues in suppliers with respect to the different regions of the world. To help answer this sub-question, US companies were asked a set of issues that they have encountered during their outsourcing efforts from different regions throughout the world (i.e., North America (Canada, Mexico), Central and South America, East Asia (including China), South Asia (including India), Middle East, Central and Eastern Europe (including Turkey), Western Europe, Africa). The issues which were asked to US textile companies are shown in Table 4-15.

Table 4-15: Issues That Are Encountered During Sourcing Efforts

Cost Issues
Quality Issues
Delivery Issues
Unavailability of Factors
Overall Risk
Other (Environmental Issues, Intellectual Property Protection etc.)

Table 4-16 represents the number of occurrence of issues within each specific region for all of the six issues along with a total occurrence of region. The world map figures in the next sections were created from the values within this table.

Table 4-16: Occurrence of Issues within Specific Regions

Name of the Region	Total Occur. of Region	Overall Quality Issues	Overall Cost Issues	Delivery Issues	Unavail. of Factors	Overall Risk	Other (IP Protection, Environment)
1.North America (Canada, Mexico)	29	7	13	4	5	1	0
2.Central and South America	22	9	9	9	2	6	6
3.East Asia (including China)	55	21	18	30	3	18	12
4.South Asia (including India)	23	8	8	8	2	6	5
5.Middle East	10	1	2	0	2	6	0
6.Central and Eastern Europe	12	4	4	1	1	5	0
7.WesternEurope	24	1	12	8	3	2	1
8.Africa	6	4	1	2	1	2	1

The percentage of existence of a particular issue within a particular region was calculated using the following formula.

$$\%\ of\ Existence\ of\ Issue\ in\ a\ Region = \frac{\#\ of\ existence\ of\ issue\ in\ that\ region}{\#\ of\ companies\ outsourcing\ to\ this\ region}$$

By calculating the percentage of each issue within a particular region, the histograms of existence of a specific issue with respect to different regions were obtained. As an example, Figure 4-12 plots the histogram of the 'Overall Risk' issue for the different regions.

The *Middle East* can be perceived to be the worst region in terms of overall risk as compared to other regions.

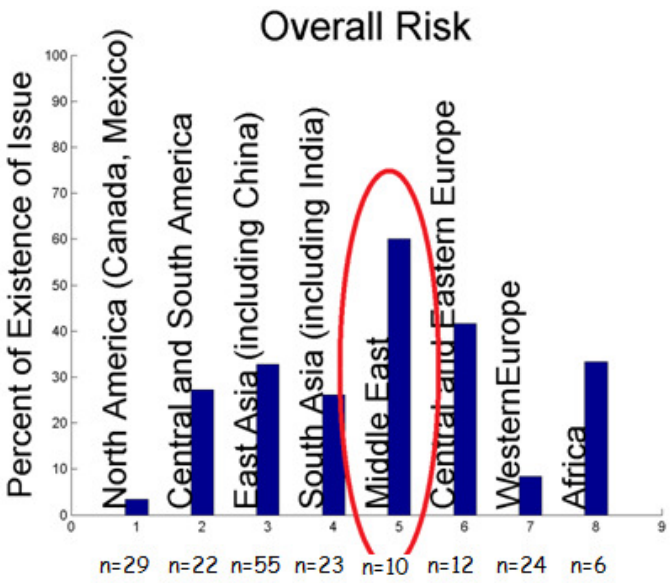


Figure 4-12: The percent of existence of Overall Risk for different regions

To visually see the percentages, a world map view has been created by using SAS JMP™ software which represents the intensity of a particular issue for each region of the world by the means of different color intensity. The darker colors represent worse conditions (i.e., higher percentages) in terms of the specific issue for that region whereas the lighter colors represent less intensity of the issue. Figure 4-13 represents the overall percentages of Figure 4-12 on to a world plot. Again, the Middle East is represented with the darkest color – showing the most problematic region in terms of overall risk. This overall risk issues originate from the political instability in the region as validated from the personal interviews. It can be observed that from the Middle East to west, the overall risk is gradually decreasing.

The regions with the lowest overall risk issues are Western Europe and North America (i.e., Canada and Mexico).

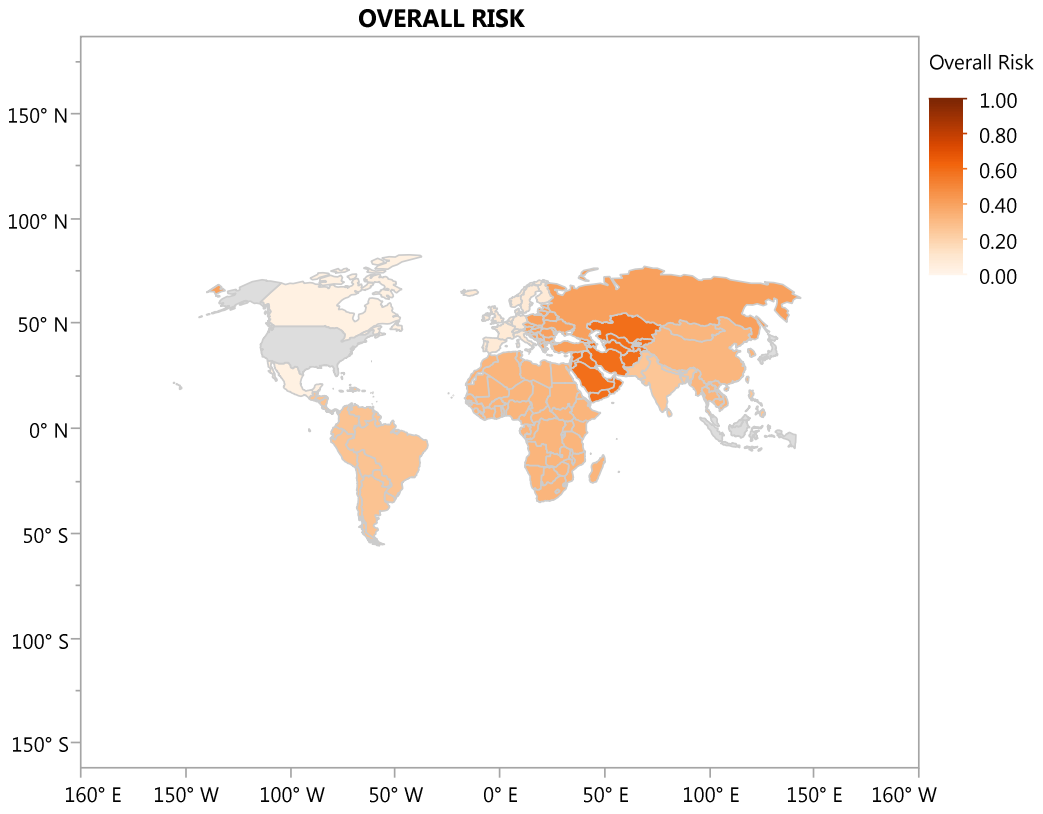


Figure 4-13: Overall Risk Issues Encountered in Different Regions

Even though the word issue maps of Figure 4-13 help visually convey the issues in particular regions, they do not say anything about the statistical significance (i.e., taking into account the number of items per group). To further validate the results, Figure 4-14 shows the confidence intervals for the percentages by taking the sample sizes of each group into account for the existence of overall risk issue for some different regions (Ross, 2003). Here,

because the confidence intervals do not overlap, there is an obvious difference between Middle East, East Asia and Western countries (North America and Western Europe) in terms of overall risk. This statistical validation supports the findings that the Middle East represents the most problematic region in terms of overall risk. Once again, Western Europe and North America have significantly lower overall risk issues in comparison to East Asia and Middle East.

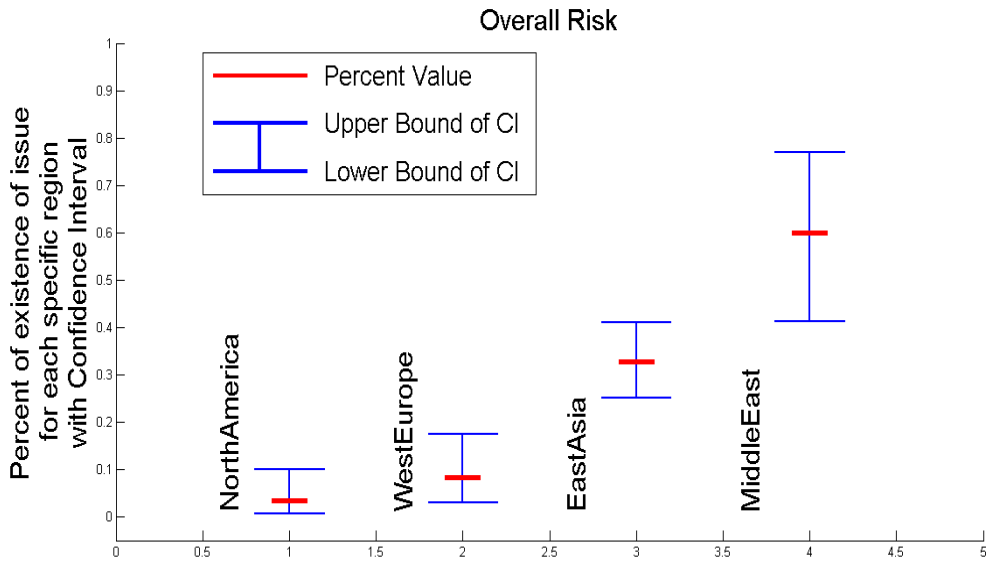


Figure 4-14: Confidence Intervals of Percentage of Existence of Overall Risk for Different Regions

Next, the issues with regard to "Overall Cost" and "Overall Quality" will be presented. These two issues have a high level of importance with regard to outsourcing decisions, and these issues will be analyzed in detail separately for US companies who have previously changed their international suppliers and for US companies who have not changed

their international suppliers. These separate investigations enabled comparisons to be made about the outsourcing motivations of these two different groups of companies in previous sections.

In order to identify the differences between the companies that changed their international suppliers compared to the companies who did not change their international suppliers, the question of issues was differentiated in the survey for these two groups of companies as seen in Figure 4-15. For the US companies who have changed their international suppliers, they were asked about issues in the regions of their abandoned suppliers. However, for the US companies who did not change their international suppliers, they were asked about the issues in the regions of their current suppliers.

Figure 4-15: Issues in outsourcing for US companies who changed international source vs. not

4.2.1 Overall Cost Issues

From the perspective of US companies who have previously reshored and relocated their international suppliers, many issues with respect to overall cost are encountered throughout the world. The intensities of the cost issues for different regions are depicted in the world map in Figure 4-16 while Figure 4-17 represents the confidence intervals for percent of existence of cost issues for the different regions. As seen from the two figures, Western Europe has the highest rate of cost issues and because their confidence intervals do not overlap this region is significantly different from Middle East and Africa in terms of costs. This can be attributed to the high labor costs in Western Europe as validated from the personal interviews. The confidence intervals for percentages indicate a trend associated with

the costs while there is quite a bit of overlap owing to the small sizes for each category. In addition, there are considerable cost issues emerging from East and South Asia since the labor costs in these two regions are increasing. Coupled with high energy prices in these regions, these cost increases are naturally reflected to unit prices. A similar structure for the Mexico and South America in terms of cost issues can be seen as well.

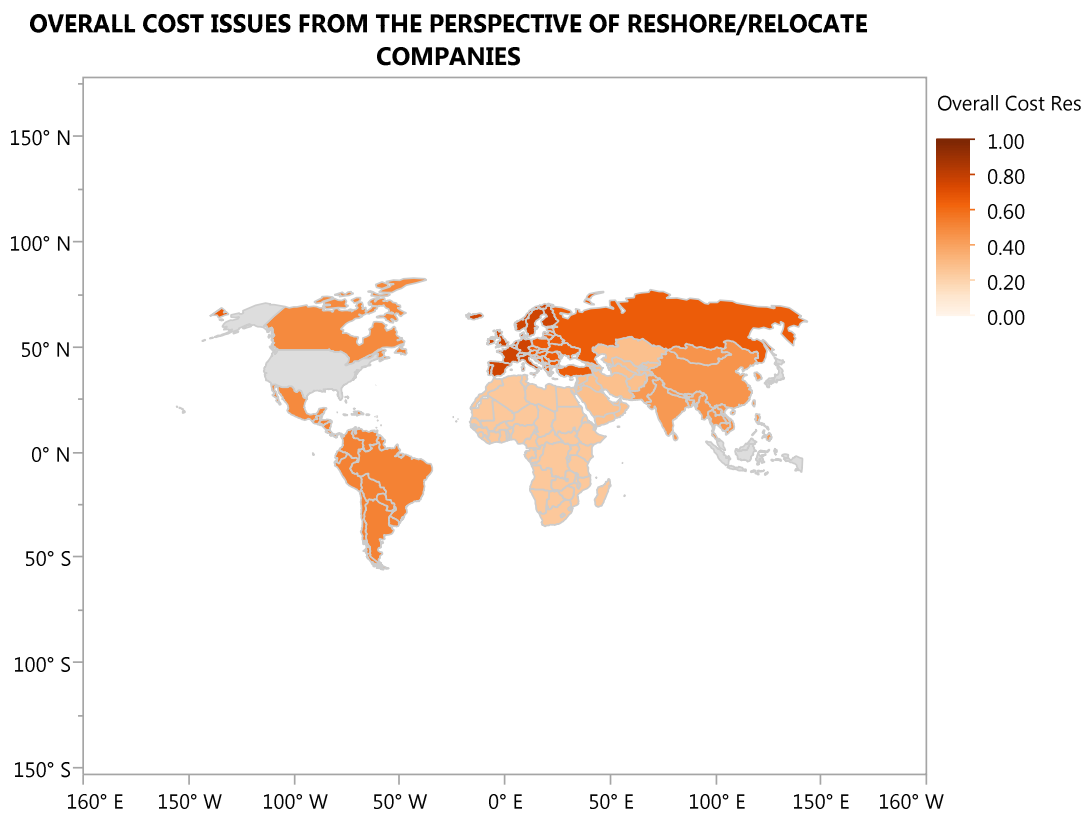


Figure 4-16: Overall Cost Issues from Perspective of Reshore/Relocate Companies

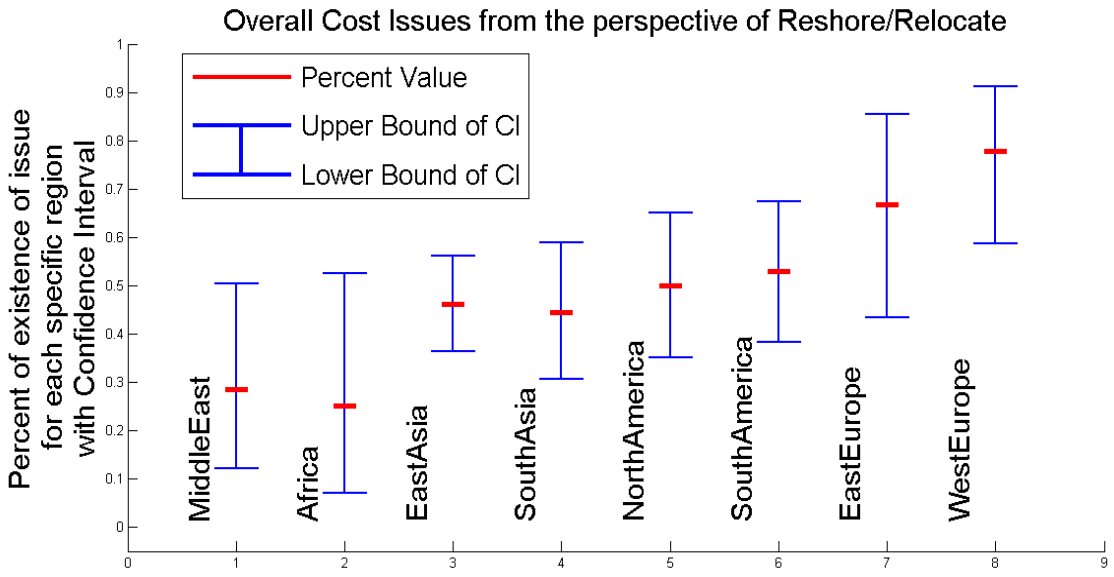


Figure 4-17: Confidence Intervals of Percentage of Existence of Overall Cost Issues for Different Regions from the Perspective of Reshore/Relocate Companies

It has been shown that from the perspective of Reshore/Relocate companies the world has many issues regarding costs. On the other hand, the issues associated with overall cost from the perspective of the companies who did not change their international suppliers, is much smaller throughout the world. Therefore, the world is perceived differently by Non-Reshore/Relocate Companies regarding to cost as seen in Figure 4-18. To further analyze these issues, Figure 4-19 represents the confidence intervals for the percentage of existence of cost issues for different regions from the perspective of Non-Reshore/Relocate companies. Only Western Europe and North America are different and have greater issues as compared to the rest of the world.

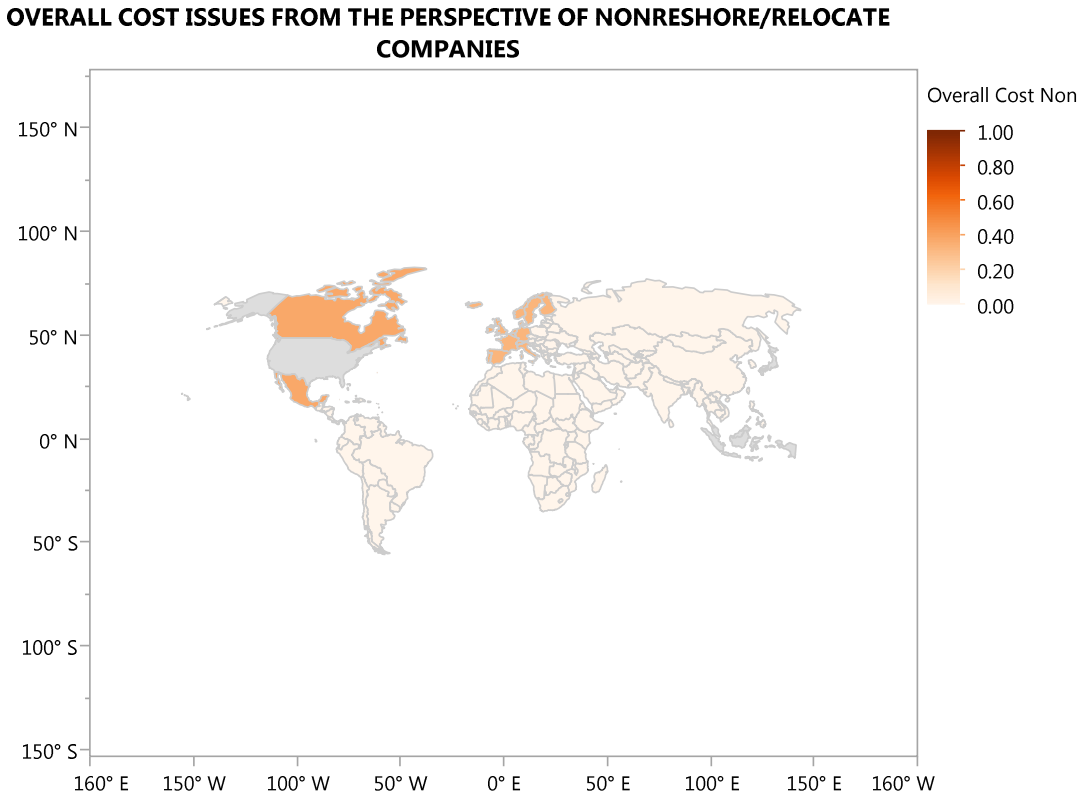


Figure 4-18: Overall Cost Issues from Perspective of Non-Reshore/Relocate Companies

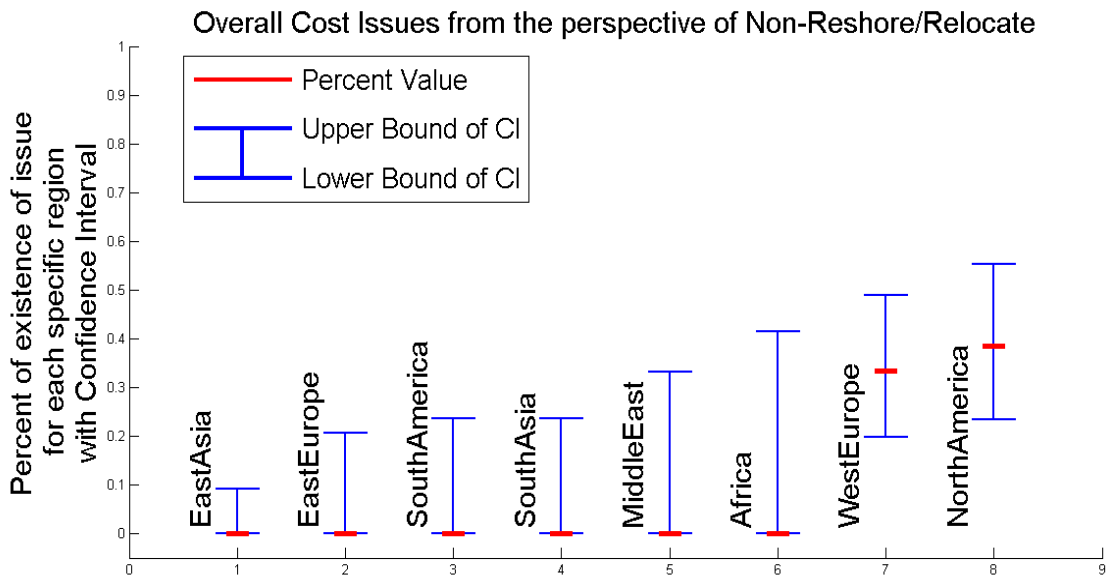


Figure 4-19: Confidence Intervals of Percentage of Existence of Overall Cost Issues for Different Regions from the Perspective of Non-Reshore/Relocate Companies

4.2.2 Overall Quality Issues

As far as overall quality issues from the perspective of US companies who have reshored and relocated their international suppliers are concerned, Figure 4-20 and Figure 4-21 show that there is a trend associated with quality issues with respect to different regions. Africa possesses the highest quality issues compared to other regions probably due to the lack of infrastructure and technology in this region. On the other hand, although high quality issues arising from Central and Eastern Europe might be surprising, this region includes countries that are newer members of European Union. Therefore, there is an obvious gap between this region and the Western Europe in terms of quality. In addition to these, there are also considerable quality issues in East and South Asia as well as South America. The confidence

intervals for percentages indicate a trend associated with the costs while there is quite a bit of overlap owing to the small sizes for each category.

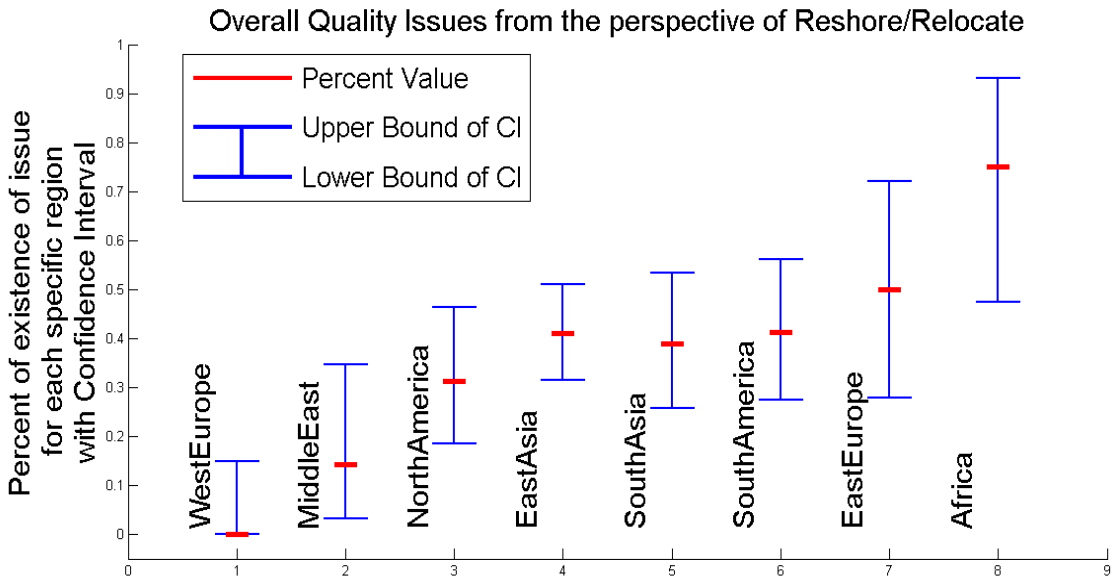


Figure 4-20: Confidence Intervals of Percentage of Existence of Quality Issues for Different Regions from the Perspective of Reshore/Relocate Companies

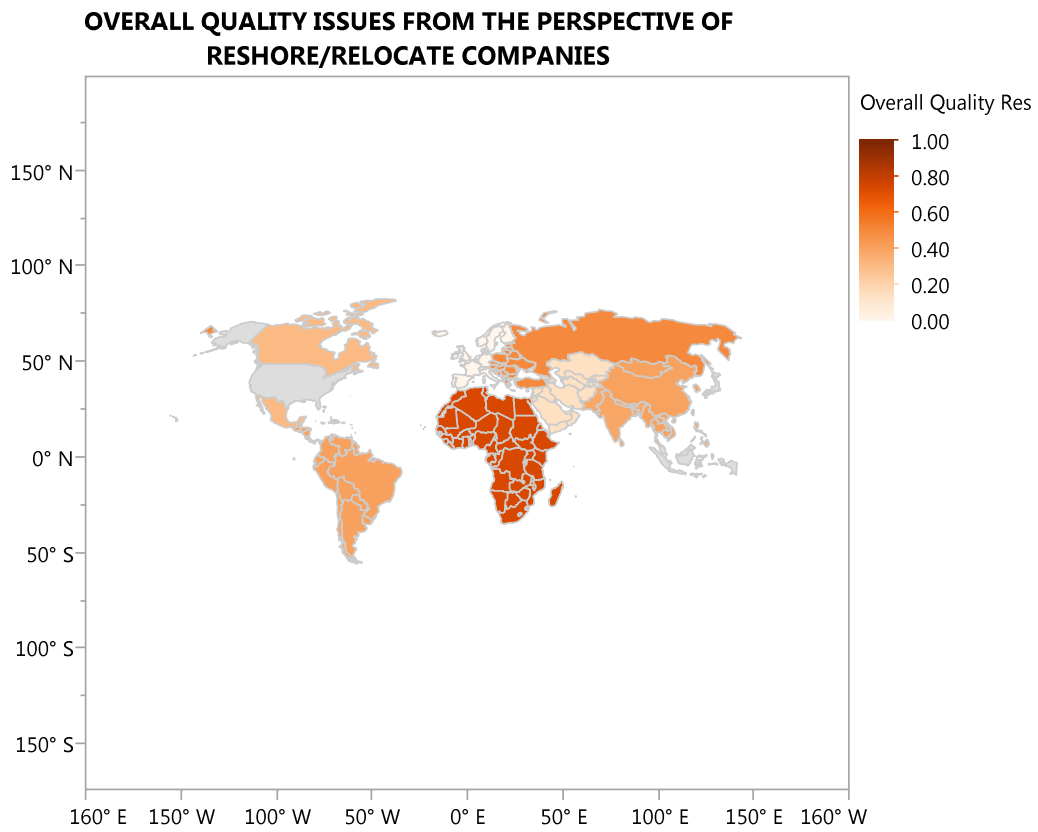


Figure 4-21: Overall Quality Issues from Perspective of Reshore/Relocate Companies

On the other hand, when the overall quality issues from the perspective of the non-reshore/relocate companies are examined, again a trend is observed with respect to different regions and there are some issues that arise from East Asia, South America and North America as seen in Figure 4-22 and Figure 4-23. However, again, these issues are not as intense as those in the case of companies who reshore/relocate their suppliers. Therefore, in terms of quality, the world is a better place in the eyes of non-reshore/relocate companies (i.e., they are happy with their suppliers' quality).

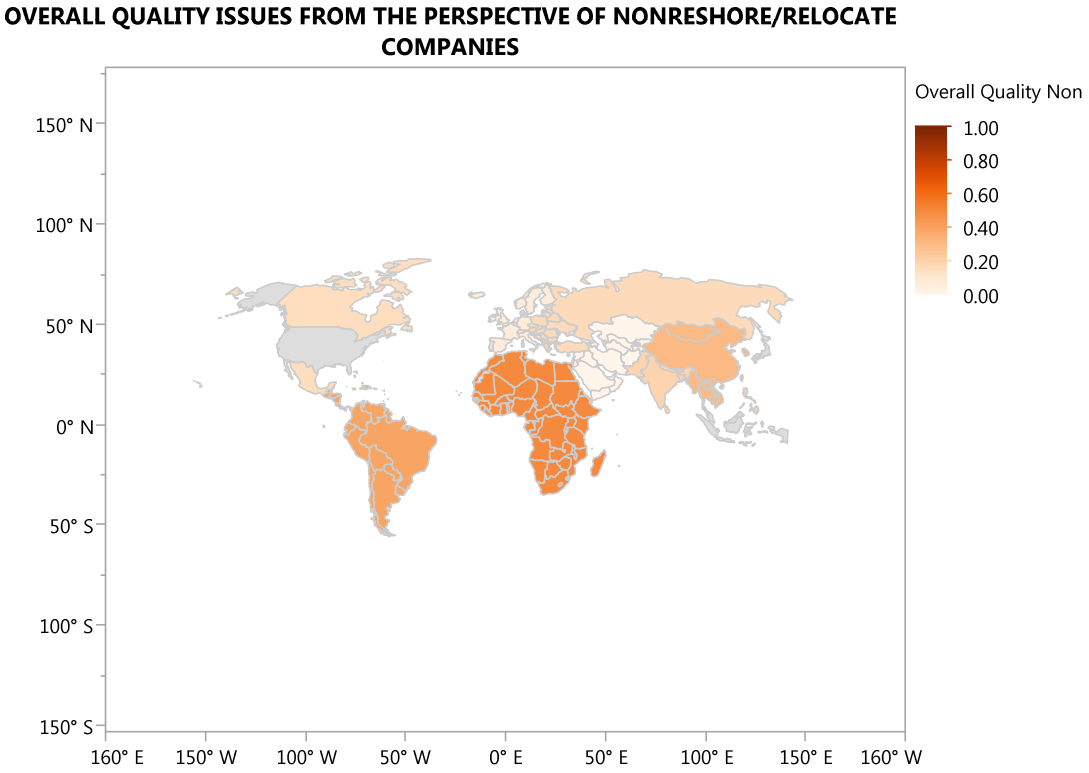


Figure 4-22: Overall Quality Issues from Perspective of Non-Reshore/Relocate Companies

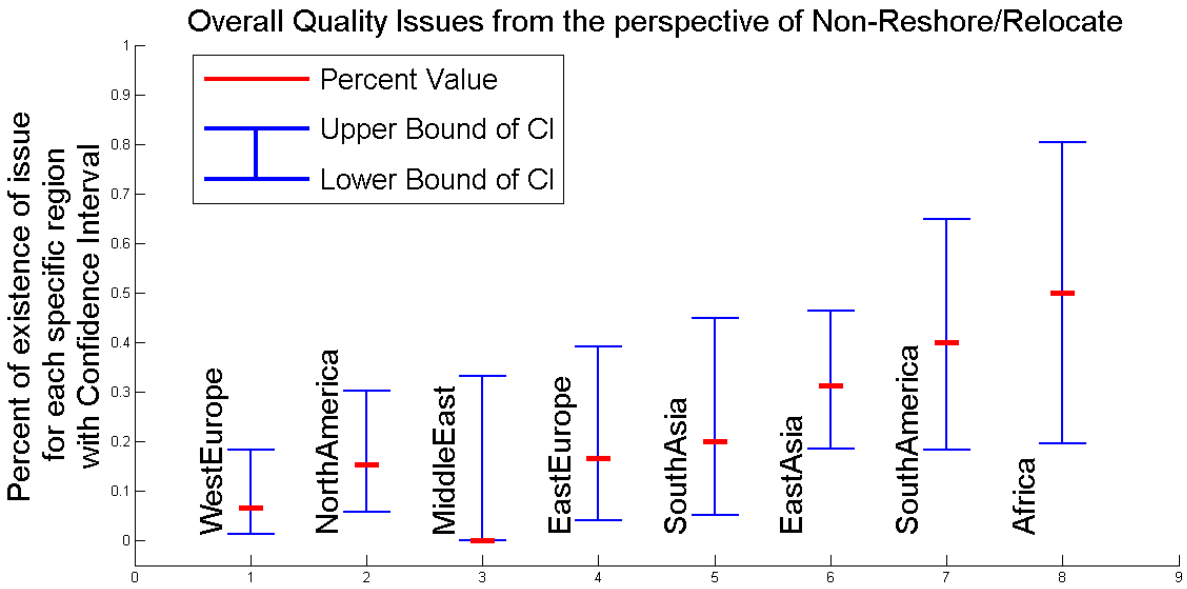


Figure 4-23: Confidence Intervals of Percentage of Existence of Quality Issues for Different Regions from the Perspective of Non-Reshore/Relocate Companies

4.2.3 Delivery Issues, Unavailability of Factors and Other Issues

For this section, these issues will be analyzed for all US companies (i.e., by not separating into two groups). As far as delivery issues are concerned, it is not surprising to see that there are many issues scattered throughout the world as seen in Figure 4-24 and 4-25. The confidence intervals for percentages indicate that there is a trend associated with the delivery issues while there is quite a bit of overlap owing to the small sizes for each category. These delivery issues occur mainly because of the distant location of the suppliers with respect to the US buyers as validated from the personal interviews. The longer distance will result in more complicated logistics which requires more complex distribution channels, and therefore will result in delivery issues. East Asia including China is seen as having the highest delivery problems. The large volume demands (i.e., cannot air ship products) and again the distance

from this region, especially from China, can be regarded as the main reasons behind these delivery problems as validated from the personal interviews. There are also issues arising from South Asia, South America, Africa, and Europe. Not surprisingly, delivery issues encountered during outsourcing from Canada and Mexico are among the least problematic ones for US companies.

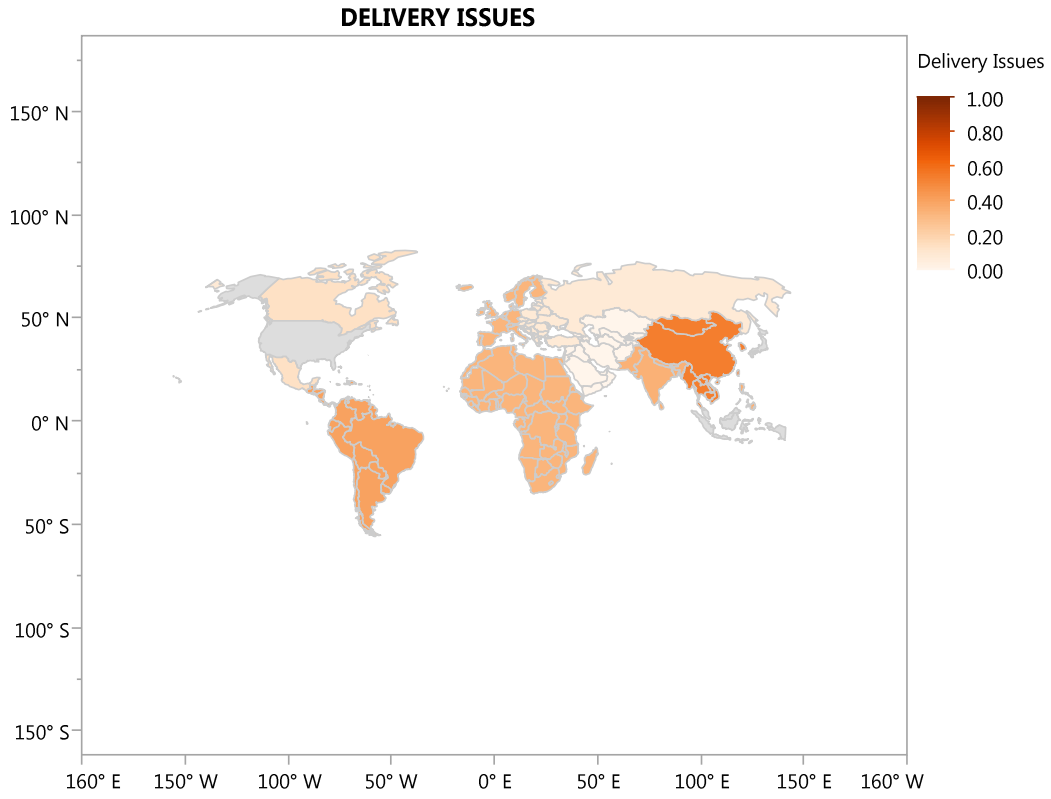


Figure 4-24: Overall Delivery Issues

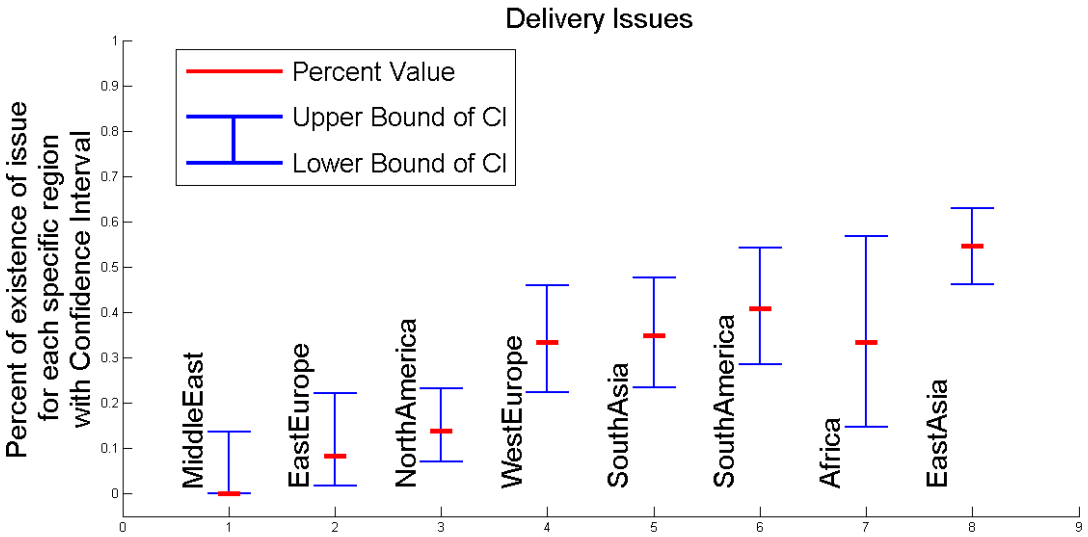


Figure 4-25: Confidence Intervals of Percentage of Existence of Overall Delivery Issues for Different Regions

When looking at the unavailability of factors such as raw and intermediate materials, labor, etc., there are issues in almost every region but the intensity of all of them are significantly low as seen in Figure 4-26 and Figure 4-27. Especially East Asia which includes China has the least percentage rate of this type of issue because this region has an important level of availability of factors in terms of raw and intermediate materials, labor, etc.

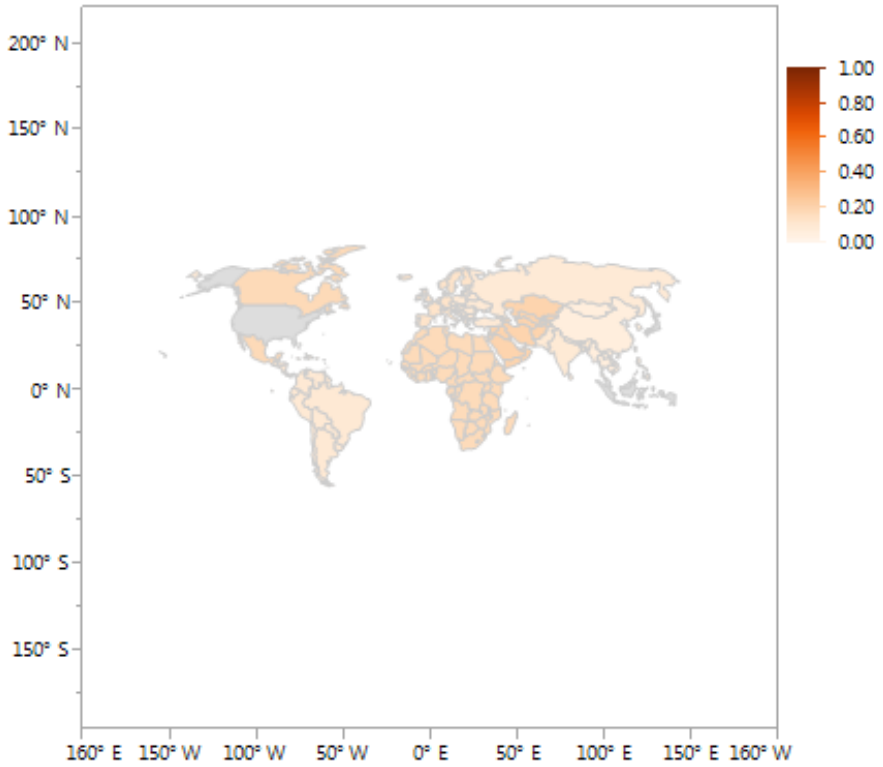


Figure 4-26: Unavailability Factors

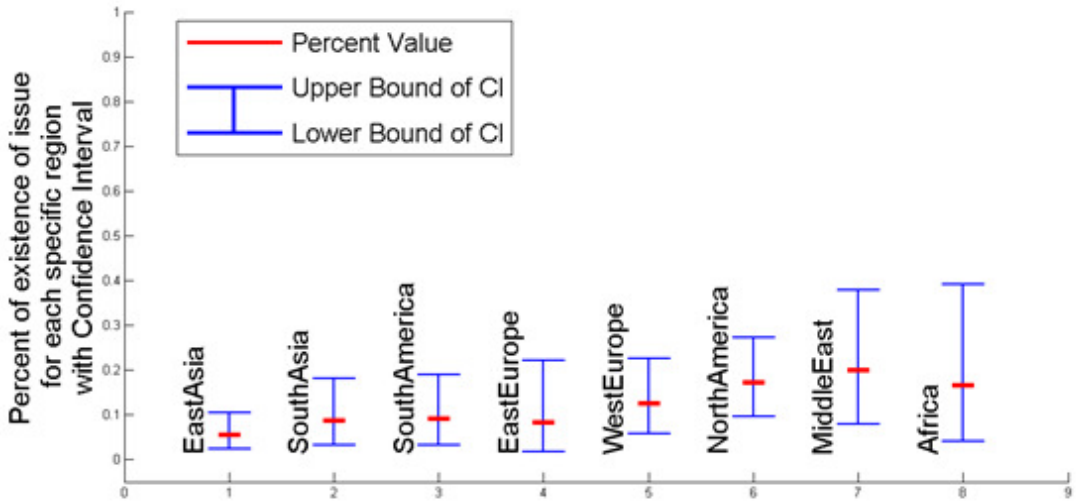


Figure 4-27: Confidence Intervals of Percentage of Existence of Unavailability of Factors

With regard to other issues including intellectual property protection and environmental issues, as one might expect as seen in Figure 4-28 and Figure 4-29, there are some issues encountered in South and East Asia as well as South America and Africa due to less governmental regulations in these regions.

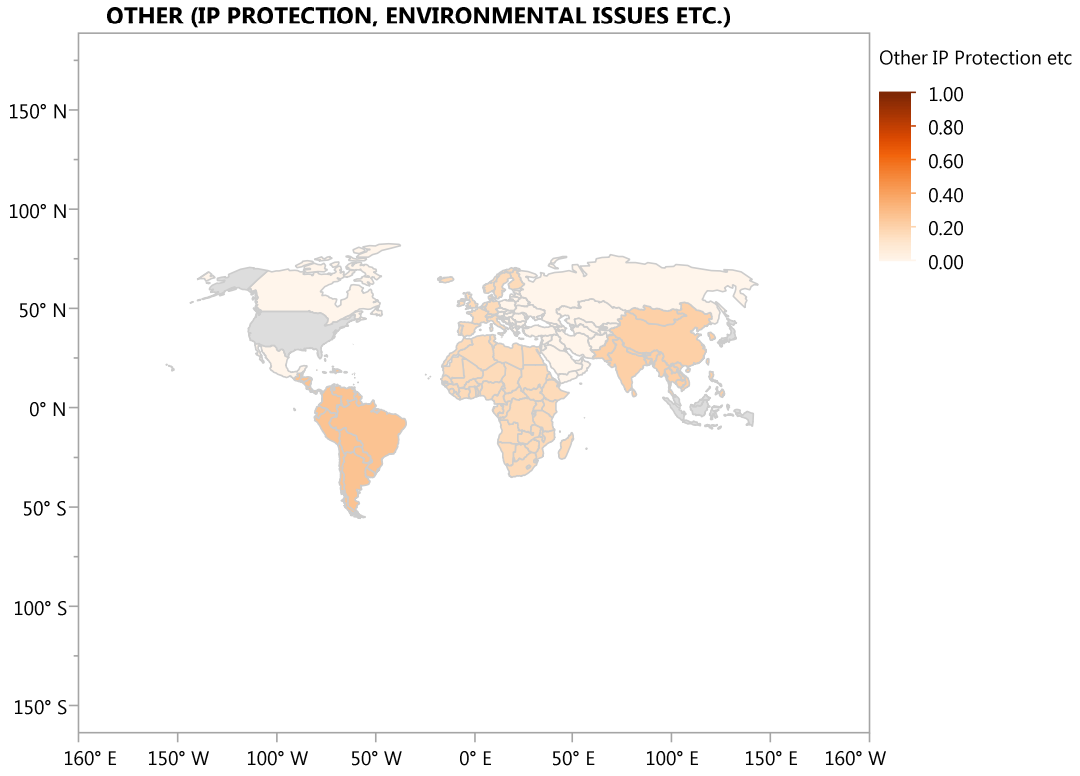


Figure 4-28: Other Issues (Environmental, IP Protection etc.)

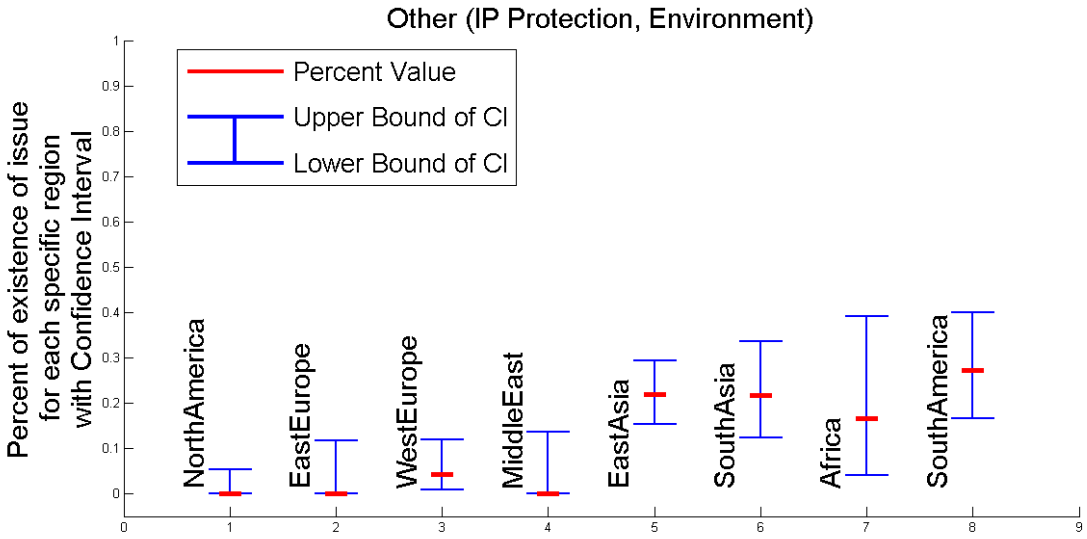


Figure 4-29: Confidence Intervals of Percentage of Existence of Other Issues Including IP Protection and Environmental Issues

4.3 Research Question 1-C Factors Due To Supplier Quality Part 1

The previous section showed that companies who change their suppliers tend to have issues with their current suppliers in terms of cost and quality. Research Question 1-c will be used to further analyze the dimensions of quality that most influence sourcing decisions. In order to answer this question, the direct and indirect quality as a factor of reshore and relocation of outsources will be analyzed. Survey respondents were asked if the following quality issues listed in Table 4-17 could be a factor in reshoring and relocation of their international suppliers.

Table 4-17: Quality Issues in Reshoring and Relocation Decisions

Issues in product quality of supplier
Issues in supply chain quality of supplier
Issues in management quality of supplier
Issues in workforce quality of supplier
Issues in process quality of supplier

Because these are 'YES-NO' questions, a rate of 50% of 'YES' creates an uncertainty about if the quality is a factor of reshore/ relocation. Therefore, the %50 level is marked with a dashed line to able to analyze the case better as seen in Figure 4-30.

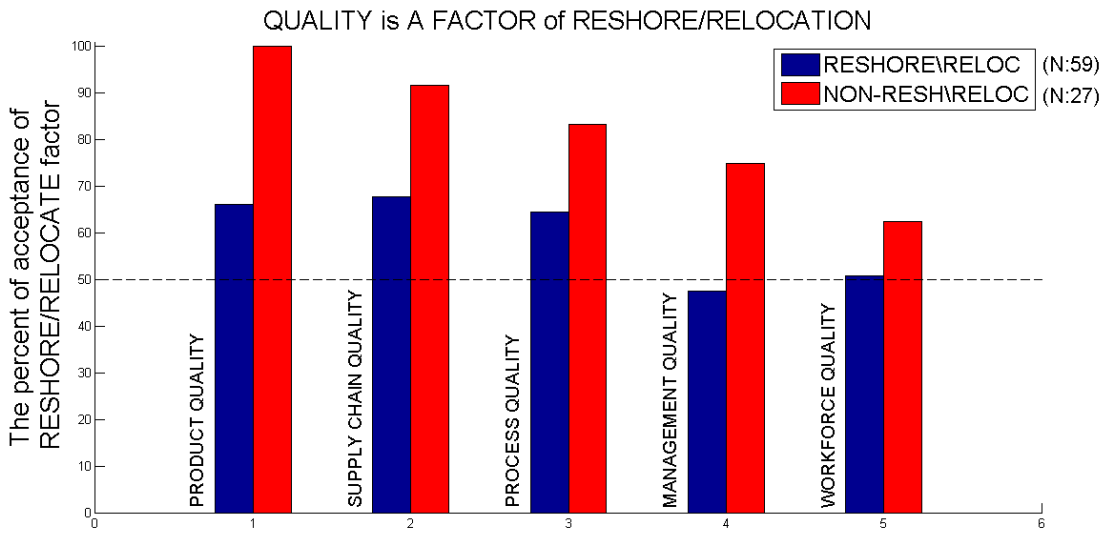


Figure 4-30: Quality as a Factor in Outsourcing Decisions

All of the non-reshore/relocate companies believe that product quality would be a factor for abandoning their suppliers. Moreover, all of the quality issues are more important in outsourcing decisions of non-reshore/relocate companies which have already been confirmed as being less oriented to cost as compared to companies who changed their

suppliers. As a whole, product quality and supply chain quality are the most important factors in outsourcing decisions of the companies. On the other hand, indirect qualities are less important in outsourcing decisions. In addition to these, on average around 70% of the non-reshore/relocate companies stated that management quality and workforce quality of the suppliers are important in their outsourcing decisions, whereas, this percentage is very small (around 50%) for those companies that reshored/relocated. Therefore, similar to the situation with the direct qualities, the indirect qualities are also more important for companies who did not change their international suppliers as compared to companies which changed their international suppliers. To further validate the results, Figure 4.31 shows the confidence intervals for the percentages by taking the sample sizes of each group into account for specific quality as a factor of reshore/relocation (Ross, 2003). Here, because the confidence intervals do not overlap, there is an obvious difference between reshore/relocate and non-reshore/relocate companies in terms of product quality, supply chain quality, workforce quality and process quality as a factor for their reshore/relocation decisions.

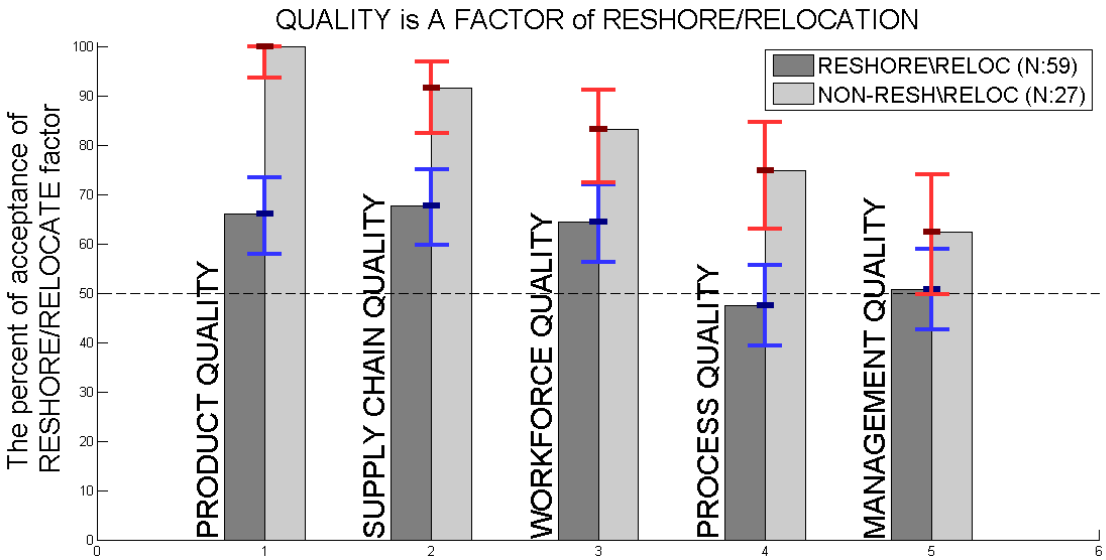


Figure 4-31: Confidence intervals of percentage of specific quality as a factor of reshore/relocation

4.4 Research Question 1.D. Factors Due To Supplier Quality Part 2:

The previous part associated with supplier quality suggested that companies would abandon their current supplier if they began to suffer from product quality of their suppliers. Research Question 1.d. will be used to explain the differences in quality performance that exist between international and domestic textile suppliers. To answer this question, the analysis will utilize Linear Discriminant Analysis (LDA) using three main phases as described in Figure 4-32. The first phase is to develop six quality features that will be used with LDA to do further analysis. After six quality features have been identified, in the second phase, a reshore threshold in terms of quality will be determined. Next in the final phase, the analysis utilizing LDA will determine the reshore vector which will be used to explain the difference between domestic and international suppliers.

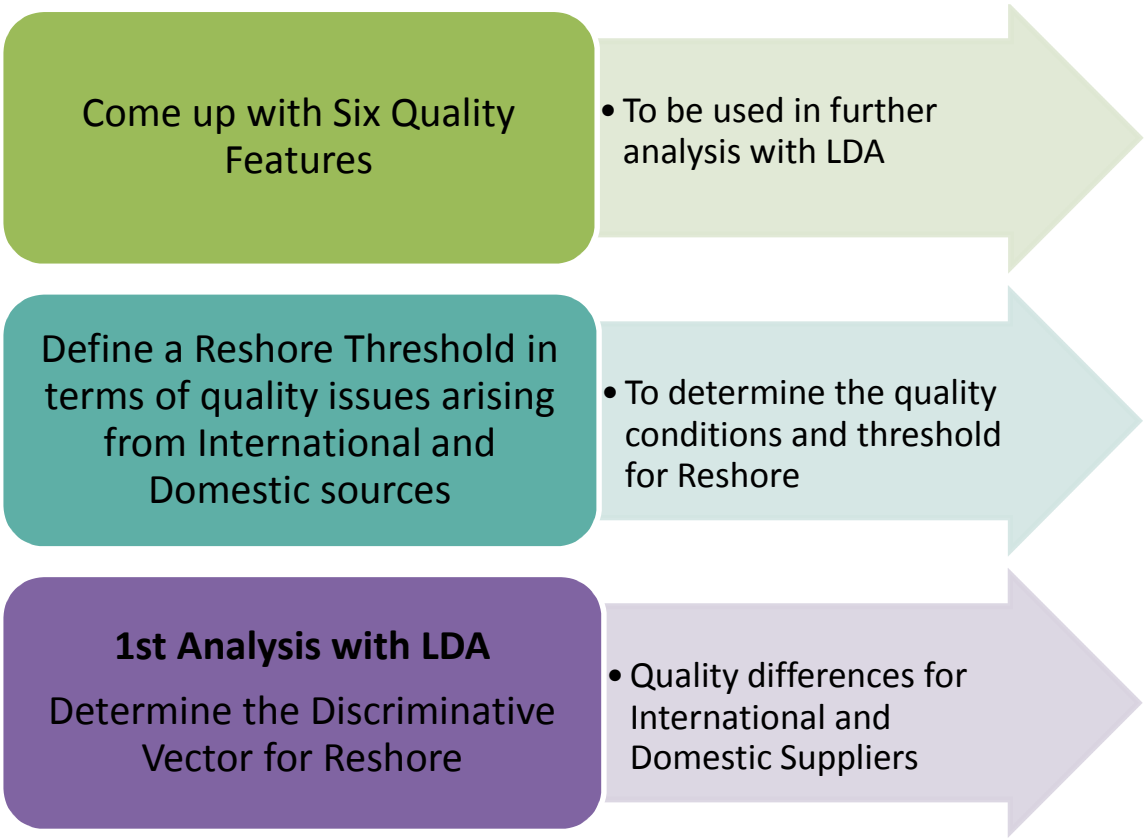


Figure 4-32: Details for each phase and analysis

4.4.1 First Phase: Six Quality Features

The goal in the first phase is to come up with quality features that summarize the quality issues encountered during sourcing efforts. In order to determine these quality features, the six quality issue categories from the survey will be utilized. Figure 4-34 summarizes the steps of the first phase using a flow diagram.

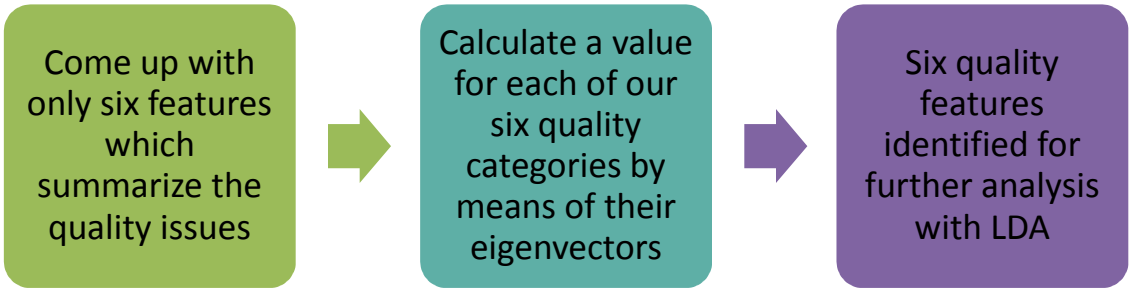


Figure 4-33: Flow Diagram of the Phases

The quality categories used in the survey represent the potential quality issues encountered during sourcing efforts by the companies. Again, these quality categories were determined after a rigorous literature review (see Chapter 2 for details). The six quality categories (i.e., *Supply Chain Quality, Product Quality, Product Quality Based Issues, Management Quality, Process Quality,* and *Workforce* Quality) are related to the issues of the suppliers. The first three quality categories will be defined as "Direct" or "Received Quality" whereas latter three will be defined as "Indirect Quality." Table 4-18 provides the items of each of the categories again.

Table 4-18: Six Quality Categories

*Received Quality Items		
Supply Chain Quality	**Product Quality**	**Product Quality Based Issues-Costs**
1-Fill rate (Rate of order fulfillment)	7-Product quality	10-Distributor rejection rates
2-Delivery time (Order lead time)	8-Product appearance	11-End customer returns
3-On time delivery rate	9-Meet specifications (Conformance)	12-Warranty costs
4-% of perfect orders		13-Incoming goods inspection costs
5-Accurate and precise information sharing		14-Local onsite inspection costs
6-Fast response		

*Indirect Quality Items		
Supplier Management Quality	**Supplier Workforce Quality**	**Supplier Process Quality**
15-Overall management of the supplier	19-Training level	22-Design and development capability
16-Communication and cooperation ability	20-Skills and experience	23-Ability to modify products
17-Documentation and self-inspection	21-Productivity	24-Process technology
18-Quality management practices and systems		25-Level of automation
		26-Work safety

Now that the six quality categories have been identified, the next step is to develop a method to determine a single value that best represents all the items of a corresponding category for each respondent. Similar to the previous discussion in question 1-a, the eigenvectors with the highest eigenvalue for these calculations will be used. Tables 4-19 through 4-21 list the eigenvectors of the most important principal components for each of the

six quality categories respectively. In other words, these tables provide the weights for each item within that factor.

Table 4-19: Weights for Items of Supply Chain Quality and Product Quality Categories

Item – Supply Chain Quality	Weight		Item – Product Quality	Weight
FILL RATE	0.40788		PRODUCT QUALITY	0.59337
DELIVERY TIME	0.47042		PRODUCT APPEARANCE	0.54354
ON TIME DELIVERY RATE	0.44883		MEET SPECIFICATIONS	0.59370
% OF PERFECT ORDERS	0.31841			
ACCURATE and PRECISE INFORMATION SHARING	0.38314			
FAST RESPONSE TO REQUESTS	0.40337			

Table 4-20: Weights for Items of Product Quality Based and Management Quality Categories

Item – Product Quality Based	Weight		Item – Management Quality	Weight
DISTRIBUTOR / RETAILER REJECTION RATES	0.41712		OVERALL MANAGEMENT of the SUPPLIER	0.47440
END CUSTOMER RETURNS	0.47261		COMMUNICATION and COOPERATION ABILITY	0.52692
RETURNS and WARRANTY COSTS	0.47361		DOCUMENTATION and SELF INSPECTION	0.48399
INCOMING GOODS INSPECTION COST	0.44360		QUALITY MANAGEMENT PRACTICES and SYSTEMS	0.51289
LOCAL ONSITE INSPECTION COSTS	0.42611			

Table 4-21: Weights for Items of Workforce and Process Quality Categories

Item – Workforce Quality	Weight		Item – Process Quality	Weight
TRAINING LEVEL	0.58798		DESIGN/DEVELOPMENT CAPABILITY	0.47731
SKILLS and EXPERIENCE	0.59936		ABILITY TO MODIFY PRODUCTS	0.45489
PRODUCTIVITY	0.54318		PROCESS TECHNOLOGY	0.46651
			LEVEL of AUTOMATION	0.44342
			WORK SAFETY	0.38859

Similarly, value of each quality category for each respondent is calculated according to the following formula:

$$Factor\ Value = X_1 w_1 + X_2 w_2 + \cdots + X_n w_n$$

where;

$$X_i = observed\ value\ of\ the\ i^{th} item\ within\ the\ factor$$

$$w_i = weight\ (corresponding\ component\ of\ the\ eigenvector)\ of\ the\ i^{th} item$$

4.4.2 Definition of 'Reshore Threshold'

The six quality features have been identified by the means of the method mentioned above to convert each respondent's items into a single value for each category. Before the further LDA based analysis is performed, the definition of the reshore threshold needs to be

determined. The goal is to define a *reshore threshold* in terms of quality by examining the quality issues arising from international and domestic suppliers. In other words, a quality threshold needs to be determined that would separate the domestic suppliers from the international suppliers in terms of their quality levels. The *reshore threshold* is defined as a threshold that separates the domestic suppliers from the international suppliers regarding their quality levels and makes it advantageous to choose a domestic supplier over an international supplier. The lower side of the reshore threshold represents worse quality conditions where most of the international suppliers would be located as seen in Figure 4-34. On the other hand, the upper side of the reshore threshold represents better quality conditions where most of the domestic suppliers would be located. And, these domestic suppliers are likely to be chosen over international suppliers which are located below the threshold level.

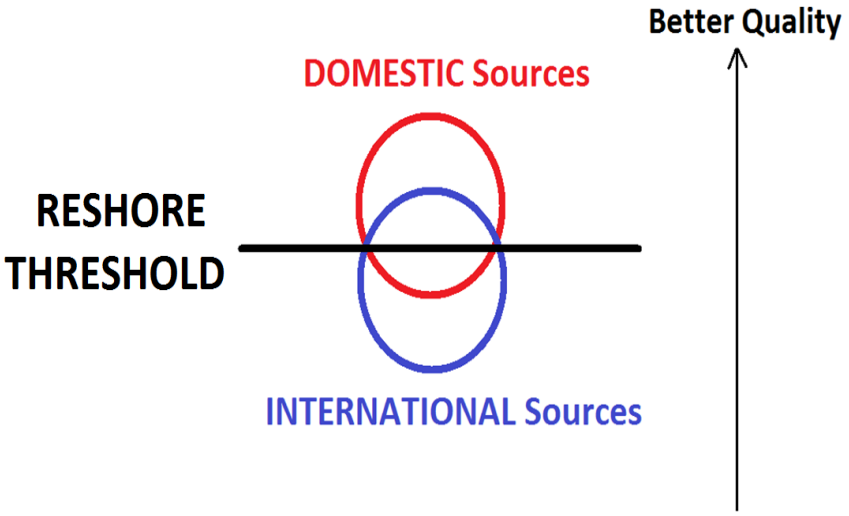


Figure 4-34: Reshore Threshold

According to this definition, an international supplier which is located under the reshore threshold would have bad quality conditions and could be substituted with a domestic supplier who has better quality conditions. Therefore, any quality implementation in international suppliers which increases their quality conditions will inhibit US companies from substituting them with a better domestic supplier. In other words, it is conjectured that implementation of a quality initiative in international suppliers can inhibit reshoring activities of US buyer companies. Therefore, for an international supplier to stay competitive in the presence of qualified domestic suppliers, it must increase its quality levels by the means of these types of initiatives. Ultimately, the goal is to determine which quality initiatives are more effective in improving quality in international suppliers and thus affecting sourcing decisions.

It should be noted that the decision to reshore is not solely a quality-oriented decision and there are several other reasons/factors for reshoring activities. However, quality does have a contribution to these reshoring decisions. Therefore, when discussing inhibiting or preventing reshore activity, the discussion will center on reaching a quality condition within an international supplier which does not encourage US companies to reshore. In the presence of high quality conditions in its international suppliers, a US company may still choose to reshore for other reasons, which is not the subject of this section.

4.4.3 Using LDA to Distinguish International and Domestic Suppliers

In order to distinguish international and domestic suppliers and determine these thresholds, the six quality features will be used in a linear discriminant analysis (LDA).Linear

discriminant analysis (LDA) is a method of finding a linear combination of features which best discriminate two or more classes. The weights within the discriminative linear combination (or equation) represent the importance levels of the corresponding features for discrimination of the classes. From this perspective, in the case of only two classes to be separated (i.e., domestic and international suppliers), a first assumption about the most discriminative direction can be simply proposed to be the vector which is the subtraction of the mean vectors of these two classes. By the means of this proposal, the feature which has the highest mean difference for these two classes must have the highest importance level in the discrimination (i.e., the feature with the highest weight). However, the distance or difference between means on each feature is not a good measure since it does not take the standard deviation of the classes into account along the corresponding features (Gutierrez-Osuna, 2014). Because of this reason, LDA is developed as the algorithm which finds the vector (or direction) along which the ratio of the variance between the classes to the variance within the classes is maximized (Welling, 2014). As a result, LDA takes into consideration both the means and the standard deviations of the classes concurrently during determination of the most discriminative linear combination of features. Therefore, LDA is an appropriate method for the robust and reliable discrimination of international and domestic suppliers in terms of quality issues. The assumption of homogeneous covariance matrices is met and the data does not deviate from normality. For the sake of robustness, there are some normality assumptions that have been proposed for some types of algorithms of LDA. However, there are a lot of studies which investigated and proved that the LDA does work quite successfully unless the data violates the normality conditions too harshly (Pohar et al., 2004). There are

even academic books and sources which explicitly state the non-normality is not fatal in linear discriminant analysis and the resultant tests are reliable (Tabachnick and Fidell, 2006). Consequently, under this practical and flexible framework of LDA, the differences between international and domestic suppliers in terms of issues in quality will be analyzed and then utilized to creatively determine a reshore vector.

The goal in this analysis is to attain the weights for each of these quality features, thus, to attain a discriminative vector for reshore. Using 149 samples, the LDA is conducted to attain a combination of weights that represent the quality conditions for international suppliers with respect to domestic suppliers using all six categories which are provided in Table 4-22.

Table 4-22: Ordered Weights of Six Quality Features for International Suppliers – Reshore Vector

FeatNo	Weigth	Name	Descriprition
1	-0.53	MQ	Management Quality
2	-0.49	PCQ	Process Quality
3	-0.40	SCQ	Supply Chain Quality
4	-0.37	PQ	Product Quality
5	-0.33	WFQ	Workforce Quality
6	-0.27	PBQ	Product Quality Based Issues

Since all of the weights for every quality feature are negative, it can be concluded that these quality features are worse for international suppliers as compared to domestic suppliers based on the 149 respondents. Therefore, an international supplier yields worse quality conditions compared to domestic suppliers for all six quality features. Because these are ranked order of weights of the quality features, the management quality feature has the most discriminative power in explaining the difference between the international and domestic suppliers. In other words, the largest gap between the international and domestic suppliers' quality occurs in management quality feature. Management quality is followed by process

quality and supply chain quality. This combination of weights can be regarded as a six dimensional vector which represents '*Bad Quality'* or '*Reshore*' direction.

4.5 Research Question 2.A.Quality Strategies in Suppliers:

The previous section utilized LDA to determine that with regard to the six quality features, international suppliers can be concluded to be worse. As continuation, Research Question 2.a. will identify the most effective quality improvement strategies in suppliers and the impact that these strategies have on sourcing decisions of US buyer companies (i.e., can quality implementations inhibit reshore activities).

The goal of the second analysis by the means of LDA is to find which quality implementations most help quality improvement in international suppliers. Here, a separate LDA is conducted for international suppliers who have Six Sigma implementation, who have Lean implementation, who have TQM implementation, and who have ISO implementation strategies versus those who do not. For each of these quality implementations, a discriminative vector is obtained similar to the previous section. The angle θ between these vectors and the reshore vector can be calculated by the means of the following formula:

$$\vec{u}_{reshore} = [w_1 w_2 \dots w_n]$$

$$\vec{u}_{qualimp} = [v_1 v_2 \dots v \quad]$$

$$\theta = \cos^{-1}\left(\vec{u}_{reshore}.\vec{u}_{qualimp}\right) = \cos^{-1}(w_1 v_1 + w_2 v_2 + \cdots + w_n v_n)$$

where,

$$\vec{u}_{reshore} = reshore\ vector$$

$$\vec{u}_{qualimp} = quality\ implementation\ vector\ (Lean, Six\ Sigma, TQM, ISO)$$

When the angular differences are compared between the quality implementation vectors and the reshore vector in accordance with these equations, the Six Sigma and Lean vectors almost align in the opposite direction of the reshore vector as seen in Figure 4-35. This means that the Lean and Six Sigma implementations in international suppliers are the ones which can best reverse the bad quality conditions into good conditions. In other words, it can be concluded that implementation of Six Sigma and Lean strategies can increase the quality conditions of these international suppliers to the level of domestic suppliers' quality. Therefore, Six Sigma and Lean implementations in international suppliers will inhibit US companies from substituting them with domestic suppliers. Subsequently, these implementations will inhibit reshoring activities of US companies' sourcing.

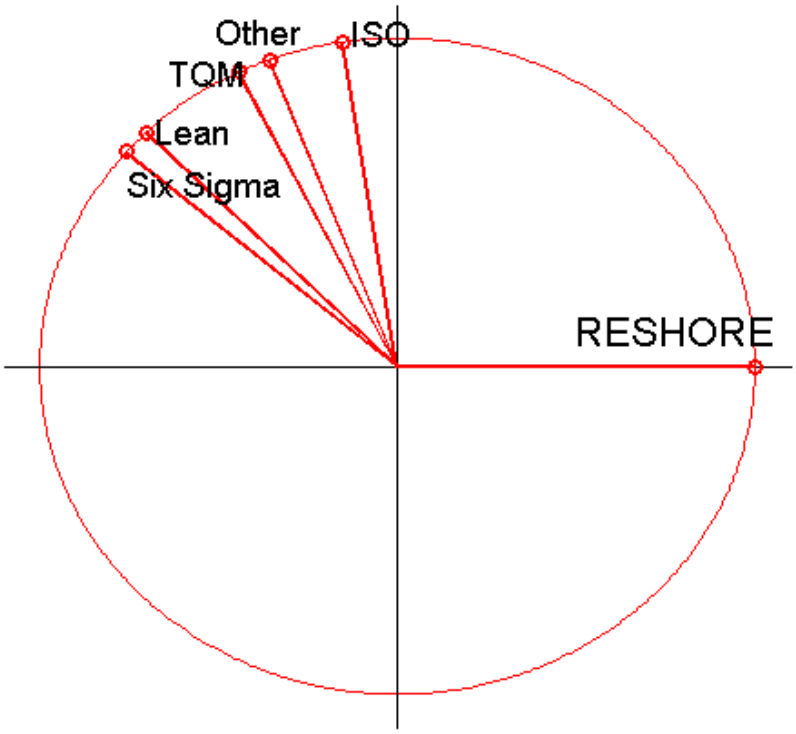


Figure 4-35: Discriminative Vectors for Different Quality Iniatives, and Their Angular Differences with Reshore Vector

When the Six Sigma vector is examined in detail in Table 4-23, the Six Sigma vector has almost all of positive weights as opposed to the reshore vector in Table 4-22. This means that the implementation of Six Sigma in international suppliers converts the negative quality conditions into positive quality conditions. The biggest improvement occurs in product quality which was one of the driving reasons in that US buyers might change suppliers as seen in Section 4.3 (Research Question 1-C). Because these results are attained from the perspective of the buyer companies, finding the biggest improvement in product quality for Six Sigma is very reasonable. If these were from the perspective of actual suppliers, the

biggest improvement could be seen in process quality as a result of a Six Sigma implementation.

Table 4-23: Weights of Six Quality Features for Six Sigma

Six Sigma

FeatNo	Weigth	Name	Descriprition
1	0.74	PQ	Product Quality
2	0.45	MQ	Management Quality
3	0.45	SCQ	Supply Chain Quality
4	0.19	PBQ	Product Quality Based Issues
5	0.10	PCQ	Process Quality
6	-0.09	WFQ	Workforce Quality

As it can be seen from Table 4-24, a similar pattern exists for Lean implementations. However, for Total Quality Management (TQM) vector as seen in Table 4-25, half of the weights are positive while the other half of the weights are close to 0 from negative side. This means that TQM is not perceived as effective as Six Sigma and Lean implementations in improving the overall quality in international suppliers.

Table 4-24: Weights of Six Quality Features for Lean

Lean			
FeatNo	**Weigth**	**Name**	**Descriprition**
1	0.73	PQ	Product Quality
2	0.48	SCQ	Supply Chain Quality
3	0.42	MQ	Management Quality
4	0.12	PBQ	Product Quality Based Issues
5	0.11	PCQ	Process Quality
6	-0.20	WFQ	Workforce Quality

Table 4-25: Weights of Six Quality Features for TQM

TQM			
FeatNo	**Weigth**	**Name**	**Descriprition**
1	0.79	SCQ	Supply Chain Quality
2	0.41	PQ	Product Quality
3	0.33	MQ	Management Quality
4	-0.11	PBQ	Product Quality Based Issues
5	-0.20	PCQ	Process Quality
6	-0.20	WFQ	Workforce Quality

In summary, the existence of Six Sigma and Lean implementations in international suppliers can reverse *bad quality* conditions into *good quality* conditions. To emphasize again, increased quality levels in international suppliers will reduce the quality-based reasons for replacement of these suppliers with domestic ones. Therefore, these two quality implementations can inhibit reshoring efforts of US companies and considered as the most important quality implementation techniques that most effect sourcing decisions.

4.6 Research Question 2.B. Providing Help for Quality Improvements in Suppliers:

Since it has been determined that Lean and Six Sigma implementation can help improve quality within suppliers and prohibits relocating/reshoring, Research Question 2.b will be used to identify how involved US companies are in supporting their international and domestic suppliers and how it impacts quality. Even though it seems quite challenging, for the sake of maintaining long-term relations with their suppliers, US companies sometimes can choose to provide help in implementations of quality initiatives to both their international and domestic suppliers. Providing this type of help can increase quality and performance of the suppliers which allows US buyers (i.e., those that source) to maintain their relations with their current suppliers. Even though it appears that it is mostly beneficial for the suppliers, there are many benefits and advantages of US companies that build long-term relations with their suppliers by avoiding the painful supplier switching costs.

Because of the reasons mentioned above, it will be observed that a portion of US companies are really willing to provide their suppliers with help on implementing quality initiatives, even for the complicated ones such as Six Sigma and Lean. Below in the pie charts of Figure 4-36, the percent of US companies which provide their supplier with help in

quality implementation as well as the percent who provide technical assistance are presented. Technical assistance includes providing advice, assistance, and training pertaining to the installation, operation and maintenance of the equipment. Technical assistance and help in quality implementations questions are asked separately to eliminate the misinterpretations. Note that the number of companies who have international suppliers is 70 while those that have domestic suppliers is 75.

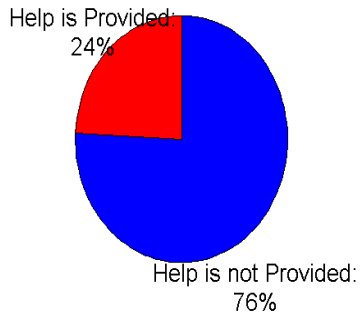
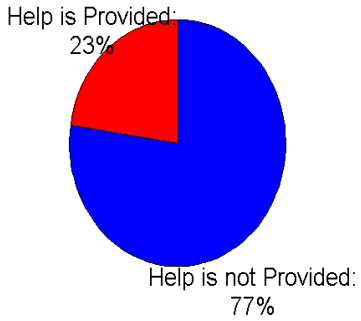
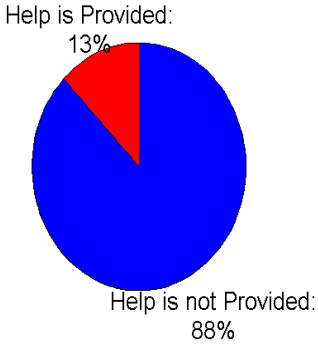
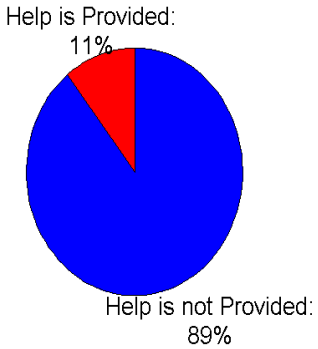
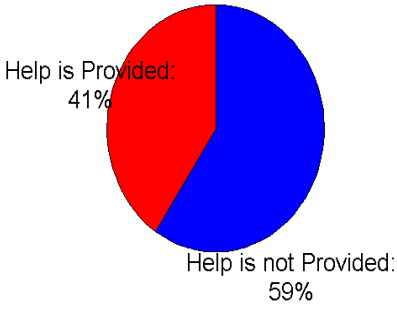
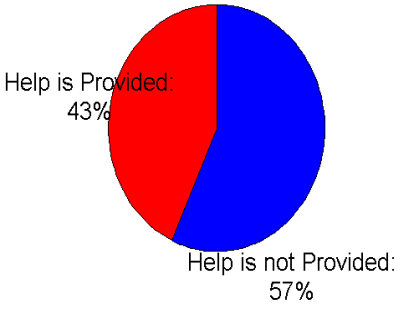
	TO INTERNATIONAL SUPPLIERS	TO DOMESTIC SUPPLIERS
Help in implementation of any quality initiatives (Lean, Six Sigma, ISO and other)		
Help in implementation of **only Lean and Six Sigma**		
Technical Assistance		

Figure 4-36: The percentages of US companies which provide their supplier with help in quality implementation

As observed, the percentages of US companies who are willing to provide help in quality implementations or technical assistance to international suppliers versus domestic ones are almost the same. In other words, even though it might seem that it is more difficult to provide help to international suppliers, the rate of providing help to domestic suppliers versus that of international suppliers are basically the same. And not surprisingly, only a small portion of US companies (i.e., around 10%) provides help for Lean and Six Sigma. However, a larger portion (i.e., around 45%) provides technical assistance to their suppliers. However, in the next part, it will be showed that technical assistance is not as effective as providing help in quality implementations.

Next, if a US company provides help to their supplies, does it impact the quality? In order to answer this question, the six quality features will be used to identify the quality differences for the suppliers of different types of companies. Here, company type refers to three different groups of companies in terms of providing help to their suppliers or not (i.e., provide quality and technical help, technical help only, and no help). If a company is in *QualityTech* group then these companies provide help or training to their suppliers in implementation of a quality initiative (i.e. Six Sigma, Lean, TQM and ISO) as well as provide technical assistance. If a company only provided only technical assistance to their suppliers, they would be in the *Tech Only* group and the remaining companies which neither assisted their suppliers in implementation of a quality initiative nor with any technical issues are in the *No Help* group. Here, it is important to note that we do not have *Quality Only* group because there are only two companies who solely provide help for quality initiative implementation but not technical assistance. Therefore, the hypothesis that is tested claims

that the companies of different help groups (i.e., quality and technical help, technical help only, and no help) will differ in their supplier quality levels.

H_0: "QualityTech= TechOnly = No Help" The supplier quality levels for these companies are all the same.

H_1: At least one of the company groups differs from others.

To test the validity of this hypothesis, ANOVA using the Kruskal-Wallis test and the multiple comparison tests using the Steel-Dwass method were used again. The result of Kruskal-Wallis test (i.e., χ^2= 6.2065, p-value=0.0449) determines that the supplier quality level differs statistically significantly for different types of companies (i.e., the null hypothesis is rejected). The Steel-Dwass method shows that there are significant differences in supplier quality levels between *Quality&Tech* and *No-help* companies (i.e., p-value = 0.0351) as seen in Table 4-26. It can be concluded that providing suppliers with help in implementation of a quality initiative, i.e. Six Sigma, Lean, TQM and ISO combined with providing technical assistance can increase the supply chain quality including delivery, fill rate, flexibility, information sharing quality, etc. However, there are no statistically significant differences between providing technical assistance only or providing no help at all. Note that higher numbers mean that the supplier quality is better according to the original Likert scale for quality issues where one meant very problematic and seven meant no problems at all.

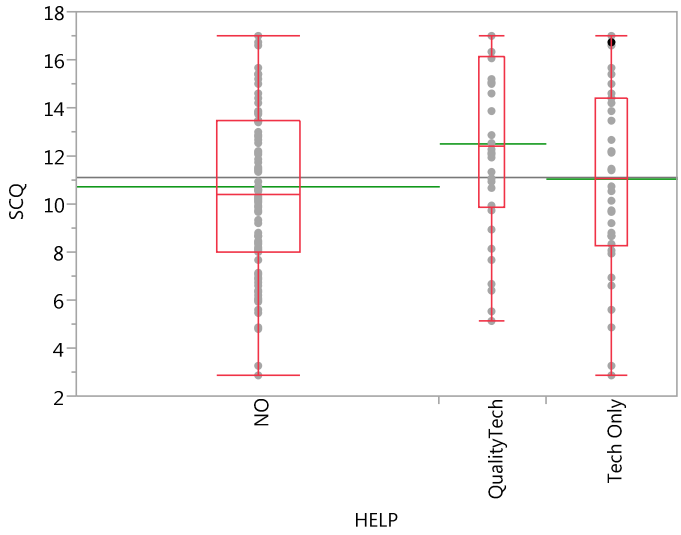


Figure 4-37: Means and Box Plots for Three Groups

Table 4-26: Results of Steel-Dwass Test

Level	- Level	Score Mean Difference	Z	p-Value	Lower CL	Upper CL
QualityTech	No Help	20.9939	2.4793	0.0351*	0.0000	3.7627
Tech Only	No Help	4.8483	0.5888	0.8262	-1.3078	2.0906
Tech Only	QualityTech	-8.4356	-1.6578	0.2216	-3.7467	0.6224

Similarly, the differences with regard to workforce and process quality of suppliers for companies who provide help vs. not are examined. The results of Kruskal-Wallis and multiple comparison tests using Steel-Dwass method indicate that supplier workforce and process quality levels differ statistically significantly for *Quality&Tech* and *No-help* companies as seen in Figure 4-38. Again, providing suppliers with help in implementation of a quality initiative (i.e. Six Sigma, Lean, TQM and ISO) combined with technical assistance can improve workforce and process quality conditions in suppliers while technical assistance

provides no significant improvement. It can be observed that even though technical assistance is also decreasing the complaints in supplier at some rate, it is not as effective alone. Therefore, any form of help in quality implementation within the suppliers combined with technical assistance will help improve suppliers' processes, development capabilities as well as their worker skills and productivity.

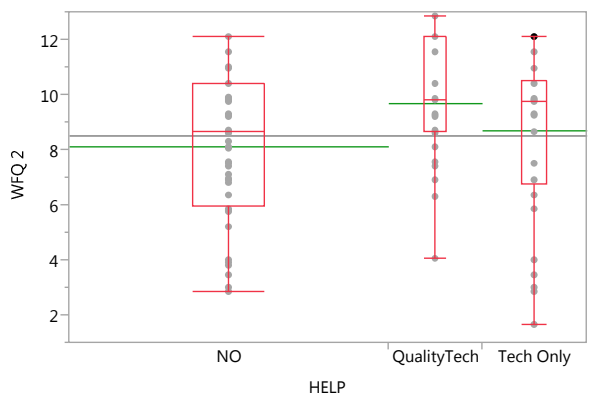
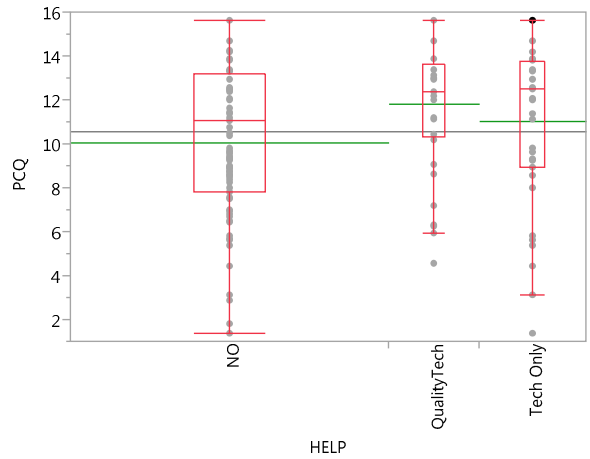
	Box Plot, Means	Kruskal-Wallis (p-value)	Level	Steel-Dwass (p-value)
Workforce Quality by Company Type		0.02341	Quality& Tech -NO	0.0315
Process Quality by Company Type		0.0248	Quality& Tech -NO	0.0403

Figure 4-38: Workforce Quality and Process Quality by Company Type Analysis Results

4.7 Research Question 2.C: Challenges and Barriers for Quality Implementations:

Implementing quality initiatives can help improve quality which will potentially prevent companies from relocating/reshoring their current suppliers. The previous section demonstrated providing quality initiative help along with technical assistance can help improve the quality within a company's suppliers. Research question 2.c. will identify the challenges and barriers of implementing process improvement strategies in suppliers or providing help to suppliers on this subject. In order to answer this question, the respondents were asked about the potential challenges which can be encountered during collaboration with suppliers. In order to determine the differences between the international and domestic suppliers in terms of challenges in implementation of quality initiatives or in providing the suppliers with help on these initiatives, another linear discriminant analysis was conducted. These findings will be further validated by the means of hypothesis testing using the Wilcoxon tests.

For each of the six features associated with challenges of implementing or helping, the LDA based analysis will attain a combination of weights that represent the challenges for international suppliers with respect to domestic suppliers. Because all of the weights for every challenge features as seen in Table 4-27 are negative, it can be concluded that these challenges are all higher for international suppliers compared to domestic suppliers. Therefore, in general, implementation of a quality initiative and providing help for implementation of a quality initiative is more challenging in international suppliers as compared to domestic suppliers. In other words, problems encountered during the

implementation of quality initiatives or providing help for implementation of quality initiatives in international suppliers exceed the problems with domestic suppliers.

Table 4-27: Ordered Weights of Six Challenge Features for International Suppliers

Weight	Description
-0.75	TIME COST AND EXPENSE TO VISIT SUPPLIER
-0.51	INFORMATION EXCHANGE WITH SUPPLIERS
-0.35	MANAGEMENT STYLE IN SUPPLIERS
-0.17	LACK OF AWARENESS IN QUALITY MANAGEMENT METHODS (Lean, Six Sigma etc.)
-0.11	RELUCTANCY OF EMPLOYEE IN PARTICIPATION IN QUALITY IMPLEMENTATIONS
-0.10	OTHER
-0.07	SUPPLIER TRAINING COSTS

Since Table 4-27 shows a ranked order of weights of the challenges, it seems realistic that the time, cost and expense to visit suppliers' facilities feature has the most discriminative power in explaining the difference between the international and domestic suppliers. In other words, time cost and expense to visit suppliers' facilities is a very challenging factor for international suppliers as compared to domestic suppliers. This can be attributed mainly due to the location and proximity of the domestic suppliers. Physical and in-person

communication and collaboration are much easier and faster with local partners compared to international ones.

Time cost and expense to visit suppliers' facilities is followed by information exchange and management style. Information exchange with international suppliers raises higher barriers compared to domestic suppliers. These problems may arise from language barriers as well as distant location of these suppliers even in the presence of high tech communication and information exchange tools. In addition to information exchange issues, management style in international suppliers raises higher barriers compared to domestic suppliers. Cultural differences with international suppliers can be reflected on managerial behaviors leading to various conflicts between the buyer and supplier companies.

For the top three challenges, Wilcoxon tests are conducted to stastically verify that "Time Cost to Visit Supplier, Information Exchange, and Management Style" are more challenging in international suppliers compared to domestic suppliers.Because all the test results are significant (i.e., p-value less than 0.01) as seen in Figure 4-39, the null hypothesis of all three tests are rejected, which verifies the findings from LDA based analysis. Therefore, in general, implementation of a quality initiative and providing help for implementation of a quality initiative is more challenging in international suppliers as compared to domestic Suppliers.

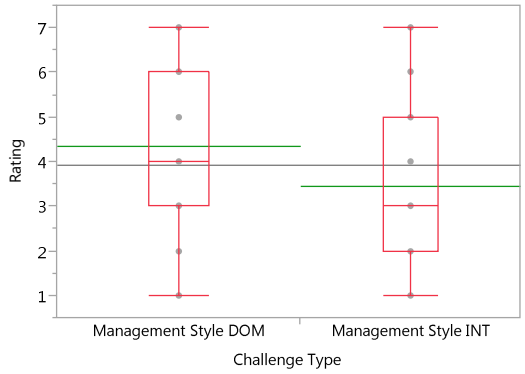
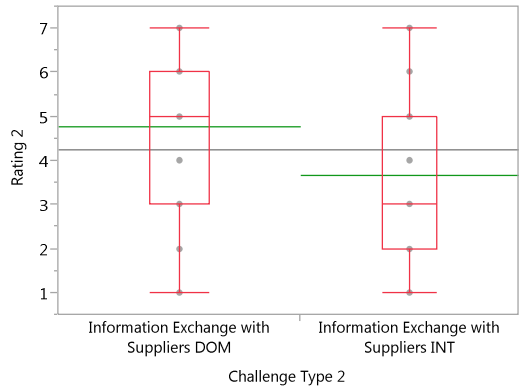
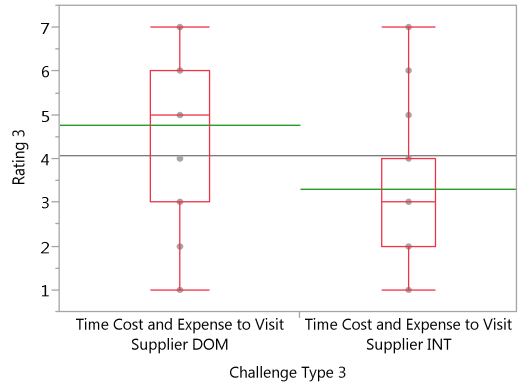
		Wilcoxon Test Result
Management style in supplier		0.0122
Information exchange with supplier		0.0009
Time cost and expense to visit supplier		<0.0001

Figure 4-39: Challenges in Implementation of a Quality Initiative in Suppliers Analysis

4.8 Research Question 2.D. Quality Management and Organizational Performance:

Again, the impact of quality initiatives has been shown to impact the sourcing decisions of US companies and that certain initiatives are more influential than others. Research Question 2.d. will be used to determine the strength of the relationships of the quality dimensions that most influence the performance of the organization. In Table 4-28, the fifteen quality management items developed earlier under each category are presented in detail.

Table 4-28: Quality Management Items

Quality Management Item	Definition
Top Management 1 (TM1)	Top Management supports long-term quality improvement process.
Top Management 2 (TM2)	Top Management regularly reviews quality issues in meetings.
Top Management 3 (TM3)	Top Management considers improvement as a way to increase profits.
Customer Relationship Management 1 (CRM1)	We have a clear definition of customer requirements.
Customer Relationship Management 2 (CRM2)	Our company uses customer requirements as the basis of quality.
Customer Relationship Management 3 (CRM3)	Our company attains customer feedback on quality and delivery performance.
Employee Relations 1 (ER1)	Our employees are responsible for quality.
Employee Relations 2 (ER2)	Our employees are provided with the feedback on their quality performance.
Employee Relations 3 (ER3)	Our employees are encouraged to participate in quality decisions.
Process Management 1 (PM1)	Preventive actions are more important than corrective ones during processes.
Process Management 2 (PM2)	We have standardized processes and instructions in place.
Process Management 3 (PM3)	We have clean and well-organized facilities.
Six Sigma Role Structure 1 (SS1)	We have black/green belt role structure (or equivalent structure) for continuous improvement in our company.
Six Sigma Role Structure 2 (SS2)	The roles and responsibilities of quality improvement teams are clearly identified in our company.
Six Sigma Role Structure 3 (SS3)	Our company uses a structured approach (such as DMAIC) to manage quality improvement activities.

Because there are so many items, they will be first grouped into several quality management factors using an exploratory factor analysis. Organizational performance factor will be also determined again using exploratory factor analysis. Then the item structure of the factors will be verified by checking the Cronbach's alpha values. After the item structure is determined and verified, the values for each factor by the means of the eigenvectors needs to be created. Subsequently, a regression analysis will be run to determine the relations of quality management features and performance. Then, a model based on these findings from regression analysis is created in IBM®AMOS and conclusions on relationships between the quality management features and organizational performance are determined. Figure 4-40 shows the flow of the analysis to answer research question 2-d.

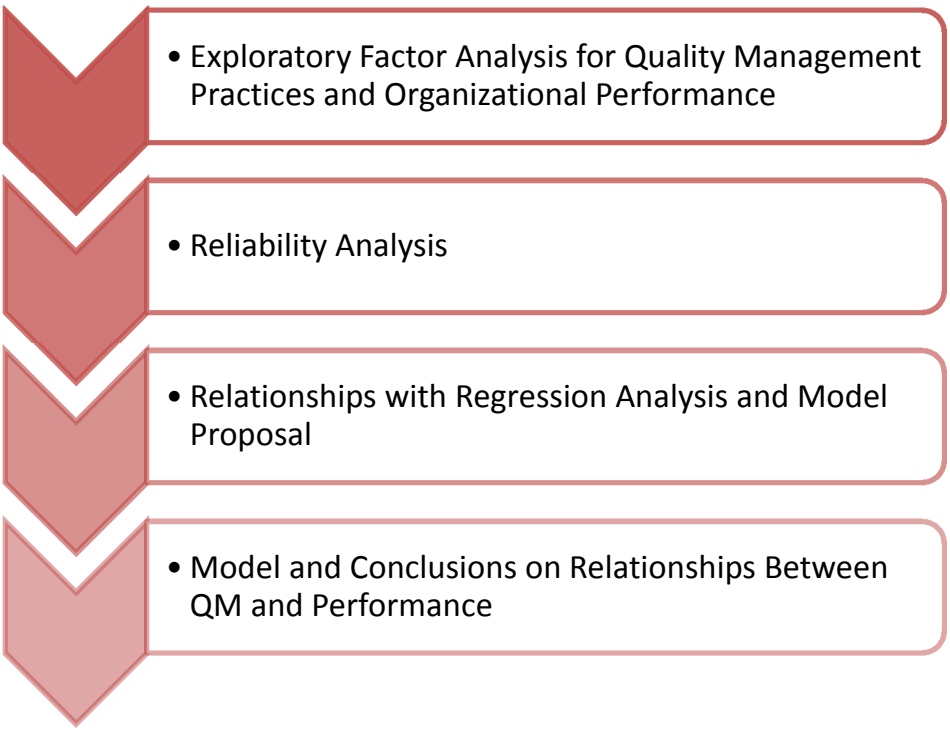


Figure 4-40: Flow of the Analyses for RQ2-d

Again, principal component analysis using a varimax rotation was conducted to analyze the 15 items for quality management practices developed for this study. The output for the principal component analysis (see the scree plot in Figure 4-41 and Table 4-29) suggests using five factors with eigenvalues above one.

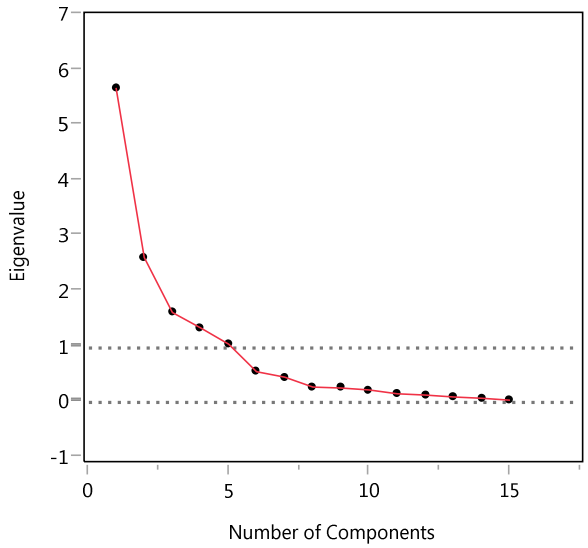


Figure 4-41: Scree Plot for Five Factors

Table 4-29: Eigenvalues for Quality Management Practices

Number	Eigenvalue	Percent	Cum Percent
1	5.7089	38.059	38.059
2	2.6440	17.626	55.685
3	1.6507	11.005	66.690
4	1.3745	9.163	75.854
5	1.0765	7.177	83.031
6	0.5797	3.864	86.895

The proportion of variance captured by first factor is 38%, and the factors two through five explain 17%, 11%, 9% and 7% variance respectively. Therefore, 83% of the total variance can be explained by these five factors. The factor loadings for all quality management items are shown in Table 4-30. After analyzing these factor loadings, all 15 items are retained for further analysis.

Table 4-30: Factor loadings for all QM items -based on principal component analysis with varimax rotation

	Factor1	Factor2	Factor3	Factor4	Factor5
TM1	0.922				
TM3	0.882				
TM2	0.853				
CRM2		0.885			
CRM1		0.836			
CRM3		0.788			
SS1			0.927		
SS3			0.923		
SS2			0.812		
PM3				0.859	
PM1				0.819	
PM2				0.769	
ER1					0.813
ER3					0.801
ER2					0.630

In order to evaluate the reliability of the factors that we attained from Exploratory Factor Analysis we looked at the Cronbach's Alpha values for Quality Management factors. After observing the alpha values of the quality management factors, all of the items in the factors were retained as seen in Table 4-31.

Table 4-31: Cronbach's Alpha Values for Quality Management Factors

Quality Management Factors	**Cronbach's Alpha Values**
TM1,TM2,TM3	0.9210
CRM 1, CRM 2, CRM3	0.8787
PM1, PM2, PM3	0.8357
ER1, ER2, ER3	0.7898
SS1, SS2, SS3	0.9001

Similarly, a principal component analysis using a varimax rotation was conducted to analyze the six items for organizational performance as seen in Table 4-32. The output for the principal component analysis (see Figure 4-42 and Table 4-33) suggests using one factor with an eigenvalue above one.

Table 4-32: Organizational Performance Items

Organizational Performance Items	
Performance 1 (P1)	Net Profit Margin (Profit Per Product)
Performance 2 (P2)	Order Fulfillment Cycle Time
Performance 3 (P3)	Full and On Time Delivery Rate
Performance 4 (P4)	Defect Rate
Performance 5 (P5)	Product Quality
Performance 6 (P6)	Employee Performance

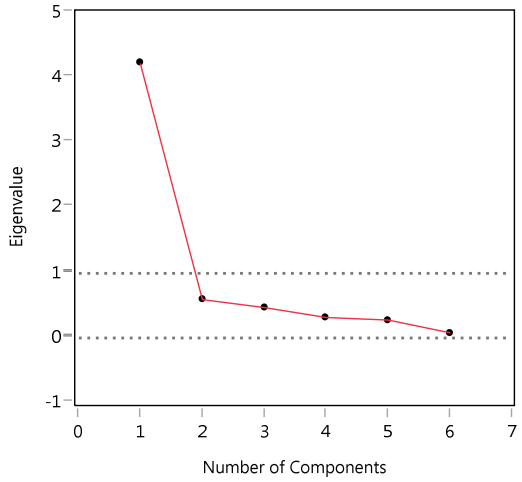


Figure 4-42: Scree Plot for One Factor

Table 4-33: Eigenvalues for Organizational Performance

Number	Eigenvalue
1	4.2314
2	0.6009
3	0.4751
4	0.3242
5	0.2822
6	0.0862

Total variance explained by this factor was 70.5%. The factor loadings for all organizational performance items are shown in Table 4-34. Looking at these loadings, all items were retained for further analysis. Again, in order to evaluate the reliability of the factors attained from the exploratory factor analysis and to be used in further analysis, the Cronbach's Alpha value is calculated for the organizational performance factor as well. Table 4-35 represents the reliability coefficient for the single performance factor. After observing the alpha value, all items in the performance factor were retained.

Table 4-34: Factor loadings for all Organizational Performance items

	Factor1
P1	0.903263077
P2	0.8908199576
P3	0.8304577181
P4	0.8203180788
P5	0.8090489799
P6	0.7777259955

Table 4-35: Cronbach's Alpha Value for Organizational Performance Factor

Organizational Performance Factor	Cronbach's Alpha Value
P1, P2, P3, P4, P5, P6	0.9145

Similar to the previous analysis, after the factors from exploratory factor analysis are determined and the factor structures are verified by the reliability analysis, the value that best represents the corresponding factor for each respondent is attained by the means of eigenvectors. In Table 4-36 through Table 4-38, the eigenvectors of the most important principal components for each of our quality management and performance factors are provided (i.e., the weights for each item within that factor).

Table 4-36: Weights for Quality Management Practices

Top Management	Weight	Customer Relations	Weight	Process Management	Weight
TM2	0.53673	CRM1	0.59763	PM3	0.69400
TM3	0.60607	CRM2	0.56397	PM4	0.43676
TM4	0.58703	CRM3	0.56989	PM5	0.57236

Table 4-37: Weights for Quality Management Practices

Employee Relations	Weight		Six Sigma Role Structure	Weight
ER1	0.38622		SS1	0.60676
ER2	0.57761		SS2	0.50203
ER3	0.71916		SS3	0.61629

Table 4-38: Weights for Organizational Performance Items

Performance	Weight
P1	0.41792
P2	0.43227
P3	0.42863
P4	0.41537
P5	0.34651
P6	0.40269

4.8.1 Proposed Model Based On Multiple Linear Regression

Next using the factors obtained, a linkage (i.e., a model of relationships) between the quality management and organizational performance factors will be tested using these factors. Path analysis will be used to analyze the proposed model using the IBM®AMOS Program. The first model to find the relationship between the quality management and organizational performance will be based on a stepwise multiple linear regression (MLR) models.

The SAS JMP™ software will be used to conduct the stepwise MLR analysis. In the first phase, all of the quality management factors are treated as independent variables and the organizational performance factor as the dependent variable to identify which quality

management factors have direct impact on performance. After doing this, the relationships among the quality management factors have to be determined. In order to achieve this task, each of the variables must be decided whether to stay as exogenous variables or as mediator endogenous variables. Based on the findings from literature review, it is decided to use all quality management factors as mediator endogenous variables except top management. Top management is used as the only exogenous variable because it has a direct impact on all the other quality management practices but not vice versa. Table 4-39 summarizes the possible reasonable dependencies of variables on other variables in our prospective model.

Table 4-39: Possible Dependencies Used in Stepwise Linear Regression Analysis

Variable Name	Possible Dependencies
Organizational Performance	TM, SS, ER, CRM, PM
ER	TM, SS, CRM, PM
CRM	TM, SS, ER, PM
PM	TM, SS, ER, CRM
SS	TM, ER, CRM, PM

After conducting the stepwise multiple linear regression analysis, the regression coefficients which are given in Table 4.40 are attained for each variable and a relationship model is proposed as seen in Figure 4-43.

Table 4-40: Regression Coefficients for each Variable

Dependent Variables	Independent Variables	
Organizational Performance	CRM	SS
	0.4045	0.2150
ER	TM	
	0.1551	
CRM	TM	ER
	0.3122	0.3325
PM	ER	
	0.6047	
SS	PM	
	0.7022	

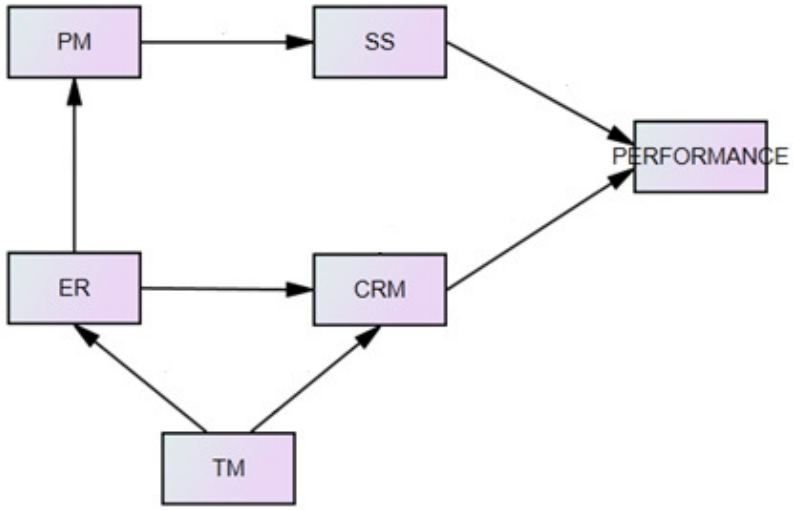


Figure 4-43: Proposed Model After Stepwise Regression Analysis

After the model was created in IBM®AMOS, the model fit indices which are widely reported in the literature were analyzed. Many researchers, such as Marsh, Balla, and Hau (1996), recommend that individuals utilize a range of fit indices. Indeed, Jaccard and Wan (1996) recommend using indices from different classes as well because this strategy overcomes the limitations of each index. The results indicated a good fit ($\chi 2/df = 1.057$, GFI = 0.977, CFI = 0.997, NFI= 0.944, and RMSEA = 0.022) with the data where Table 4-41shows these fit indices for the model as well as their recommended threshold values.

Table 4-41: Fit Indices for Model Proposed from Stepwise Regression

Goodness of fit statistics	Recommended values for satisfactory fit of a model to data	Proposed Model from Regression Analysis
Normed chi-square ($\chi 2/df$)	1-3[1]	1.057
Goodness-of-fit index (GFI)	>0.9[2]	0.977
Normed fit index (NFI)	>0.9[2]	0.944
Root mean square error of approximation (RMSEA)	<0.08[3] ideally<0.05[4]	0.022
Comparative fit index (CFI)	>0.93[5]	0.997

1. Kline, 1998; Ullman, 2001; 2. Byrne, 1994, 3. Browne & Cudeck, 1993; 4.Stieger, 1990; 5. Byrne, 1994

The estimates of path coefficients which are represented as the un-standardized regression coefficients (β) are shown in Figure 4-44 as the numbers next to the arrows indicating the direction of the effects. The value of these coefficients indicates the weights of the direct effects of one variable on another. The path coefficients are all significant at the

0.05, 0.01 or 0.001 levels. Therefore, all the lines in the model indicate significant paths (all p-values are < 0.05, 0.01 or 0.001 levels). Finally, the model which shows the direct and indirect effects of quality management practices on organizational performance has been verified.

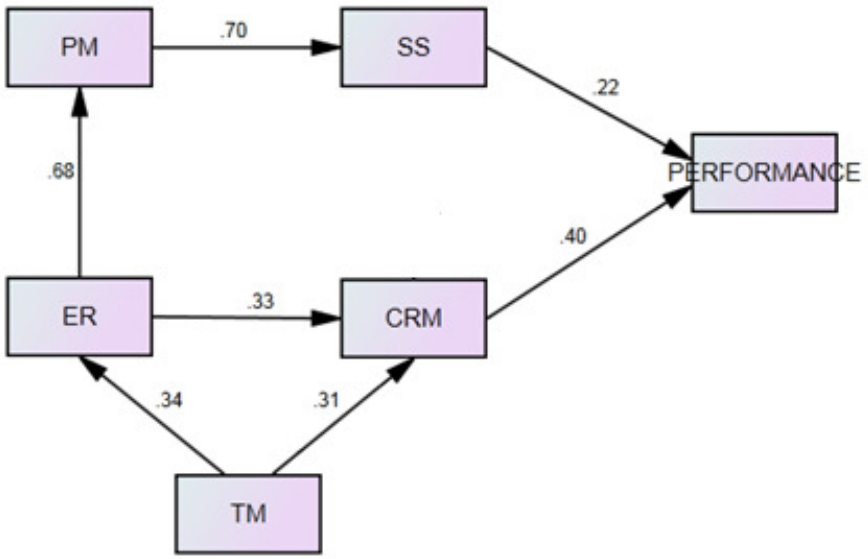


Figure 4-44: Proposed Model from Stepwise Regression Analysis with Unstandardized Path Coefficients

4.8.2 Conclusions on Impact of Quality Management Factors on Organizational Performance

The primary objectives of this section were to investigate the relationships among quality management factors and to identify the direct and indirect effects of quality management factors on the organizational performance. After testing the hypothesized model, which was developed based on a multiple regression analysis, the structure will provide the cues to answer this question. The results in Table 4-42 attained from the model show positive direct and indirect effects of quality management factors on organizational performance.

Table 4-42: Direct, Indirect and Total Effects

Effects of		SS	CRM	PM	ER	Performance
TM	Direct	-	.312	-	.339	-
	Indirect	.162	.113	.231	-	.207
	Total	**.162**	**.425**	**.231**	**.339**	**.207**
SS	Direct		-	-	-	.215
	Indirect		-	-	-	-
	Total		**-**	**-**	**-**	**.215**
CRM	Direct	-		-	-	.405
	Indirect	-		-	-	-
	Total	**-**		**-**	**-**	**.405**
PM	Direct	.702	-		-	-
	Indirect	-	-		-	.151
	Total	**.702**	**-**		**-**	**.151**
ER	Direct	-	.333	.682		-
	Indirect	.479	-	-		.238
	Total	**.479**	**.333**	**.682**		**.238**

First, it is found that a successful establishment of a "Lean Six Sigma Role Structure" within the company has a positive direct impact on the organizational performance. This finding indicates that having a Six Sigma role structure for continuous improvement, clearly defining the roles, and determining responsibilities of quality improvement teams positively

and directly impact the organizational performance which at the end leads to competitive advantages.

In addition to a well-established Six Sigma role structure, customer relationship management is found to have the strongest direct effect on organizational performance. This result emphasizes the importance of customer relations on organizational performance in the textile and apparel industry. The result illustrates the fact that the success in organizational performance is directly related to the success in customer relations. Customer relationship management efforts include clear definition of customer requirements, usage of customer requirements as the basis of quality, and attaining customer feedback on quality and delivery performance. All of these efforts exert a direct influence on organizational performance. This result is expected since understanding the customer and developing close relationships with them are key strategies for gaining the competitive advantage in the market (Zu et al., 2010). Therefore, other QM activities should all support customer relations and customer focus to achieve superior organizational performance.

The process management (PM) efforts including standardized processes and instructions, clean and well organized manufacturing floors, and importance given to preventive actions over corrective ones have direct impact on successful implementation of Lean Six Sigma projects. Therefore, process management increases organizational performance through Lean Six Sigma structure in the company. In the absence of organized quality initiatives such as Lean Six Sigma, the model states that process management will be

the factor which directly increases the organizational performance together with the customer relations.

Human resource management (i.e., employee relations-ER) has direct impacts on process management and on customer relationship management (CRM). This result is very reasonable because both process management and customer relations can only start with good relations with the employees. Only when workers are encouraged to participate in quality decisions, and when employees are rewarded for superior quality performance, the company can achieve a successful process management. And, relying on the feedback of the employees can be regarded as the first phase of further customer relations.

Ultimately, top management has direct impacts on customer relationship management (CRM) and human resource management (ER). These direct effects support the results in Flynn et al. (1995), Kaynak (2003), Lee et al. (2006) and Tari et al. (2007). And, all the impacts of top management on other quality management factors and on organizational performance can be achieved through ER and CRM. According to the model, top management has an indirect effect on process management through human resource management (ER). It is reasonable that ER must be an intermediate tool for top management to impact process management. Top management has effects on Lean Six Sigma structure through human resource management (ER) and process management (PM) which is acceptable in practice. Because initiation and sustainable implementation of Lean Six Sigma projects require effective employee relations and efficient process management activities in

place. Finally, top management's effect on organizational performance is mainly achieved through customer relationship management.

To sum up, the analysis of the interdependence of quality management practices and their impact on organizational performance revealed that starting from the top management, all quality management practices should support effective customer relationship management and structured quality implementation such as Six Sigma to achieve superior performance and ultimately better competitiveness within the fierce market conditions.

Chapter 5
Conclusions and Future Work

Companies have been forced by increasing global competition to pursue international sourcing strategies that emphasize lower prices and consequently they are focused on identification of opportunities to improve quality or gain efficiencies on a worldwide or regional basis (Frahm, 2003; Wisner et al., 2005, Cagliano et al., 2008). Global sourcing requires additional skills and knowledge to deal with international suppliers, logistics, communication, political environment, and other issues (Kotebe and Helsen, 2004; Wisner et al., 2005). As a result, companies that have failed to pursue successful sourcing strategies have struggled to survive or faced large setbacks owing to failures.

This study provides an in-depth understanding of sourcing decisions of US textile and apparel companies, explains the issues encountered during sourcing from different regions of the world and identifies the roles of quality practices in sourcing decisions. Insights into the current state of the supplier quality and the role of quality in sourcing decisions including reshore or relocate have been provided. A broad comparison of quality issues arising from domestic and international suppliers has been explored which subsequently led to the identification of the most effective quality improvement strategies and their impact on sourcing decisions. The research has also determined to what extent the buyer companies provide support to their suppliers and finally the challenges encountered during these supporting efforts.

This chapter presents a summary and discussion of the results of the research study. The contributions to the mostly theoretical literature are summarized with the emphasis on

the practical and quantitative results on the applied areas of the sourcing field especially with regard to the textile and apparel industry. Further, significance of the research is discussed, limitations are presented and recommendations for future research are suggested.

5.1 Summary of Conclusions

Chapter 4 contains most of the detailed summaries. The following two sections will provide a follow up summary to point out the importance of the findings.

5.1.1 Research Objective 1: To identify the factors that impact sourcing decisions

Analysis revealed that primary and secondary costs (including unit price and labor costs as well as energy and raw material costs) are all more influential in large companies' outsourcing decisions compared to small and medium-sized companies. This does not say that cost is not a concern for smaller companies, but larger companies by annual revenue and by number of employees are more cost oriented in their outsourcing decisions. In addition to differences with respect to different company sizes, retailers and private brands are found to be more cost oriented in their outsourcing decisions as compared to manufacturers.

Finally, within the framework of sourcing decisions, it is shown that companies who are more cost oriented tend to change their international suppliers. Large companies having more abundant resources can seek for better prices for a certain quality and service level based on their volumes because a small change in cost can make a large difference in their revenue. Furthermore, if necessary, they can bear the supplier switching costs and create new supply chains more easily. Small and medium sized companies who do not have the resources and international sophistication of large companies may not take the risk of

rebuilding the supply chain. Therefore, smaller companies tend to create more stable relations with their existing suppliers and do not seek continuously for cheaper prices.

This research showed that, within all other strategies, *Made-in-USA* as the marketing strategy has the highest rate of reshoring activities compared to companies with other strategies, which shows that it is an important reshore-factor. This result is very reasonable because this strategy is one of the popular strategies followed by US companies to promote the reshoring activities (e.g., Walmart). Made-in-USA strategy is followed by *speed-to-market* and *green/sustainable strategies* as important strategies with high rates of reshoring activities. If speed-to-market is critical in companies' competitiveness, they will look for closer suppliers in terms of geographical distance to decrease the longer lead times encountered during outsourcing from overseas suppliers. On the other hand, *niche* marketing calls for stable product quality, and as a result, stable relationships and close collaboration with suppliers.

In this research, various issues encountered during outsourcing efforts from different regions of the world are presented visually by the means of world issue maps. The analysis of cost issues showed that huge differences exist between the perceptions of reshore/relocate companies and non-reshore/relocate companies. In other words, although these companies operate in the same world, these two groups have very different levels of issues. The research also provides the world issues maps for quality, delivery, unavailability of factors such as raw material and labor, and other issues including intellectual property protection and environmental issues.

This analysis revealed that quality is an important factor in outsourcing decisions of US textile companies. All of the non-reshore/relocate companies believe that product quality is a factor for abandoning their suppliers which indicates that if quality starts to suffer, they will switch their suppliers. As a whole, product quality and supply chain quality are the most important factors in outsourcing decisions of the companies. On the other hand, indirect qualities, i.e. management, process and workforce qualities of the suppliers, are less important in outsourcing decisions.

In addition to these findings, by examining the quality issues arising from *international* and *domestic suppliers*, it is shown that international suppliers yield worse quality conditions as compared to domestic ones. In other words management, supply chain, product, workforce and process qualities are all worse for international suppliers as compared to domestic suppliers. Moreover, a *quality threshold* is defined to separate the domestic suppliers from international ones in terms of their quality levels. According to the definition of this quality threshold, an international supplier which is located under the reshore threshold will have worse quality conditions and it can be substituted with a domestic supplier which has better quality conditions. Therefore, any quality implementation in international suppliers which increases their quality conditions will inhibit US companies from substituting them with a domestic supplier. In other words, implementation of a quality initiative in international suppliers can inhibit reshoring activities of US buyer companies. Therefore, for an international supplier to stay competitive in the presence of domestic suppliers, it must increase its quality levels by the means of quality initiatives. Ultimately,

the goal was to determine which quality initiatives are more effective in improving quality in international suppliers.

5.1.2 Research Objective 2: To determine the impact of quality process improvement strategies on sourcing decisions and on organizational performance

The research demonstrated that Lean and Six Sigma in international suppliers are the implementations which can best reverse the poor quality conditions into good quality conditions. Subsequently, these implementations will inhibit reshoring activities of US buyer companies. With the Six Sigma implementation in international suppliers, the biggest improvement occurs in product quality from the perspective of buyer companies.

For the sake of maintaining long-term relations with their suppliers, US companies sometimes choose to provide technical assistance and/or help in implementations of quality initiatives to their domestic and international suppliers. The research showed that providing only technical assistance is not as effective as providing technical assistance along with help in quality implementations. When looking at challenges in providing help to suppliers, it was not surprising to see *time cost and expense to visit suppliers' facilities* to be more challenging for international suppliers as compared to domestic suppliers. Time cost and expense to visit supplier is followed by *information exchange* and *management style*. These problems mainly arise from language barriers as well as the distant location of these suppliers even in the presence of high tech communication and information exchange tools. Errors from language and/or cultural differences and misunderstandings may occur during outsourcing efforts from international suppliers.

Finally, a hypothesized model to investigate the relationships among quality management factors and to identify the direct and indirect effects of these factors on the organizational performance was tested. As a result, a successful establishment of a Lean Six Sigma role structure within the company and successful customer relationship management are found to have a positive direct impact on the organizational performance which at the end leads to competitive advantages. This result emphasizes the importance of Lean Six Sigma implementations and customer relationship management within the textile and apparel industry. The process management efforts including "standardized processes and instructions", "clean and well organized manufacturing floors" and "importance given to preventive actions over corrective ones" are found to have an indirect impact on organizational performance through Lean Six Sigma structure. Ultimately, top management and employee relations are found as the initiators for a successful quality management structure. These have indirect impacts on the organizational performance through other quality management practices. In summary, the analysis of the interdependence of quality management practices and their impact on organizational performance revealed that starting from the top management, all quality management practices should support effective customer relationship management and a structured quality implementation such as Lean Six Sigma to achieve superior performance and ultimately better competitiveness within the fierce market conditions.

5.2 Conclusions as an Executive Summary

Different sourcing strategies often present companies with complex tradeoffs. In some cases, reshoring activities can be more advantageous with respect to offshoring, or vice versa. Also,

specific locations of the world can be more advantageous compared to all other regions. However, most of the time, it is not easy to successfully predict which sourcing decision/strategy will be the most profitable and/or successful in the long run. The sourcing companies that have been interviewed stated that because their final sourcing preferences are shaped by their strategies, needs, product mix, product demands, and forecasts, a mix of sourcing needs governs the sourcing decisions of companies. Therefore, the majority of the respondents use a blended sourcing strategy (i.e., they sourced from a variety of locations). The reasons behind these mixed strategies according to the respondents were to minimize risk, minimize costs, and to leverage the manufacturing competencies of different regions. In addition, as the respondents cited, reshoring and offshoring at the same time can be also a necessary activity for particular situations.

Nowadays, reshoring has become essential for certain companies' success. Some respondents stated that they have gone too far in their offshoring activities where they chased opportunities based on cheap labor. However, currently their overall strategy has changed and they primarily started to value quick turnaround, service, fill rate, on time shipping performance, lead times, and responsiveness more as these hidden costs have become more relevant. Therefore, respondents stated that they moved their outsourcing back to the US from overseas suppliers located in China, Ecuador, Taiwan etc., for many of the similar reasons (i.e., closeness and proximity to the customer, shorter lead times, and less absolute exposure to potential quality issues). Because customers of US companies are frequently changing their forecasts, requirements, and volumes from month to month, sometimes even from week to week, it is very difficult to manage this level of fluctuation in demand.

Therefore, in this type of marketing environment where speed and responsiveness are critical for competitiveness, these companies cannot source effectively from overseas. In order to have their suppliers close to their customers, they have initiated reshoring activities. As an example, one respondent stated that they drastically reduced their transit time from one month down to a couple of days by moving some of their sourcing from China back to domestic suppliers. Moreover, they stated that because of these long lead times and transportations, defective quality is often not determined until it reaches the US distribution channels. In other words, reshoring eliminated the risk of getting more defective products in the incoming shipments which are already in the pipeline. Considering these issues, by reshoring their sourcing back to the US, these respondents could reduce their huge inventory amounts by abolishing their large stocks to stay cautious for the case of defective international shipments and changes in demand. At the end, they got virtually no important inventory in the pipeline (e.g. considering four months of defective products versus max one-two weeks of defective products / inventory). Respondents also pointed out that it is also easier to work on the issues such as product quality with the local partners, so they have become more responsive against their own customers.

In accordance with the above conclusions, in this research, it has been shown that companies with some specific characteristics must follow a specific set of outsourcing decisions. As an example, companies which follow "Made in USA", "Speed-to-market", "Green and sustainable" or "Niche" as their marketing strategy have higher rates of reshoring activities compared to other companies. In order to be convincing and reliable, a company that claims to follow "Made-in-USA" strategy cannot continue to heavily outsource from

offshore suppliers. Respondents also pointed out that proximity is critical when they try to develop new products constantly. Therefore, reshoring can emerge as a required action for some US companies pursuing these strategies. In addition to reshoring activities, according to the respondents, relocation decisions can also take place in the case of some issues with suppliers. As an example, when they started to suffer from their suppliers' product quality, a US buyer company decided to switch their sourcing from Taiwan to China. In addition, despite the supply chain advantages offered by East Asia, respondents stated that they shifted their sourcing to Western Hemisphere - Mexico, Central America and the Caribbean region for cost and speed-to-market advantages.

There are also region specific factors for reshore and relocation of offshore suppliers. Respondents stated that China is getting a bit more difficult to work with as the country's labor costs are increasing. It is claimed that because China started to evolve with their labor, workers have started to demand higher wages and to quit and shift their jobs without any notice. Therefore, it is emphasized that these current situations yield in high turnover rates in this country. Some respondents commented that because workforce turnovers very quickly, US buyer companies have to go to China as frequent as every three months to re-train employees within Chinese partners which is making it more difficult to work with employees in China.

In addition to above findings, the rising cost of labor in low-cost countries is also causing many companies to rethink their current sourcing location. The search for lower labor costs is found to be one of the main factors determining reshore and relocation

activities. For instance, in dollars, wages in China are five times more what they were in 2000 - and they are expected to keep rising 18 percent a year. However, hourly wages alone do not tell the complete story when deciding where to locate a manufacturing plant or supply chain. For instance, in the case of China, higher labor costs alone are not enough to prompt companies to leave. As the participants stated, China has the world's best supply chains of components for different industries and its infrastructure works well. Some companies have also already invested heavily in being there. Moreover, although wages have been rising in low cost countries, still a very large gap remains. Manufacturing costs per hour in Western Europe or in the US are about 15 times higher compared to China.

Furthermore, offshore sourcing can sometimes be inevitable for US companies. The participants stated that even for a single particular product category, a large variety of machines and production techniques can be required. Within the past 10 years, as respondents stated, many of their domestic partners such as fiber and knit product manufacturers have gone out of business. Moreover, they also pointed out that many of these products are not manufactured in the US anymore and also they cannot manufacture these products within their facilities as they do not have the necessary technology and the capability. Acrylic fiber, special knit products such as fishnet tights, particular hosiery with lace, as well as, medical thigh bands are among the cited products that are not currently offered in the US but can be found only in suppliers located in Germany, Turkey, China etc. In addition to these particular products, the cut and sew processes are also cited as being very limited in the US for high volume manufacturing. Therefore, even though it was initially seen

as very challenging, offshoring their sourcing for these particular intermediate and finished products has become a requirement for some of the buyer companies to stay in the business.

In addition to still ongoing low cost benefits of offshore locations, the hesitation of the US companies in making reshoring decisions is due to the fewer governmental incentives that they have in the US as compared to other offshore countries. Respondents stated that business environment in the US is not better than the environment provided in offshore countries. It is stated that there is more bureaucracy in the US which is coupled with high tax rates. It is said that US has the second highest income tax rate in the world after Japan which has 40% tax rate and this situation is not seen as favorable for the businesses located in the US. Respondents also pointed out that Chinese government does all kinds of things to be business friendly while US government does not care enough about this. As stated by the respondents, close to 60% of their profits is taken out with taxes in the US in the form of federal and state taxes and economic structure it is not conducive for businesses located in the US.

Based on these facts, even in the presence of new reshoring trends, it appears that offshore sourcing will maintain its important position for US buyer companies for a reasonably long period. However, this research showed that along with other issues, offshore sourcing brings quality concerns to US buyer companies. Domestic suppliers are proven to yield better quality conditions compared to international ones. As a critical fact, it has been shown that supplier quality has an important place in sourcing decisions of buyer companies. Therefore, to resolve this contradiction, this research proved that supplier development programs such as providing help on implementation of quality initiatives along with technical

assistance can significantly increase the quality levels of the suppliers. And, the most effective quality implementations are proven to be Lean and Six Sigma for the suppliers. As a result, for the sake of long reliable relations with suppliers, if the US company decides to provide some help to their suppliers, our recommendation is that the help must be directly on the implementation of organized and well-structured quality initiatives, namely on Lean and Six Sigma.

On the hand, US buyer companies which will get involved with supplier development programs, especially in the form of "direct involvement" (i.e. investing capital on these programs) must not forget that providing help to international suppliers can be very challenging particularly compared to domestic ones. As also emphasized by the respondents, time cost and expense to visit the international suppliers, information exchange with them, and their management styles which are mainly shaped by their culture are proven to be significantly challenging barriers compared to domestic suppliers. Furthermore, as a notable example, respondents pointed out that, due to their cultural structure, some international suppliers would not pass potential financial benefits of quality implementations to their buyer companies. Therefore, reshore and relocation activities should be always an option for the buyer companies - whenever they face lack of volunteerism and considerable level of unwillingness from their suppliers towards their supplier development programs. Otherwise, the large investments on supplier development which is mostly intended for long term benefits can easily turn into vain attempts with a lot of losses.

In the pursuit of superior quality and processes, Six Sigma which seeks excellence in organizational performance, at the first glance, can be assumed to be suitable only for the organizations which have already established a reasonable level of performance, i.e. which is able to start considering the level of excellence. Therefore, Six Sigma structures and implementations for some international organizations which are primarily suffering from lack of some essential resources and technological infrastructures might appear as sophisticated tools which exceed their primary needs. On the other hand, during her internship in Haiti, for the Six Sigma and quality improvement strategies, the researcher had found the opportunity to observe the substantial rate of organizational willingness as well as important levels of expectations of Haitian employers and managers.

Although it seems quite challenging to implement structured quality improvement strategies in suppliers located in the low cost and developing countries, the willingness of the company executives and their motivation for their employees towards to the implementation plays a key role in the success of the implementation. The suppliers' willingness to participate in these improvement activities is the determinant of the success in the long term as it is observed in the Haitian apparel suppliers' case. Because Six Sigma implementations must be regarded as a cultural change in business, the efforts and willingness of the supplier will yield in positive outcomes throughout the suppliers' processes, which will be naturally reflected on the profits of both parties - supplier and the buyer company. However, still, the initiation and the permanence of these advanced improvement strategies which are intensively based on the usage of statistical tools will require additional significant efforts in terms of training of employees.

Some of the respondents stated that because they have very high brand recognition among their customers, they have to protect the value of their brand equity, and as a result, they are very quality conscious. Therefore, they stated that they have to qualify all their vendors by the means of ISO certifications and quality implementations. They stated that when they take on a new supplier, as part of their approval process, they implement a documented rigorous qualification process which their suppliers have to submit. Consequently, because suppliers play a critical role in the success of a buyer company, before establishing international supply chains, US buyer companies should carefully select the location of sourcing and the candidate suppliers with a patient and thorough selection period in accordance with the mix of sourcing needs of their companies. Otherwise, the risks of rebuilding the supply chains and the supplier switching costs can create significant financial and physical problems. However unexpectedly, after a period of time, the current suppliers can start to be an expensive or inefficient choice for the needs of US buyer companies. In the emergence of this-kind of situation, different sourcing decisions must be carefully and critically considered: reshore, or relocate offshore sourcing, or keep the current suppliers but with a supplier development program. Regardless of which decision is being made, the sourcing decision must be established on the basis of the best possible long term relations and benefits for the US companies.

5.3 Significance of Research

This research which is primarily focused on sourcing decisions of US textile and apparel companies with an emphasis on quality has significant contributions to the literature not only in terms of different perspectives to examine the related subject but also in terms of different

applications to analyze the data. Academic literature in the area of supplier selection, supplier quality, and sourcing has been primarily focused on sectors other than the textile and apparel industry such as information and communication technologies, electronic industries, etc. Literature on supplier selection has very limited studies that examine the actual state of suppliers' quality levels and analytical quality comparisons can be rarely found for different types of suppliers especially in the textile and apparel industry. Previous research which has focused on supplier quality does not go beyond the case studies conducted with a limited number of companies and fails to provide a general picture of the industry as a whole. Previous studies are mainly focused on supplier selection criteria in theory and very limited research has been focused on analytically investigating the actual quality issues arising from suppliers within the textile and apparel industry. At this point, this research primarily investigates the supplier quality issues within the textile and apparel industry and its impact on sourcing decisions by providing a general picture by means of a large number of respondents (e.g., 149 in some cases) from various types of companies within the same industry. The research also moves beyond the traditional case-studies by providing objective quantitative results by the means of a detailed and technical survey.

This research introduces new notions and approaches by separating the supplier's quality into two general categories (i.e., *received* and *indirect qualities*) during the definition of supplier quality. The categories within received and indirect qualities were created after a rigorous literature review and provide a well-defined combination and summary of supplier quality. These proposed supplier quality categories can be used as constructs and framework for future studies regarding supplier quality and supply chains for different industries.

This research contributes to the academic literature with an overview of the rate of the existence and effectiveness of the quality initiative implementations within textile suppliers. By looking at the impact of different quality initiatives on supplier quality levels, the research identifies the impact of these implementations on the sourcing decisions of buyer companies. This research is primarily focused on reshore or relocation decisions of the US buyer companies which can be regarded as the most important sourcing decisions. Since reshoring is a fairly new phenomenon, the academic research that has been focused on this area is very limited and a majority of the research on reshoring does not go beyond defining the term reshoring. Therefore, this research can be regarded as the second phase of studies about reshore which move beyond just defining or classifying reshoring. Since conclusions are made based on reshore and relocation efforts within the US textile and apparel industry (i.e., reshore is now accepted as an intermediate tool to explain various notions and structures), this research has a noteworthy contribution to the reshore and relocation literature by reconsidering reshoring/relocation efforts within the US textile and apparel industry with a focus on quality.

In the literature, the research that combines sourcing efforts and quality is very limited. Furthermore, this type of study does rarely exist within the context of textile and apparel industry. The previous research into quality initiative implementations are mainly focused on the quality implementation within the company itself and not within company's suppliers. There does not exist any research that views the quality initiatives in suppliers as a factor of sourcing decision of buyer companies. Therefore, in addition to looking at the impact of these implementations within the company, this study looked at the impacts of

quality implementations within the US companies' suppliers. Moreover, this research combines sourcing decisions of buyer companies with quality initiative implementations in suppliers in the textile and apparel industry. In addition to the area and content related contributions to the literature, this research also does not limit itself with conventional survey techniques. A very comprehensive survey was prepared which investigates almost all of the dimensions of sourcing decisions with an emphasis on quality. Very different types of questions which appear independently for the respondents are tied to each other in such a way that at the end they created the overall big picture of sourcing efforts of US textile and apparel companies. The respondents are not psychologically biased to prefer some notions over other ones. By means of our detailed company profile questions, the companies were easily grouped into several types of classes for analysis. Many different features were investigated for various groups of companies thanks to the large number of questions in the survey as well as the number of respondents. Furthermore, this research is also not limited to conventional survey data analysis tools and structures. The creative usage of linear discriminant analysis (LDA) offered multidimensional geometrical vector representations of reshore and quality implementations within the suppliers. Different explanation of the angular differences between these vectors, and definition of reshore threshold by the means of LDA structures are all different approaches in this field.

The separate depiction of the observed issues, which are encountered during global sourcing, in the form of visual world issue maps with respect to different regions both from the perspective of reshore/relocate and non-reshore/relocate companies are great contributions to the related literature and they provide new visions for the readers and future

researchers. The efforts made in this study to explain reshore and relocate by the means of US companies' marketing strategies, to create reshore vs. non-reshore patterns with these marketing strategies and to make comparisons with these patterns to extract reshore factors are all original in this field, which analytically investigate the relations between the company characteristics and sourcing decisions. Explanation of differences in outsourcing motivations of large and small companies, and by the means of these different motivations, explanation of differences in outsourcing decisions of large and small companies are filling the related gaps in the literature in the corresponding field. The path analysis model for the relations of quality management factors and organizational performance provides the academic literature in this field with a better structural understanding that all of the quality management practices should support customer relations and Six Sigma practices to achieve an effective increase in organizational performance.

This research is one of the first direct investigations of the effectiveness of supplier quality in important sourcing decisions, such as reshore and relocation, of US buyer companies. In order to provide a comprehensive representation in this field, along with possible challenges and barriers of providing help and support to suppliers, a determination of how involved the US companies are in providing their suppliers with help and support is given. Therefore, considering all the aspects mentioned in the previous sections, the current study draws an overall comprehensive picture of the triangle *quality-sourcing decisions-textile and apparel industry* and is very broad compared to other studies in this field.

To sum up, this research does not only contribute to the supply chain and reshoring literature in terms of content but also in terms of different application of techniques and methods used to analyze the data. The proposed supplier quality notions, the supplier quality evaluation within the textile and apparel industry, the world issues maps, the combination of sourcing efforts with quality initiative implementations and the barriers of providing help to suppliers can all serve as a guide and framework for future research in various areas.

5.4 Limitations and Recommendations

Every effort was made at the design and data compilation stage of this study to obtain reliable and valid findings. Nevertheless, some limitations of this study should be discussed. Methodologically, this study is based on the cross-sectional survey data gathered via questionnaires and interviews. The respondents of the survey and interviews, who mostly hold senior management positions, were good representatives of the textile and apparel industry. However, because this survey is a comprehensive multi-dimensional survey, the data is somewhat limited with the respondents' level of knowledge for different areas within their company.

In addition, this research is only limited to textile and apparel industry. The overall view of the sourcing issues and characteristics of different regions of the world, the effects of quality implementations in sourcing decisions, different tendencies in sourcing behaviors of different types of companies can be better analyzed with a larger data set which includes companies from various different types of industries. To overcome these limitations, a future research should be conducted within different industries to compare various industry

practices in terms of the role of supplier quality, and the role of quality practices and systems implementations in sourcing decisions and efforts.

5.5 Future Work

For future work, the most valuable and significant contribution to the literature can be accomplished by building a simulation environment which guides US companies for three different sourcing decisions: *Reshore*, *Relocate* and *Keep Current Supplier but with a Supplier Development System*. All of these methods have their own risks and costs associated with them. Reshoring and relocation include supplier switching costs, as well as the risks of problems that can be encountered during sourcing efforts from new suppliers. On the other hand, keeping current suppliers but providing supplier development support with a supplier development system includes a lot of risks in terms of the potential problems such as low commitment of suppliers on these development programs. And the large investments on supplier development which is mostly intended for long term benefits can easily turn into vain attempts with a lot of losses. There are also many other risk factors such as currency rate changes etc. in the overall global outsourcing framework. The simulation will require the user to provide some inputs regarding its suppliers. These inputs can include the current issues with the supplier (cost, quality, delivery issues etc.), and the current behaviors of the suppliers (as the cues for potential commitment and volunteerism for the future supplier development programs). Based on these inputs the simulation will calculate the probabilities of being most profitable sourcing decision in both short-run and long run for *Reshore, Relocate and Supplier Development*. Therefore, considering the cost of supplier development programs versus supplier switching costs, long term and short term benefits can be

determined by the means of this simulation. In other words, the circumstances when it is more profitable to invest in suppliers by the means of supplier development programs or the circumstances when it is more profitable to switch suppliers by the means of reshoring or relocation activities can be quantitatively determined. And furthermore, if the decision seems to be *Relocation*, the simulation will provide a suggestion for the new location of sourcing around the world. This type of research may require a very large database which includes all of the domestic and international sourcing decisions of a very large number of companies along with many parameters related to each decision. However, this can be accomplished by keeping the research at the industry-specific level.

REFERENCES

Albacete-Saez, C. A., Fuentes-Fuentes, M. M. and Bojica, A. M., (2011), Quality Management, Strategic Priorities and Performance: The Role of Quality Leadership, *Industrial Management & Data Systems*, 111 (8), 1173-1193.

Alonso-Almeida, M. M. and Fuentes-Frías, V. G., (2012), International Quality Awards and Excellence Quality Models Around The World: A Multidimensional Analysis, *Springer Science+Business Media B.V., Qual. Quant.,* 46, 599-626.

Amin, S., Razmi, J. and Zhang, G., (2011), "Supplier Selection And Order Allocation Based On Fuzzy SWOT Analysis And Fuzzy Linear Programming", *Expert Systems with Applications*, 38, 334-342.

Amindoust, A., Ahmed, S., Saghafinia, A. and Bahreininejad, A., (2012), Sustainable Supplier Selection: A Ranking Model Based On Fuzzy Inference System, *Applied Soft Computing* 12, 1668-1677.

Anon (2012), The End of Cheap China?, *Economist*, Retrieved from http://www.economist.com/node/2154995624.

Antony, J. & Banuelas, R. (2002), "Key Ingredients for the Effective Implementation of Six Sigma Program", *Measuring Business Excellence* 6 (4), 20-7.

Antras, P. and Helpman, E., (2004), Global Sourcing, Journal of Political Economy, *The University of Chicago,* 112 (3), 552-580.

Arnolds, H., Heege, F., Roh, C. and Tussing, W., (2010) Materialwirtschaft und Einkauf, *Grundlagen – Spezialthemen – Ubungen*, 11th Edition, Gabler I GWV, Fachverlag GmbH, Wiesbaden.

Arroyo-Lopez, P., Holmen, E. and de Boer, L., (2012), How Do Supplier Development Programs Affect Suppliers? Insights For Suppliers, Buyers And Governments From An Empirical Study In Mexico, *Business Process Management Journal*, 18 (4), 680-707.

Autry, C.W. and Golicic, S.L., (2010), Evaluating Buyer–Supplier Relationship–Performance Spirals: A Longitudinal Study, *Journal of Operations Management* 28, 87-100.

Avila, P., Mota, A., Pires, A., Bastos, J., Putnik, G. and Teixeira, J., (2012), "Supplier's Selection Model Based On An Empirical Study", CENTERIS 2012 - Conference on Enterprise Information Systems / HCIST 2012 – International Conference on Health and Social Care Information Systems and Technologies, *Procedia Technology*, 5, 625-634.

Bai, C. and Sarkis, J., (2010), "Integrating Sustainability Into Supplier Selection With Grey System And Rough Set Methodologies", *International Journal of Production Economics*, 124, 252-264.

Baird, K., Hu, K. J. and Reeve, R., (2011), The Relationships Between Organizational Culture, Total Quality Management Practices And Operational Performance, *International Journal of Operations & Production Management*, 31 (7), 789-814.

Barry, J.M., Dion, P. and Johnson, W., (2008), A Cross-Cultural Examination of Relationship Strength in B2B Services, *Journal of Services Marketing* 22 (2), 114-135.

Bayo-Moriones, et al., (2011), The Impact of ISO 9000 and EFQM on the Use of Flexible Work Practices, *International Journal of Production Economics*, 130, 33-42.

Behar, A. and Venables, A.J., (2010), Transport Costs and International Trade, Paper written for *Handbook of Transport Economics,* June, Number 488.

Bishop, M.L, Bhola, N. and Ma, L., (2011), Reshoring Garment Production: China to the United States The Tipping Point, *Fashion Institute of Technology*, New York, NY.

Boyer, K. K. and Pagell, M., (2000), Measurement Issues in Empirical Research: Improving Measures of Operations Strategy and Advanced Manufacturing Technology, Journal of Operations Management, 18 (3), 361-374.

Braglia, M., & Petroni, A.,(2000), A Quality Assurance-Oriented Methodology For Handling Tradeoffs In Supplier Selection, *International Journal of Physical Distribution & Logistics Management, 30* (2), 96-11.

Byrne, B. M., (1994), Structural Equation Modeling With EQS and EQS/Windows, *Thousand Oaks*, CA: Sage Publications.

Browne, M. W., and Cudeck, R., (1993), Alternative Ways Of Assessing Model Fit

Bollen, K.A. and Long, J. S. (Eds.), Testing Structural Equation Models, Newsbury Park, CA: Sage, 136-162.

Cagliano, R., Golini, R., Caniato, F., Kalchschmidt, M. and Spina, G., (2008), Supply Chain Configurations in A Global Environment: A Longitudinal Perspective, *Operations Management Research*, 1 (2), 86-94.

Calia, R.C., Guerrini, F.M. and Castro, M., (2009), The Impact Of Six Sigma In The Performance Of A Pollution Prevention Program, *Journal of Cleaner Production*, 17, 1303-1310.

Camarero, C., (2007), Relationship Orientation Or Service Quality? What Is The Trigger Of Performance In Financial And Insurance Services?, *International Journal of Bank Marketing*, 25(6), 406-426.

Carr, A.S. and Kaynak, H., (2007), Communication Methods, Information Sharing, Supplier Development and Performance: An Empirical Study of Their Relationships, International Journal of Operations & Production Management, 27 (4), 346-370.

Carter, J. R., Maltz, A. and Yan, T., (2008), How Procurement Managers View Low Cost Countries And Geographies A Perceptual Mapping Approach, *International Journal of Physical Distribution & Logistics Management*, Vol. 38 No. 3, 2008, pp. 224-243.

Chan, F.T.S., (2003), Performance Measurement In A Supply Chain, *International Journal of Advanced Manufacturing Technology*, 21, 534-548.

Chen, Y. J., (2011), Structured Methodology for Supplier Selection And Evaluation In A Supply Chain, *Information Sciences*, 181, 1651-1670.

Chen,Y.M. and Huang, P.N., (2007), Bi-Negotiation Integrated AHP In Suppliers Selection, *International Journal of Operations & Production Management*, 27 (11), 1254-1274.

Cheung, M. F. Y. and To, W. M., (2010), Management Commitment To Service Quality and Organizational Outcomes, *Managing Service Quality*, 20 (3), 259-272.

Child, D., (2006), *The Essentials of Factor Analysis*, 3rd Edition, Continuum International Publishing Group, London-NY.

Chong, V. K. and Rundus, M. J., (2004), Total Quality Management, Market Competition and Organizational Performance, *The British Accounting Review,* 36, 155-172.

Chong, H., White, R.E. and Prybutok, V., (2001), Relationship Among Organizational Support, JIT Implementation, and Performance, *Industrial management & Data Systems,* 101 (6), 273-280.

Clarke, R. A., (2012), How China Steals Our Secrets, *New York Times*, Retrieved from www.nytimes.com/2012/04/03/opinion/how-china-steals-our-secrets.html?_r=0.

Corredor, P. and Goni, S., (2011), TQM And Performance: Is The Relationship So Obvious?, *Journal of Business Research*, 64, 830-838.

Cousins, P.D., Menguc, B., (2006), The Implications Of Socialization And Integration In Supply Chain Management, *Journal of Operations Management,* 24 (5), 604-620.

Creswell, John W. (2009), *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 3rd Edition, Thousand Oaks, CA: SAGE Publications.

Cronbach, L. J., (1951), Coefficient Alpha and the Internal Structure of Tests, *Psychometrika*, 16 (3), 297-333.

Crooks, E. (2012), GE Takes $1bn Risk in Bringing Jobs Home, *Financial Times*, Retrieved from www.ft.com/intl/cms.

Culp, S., (2012), Supply Chain Risk a Hidden Liability for Many Companies, http://www.forbes.com/sites/steveculp/2012/10/08/supply-chain-risk-a-hidden-liability-for-many-companies/.

Cummins, Incorporated Official Website, Retrieved from http://www.cummins.com/cmi/

Dahlgaard, J.J. and Dahlgaard, S.M.P. (2001), Lean Production, Six Sigma Quality, TQM and Company Culture – A Critical Review, *Conference Proceedings from the International Shanghai Quality Symposium*, November.

Day, G.S., (2000), Managing Market Relationships, *Journal of the Academy of Marketing Science,* 28 (1), 24-30.

De Boer, L. and Van Der Wegen, L., (2003), Practice and Promise Of Formal Supplier Selection: A Study Of Four Empirical Cases. *Journal of Purchasing and Supply Management*, 9(3), 109-118.

De Boer, L., Labro, E. and Morlacchi, P. (2001), A Review of Methods Supporting Supplier Selection, *European Journal of Purchasing & Supply Management*, 7, 75-89.

Dick, G.P.M., Heras, I. and Casadesus, M., (2008), Shedding Light on Causation between ISO 9001 and Improved Business Performance, *International Journal of Operations & Production Management*, 28 (7), 687-708.

Dickson, G.W., (1966), An Analysis of Vendor Selection Systems and Decisions, *Journal of Purchasing*, 2 (1), 5-17.

Duening, T. N. and Click, R.L., (2005), *Essentials of Business Process Outsourcing*, Wiley.

Dyer, J. H. and Hatch, N. W. (2006), Relation-Specific Capabilities and Barriers to Knowledge Transfers: Creating Advantage through Network Relationships, Journal of Strategic Management, 27, 701–719.

Ellram, L.M., (2013), Off-shoring, Reshoring and the Manufacturing Location Decision, *Journal of Supply Chain Management*, 49 (2), 3-5.

Eaton Corporation Official Website, Retrieved from http://www.eaton.com/Eaton/index.htm

Fang, T., Gunterberg, C. and Larsson, E., (2010), Sourcing in an Increasingly Expensive China: Four Swedish Cases, *Journal of Business Ethics*, 97, 119-138.

Ferdows, K. (1997), Made in the World: The Global Spread of Production, P*roduction and Operations Management*, 6 (2), 102-109.

Field, A., (2005), *Discovering Statistics Using SPSS*, Second Edition, Thousand Oaks, CA: Sage Publications.

Fishman, C., (2012), The Insourcing Boom, Retrieved from http://www.theatlantic.com/magazine/archive/2012/12/the-insourcing-boom/309166/?single_page=true.

Flynn, B.B., Schroeder, R. and Sakakibara, S., (1995). The Impact of Quality Management Practices on Performance and Competitive Advantage, *Decision Sciences*, 26 (5), 659-692.

Forker, L. B., Ruch, W. A. and Hershauer, J. C., (1999), Examining Supplier Improvement Efforts from Both Sides, *The Journal of Supply Chain Management: A Global Review of Purchasing and Supply,* August.

Frahm, S., (2003), Global Sourcing: Levels and Risks, *The Supply Chain Resource Cooperative Articles Library*, North Carolina State University.

Friedman, T.L., (2005), *The World Is Flat: A Brief History of The Twenty-First Century*, Farrar, Strous and Groux, NewYork.

Fullerton, R. R. and Wempe, W.F., (2009), Lean Manufacturing, Non-Financial Performance Measures, and Financial Performance, *International Journal of Operations & Production Management*, 29 (3), 214-240.

Gabor, A., (2001), Management: Ford Embraces Six Sigma, *Newyork Times*, Retrieved from http://www.nytimes.com/2001/06/13/business/13QUAL.html.

Geng, W. and Hu, Y., (2012), Selection of Data Process Outsourcing Provider Based on AHP, *International Conference on Measurement, Information and Control (MIC)*, May 18-20, IEEE.

Ghadimi, P. and Heavey, C., (2014), Sustainable Supplier Selection in Medical Device Industry: Toward Sustainable Manufacturing, 21st CIRP Conference on Life Cycle Engineering, *Procedia CIRP,* 15, 165-170.

Golden, P., (1999), Deere on the Run: Quick Response Manufacturing Drives Supplier Development at John Deere, *IIE Solutions*, 31 (7), 24-31.

Golini, R. and Kalchschmidt, M., (2011), Moderating the Impact Of Global Sourcing On Inventories Through Supply Chain Management, *International Journal of Production Economics*, 133, 86-94.

Gotzamani, K. D. and Tsiotras, G. D., (2001), An Emprical Study of the ISO 9000 Standards' Contribution Towards Total Quality Management, *International Journal Of Operations and Production Management*, 21 (10), 1326-1342.

Gray, J.V., K., Skowronski, G., Esenduran, and M.J., Rungtudanatham, (2013), Reshoring Phenomenon: What Supply Chain Academics Ought to Know and Should Do, *Journal of Supply Chain Management*, 49 (2), 27-33.

Green Jr., K. W., Whitten, D., & Inman, R. A., (2008), The Impact of Logistics Performance On Organizational Performance In a Supply Chain Context, *Supply Chain Management: AnInternational Journal,* 13(4), 317-327.

Groom, B. and Powley, T., (2014), Reshoring Driven by Quality, Not Costs, Say UK Manufacturers, *Financial Times*, http://www.ft.com/cms/s/0/9757ffcc-9fc9-11e3-94f3-00144feab7de.html#axzz3GLb6tvcP.

Gunasekaran, A., Patel, C. and McGaughey, R.E., (2004), A Framework For Supply Chain Performance Measurement, *International Journal of Production Economics*, 87, 333-347.

Gutierrez-Osuna, (2014), Pattern Analysis, CSCE 666, Course Notes, Computer Science & Engineering, Texas A&M University, TX, USA.

Habidin, N. F., (2012), Lean Six Sigma Initiative: Business Engineering Practices and Performance in Malaysian Automotive Industry, *IOSR Journal of Engineering (IOSRJEN,* 2 (7), 13-18.

Hagerty, J.R., 2011, U.S. Factories Buck DeclineSector Creating More Jobs Than It's Cutting; Shining Star, *Wall Street Journal*, Retrieved from http://online.wsj.com/articles/.

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R., (2006), *Multivariate Data Analysis,* 6th Edition, Uppersaddle River, N.J.: Pearson Prentice Hall.

Hahn, G., (2005), Supplier Development Serves Customers Worldwide, *DSN Retailing Today*, 44 (December 19), 6.

Hallgren, M. and Olhager, J., (2009), Lean and Agile Manufacturing: External and Internal Drivers and Performance Outcomes, *International Journal of Operations & Production Management*, 29 (10), 976-999.

Handfield, R.B., Krause, D.R., Scannell, T.V. and Monczka, R. M., (2000), Avoid The Pitfalls In Supplier Development, *MIT Sloan Winter Magazine*, Retrieved from http://sloanreview.mit.edu/article/avoid-the-pitfalls-in-supplier-development/.

Harry, M. and Schroeder, R., (2000), *Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations*, Doubleday Random House, Inc., New York.

Hesselschwerdt, P., (2006), Making Lean Six Sigma Work in Sales, Retrieved from www.globalpartnersinc.com.

Ho, W., Xu, X. and Dey, P.K., (2010), Multi-Criteria Decision Making Approaches For Supplier Evaluation and Selection: A Literature Review, *European Journal of Operational Research,* 202, 16–24.

Hollander, M., Wolfe, D.A., & Chicken, E., (2013), *Nonparametric statistical methods*, 3rd Edition, New York: Wiley.

Holweg, M., Reichhart, A. and Hong, E., (2011), On Risk and Cost in Global Sourcing, *International Journal of Production Economics*, 131, 333-341.

Holz, R., (2009), An Investigation into Off-shoring and Back-shoring in the German Automotive Industry, *PhD Thesis,* University of Wales, Swansea, November.

Huang, S. H. and Keshar, H., (2007), Comprehensive and Configurable Metrics for Supplier Selection, *International Journal of Production Economics*, 105, 510-523.

Ittnera, C. D., Larckera, D. F. and Randall, T., (2003), Performance Implications Of Strategic Performance Measurement In Financial Services Firms, *Accounting, Organizations and Society*, 28, 715-741.

Jaafreh, A. B., (2013), The Effect of Quality Management Practices on Organizational Performance in Jordan: An Empirical Study, *International Journal of Financial Research*, 4(1), 93-109.

Jaccard, J., & Wan, C. K., (1996), LISREL Approaches To Interaction Effects In Multiple Regression, *Thousand Oaks Sage Publications*.

Johnson, A., Swisher, B., (2003), How Six Sigma improves R&D, *Research Technology Management*, 46 (2), 12-15.

Johnston, D.A., McCutcheon, D.M., Stuart, F.I. and Kerwood, H., (2004), Effects Of Supplier Trust On Performance Of Cooperative Supplier Relationships, *Journal of Operations Management*, 22, 23-38

Joiner, T. A., (2006), Total Quality Management and Performance: The Role Of Organization Support And Co-Worker Support, *International Journal of Quality & Reliability Management*, 24 (6), 617-627.

Junyan, H., (2010), The Determinants of Sourcing by Multinationals in China, *Management and Service Science (MASS) International Conference*, 1-4.

Kakabadse, A.P. and Kakabadse, N., (2002), Trends in outsourcing: Contrasting USA and Europe, *European Management Journal,* 20 (2), 189-198.

Kanapathy, K., (2008) Critical Factors of Quality Management Used In Research Questionnaires: A Review Of Literature, *Sunway Academic Journal,* 5, 19-30.

Kannan, V. R., and Tan, K. C., (2005), Just In Time, Total Quality Management, and Supply Chain Management: Understanding Their Linkages And Impact On Business Performance, *Omega,* 33, 153-162.

Kaplan, R.S. and Norton, P.D., (1992), The Balanced Scorecard-Measures That Drives Performance, *Harvard Business Review*, 70, 71-79.

Karuppusami, G. and Gandhinathan, R., (2006), Pareto Analysis of Critical Success Factors Of Total Quality Management:A Literature Review And Analysis, *The TQM Magazine*, 18 (4), 372-385.

Kausik, U. and Mahadevan, B., (2012), A Review of Strategic Sourcing Literature During 1997-2010: Trends and Emerging Issues for Research, *South Asian Journal Of Management*, 19 (2), 78-98.

Kaynak, H., (2003), The Relationship Between Total Quality Management Practices and Their Effects on Firm Performance, *Journal of Operations Management* 21, 405-435.

Keskin, G. A., Ilhan, S. and Ozkan,C., (2010), The Fuzzy ART Algorithm: A Categorization Method for Supplier Evaluation and Selection, *Expert Systems with Applications*, 37, 1235-1240.

Kim, M. and Boo, S., (2010), Understanding Supplier-Selection Criteria: Meeting Planners' Approaches to Selecting and Maintaining Suppliers, *Journal of Travel & Tourism Marketing*, 27 (5), 507-518.

Kim, J. O. and Mueller, C.W., (1984), *Introduction to Factor Analysis*, Beverly Hills; Sage.

Kinkel, S., and S. Maloca, (2009), Drivers and Antecedents of Manufacturing Off-shoring and Backshoring: A German perspective, *Journal of Purchasing & Supply Management*, 15, 154-165.

Kinkel, S., (2012), Trends in Production Relocation and Back-shoring Activities: Changing

Patterns in the Course of the Global Economic Crisis, *International Journal of Operations & Production Management*, 32 (6), 696-720.

Kim, D. Y., Kumar, V. and Kumar, U., (2012), Relationship between Quality Management Practices and Innovation, *Journal of Operations Management*, 30, 295-315.

Kline, R. B. (1998), Principles and Practice of Structural Equation Modeling, NY: Guilford Press.

Kocabasoglu, C and Suresh, N.C., (2006), Strategic Sourcing: An Empirical Investigation of the Concept and Its Practices in U.S. Manufacturing Firms. *The Journal of Supply Chain Management* 42 (2), 4-16.

Koh, T. K., Fichman, M. and Kraut, R. E., (2012), Trust Across Borders: Buyer-Supplier Trust in Global Business-to-Business E-Commerce, *Journal of the Association for Information Systems*, 13 (11), Nov, 886-922.

Kotabe,M and Helsen, K., (2004), *Global Marketing Management*, Wiley.

Krajewski, L.J. and Ritzman, L.P., (2004), *Operations Management: Processes and Value Chains*, 7th Edition., Upper Saddle River, NJ: Prentice-Hall.

Krause, D.R., Handfield, R.B. and Tyler, B.B., (2007), The Relationships Between Supplier Development, Commitment, Social Capital Accumulation And Performance Improvement, *Journal of Operations Management*, 25, 528-545.

Krause, D.R., Handfield, R.B. and Scannell, T.V., (1998), An Empirical Investigation Of Supplier Development: Reactive And Strategic Processes, *Journal of Operations Management*, 17, 39-58.

Krause, D.R., Scannell, T.V., Calantone, R.J., 2000, A Structural Analysis of the Effectiveness of Buying Firms' Strategies to Improve Supplier Performance, *Decision Sciences*, 31 (1), 33-55.

Kuo, R.J., Wang, Y.C. and Tien, F.C., (2010), Integration Of Artificial Neural Network and MADA Methods For Green Supplier Selection, *Journal of Cleaner Production*, 18, 1161-1170.

Lakhal, L., Pasin, F. and Limam M., (2006), Quality Management Practices and Their Impact On Performance, *International Journal of Quality & Reliability Management*, 23 (6), 625-646.

Lam, S. Y. et al., (2011), The Relationship Between TQM, Learning Orientation And Market Performance In Service Organizations: An Empirical Analysis, *Total Quality Management*, 22(12), 1277-1297.

Lampon, J.F. and Lago-Penas, S. (2013), Factors Behind International Relocation And Changes In Production Geography In The European Automobile Components Industry, *MPRA*, Paper No. 45659, University of Vigo and REDE.

Laohavichien, T., Fredendall, L. D. and Cantrell, R. S., (2011), Leadership And Quality Management Practices In Thailand, *International Journal of Operations & Production Management*, 31 (10), 2011, 1048-1070.

Larsen MM, Manning S, Pedersen T., (2013), Uncovering the Hidden Costs Of Offshoring: The Interplay Of Complexity, Organizational Design, and Experience, *Strategic Management Journal,* 34, 533-552.

Lawson, B., Tyler, B.B. and Cousins, P.D., (2006), Social Capital Effects On Relational Performance Improvement: An Information Processing Perspective. *Best Paper Proceedings of Academy of Management Conference*, August 2006.

Lee, K.C., and Choi, B., (2006), Six Sigma Management Activities And Their Influence On Corporate Competitiveness, *Total Quality Management*, 17(7), 893-911.

Lehman, A., O'Rourke, N., Hatcher, L. and Stepanski, E., (2013), *JMP for Basic Univariate and Multivariate Statistics: Methods for Researchers and Social Scientists*, Second Edition, SAS Institute Inc., Cary, NC, USA.

Leibl, P.R., Morefield, & R., Pfeiffer, (2011), A Study of Effects of Back-shoring in the EU, *Journal of Business and Behavioural Sciences*, 23 (2), Summer, 72-79.

Lewin, A.Y., Massini S. and Peeters, C.,(2009), Why Are Companies Offshoring Innovation? The Emerging Global Race For Talent, *Journal of International Business Studies*, 40, 901-925.

Li, W., Humphreys, P.K., Yeung, A.C.L., and Cheng T.C.E., (2007), The Impact Of Specific Supplier Development Efforts On Buyer Competitive Advantage: An Empirical Model. *International of Production Economics,* 106, 230-247.

Lockstrom, M., (2007), *Low-Cost Country Sourcing: Trends and Implications*, 1st Edition, Deutscher Universitäts-Verlag, GWV Fachverlage GmbH, Wiesbaden.

Marin, L.M. and Ruiz-Olalla, M.C., (2011), ISO 9000:2000 Certification and Business Results, *International Journal of Quality & Reliability Management*, 28 (6), 649-661.

Marr, B., (2012), *Key Performance Indicators (KPI): The 75 Measures Every Manager Needs To Know*, Financial Times Publishing, Pearson, Great Britain.

Marsh, H. W., Hau, K.T., and Wen, Z., (1996), An Evaluation of Incremental Fit Indices: Aclarification of Mathematical and Empirical Properties, In G.A. Marcoulides and R.E. Schemacker (Eds.), *Advanced Structural Equation Modeling: Issues and Techniques* (315 353), Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Marti, F. (2005), Lean Six Sigma Method in Phase 1 Clinical Trials: A Practical Example. Quality Assurance Journal, 9, 35-39.

Martínez-Lorente, A. R. and Martínez-Costa, M., (2000), ISO 9000 & TQM: Substitutes Or Complementaries? An Empirical Study in Industrial Companies, Polytechnic University of Cartegana, Spain.

McClelland, G.H. and Judd, C.M., (1993), Statistical Difficulties Of Detecting Interactions and Moderator Effects.

McGill, R., John W. Tukey and W. A. Larsen, 1978, Variations of Box Plots, *American Statistician,* 32, 12-16.

Mellahi, K. and Eyuboglu, F., (2001), Critical Factors For Successful Total Quality Management Implementation In Turkey: Evidence From The Banking Sector, *Total Quality Management*, 12 (6), 745-756.

Mellat-Parast, M. and Digman, L. A., (2007), Framework for Quality Management Practices In Strategic Alliances, *Management Decision*, 45 (4), 802-818.

Modi, S.B. and Mabert, V.A., (2007), Supplier Development: Improving Supplier Performance Through Knowledge Transfer, *Journal of Operations Management*, 25 (1), 42-64.

Morschett, D., Schramm-Klein, H. and Zentes, J., (2010), *Strategic International Management*, 2nd Edition, Springer.

Moran, P., (2005), Structural versus Relational Embeddedness: Social Capital And Managerial Performance, *Strategic Management Journal*, 26, 1129-1151.

Motwani, J., Kumar, A. and Antony, J. (2004), A Business Process Change Framework For Examining The Implementation Of Six Sigma: A Case Study Of Dow Chemicals, *The TQMMagazine*, 16 (4), 273-83.

Muralidharan, C., Anantharaman, N., and Deshmukh,S.G., (2002), A Multi-Criteria Group Decision Making Model For Supplier Rating, *The Journal of Supply Chain Management*, 22-33.

Najeh, R. I. and Kara-Zaitri, C., (2007), A Comparative Study of Critical Quality Factors in Malaysia, Palestine, Saudi Arabia, Kuwait and Libya, *Total Quality Management*, 18 (1-2), 189-199.

Nash-Hoff, M., (2011), The 'Reshoring' Initiative-Part I: Examining The Root Causes Behind Offshoring, and Determining What's Needed to Reverse the Trend, Retrieved from *www.metalfinishing.com.*

Nassimbeni, G. and Sartor,M., (2006), Sourcing In China: A Typology, *International Journal of Production Economics*, 107, 333-349.

Nawanir, G., Teong, L.K. and Othman, S. N., (2013), Impact Of Lean Practices On Operations Performance and Business Performance: Some Evidence From Indonesian Manufacturing Companies, *Journal of Manufacturing Technology Management*, 24 (7), 1019-1050.

Nunnally, J. C., (1978), *Psychometric Theory*, 2nd Edition, New York: McGraw-Hill.

Pande, P., Neuman, R. and Cavanagh, R.,(2000), The Six Sigma Way: How GE, Motorola, and Other Top Companies are Honing Their Performance, McGraw Hill Professional.

Parthiban P., Zubar H. A., and Garge C. P., (2009), A Multi Criteria Decision Making Approach For Suppliers Selection, *Procedia Engineering*, 38, 2312-2328.

Paulson, D. S., (2008), Biostatistics and Microbiology: A Survival Manual, *Springer*, USA Walmart Official Website, Retrieved from http://corporate.walmart.com/global-responsibility/us-manufacturing.

Phan, A.C., Abdallah, A. B. and Matsui, Y., (2011), Quality Management Practices And Competitive Performance: Empirical Evidence From Japanese Manufacturing Companies, *International Journal of Production Economics*, 133, 518–529.

Pena, L., (2000), Retaining A Mexican Labor Force, *Journal of Business Ethics*, 26 (2), 123-131.

Peng, M. W., (2006), *Global Strategy*, Cincinnati: Thomson South-Western.

Phan, A.C., Abdallah, A. B. and Matsui, Y., (2011), Quality Management Practices And Competitive Performance: Empirical Evidence From Japanese Manufacturing Companies, *International Journal of Production Economics*, 133, 518–529.

Pohar, M., Blas, M. and Turk, S., (2004), Comparison of Logistic Regression and Linear Discriminant Analysis: A Simulation Study, *Metodoloski Zvezki*, 1 (1), 143-161.

Polidoro, R., (2012), Apple CEO Tim Cook Announces Plans To Manufacture Mac Computers In USA, *NBC News*, Retrieved from

http://rockcenter.nbcnews.com/_news/2012/12/06/15708290-apple-ceo-tim-cook-announces-plans-to-manufacture-mac-computers-in-usa.

Psomas, E.L.,Pantouvakis, A. and Kafetzopoulos, D.P., (2013), The Impact Of ISO 9001 Effectiveness On The Performance Of Service Companies, *Managing Service Quality*, 23 (2), 149-164.

Prahinski, C., and Benton, W.C., (2004), Supplier Evaluations: Communication Strategies to Improve Supplier Performance, *Journal of Operations Management*, 22 (1), 39-62

Punniyamoorthy, M., Mathiyalagan, P. and Parthiban, P., (2011), A Strategic Model Using Structural Equation Modeling And Fuzzy Logic In Supplier Selection, *Expert Systems with Applications*, 38, 458-474.

Rahman, S. and Bullock, P.(2005), Relationships Between Soft TQM, Hard TQM, and Organizational Performance, *Omega*, 33 (1), February, 73-83.

Rajesh, G. and Malliga, P., (2013), Supplier Selection Based on AHP QFD Methodology, International Conference on Design and Manufacturing, *IConDM 2013 Procedia Engineering*, 64 (2013), 1283-1292.

Ramos, J. C., Asan, S. S. and Majetic, J., (2007), Benefits Of Applying Quality Management Techniques To Support Supply Chain Management, *International Logistics and Supply Chain Congress' 2007 November 8-9*, 2007, Istanbul, Turkiye.

Riley, M., & Vance, A., (2012), Inside The Chinese Boom In Corporate Espionage, *Bloomberg Business Week*, Retrieved from www.business-week.com/articles/2012-03-14/inside-the-chinese-boom-in-corporate-espionage.

Robinson, C.J. and Malhotra, M.K., (2005), Defining The Concept Of Supply Chain Quality Management And Its Relevance To Academic And Industrial Practice, *International Journal of Production Economics*, 96(3), 315-37.

Roger John Hilton, Amrik Sohal, (2012), A conceptual model for the successful deployment of Lean Six Sigma, *International Journal of Quality & Reliability Management*, 29 (1), 54-70.

Ross, T.D., (2003), Accurate Confidence Intervals for Binomial Proportion and Poisson Rate Estimation, *Computers in Biology and Medicine*, 33(6), November, 509-531.

Ruamsook, K., Russell, D., & Thomchick, E., (2007), U.S. Sourcing from Low-Cost Countries A Comparative Analysis of Supplier Performance, *The Journal of Supply Chain Management*, 43(4), 16-30.

Rusjan, B. and Alic, M., (2010), Capitalizing On ISO 9001 Benefits for Strategic Results, *International Journal of Quality & Reliability Management*, 27 (7), 756-778.

Russell, C. J. and Bobko, P., (1992), Moderated Regression Analysis and Likert Scales Too Coarse for Comfort, *Journal of Applied Psychology*, June, 77 (3), 336-342.

Sadikoglu, E. and Zehir, C., (2010), Investigating The Effects Of Innovation And Employee Performance On The Relationship Between Total Quality Management Practices And Firm Performance: An Empirical Study Of Turkish Firms, *International Journal of Production Economics*, 127, 13-26.

Sadikoglu, E. and Zehir, C., (2010), Investigating The Effects Of Innovation And Employee Performance On The Relationship Between Total Quality Management Practices And

Firm Performance: An Empirical Study Of Turkish Firms, *International Journal of Production Economics*, 127, 13–26.

Sako, M., (2004), Supplier Development AtHonda, Nissan And Toyota: Comparative Case Studies Of Organizational Capability Enhancement,*Industrial and Corporate Change*, 13 (2), 281-308.

Sanchez-Rodríguez, C., Hemsworth, D. and Martínez-Lorente, A. R., (2005), TheEffect Of Supplier Development Initiatives On Purchasing Performance: A Structural Model, *Supply Chain Management: An International Journal*, 10 (4), 289-301.

Sarkis, J., Talluri, S., (2002), A Model for Strategic Supplier Selection, *Journal of Supply Chain Management*, 38 (1), 18-28.

Shafer, S. M. and Moeller, S. B., (2012), TheEffects Of Six Sigma On Corporate Performance: An Empirical Investigation, *Journal of Operations Management*, 30, 521-532.

Schniederjans, M. J., Schniederjans, A. M. and Schniederjans, D. G. (2005), *Outsourcing and Insourcing in an International Context*, M.E. Sharpe.

Schroeder, R.G., Linderman, K., Zhang, D., (2005), Evolution Of Quality: First Fifty Issues of Production And Operations Management, *Production and Operations Management*,14 (4), 468-481.

Schroeder, R.G., Linderman, K., Liedtke, C., and Choo, A.S., (2008), Six Sigma: Definition and underlying theory, *Journal of Operations Management*, 26 (2008), 536-554.

Senft, D., (2014), *International Sourcing: A method to Create Corporate Success*, Springer Gabler,Germany.

Serfaty, R., (2014), Chinese Employees Witness Average Salary Increase of 8.5% and 14.3% Turnover in 2013, Retrieved from http://aon.mediaroom.com/Chinese-Employees-Witness-Average-Salary-Increase-of-8-5-and-14-3-Turnover-in-2013.

Seshadri, S., (2005), Sourcing Strategy: Principles, Policy and Designs, *Springer*, USA

Shah, R. and Ward, P.T., (2007), Defining and Developing Measures Of Lean Production, *Journal of Operations Management*, 25 (4), 785-805.

Sharland, A., Eltantawy, R. A. and Giunipero, L. C., (2003), The Impact of Cycle Time on Supplier Selection and Subsequent Performance Outcomes, *Journal of Supply Chain Management*, 39, 4-12.

Sharma, U., (2003), Implementing Lean Principles with the Six Sigma Advantage: How A Battery Company Realized Significant Improvements,*J. Org. Exc.*, 22, 43-52.

Shore, B. and Venkatachalam, A. R., (2003), Evaluating The Information Sharing Capabilities Of Supply Chain Partners: A Fuzzy Logic Model, *International Journal of Physical Distribution & Logistics Management*, 33(9), 804-824.

Sila, I. and Ebrahimpour, M., (2005), Critical Linkages Among TQM Factors And Business Results, *International Journal of Operations & Production Management*, 25 (11), 1123-1155.

Sila, I. and Ebrahimpour, M., (2005), Critical Linkages Among TQM Factors And Business Results, *International Journal of Operations & Production Management*, 25 (11), 1123-1155.

Sirkin, H. L., Zinser, M., & Hohner, D., (2011), Made in America Again, *Boston Consulting Group Study,* August 2011.

Skipper, W., (2006), Services Off-shoring: An Overview, *Anthropology of Work Review*, 27 (2), 9-17.

Sousa, R. and Voss, C. A., (2002), Quality Management Re-Visited: A Reflective Review and Agenda for Future Research, *Journal of Operations Management*, 20.

Snee, R.D., (2011), Lean Six Sigma-Getting Better All the Time, *International Journal of Lean Six Sigma 1(1)*, 9-29.

Starke, F., Eunni, R. V., Dias Fouto, N.M.M. and Angelo, C.F., (2012), Impact of ISO 9000 Certification On Firm Performance: Evidence From Brazil, *Management Research Review*, 35 (10), 974-997.

Steiger, J. H., (1990), Structural Model Evaluation and Modification: An Interval Estimation Approach, *Multivariate Behavioral Research*, 25, 173-180.

Su et al., (2008), The Impacts Of Quality Management Practices On Business Performance: An Empirical Investigation From China, *International Journal of Quality & Reliability Management*, 25 (8), 809-823.

Suhr, D.D., (2005), Principle Component Analysis versus Exploratory Factor Analysis, *SUGI 30 (SAS Users Group International)*, Statistics and Data Analysis.

Sunder, V., (2013), Six Sigma: A Strategy for Increasing Employee Engagement, *The Journal for Quality & Participation*, July, 34-38.

Swink, M. and Jacobs, B. W., (2012), Six Sigma adoption: Operating performance impacts and contextual drivers of success, *Journal of Operations Management*, 30, 437-453.

Tabachnick, B.G. and Fidell, L.S., (2006), *Using Multivariate Statistics*, Fifth Edition, Pearson, NY.

Tabachnick, B. G., Fidell, L. S., (2001), *Using Multivariate Statistics*, Needham Heights Allyn & Bacon, 4th edition, 653-771.

Taj, S,. (2008), Lean manufacturing performance in China: Assessment of 65 manufacturing plants, *J. Manuf. Technology Management*, 19(2), 217-234.

Talluri, S. and Narasimhan, R., (2005), A Note On A Methodology For Supply Base Optimization, *IEEE Transactions on Engineering Management*, 52 (1), 130-139.

Tari, J.J, Molina, J. F. and Castejon, J. L., (2007), The Relationship Between Quality Management Practices And Their Effects On Quality Outcomes, *European Journal of Operational Research*, 183, 483-501.

Tate, W. L., Ellram, L. M., Petersen, K. J., & Schoenherr, T., (2012), Offshoring and Reshoring: A Survey Of Current Practices, Council Of Supply Chain Management Professionals, *Oakbrook*, IL.

Truxillo, C., Hamer, R., Rothenberg, L. and Tao, J., (2005), Multivariate Statistical Methods: Practical Research Applications Course Notes, *SAS Institute Inc.*, Cary, NC, USA.

Ullman, J. B., (2006), Structural Equation Modeling: Reviewing The Basics And Moving Forward, *J. Pers. Assess*, 2006 Aug, 87(1), 35-50.

Vagadia, B., (2012), *Strategic Outsourcing: The Alchemy to Business Transformation in a Globally Converged World*, Springer.

Van de Van, A. and Ferry, D., (1979), *Measuring and Assessing Organizations*, New York, John Wiley.

VF Corporation Official Website, Retrieved from *vfc.com.*

Wagner, S.M., (2011), Supplier Development and The Relationship Life-Cycle, *International Journal of Production Economics*, 129, 277-283.

Welling, M., (2014), Fisher Linear Discriminant Analysis Notes, Department of Computer Science, *University of Toronto.*

Williamson, J., (2012), Growing Supply Chain Disruption Encourages Re-Shoring, *Manufacturing Digital*, August 13, retrieved from http://www.manufacturingdigital.com/people_skills/growing-supply-chain-disruption-encourages-re-shoring.

Wisner, J.D., Tan, K.C. and Leong, G.K., (2005), Principles of Supply Chain Management: A Balanced Approach, *Thomson Business and Professional Publishing*.

Womack. J. P., Jones, D. T. and Roos, D., (1990), *The Machine That Changed The World*, Free Press.

Wu, Z., Choi, T.Y. and Rungtusanatham, M.J., (2010), Supplier–Supplier Relationships In Buyer–Supplier–Supplier Triads: Implications for Supplier Performance, *Journal of Operations Management*, 28 (2), March, 115-123.

Yeung, A. C.L., (2008), Strategic Supply Management, Quality Initiatives, and Organizational Performance, *Journal of Operations Management*, 26 (2008) 490-502.

Yusuf, Y., Gunasekaran, A. and Dan, G., (2007), Implementation of TQM in China and Organization Performance: An Empirical Investigation, *Total Quality Management*, 18 (5), 509-530.

Zang, W., Liu, Y. and Li, Z., (2012), Optimizing Supplier Selection with Disruptions by Chance-Constrained Programming, *ICSI 2012*, Part II, LNCS 7332, 108-116, Springer-Verlag Berlin Heidelberg.

Zsidisin, G.A. and Ellram, L.M., (2003), AnAgency Theory Investigation Of Supply Risk Management, *The Journal of Supply Chain Management*, 39(3), 15-27.

Zu, X., Robbins, T.L, & Fredendall, L.D., (2010), Mapping the Critical Links Between Organizational Culture and TQM/Six Sigma Practices, *International Journal of Production Economics,*123, 86-106.

APPENDICES

Appendix A

Survey

Q1 Could you please write:1) Your company's name,2) Your position in your company,3) Your company's primary products?

Q2 How do you describe your company in terms of its basic operations? Please check all that apply.

- ❑ Manufacturer
- ❑ Private Brand
- ❑ Retailer
- ❑ Other (please specify) _____

Q3 Which of the following marketing strategies apply to your company? Please check all that apply.

- ❑ Low Cost
- ❑ High Automation
- ❑ High Technology
- ❑ High Quality
- ❑ Made-in-US
- ❑ Green/Sustainable
- ❑ Speed-to-Market
- ❑ Niche Marketing
- ❑ Mass production
- ❑ High Innovation
- ❑ High Research and Development
- ❑ Other (please specify) _____

Q4 How many employees are working in your company?

- ❍ 1-50
- ❍ 51-100
- ❍ 101-250
- ❍ 251-500
- ❍ 501-1,000
- ❍ 1,001-5,000
- ❍ 5,001 -10,000
- ❍ 10,001-15,000
- ❍ 15,001-25,000
- ❍ 25,001-35,000
- ❍ 35,001-45,000
- ❍ >45,000

Q5 What is your company's annual revenue?
❍ Less than 10 million
❍ 10 million – 25 million
❍ 25 million – 50 million
❍ 50 million – 100 million
❍ 100 million – 250 million
❍ 250 million – 500 million
❍ 500 million – 1 billion
❍ 1 billion – 10 billion
❍ 10 billion – 25 billion
❍ More than 25 billion

Q6 Do you have DOMESTIC SUPPLIERS located in the United States?
❍ YES ❍ NO

Q7 Do you have any INTERNATIONAL SUPPLIERS?
❍ YES ❍ NO

Q8 Have you moved any of your OFFSHORE outsourcing back to the United States? (i.e. RE-SHORING)
❍ YES ❍ NO

Q9 Have you ever changed the location or the country of your OFFSHORE outsourcing to another location or country other than the US?
❍ YES ❍ NO

Q10 Why did you choose to source from different countries other than US? Please rate how influential the following factors in your decisions to outsource your products.

	VERY INFLUENTIAL 1	2	3	4	5	6	LEAST INFLUENTIAL 7
Unit Price	❍	❍	❍	❍	❍	❍	❍
Labor Costs in the Country	❍	❍	❍	❍	❍	❍	❍
Energy Costs in the Country	❍	❍	❍	❍	❍	❍	❍
Raw Material Costs in the Country	❍	❍	❍	❍	❍	❍	❍
Raw Material Availability	❍	❍	❍	❍	❍	❍	❍
Proximity to the source of raw or intermediate materials	❍	❍	❍	❍	❍	❍	❍
Mass production capability	❍	❍	❍	❍	❍	❍	❍

Q11 YOU STATED THAT:
- You have changed some of your international suppliers (RELOCATING), or
- You have brought some of your manufacturing or sourcing back to the US (RE-SHORING).
From where did you draw your sourcing back (or the location you had changed) and WHY?

	From WHERE?	WHY? What were the ISSUES? Please check all that apply					
	Regions	Overall Quality Issues	Overall Cost Issues	Delivery Issues	Unavailability of Factors - Energy, Raw Mater. etc.	Overall Risk	Other (IP Protection, Environment. Issues etc.)
North America (Canada, Mexico)	❑	❑	❑	❑	❑	❑	❑
Central and South America	❑	❑	❑	❑	❑	❑	❑
East Asia (including China)	❑	❑	❑	❑	❑	❑	❑
South Asia (including India)	❑	❑	❑	❑	❑	❑	❑
Middle East	❑	❑	❑	❑	❑	❑	❑
Central and Eastern Europe (including Turkey)	❑	❑	❑	❑	❑	❑	❑
Western Europe	❑	❑	❑	❑	❑	❑	❑
Africa	❑	❑	❑	❑	❑	❑	❑

Q12 How much of your company's manufacturing or sourcing did you bring back to the US?
❍ < 10%
❍ 11 - 25%
❍ 26 - 50%
❍ > 50%

Q13 Are you planning to bring MORE manufacturing or sourcing back to the US?
❍ Yes
❍ No

Q14 How INFLUENTIAL are each of the following factors for your company in your decisions to RESHORE or RELOCATE your INTERNATIONAL sourcing or manufacturing?

	Very Influential 1	2	3	4	5	6	Not Influential 7
Increase In Unit Price	❍	❍	❍	❍	❍	❍	❍
Increase In Labor Costs In The Country	❍	❍	❍	❍	❍	❍	❍
Increase In Energy Costs In The Country	❍	❍	❍	❍	❍	❍	❍
Increase In Raw Material Costs	❍	❍	❍	❍	❍	❍	❍
Increase In Shipment Costs	❍	❍	❍	❍	❍	❍	❍
Problems In Availability Of Raw Materials	❍	❍	❍	❍	❍	❍	❍
Low Process Technology	❍	❍	❍	❍	❍	❍	❍
Communication And Cooperation Problems With The Suppliers	❍	❍	❍	❍	❍	❍	❍
Political And Economic Instability/Risk In The Country	❍	❍	❍	❍	❍	❍	❍
Problems In Intellectual Property Protection	❍	❍	❍	❍	❍	❍	❍
Nonconformance Incidents And Work Safety	❍	❍	❍	❍	❍	❍	❍

Q15 Please state if each of the QUALITY FACTORS can be a factor for your company to decide to RESHORE or RELOCATE your INTERNATIONAL sourcing?

	YES	NO
Issues In Product Quality Of Supplier	❍	❍
Issues In Supply Chain Quality Of Supplier (Delivery Performance Etc.)	❍	❍
Issues In Management Quality Of Supplier	❍	❍
Issues In Workforce Quality Of Supplier	❍	❍
Issues In Process (Manufacturing) Quality Of Supplier	❍	❍

(Q16, Q17 and Q18 are same the questions with Q11, Q14 and Q15 respectively, however in the form of non-reshore and relocate companies.)

Q19 IN THIS PAGE, some of the QUALITY ISSUES are listed briefly in groups. Please rate how problematic the following factors are for your international suppliers.

Q20 "SUPPLY CHAIN QUALITY" ISSUES: regarding INTERNATIONAL SUPPLIERS

	Very Problematic 1	2	3	4	5	6	No Problems At All 7
Fill Rate (Rate Of Order Fulfillment)	❍	❍	❍	❍	❍	❍	❍
Delivery Time (Order Lead Time)	❍	❍	❍	❍	❍	❍	❍
On Time Delivery Rate	❍	❍	❍	❍	❍	❍	❍
% Of Perfect Orders	❍	❍	❍	❍	❍	❍	❍
Accurate And Precise Information Sharing	❍	❍	❍	❍	❍	❍	❍
Fast Response To Requests	❍	❍	❍	❍	❍	❍	❍

Q21 "PRODUCT QUALITY" ISSUES: regarding INTERNATIONAL SUPPLIERS

	Very Problematic 1	2	3	4	5	6	No Problems At All 7
Product Quality	❍	❍	❍	❍	❍	❍	❍
Product Appearance	❍	❍	❍	❍	❍	❍	❍
Meet Specifications (Conformance)	❍	❍	❍	❍	❍	❍	❍

Q22 "PRODUCT QUALITY" based ISSUES: arising from INTERNATIONAL SUPPLIERS

	Very Problematic 1	2	3	4	5	6	No Problems At All 7
Distributor / Retailer Rejection Rates	❍	❍	❍	❍	❍	❍	❍
End Customer Returns	❍	❍	❍	❍	❍	❍	❍
Returns And Warranty Costs	❍	❍	❍	❍	❍	❍	❍
Incoming Goods Inspection Cost	❍	❍	❍	❍	❍	❍	❍
Local Onsite Inspection Costs	❍	❍	❍	❍	❍	❍	❍

Q23 "MANAGEMENT QUALITY": of INTERNATIONAL SUPPLIERS

	How Problematic Is The Factor?						
	Very Problematic 1	2	3	4	5	6	No Problems At All 7
Overall Management Of The Supplier	❍	❍	❍	❍	❍	❍	❍
Communication And Cooperation Ability	❍	❍	❍	❍	❍	❍	❍
Documentation And Self Inspection	❍	❍	❍	❍	❍	❍	❍
Quality Management Practices And Systems	❍	❍	❍	❍	❍	❍	❍

Q24 "WORKFORCE QUALITY": of INTERNATIONAL SUPPLIERS

	How Problematic Is The Factor?						
	Very Problematic 1	2	3	4	5	6	No Problems At All 7
Training Level	❍	❍	❍	❍	❍	❍	❍
Skills And Experience	❍	❍	❍	❍	❍	❍	❍
Productivity	❍	❍	❍	❍	❍	❍	❍

Q25 "PROCESS (MANUFACTURING) QUALITY": of INTERNATIONAL SUPPLIERS

	How Problematic Is The Factor?						
	Very Problematic 1	2	3	4	5	6	No Problems At All 7
Design/Development Capability	❍	❍	❍	❍	❍	❍	❍
Ability To Modify Products	❍	❍	❍	❍	❍	❍	❍
Process Technology	❍	❍	❍	❍	❍	❍	❍
Level Of Automation	❍	❍	❍	❍	❍	❍	❍
Work Safety	❍	❍	❍	❍	❍	❍	❍

Q26 IN THIS PAGE, some of the QUALITY ISSUES are listed briefly in groups. Please rate how problematic the following factors are for your DOMESTIC suppliers.

(Q27 - Q33 are the same questions with Q20-Q25, however in the form of domestic suppliers.)

Q33 Which quality initiative(s) has YOUR COMPANY implemented in the past and present? Please check all the ones applicable.

- ❑ Lean
- ❑ Six Sigma
- ❑ Total Quality Management (TQM)
- ❑ ISO Quality Certifications (ISO 9001 etc.)
- ❑ Others (Please state) _____
- ❑ No Initiative Undertaken

Q34 Which quality initiative(s) have your DOMESTIC SUPPLIERS implemented in the past and present? Please check all the applicable ones.

- ❑ Lean
- ❑ Six Sigma
- ❑ Total Quality Management (TQM)
- ❑ ISO Quality Certifications (ISO 9001 etc.)
- ❑ Other Quality Initiatives (Please state) _____
- ❑ No Initiative Undertaken

Q35 Has your company ever provided ASSISTANCE or TRAINING to your DOMESTIC SUPPLIERS for the implementation of the following quality initiatives:

- ❑ Lean
- ❑ Six Sigma
- ❑ Total Quality Management (TQM)
- ❑ ISO Quality Certifications (ISO 9001 etc.)
- ❑ Other Quality Initiatives (Please state) _____
- ❑ No Help or Training Provided

Q36 Has your company ever provided technical assistance to your DOMESTIC SUPPLIERS in the past or present?

- ❍ Yes
- ❍ No

Q37 Which quality initiative(s) have your INTERNATIONAL SUPPLIERS implemented in the past and present? Please check all the applicable ones.

- ❑ Lean
- ❑ Six Sigma
- ❑ Total Quality Management (TQM)
- ❑ ISO Quality Certifications (ISO 9001 etc.)
- ❑ Other Quality Initiatives (Please state) _____
- ❑ No Initiative Undertaken

Q38 Has your company ever provided ASSISTANCE or TRAINING to your INTERNATIONAL SUPPLIERS for the implementation of the following quality initiatives:

- ❑ Lean
- ❑ Six Sigma
- ❑ Total Quality Management (TQM)
- ❑ ISO Quality Certifications (ISO 9001 etc.)
- ❑ Other Quality Initiatives (Please state) _____
- ❑ No Help or Training Provided

Q39 Has your company ever provided technical assistance to your INTERNATIONAL SUPPLIERS in the past or present?

- ❍ Yes
- ❍ No

Q40 Has implementation of a quality initiative resulted in improvement in your company in the following factors? How do you rate the impact of these Quality Management Practices i.e. leadership, employee relations, customer relations, process management and quality improvement role structure, on your company's performance improvement? (1- Significant Improvement ... , 7-No Improvement)

Q41 Organizational Performance Factors

	Significant Improvement 1	2	3	4	5	6	Insignificant / No Improvement 7
Net Profit Margin (Profit Per Product)	❍	❍	❍	❍	❍	❍	❍
Order Fulfillment Cycle Time	❍	❍	❍	❍	❍	❍	❍
Full And On Time Delivery Rate	❍	❍	❍	❍	❍	❍	❍
Defect Rate	❍	❍	❍	❍	❍	❍	❍
Product Quality	❍	❍	❍	❍	❍	❍	❍
Employee Productivity	❍	❍	❍	❍	❍	❍	❍

Q42 Please indicate your agreement level with the statements below:

Q43 YOUR COMPANY'S TOP MANAGEMENT ...

	Strongly Agree 1	2	3	4	5	6	Strongly Disagree 7
Supports Long-Term Quality Improvement Process.	❍	❍	❍	❍	❍	❍	❍
Regularly Reviews Quality Issues In Meetings	❍	❍	❍	❍	❍	❍	❍
Considers Quality Improvement As A Way To Increase Profits	❍	❍	❍	❍	❍	❍	❍

Q44 CUSTOMER RELATIONSHIP EFFORTS IN YOUR COMPANY:

	Strongly Agree 1	2	3	4	5	6	Strongly Disagree 7
We Have A Clear Definition Of Customer Requirements	❍	❍	❍	❍	❍	❍	❍
Our Company Uses Customer Requirements As The Basis Of Quality	❍	❍	❍	❍	❍	❍	❍
Our Company Attains Customer Feedback On Quality And Delivery Performance	❍	❍	❍	❍	❍	❍	❍

Q45 EMPLOYEE RELATIONS/ HUMAN RESOURCES MANAGEMENT SYSTEM IN YOUR COMPANY:

	Strongly Agree 1	2	3	4	5	6	Strongly Disagree 7
Our Employees Are Responsible For Quality	❍	❍	❍	❍	❍	❍	❍
Our Employees Are Provided With The Feedback On Their Quality Performance	❍	❍	❍	❍	❍	❍	❍
Our Workers Are Encouraged To Participate In Quality Decisions	❍	❍	❍	❍	❍	❍	❍

Q46 PROCESS MANAGEMENT IN YOUR COMPANY:

	Strongly Agree 1	2	3	4	5	6	Strongly Disagree 7
Preventive Actions Are More Important Than Corrective Ones During Manufacturing Processes	❍	❍	❍	❍	❍	❍	❍
We Have Standardized Processes And Instructions In Place	❍	❍	❍	❍	❍	❍	❍
We Have Clean And Well Organized Manufacturing Floors	❍	❍	❍	❍	❍	❍	❍

Q47 SIX SIGMA ROLE STRUCTURE IN YOUR COMPANY:

	Strongly Agree 1	2	3	4	5	6	Strongly Disagree 7
We Have A Black/Green Belt Role Structure (Or Equivalent Structure) For Continuous Improvement In Our Company	❍	❍	❍	❍	❍	❍	❍
The Roles And Responsibilities Of Quality Improvement Teams Are Clearly Identified In Our Company	❍	❍	❍	❍	❍	❍	❍
Our Company Uses A Structured Approach (Such As DMAIC) To Manage Quality Improvement Activities	❍	❍	❍	❍	❍	❍	❍

Q48 What are the most challenging factors in implementation of a quality initiative (such as Lean and Six Sigma) IN YOUR COMPANY? 1- VERY CHALLENGING ... 7-NOT A CHALLENGE

	Very Challenging 1	2	3	4	5	6	Not A Challenge 7
Lack Of Commitment Of Managers	❍	❍	❍	❍	❍	❍	❍
Resistance Of Employees To New Implementations	❍	❍	❍	❍	❍	❍	❍
Lack Of Knowledge In Quality Methods	❍	❍	❍	❍	❍	❍	❍
No Clearly Defined Financial Benefits Of Quality Methods	❍	❍	❍	❍	❍	❍	❍
Poor Definition Of Customer Requirements	❍	❍	❍	❍	❍	❍	❍
Problems In Project Selection, Execution And Review Process	❍	❍	❍	❍	❍	❍	❍
Inadequate Process Control Techniques	❍	❍	❍	❍	❍	❍	❍
Lack Of Continuity In Implementation Of Quality Methods	❍	❍	❍	❍	❍	❍	❍
Lack Of Communication Between Different Departments	❍	❍	❍	❍	❍	❍	❍
Lack Of Financial Resources	❍	❍	❍	❍	❍	❍	❍

Q49 QUALITY INITIATIVES in INTERNATIONAL SUPPLIERS What are the main problems during the implementation of quality initiatives or providing assistance for the quality initiatives in INTERNATIONAL suppliers?

	Very Challenging 1	2	3	4	5	6	Not A Challenge 7
Management Style In Suppliers	❍	❍	❍	❍	❍	❍	❍
Information Exchange With Suppliers	❍	❍	❍	❍	❍	❍	❍
Time Cost And Expense To Visit Supplier	❍	❍	❍	❍	❍	❍	❍
Lack Of Awareness In Quality Management Methods (Lean, Six Sigma Etc.)	❍	❍	❍	❍	❍	❍	❍
Employee Reluctance To Participate In Quality Implementations	❍	❍	❍	❍	❍	❍	❍
Supplier Training Costs	❍	❍	❍	❍	❍	❍	❍
Other (Please Specify)	❍	❍	❍	❍	❍	❍	❍

Q50 QUALITY INITIATIVES in DOMESTIC SUPPLIERS What are the main problems during the implementation of quality initiatives or providing help for the quality initiatives in DOMESTIC suppliers? (1- VERY CHALLENGING, 7- NOT AT ALL A CHALLENGE)

	Very Challenging 1	2	3	4	5	6	Not At A Challenge 7
Management Style In Suppliers	❍	❍	❍	❍	❍	❍	❍
Information Exchange With Suppliers	❍	❍	❍	❍	❍	❍	❍
Time Cost And Expense To Visit Supplier	❍	❍	❍	❍	❍	❍	❍
Lack Of Awareness In Quality Management Methods (Lean, Six Sigma Etc.)	❍	❍	❍	❍	❍	❍	❍
Employee Reluctance To Participate In Quality Implementations	❍	❍	❍	❍	❍	❍	❍
Supplier Training Costs	❍	❍	❍	❍	❍	❍	❍
Other (Please Specify)	❍	❍	❍	❍	❍	❍	❍

Appendix B

Institutional Review Board Approval Letter

From: Jennifer Ofstein, IRB Coordinator
North Carolina State University
Institutional Review Board
Date: January 8, 2014
IRB#: 3694

Dear Meryem Uluskan,

The research proposal named above has received administrative review and has been approved as exempt from the policy as outlined in the Code of Federal Regulations (Exemption: 46.101. b.2). Provided that the only participation of the subjects is as described in the proposal narrative, this project is exempt from further review. This approval does not expire, but any changes must be approved by the IRB prior to implementation.

NOTE:

1. This committee complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU projects, the Assurance Number is: FWA00003429.
2. Any changes to the research must be submitted and approved by the IRB prior to implementation.
3. If any unanticipated problems occur, they must be reported to the IRB office within 5 business days.

Please forward a copy of this letter to your faculty sponsor, if applicable.

Thank you.

Sincerely,