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A Qualitative Study of Selected Quality Knowledge and Practices in Guangdong Province, China

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A QUALITATIVE STUDY OF SELECTED QUALITY KNOWLEDGE AND PRACTICES IN GUANGDONG PROVINCE, CHINA

by

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ABSTRACT

A QUALITATIVE STUDY OF SELECTED QUALITY KNOWLEDGE AND PRACTICES IN GUANGDONG PROVINCE, CHINA

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The manufacturing industry has become very competitive in today's global market environment. Many US companies are faced with the choice of keeping their manufacturing domestic or looking to low cost off-shore countries to take advantage of the labor costs differences. To gain an understanding of the state of manufacturing in China, a major focus in the manufacturing world today, this thesis was undertaken. This thesis presents the findings of research conducted in Guangdong Province, China in June – July, 2005.

This research addressed customer focus, leadership and general manufacturing and quality knowledge and practices of small, medium and large sized companies in Guangdong Province, China. Customer focus and leadership are two of the eight fundamental principles of the ISO 9000:2000 family of standards. These two principles, customer focus and leadership, were selected for the foundational role they play in any

organization. Companies that are customer focused and have good leadership principles and practices should tend to give quality a priority for the product/service they provide to their customers. The aim of this thesis was to determine if there is a significant difference in the way small, medium and large companies are aligned with these two fundamental principles. Data regarding customer focus, leadership, and general manufacturing and quality knowledge and practices was collected from 41 manufacturing companies in Guangdong Province, China through the use of a survey, interviews and observation.

At the conclusion of this thesis, a summary of the findings regarding the aim of the thesis is presented along with a confirmation and questioning of previous research completed.

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1. INTRODUCTION

1.1. Background

Manufacturing, as we now know it, has evolved to become a world-wide operation. Manufacturing firms in less developed countries now play an integral role in the supply chain of major corporations throughout the world. There are many different reasons for the great expansion in operations. Some companies wish to expand their reach into emerging markets. Others wish to cut production or assembly costs by outsourcing these operations to low labor cost companies in developing countries. Whatever the reason used to justify the move into international markets, the fact remains that outsourcing is fast becoming an integral strategy for many major corporations (Hymowitz, 2004).

Outsourcing to foreign manufacturers can be a risky move, but, if done right, can also prove to be very profitable. Many factors must be analyzed when companies outsource their manufacturing to offshore manufacturers in developing countries. To be profitable, corporations must be sure product quality isn't compromised through outsourcing production or assembly operations to foreign businesses. In an effort to safeguard against poor quality, it is not unusual for many businesses to send representatives of their companies to foreign manufacturing facilities to review off-shore

operations and the quality of product(s) produced (Hawks, 2004). Traveling to foreign manufacturing companies to check on their operations is an expensive and cumbersome practice and could prove to have insufficient results. "Accurately assessing both the current quality level of suppliers and their potential for achieving the quality requirements of U.S. firms is difficult and often unscientific" (Hawks, 2005). Efforts have been made by the International Standards Organization (ISO) to standardize quality management practices. The ISO 9000 family of standards were established to ensure consistency in quality management across international borders. Because of the standards' international acceptance, certification with the standards has become necessary for entry into international markets. Customers (commercial and consumer) recognize certified organizations as establishments with which they would like to do business.

Manufacturing firms in developing countries face inherent problems for quality production because of their location which suffers from limited availability of resources and poor infrastructures within the country. Small and medium sized enterprises (SMEs) that manufacture in developing countries are at an even greater disadvantage in their operations. Factors that impact SMEs include: a) SMEs in developing countries do not have as much capital to run their operations as do the larger corporations in their country; b) Unskilled and non-secondarily educated employees often make up the workforce for these establishments; and c) State of the art equipment is rarely utilized within these companies due to the high cost of the equipment and limited availability within their country or the lack of knowledge to properly operate the equipment. Under these conditions, inefficient production methods and outdated equipment form the basis for the SME's operations. It is not impossible to produce quality products under such

conditions, but such conditions make it more challenging to do so. The performance of the SMEs is critical to the success of the international supply chains being utilized today. Companies are more commonly using international supply chains and SMEs are integral to the supply chain. In order to be an effective contributor to their local economy and to the world's economy, and to remain profitable, SMEs and larger corporations in developing countries need to produce goods that are compliant with international quality standards.

Larger corporations utilize and often depend on SMEs for the parts that are used in their final products (Jones *et al.*, 2005; Temtime and Solomon, 2002; Thomas and Webb, 2003). The practice of contracting components to be produced by outside suppliers helps to keep large corporations' production costs down and reduces the amount of time required to produce a final product.

In addition to being important in the supply chain, SMEs are also critical to the economic growth and strength of their countries (Tannock *et al*., 2002). For example, they account for more than half of the new jobs created in the U.S. economy (Boyko and Gottesman, 2004). Similarly, small manufacturing firms in developing countries account for nearly half of manufacturing employment (Little, 1987) and in some cases have captured as much as 44% of their respective markets (Tybout, 1999). Because of the important economic role SMEs play in their countries and their contribution to final products, SMEs in developing countries are integral in the success of their manufacturing industry. It is, therefore, in the best interest of the SME and the companies with whom they do business to increase their quality awareness and production.

1.2. Problem Statement

Whatever the size of the manufacturing enterprise, quality plays a very important role in its success. SMEs, and more particularly, SMEs in developing countries, face greater challenges in implementing a Quality Management System (QMS) than their larger counterparts. Factors such as their lack of resources (capital, employees, equipment, etc.) and lack of knowledge of quality practices all impact the ability of the SME to achieve high quality. SMEs in developing countries need proper guidance to aid in the implementation of an appropriate QMS. Post-WWII Japan learned this. The level of quality awareness in Japan has made it a manufacturing giant. Japanese quality has become the benchmark in manufacturing. SMEs in developing countries can achieve the same greatness in quality that Japan has but they must do so through good planning, understanding their operations and increased expertise. Before an SME implements a QMS, it needs to understand the level of quality awareness present in its operations.

China's economy has been growing dramatically since its open-door policy in 1978. A large part of that growth is due to the burgeoning manufacturing industry in China. All, however, is not well in China's manufacturing sector. China has a quality problem (Zhang, 1998) and it seems to be more prevalent in the SMEs of China than in the larger manufacturing enterprises (Zhang, 1998). With the integral role of SMEs established and the apparent interest in China today, quality capabilities in SMEs should be of great interest and concern to the global economy.

This study was initiated to gain an understanding of the state of product quality and quality management practices in place in Chinese SME manufacturing companies. The aim of this thesis was to compare SMEs to large corporations regarding their

alignment with two of the eight foundational principles of ISO 9001:2000 – leadership and customer focus. These principles were selected for the foundational role they play in any organization. Companies that are customer focused and have good leadership principles and practices should tend to give quality a priority for the product/service they provide to their customers. The remaining six principles seem to be based off these two principles. Efforts were also made to capture information regarding the general operational and quality knowledge and practices of Chinese manufacturing companies.

1.3. Research Question

The intent of this study was to determine if there is a difference in the alignment between small, medium and large companies with respect to the selected ISO 9001:2000 principles. The research question for this study was: "Is there a significant difference between small, medium and large manufacturing companies in Guangdong Province, China in terms of their alignment to the selected ISO 9001:2000 principles of leadership and customer focus?"

1.4. Size Classifications of Businesses

For the sake of understanding what range of businesses the researcher addressed, a size classification was established. Several organizations have defined the size classifications of businesses. ISO's Technical Committee 176, the committee responsible for writing the ISO 9000:2000 family of standards, has defined small businesses as having less than 50 employees, medium sized businesses as having from 50 to less than 250 employees and large businesses with 250 or more employees (Monnich, 2001). Little *et al.* classify small businesses in developing countries as having fewer than 200

employees, medium from 200 – 499 employees and large having 500 or more employees (1987). Due to the labor intensive nature of operations in the manufacturing industry in China and the fact that China is more developed than other developing nations, the size classification used in this thesis for small enterprises was adjusted to be from 1 – 130 employees, medium-sized enterprises from 131 – 499 employees and large enterprises as having > 499 employees. In addition to the labor intensive nature of manufacturing businesses in China, personal observation of businesses in China suggested a logical breakpoint at these numbers in terms of sophisticated operations usually associated with small, medium and large enterprises. Conversations with managers in China also confirmed the size classification established for this thesis (G.B., 2005; Z.T., 2005).

1.5. International Standards

In an effort to help narrow the gap in quality practices of businesses around the globe, international standards for quality have been developed to set a foundation for quality systems for all businesses world-wide. The ISO 9000 family of standards are one of the widely used versions of international standards for quality used in business today. The ISO 9000 family of standards has provided a means for standard practices in quality management, thus enabling more commonality in the approach to quality management for businesses in developed and developing nations alike. Much progress has been made in manufacturing industries and international business since the introduction of the ISO standards for quality (G.B., 2005; Z.T., 2005; G.S., 2005). The ISO standards have helped enable businesses to have a more common approach to managing for quality in their operations. The current version of the ISO standards for quality, ISO 9001:2000, is

based upon eight fundamental principles, which will be discussed further in the review of literature.

Two of the eight fundamental principles of the ISO 9000:2000 family of quality standards were selected for the framework of the survey used in this study. The two principles that were selected are: a) Customer Focus and b) Leadership (management). These principles were selected for the fundamental role they play in businesses. Businesses that are customer focused will do what they can to ensure they are meeting their customers' needs. The leadership in an organization is very influential in determining what key success factors the organization will pursue to obtain success. Quality is a customer need that needs to be met by the organization in order for it to sustain long-term success. A more comprehensive discussion of the role the selected principles play is given in Chapter 3, which outlines the methodology for this study.

1.6. Methodology

The approach selected for this thesis primarily involved the use of surveys, on-site interviews and observation. A survey was administered to 41 companies in Guangdong Province, China. The aim of the survey, interviews and observations was to determine how well the manufacturing companies in Guangdong Province, China are aligned with their leadership and customer focus and to compare the alignment of SMEs to large companies. The data collected from the surveys, interviews and observations was analyzed to quantify and interpret the results. Information obtained was used to determine how well the companies are aligned with their leadership and customer focus, two of the foundational principles of ISO 9001:2000.

1.7. Delimitations

The purpose of this thesis was not to promote the implementation of ISO 9001:2000 standards in the operations of manufacturing businesses. Rather, it was to determine the degree of alignment of companies in Guangdong Province, China with selected principles of the ISO 9001:2000 standards for quality. Selected principles from the ISO 9001:2000 standards were used as a framework for analyzing the information obtained from 41 companies. This thesis does not take the following factors into consideration in the analysis:

- Form of ownership (SOE, POE, COE, Foreign joint ventures, others)
- Age of facilities
- Age of business
- Product manufactured
- Whether the company does international business or not
- Amount of revenue
- Management style

1.8. Thesis Contribution

China has become a major focal point for business and production. With a major role being played by manufacturing companies in China in the global supply chain and an increased awareness of business opportunities in China, the quality practices of all sizes of firms in China should be of particular interest to the U.S. corporations outsourcing manufacturing jobs to China. Most of the products that are supplied to the U.S. from China come from a supply chain that is made up of small, medium and large companies. The results of this thesis shed light on the current practices of leadership, customer focus

and general quality knowledge and practices of manufacturing companies in Guangdong Province, China.

1.9. Definition of Terms

- **Privately Owned Enterprise (POE)** – businesses owned and operated by private entities
- **State Owned Enterprise (SOE)** – businesses owned and operated by the Chinese National Government.
- **Joint Venture (JV)** – businesses owned and operated as by at least two separate parties – possibly by companies from different countries
- **Foreign Owned Enterprise (FOE)** – business owned and operated by a foreign country
- **Quality Management System (QMS)** – Standardized methods and procedures used by a company to ensure they meet
- **International Organization for Standardization (ISO)** – international organization responsible for defining international standards.
- **Collectively Owned Enterprise (COE)** – businesses owned and operated as a collective effort typically by townships.
- **Small- and Medium-Sized Enterprise (SME)** – businesses with less than 500 employees.
- **Guangdong Province** – Province located in Southeast China
- **Statistical Quality Control (SQC)** – the use of statistics to improve and control quality.

- **Statistical Process Control (SPC) –** the use of statistical tools to measure an ongoing process for variation and control.
- **GI –** company located in Guangdong Province, China that provided assistance for the researcher.

2. REVIEW OF LITERATURE

2.1. Introduction

A review of literature was conducted to gain an understanding of the nature of the problem regarding the quality management practices in SMEs in mainland China and internationally. There is extensive literature covering SMEs in developing countries which aided in providing a general understanding of what challenges manufacturing SMEs face in their operations. However, less research has been conducted with regards to the quality management practices and issues of SMEs in China (Zhang, 2000). Therefore, extensive searching was conducted to discover sources that would be of benefit to the researcher. Several sources were found that discussed the general condition of quality in China as well as the general quality practices for manufacturing businesses in China. Generally speaking, none of the sources specifically targeted SMEs; rather, all sizes of businesses were grouped together in the analysis conducted. The literature reviewed does, however, provide good insight into the general condition of quality and quality practices in China. Literature was also reviewed that provides a description of the ISO 9000 standards and illustrates how the standards may aid SMEs in China in improving their quality management practices. This section will provide the reader with background of the quality practices of China through time, descriptions of the factors affecting China's quality today, and an overview of the ISO 9000 standards.

2.2. Definition of Quality

The international standard definition of "quality" is used to establish a common definition. ISO 9000:2000 defines quality as the degree to which a set of inherent characteristics fulfills requirements; requirements are needs or expectations that are stated, generally implied or obligatory (ANSI/ISO/ASQ Q9000-2000). This definition of quality is the one used for this thesis.

2.3. History of Quality Practices in China

China is well known for the rich history of its society. Records of its ancient civilizations date back to the 21st century B.C. In order to thrive, civilizations need to be able to provide for their citizens. Providing for citizens may be accomplished through such means as production, trade, and war among other methods. China has a deep history in manufacturing. China's manufacturing history nearly parallels its societal history. China's society has had a great impact on the quality practices in manufacturing through the centuries. In fact, as will be illustrated later, the ways of China's ancient society affect the quality practices of manufacturing businesses in China to this day.

2.3.1. Ancient History of Quality Practices

"China's ancient quality control system is closely related with China's ancient society" (Juran, 1990a). China has been centrally controlled for centuries. From the Xia Dynasty in the 21st century B.C. to the current governing body today, policies and procedures have been determined by a central controlling body. Along with all the societal policies are also the policies that govern quality control. With regards to the ancient Chinese society, Juran states "The centralized autocratic state included a

centralized system of quality control over the whole process of handicraft production, from the beginning to the end" (1990a). Under the Western Zhou Dynasty (11th century B.C. to 8th century B.C.), a system set up to control handicraft production was done so in the state administrative organizations. The administrative organizations were composed of five major departments, each according to their function: "1) The department in charge of production collection, storage, and distribution of raw and semi-finished materials; 2) The department of production and manufacturing; 3) The department for storing and distributing completed products; 4) The department for formulating and executing standards; and 5) The department of supervision and examination" (Juran, 1990a).

Very little changed in the structure of and policies created by the state administrative organizations throughout the ages. Through such a structure, specific policies, procedures and practices were created and enforced in the Chinese industry. One example of such a policy forbade shoddy utensils, carts, and cottons and silks from being sold in the market (Juran, 1990a). Standards were also created to ensure everyone was on the same page when it came to weights and measurements.

Self-inspection and traceability were very important in ancient times. Craftsmen would inspect their work for defects and were required to inscribe their names on their manufactured product so an end-user could track them down if the product was deemed to be of poor quality. If the product reached the market and was found to be inferior, the craftsman would be penalized and the cause of the defect had to be determined.

The state stressed planning and this was evidenced in the development and creation of cities, palaces and bridges (Juran, 1990b). Chang-an City was a carefully

planned city that was 84 square kilometers in size. In planning the city, designers went as far as building scaled wooden models of buildings.

A division of labor was instituted to improve product quality. As a result of the division of labor and good quality practices, products, such as 2,000 year old bells and a bronze vessel used for cooking that was cast in the 12th century B.C., are still functional today (Juran, 1990b). The trades and skills of craftsmen were passed down through a recruiting and training system. Craftsmen of the same trade were required to live in the same geographical area, thus enabling a streamlined manner of training others in the various professions. This practice was in place in as early as 475 B.C. (Juran, 1990b).

Management in the state owned businesses kept strict track of costs associated with the production of goods. Clear and definite standards were made regarding such things as time available for work (in the different seasons), amount of work expected to be completed by individuals (according to the various types of work performed, and the sex and age of the worker), and production quotas (Juran, 1990b).

China also eventually developed a system of random sampling of products for inspection. This was accomplished in the Song Dynasty, which was in the 12th century B.C. (Juran, 1990b). Products were selected for inspection in two manners. One manner of sample collection was when a specified volume of product was produced. When the pre-determined amount of product was made, a random sample would be taken for inspection. The other method involved the random sampling of products that were produced within a certain time frame.

"China's quality control (practices) originated from the period of the Shang and Zhou Dynasties", (Juran, 1990b) which span from the 17th century B.C. to 8th century

B.C. China has been centrally controlled for much of its history and traditions in China get passed on from generation to generation, without much changing. As a result, the laws and practices governing quality have changed very little. "Such historical inheritance and the associated conservatism contributed to the backward status of China's modern industrial production and quality control even after the abrupt rise of modern industry and commerce. Thus modern quality control could hardly break through China's traditional state of inertia" (Juran, 1990b).

2.3.2. Quality Practices from 1949 – 1956

The year 1949 marks the creation of the People's Republic of China. From 1949 to 1956, China had adopted a management system similar to that of the former Soviet Union (Chin, et al, 2001; Li *et al.*, 2003; Zhang, 2000). Zhang described this system as having three levels, that of center, locality and enterprise (2000). Under such a system, state owned enterprises (SOEs) were set up for the production of goods. This form of enterprise became the most prevalent in China because nearly all the private enterprises were taken over or bought by the government (Chin *et al.*, 2001). Everything from what and how much was to be manufactured to the marketing of the products was controlled by the central governing body (Sun, 2000). Companies did as they were told and didn't consider ways to improve things because quality was also controlled by the government. Quality control at this time depended mainly on product inspection. Most production and engineering departments were not responsible for quality concerns, so a lack of responsibility for product quality was prevalent. Because of the socialist approach of central control of operations, this phase of quality management in China's history was

marked by: no responsibility for quality, no incentive for quality, no customer focus, and ignorance of cost of poor quality (Chin *et al.*, 2001).

2.3.3. Quality Practices from 1957 – 1977

The style of quality management in China from 1957 – 1977 is known as the "Chinese" style (Chin *et al.*, 2001; Li *et al.*, 2003). The reason for the name is likely due to the quality initiatives begun during this time by the Chinese. In 1957 a research initiative was begun to improve quality in China. A research group was appointed under the Chinese Academy of Sciences. This group introduced statistical quality control (SQC) to China. China also developed a standardization system that would support the quality control framework (Chin *et al.*, 2001). In 1960, the communist party issued a charter that played an important role in enterprise management that resulted in the intensification of quality management (Chin, *et al*., 2001; Zhang, 2000). This charter encouraged management and employees to work together in technology innovation and the implementation of democratic management. Soon thereafter, another policy was created that required management and employees to participate in each others' functions. This manner of creating functional teams aided in addressing problems faced within the organization and in improving quality by providing opportunities to gain insight from other employees. This illustrates the understanding that putting more diverse minds to work on solving problems will aid in creating innovative solutions.

Things were going quite well in China's industry until the Great Cultural Revolution of 1966. As a result of the revolution, Zhang states that "Disorder, irresponsibility, low morale, and poor product quality emerged in Chinese enterprises" (2000, p. 94). Chin *et al.*, described the affects on quality as a result of the outcome of

the revolution as coming "to a standstill in the country and lagged far behind that in the West and Japan" (2001, p. 841). Chinese industry struggled in quality performance until some transformation efforts began in the mid- to late-70s.

2.3.4. Quality Practices from 1978 – 2000

In 1978, China adopted an "open door" policy which attracted many investors into the Chinese market. When China became an open market, scholars advocated the importance of quality management and total quality concepts (Chin *et al.*, 2001). Quality management techniques were introduced from nations such as Canada, Japan, the United Kingdom, and the United States of America. The Chinese Government became heavily involved in promoting efforts stimulating businesses to emphasize quality management and improve product quality (Zhang, 2000). Total Quality Management (TQM) became a very popular program for quality management within organizations and was endorsed by the Chinese Government. SOEs were encouraged to implement the TQM program in their operations. Chin *et al.*, determined that the adoption of TQM practices "brought significant impact on quality management in Chinese enterprises. They included:

- move to grant enterprises more autonomy;
- allow enterprises to retain their profits that are then taxed by the state; and
- give enterprise managers more responsibility, and as such innovations as the shareholding system" (2001, p. 842).

TQM practices became a standard for quality control and improvement in China. China also became very interested in international certifications to aid in the implementation of TQM. The ISO 9000 series was officially adopted by the Chinese Government in 1988 and eventually became the standards in developing certification

practices of the quality system (Chin *et al.*, 2001). In 1998 all joint ventures that exported products were required to be ISO 9000 certified. China encouraged enterprises to use the ISO 9000 certification and continuous quality improvement (CQI) efforts to aid in the realization of TQM.

During this transformation period, many recognition and award programs were instigated by the Chinese Government. These programs are comparable to the Malcolm Baldridge National Quality Award in the United States, the Deming Prize in Japan, and the European Quality Award in Europe. The programs were successful for a little while, but eventually the newness wore off and product quality began to deteriorate. Receiving the awards and certifications became a mere formality for companies and was no longer an incentive for companies to pursue real quality improvement in their operations (Sun, 2000; Zhang, 2000). In order to stop the downward spiral of poor quality, China instituted the State Supervision and Inspection of Product Quality (SSIPQ) (Zhang, 1998 & 2000). SSIPQ was to supervise and inspect the quality of various products throughout China. Unannounced quality audits were conducted by the SSIPQ on a quarterly basis in companies throughout the country. The inspections performed by the SSIPQ focused mainly on consumer products, production materials and products related to human health and safety.

The existence of the SSIPQ came into question when the researcher was in China. Two documented sources, an engineering manager that has been working in various locations in China over the past 13 years and a CEO of a medium-sized manufacturing company, who claimed to be the first American to build a factory in China (nearly 30 years ago), have never heard of the SSIPQ and the engineering manager said he thought it

was just a way for the Chinese Government to try to show the world it is in control of what goes on in its country (G.B., 2005; G.M., 2005). This might be due to the "surprise" nature in which the audits take place or the existence of the SSIPQ might actually be a hoax. Whether the SSIPQ exists or not isn't the purpose of this thesis, however, Zhang presented and discussed data that represents ten years of audits performed in manufacturing companies through the SSIPQ (1998). Results of these audits, that took place from 1986 – 1995, will be discussed in the following section.

2.4. State of China's Quality Today

The historical significance of quality in China has been established. The state of China's Quality today is discussed in this section. This section will present the condition of quality in China's general market and SMEs.

2.4.1. Quality of General Market

Although China has a rich history in quality control practices in its production of goods sold, the level of the quality of its products today is still relatively low (Zhang, 1998 & 2000; Li *et al.*, 2003; Lee and Zhou, 2000; Zhang *et al.*, 2000; Sun, 2000; Zhao *et al.*, 1995). Lee and Zhou (2000) found in their study that manufacturing companies in China that have a quality strategy like TQM seem to be more quality conscious and as a result have better product quality than their counterparts without a good quality strategy. In Zhang's (1998) report on the SSIPQ in China, the average sample conformity rate of products audited from 1985 – 1996 was 73.6%. Li *et al.* (2003) found that the product quality of SOEs was lower than the other types of owned businesses (POEs, COEs, and

others). This is a problem considering that as late as 2001 SOEs accounted for 44% of urban employment and represented some 70% of government revenue (Li *et al.*, 2003).

2.4.2. Quality of Small-sized Manufacturing Enterprises

Most of the literature reviewed dealt mainly with medium to large-sized companies and their level of quality management and product quality. Only one of the 20+ articles that were reviewed specifically talked about the performance of small-sized companies in China. The small companies in the article, however, were grouped with medium-sized companies, so the performance of the small companies alone was not discussed. It became apparent that the small-sized manufacturing enterprises in China weren't specifically analyzed for their quality practices and capabilities in particular.

In Zhang's breakdown of the types of manufacturing businesses that were audited by the SSIPQ, the midsize and small companies were grouped together in the analysis (1998). The midsize and small companies' conformity rates were found to be 72.3%, while the conformity rate of the large companies was 86.3% (Zhang, 1998). It would be interesting to discover the breakdown of the midsize and small companies to see if there is any significant difference in the performance between the two groups and if the performance of the small-sized companies is similar to that of the township enterprises. Small to large manufacturing firms in the province of Liaoning, China were analyzed in Zhang *et al.*'s analysis for an instrument to measure TQM implementation (2000). The categories for the different sizes of companies were determined by the Chinese Government and the smallest company had 75 employees. With respect to the number of companies that are adopting quality practices and certifications (Chin *et al.*, 2001; Lee and Zhou, 2000; Li *et al.*, 2003; Zhang *et al.*, 2000; Zhang, 2000) it is apparent that the

Chinese industry is very aware of the quality problems that plague it, but, yet again, a detailed breakdown was not given to give the reader a sense of the quality management approaches taken by small-sized manufacturing enterprises and the quality performance of such enterprises in particular.

From the available literature, it is thus concluded that the quality of products manufactured by SMEs in China is poor (Zhang, 1998 & 2000; Li *et al.*, 2003; Lee and Zhou, 2000; Zhang *et al.*, 2000).

2.5. Factors Affecting Quality in China

This section discusses some of the major factors that affect product quality in China. The factors are divided into two groups: External and Internal. External factors refer to the factors that are outside the organization and internal factors are those that are within the organization.

2.5.1. External

External factors are those that are found outside the organization of the company. These factors can play a major role for such things as business operations and types of products produced. Following is a discussion of some of the major external influences that play a role in the level of quality that is present in the manufacturing industry in China today. These include: a) Laws, b) Market, c) Local Government Protection, d) Consumers and e) Counterfeit Goods.

2.5.1.1. Laws

The governing body of China has been very heavily involved in the quality management of products manufactured in its country (Juran, 1990a & b; Chin *et al.*,

2001; Zhang, 1998 & 2000; Li *et al.*, 2003). A major instrument that has been used by the governing body to aid in managing the quality of products is the legislation and implementation of laws and activities regarding quality in the manufacturing industry. Table 1 lists a number of the various quality activities and laws that have been adopted by the Chinese government from 1979 – 1996. The laws that have been adopted deal with such things as standardization, metrology, product quality, consumer rights and protection, and combating unfair competition (Zhang, 1998). The punishment for failure to comply with such laws is fairly severe. When companies are found to be non-compliant, a number of consequences may take place. Examples of punishments used in the enforcement of the quality policies are: halting production of the good(s), jail time for those involved in the infringement, and hefty fines (Zhang, 1998 & 2000).

While in theory such measures should crack down on poor product quality and fake products being manufactured, in practice the laws aren't strictly enforced (Li *et al.*, 2003; Zhang, 1998 & 2000). Zhang (1998 & 2000) gives examples of relaxed fines and money in exchange for jail time instead of the stricter punishment being enforced. Another problem with the laws results from the ambiguity of some of the stipulations making it difficult to follow and to enforce (Zhang, 2000). With the type of enforcement of the laws in place, companies don't really fear the consequences for their actions (Zhang, 1998 & 2000), and an environment is created where quality awareness isn't taken seriously (Li *et al.*, 2003).

Table 1 - Quality-related activities, regulations and laws adopted by the Chinese Government. Source for Table - Zhang (2000, p.95)

Quality-related activities, laws, regulations	Time of enforcement
The Excellent-Quality Product Prize	1979
The Provisional Regulations on TQM Implementation in Industrial Enterprises	1980
The Product Quality Certification	1980
The Quality Management Prize	1983
The Provisional Regulations on Production License for Industrial Products	1984
The State Supervision and Inspection of Product Quality	1985
The Measurement Law	1985
The Regulations on Industrial Product Quality Responsibility	1986
The Standardization Law	1988
The Severe Crackdown on Adulteration in Commodities	1989
The Year of Quality, Variety and Profit	1991
The China Quality Long March	1992
The Senior Quality Seminar	1992
The Decision on Further Strengthening Quality Management	1992
The Severe Crackdown on the Illegal Act of Manufacturing and Marketing Low-quality or Fake Products	1992
The Law on Combating Unfair Competition	1993
The Law on Guaranteeing the Rights and Interests of Consumers	1993
The Product Quality Law	1993
The Quality System Certification	1993
The Regulations of Adaptation of International Standards and Foreign Advanced Standards	1993
The Quality Development Program	1996

2.5.1.2. Market

During the period of 1949 – 1978, the Chinese economy was comprised mostly of SOEs (Li *et al.,* 2003). Under such a structure, all things were controlled centrally by the government. Decisions were made by the government for such things as: how many workers to be employed, how budgets are to be set, and how much of a profit to make. Resultant from the centrally planned and controlled industry was poor product quality and a lack of incentives among other things (Li *et al.*, 2003). In the early 1990s the Chinese Government began to implement changes to its economic strategy (Zhang, 2000; Li *et al.*, 2003). The new strategy was a socialist market economy structure. This socialist market economy gradually replaced the socialist commodity economy that was in place. The planning involved for the economic policy went from strict central control to a guiding central plan. The implementation of the structure has been uneven and is still in its maturing phase and there is a lot of confusion and disorder (Zhang, 2000). Within this market structure there are several forms of ownership of enterprises. There are SOEs, privately owned enterprises (POEs), collectively owned enterprises (COEs), joint ventures (JV) and solely foreign-funded enterprises. Some of these enterprises (township, POEs, and foreign joint ventures) have been found to be involved in the production and marketing of low-quality and fake goods (Zhang, 2000). From the literature, it has been determined that the market manufacturing businesses in China find themselves in is immature, uncertain, confusing, and somewhat conducive to the production of inferior quality and/or fake goods (Li *et al.*, 2003; Zhang, 2000). However, it is clear they have come on strong and made vast improvements in producing quality products in the last few years. After visiting several companies, the researcher learned

that companies in China are very aware and very capable of quality in the products they manufacture.

2.5.1.3. Local Government Protection

Local governments in China take the major responsibility for the economic development within their jurisdiction (Zhang, 1998 & 2000). Local governments are therefore very involved with the local businesses and with efforts to help stimulate the local economy. In theory, such a close interaction with the local businesses should help to ensure the quality of the products manufactured by the manufacturing businesses in the area, if quality is a priority involved with economic development. This however, is regretfully not always the case. Zhang (1998 & 2000) reports that it is not too uncommon for local governments to actually encourage the production of fake or inferior-quality goods. Convenient doors are opened to such businesses, often under the belief that it will help to stimulate the development of the local economy (Zhang, 1998 & 2000). A system of scratching each others' backs is often in place where relatives of business owners are in enforcement or leadership positions in a community and/or money is exchanged to turn the heads of authorities (G.B., 2005; Z.T., 2005; G.S., 2005). The strategy of such parties seems to be to make a quick profit in absence of a long-term plan. Such strategies do not instill the importance of manufacturing quality products. These strategies are short sighted and are not good because of the integral role quality plays in the survival and establishment of competitive advantage of businesses and in developing economies (Lee and Zhou, 2000; Hua *et al.*, 2000; Pun *et al.*, 2000a).

2.5.1.4. Consumers

Consumers in any country play an important role in determining what goods are produced. Consumers cast their "votes" for what they prefer by spending money on goods. Manufacturers respond to the vote of the consumers by producing the goods the consumers wish to purchase. In China, consumers create a market for fake or low-quality goods by buying them and sometimes preferring them to higher-quality and legitimate goods because of the lower price (Zhang, 1998 & 2000). The Chinese consumers do not have much knowledge of product quality and find it difficult to detect low-quality or fake products (Zhang, 1998 & 2000).

2.5.1.5. Counterfeit Goods

Counterfeit goods have infiltrated nearly every market in China. Counterfeit goods produced in China can range from beer to automobiles. Nearly every legitimate product has its counterfeit in China. The Chinese Government has regulations in place where fines are imposed on known counterfeit peddlers and manufacturers. Only when it is found that thousands of dollars in counterfeit goods are being sold or produced will establishments be shut down (Fowler, 2005). The peddlers and manufacturers find their ways around the searches by concealing the goods when searches take place. When the officers leave the establishment, the businesses go back to selling the counterfeit goods. The problem with counterfeit goods and intellectual piracy in China is an international concern as more companies are doing business in China and the Chinese consumer is gaining more buying power in the market (Fowler, 2005). Counterfeit goods have inferior quality when compared to their legitimate counterparts. The problem is that the demand for such products is so great that it is likely that counterfeit goods will remain for

a long time. With such a strong demand in place, an environment for imitation or poor quality products that sell for a cheap price is created and encourages manufacturers and retailers to produce and sell to the demand.

2.5.2. Internal

Internal factors are those that are present within the manufacturing organization. These factors are a direct result of the business strategy of the company, size of the company and the location of the company (in China, a developing country). A discussion of some of the major internal influences that play a role in the level of quality that is present in the manufacturing industry in China today follows. These factors include: a) Leadership, b) Culture, c) Employees, d) Business Focus and e) Equipment.

2.5.2.1. Leadership

It is management's responsibility to create an environment where quality and continuous improvement is encouraged and to encourage and allow employees to be involved in the quality management and improvement process (Zhang *et al.*, 2000; ANSI/ISO/ASQ Q9000-2000). Management in SMEs tends to have a greater influence on the policies that are adopted and on the culture that is prevalent within the business. There is a higher level of communication and fewer layers in the communication lines in SMEs because their organizations are smaller and, as a result, employees have more interaction with the leadership of the company (Lee, 2004). The leadership in SMEs is often found on the factory floor overlooking what is going on in the plant. The number of employees within SMEs is also conducive to a team based attitude. Such interaction and communication can serve as a great benefit for SMEs, but it can also be detrimental

if the management of the business does not utilize good business practices. The lack of education, experience and skill can be possible explanations for the poor business practices. This is what is happening in many of the SMEs in China. One of the contributing factors to Chinese SMEs poor quality is the lack of education, experience, skill and recognition management has with respect to quality and quality management (Sun, 2000; Zhang *et al.*, 2000; Chin *et al.*, 2001; Zhang, 1998 & 2000; Pun *et al.*, 2000a; Zhao *et al.*, 1995). Management plays a crucial role in what approach is taken to achieve quality in the business's operations (Raghunathan *et al.*, 1997). Zhao *et al.* conducted an empirical study of select service industries in China and compared the results of their findings to that of previous studies in the manufacturing sector (2004). In the study, the importance of management's perception and emphasis of quality was highlighted and was said to be critical in determining the approach to quality that is taken by the business (valid for both manufacturing and service industries). When management does initiate quality measures, they need to stand behind the procedures they are implementing, or employees will not take the practices seriously (Boiral, 2003). In China, managers tend to push the practices down to operators without the input and/or feedback from the operators regarding the quality measures (Hua *et al.*, 2000). Not encouraging or receiving feedback from employees that deal with the quality measures day after day can have a crippling affect on the business that can hold the company back from progression. One reason for the lack of communication and feedback in the Chinese companies is due to the culture.

2.5.2.2. Culture

Corporate or company culture refers to the behavior and/or attitudes of those within the organization. The culture of a company plays an important role in what gets accomplished at work. If the work environment has a culture of open communication between workers and management, management should be abreast of the current highlights/lowlights of the company, with respect to the information provided by the employees, and should be able to manage in those particular areas more effectively. If the culture at work is one of complacency then the thought of improving things and of change might sound preposterous and would probably not be a priority for the company. If the organization does not have a corporate culture that is conducive to the accomplishment of its objectives, success cannot be maintained over the long run (Pun *et al.*, 2000b).

The culture at work in Chinese enterprises is highly influenced by the Chinese national culture. The Chinese culture is highly influenced by Confucianism (Pun *et al.*, 2000b). Pun *et al.* state that "Confucianism stresses the importance of an individual's place in the social hierarchy of social relationships" (2000b, p. 330). Confucianism has strongly influenced Chinese management, centralized authority, hierarchical structures and control mechanisms in Chinese business (Pun *et al.*, 2000b). This hierarchical thinking and centralized control is an orderly way of doing things, but it seems to be causing problems in Chinese management. Employees rarely question authority or provide feedback to their superiors. As was mentioned earlier, management rarely receives feedback from the operators in an organization regarding the quality policies that have been implemented by the management. Other drawbacks to the culture at work in

Chinese businesses are: a) rare employee empowerment and self-management, b) employees not reporting negative things, c) culture makes it difficult for employees to disagree with their supervisors, and d) a lack of communication from top to bottom (Pun *et al.*, 2000b). The interest of the group is considered more important than that of individual concerns. This could encourage the phenomenon of "group think" where a group's performance is inferior to that of an individual's because of compromises that take place at the discussion table that no one really agreed with individually, but felt pressure to so act when in a group. It is important that the Chinese manufacturing businesses have a culture that goes along with their goals because it may play an integral role in the path of quality transformation they take (Chen and Lu, 1998; Pun *et al.*, 2000b).

Guanxi, or personal networks or connections, is another contributing force in the culture found at work in Chinese businesses. Guanxi is assailed in China and is against state policies, but it thrives in China. The idea behind guanxi is to create and maintain connections with others (employees, businesses, etc.) in a way that would enable someone to request favors from those he has shown favor to (Wall, 1990). Relationships are critical with guanxi. Relationships or connections are what determine whether or not a company or an individual would be willing to make things happen for someone else. Forming and maintaining a relationship isn't a bad thing, it becomes a bad thing when favors or special treatment are expected as a result of the relationship. Guanxi can be manifest in situations where managers allow employees to sleep on the job or to use company equipment for personal profit in exchange for favors in the future. Guanxi also encourages managers to get things done through the "back door". The idea of using the

"back door" is to do what it takes to get things done (Wall, 1990). If it takes a bribe to get the inspector to look the other way, a bribe will be given.

2.5.2.3. Employees

Chinese employees, as is common in developing economies, are relatively uneducated and unskilled (Sun, 2000; Zhang, 1998 & 2000; Pun *et al.*, 2000a). Zhang states that "Low-skilled employees are a very important factor in causing product quality problems in China" (2000, p. 102). The lack of education not only pertains to collegiate degrees, but also education in quality in particular. Chin *et al.* state that quality practices aren't successfully implemented due to the lack of understanding and education of the employees concerning quality (2001). Uneducated and unskilled employees are less likely to be able to understand quality principles and identify areas where quality could be improved. The lack of education and/or training is not necessarily due to the lack of a formal education. Employees are rarely trained by their company and are rarely involved in quality planning and assessment (Glover and Siu, 2000; Hua *et al.*, 2000; Zhao *et al.*, 1995). Zhang *et al.* (2000), Hua *et al.* (2000), Zhang (2000), Zhao *et al.* (1995), and Chin *et al.* (2001) all imply that if China wishes to improve its quality, employees (at all levels) need to be more involved, receive more education and training and become more quality aware.

The skill level and education of employees, however, is beginning to increase. Larger companies and companies with foreign investment are offering more incentives to highly qualified individuals to work for their organizations (Venter, 2003). With the money and other incentives these companies have to offer potential recruits, they are able to attract employees that have obtained more formal education and training. The smaller

organizations, however, that do not have the means to offer such incentives, are at a disadvantage in attracting the "high potential" employees that could aid in improving productivity and performance (Venter, 2003).

2.5.2.4. Business Focus

Chinese businesses' strategies are reflective of the environment they have been in for centuries. As a result of being in a planned, centrally controlled economy, businesses have forgotten their customers (Sun, 2000; Li *et al.*, 2003). Li *et al.* (2003), Sun (2000) and Hua *et al.* (2000) all echo the concern that Chinese manufacturing businesses need to establish a better relationship with their customers and gain a better understanding and awareness of their customers' demands. Manufacturing businesses are more concerned about quantity and production efficiency rather than quality and customer satisfaction (Li *et al.*, 2003).

Zhang *et al.* (2000) and Hua *et al.* (2000) describe Chinese businesses as having a lack of vision and long-term strategies and/or planning in quality improvement and business operations. Companies tend to pursue short-term business success without regard to how it may affect them in the long run. This is evidenced by the counterfeit and low-quality goods manufacturers that were discussed earlier. The lack of vision of the Chinese companies is illustrated by the idea that companies have that supplier quality doesn't have an affect on the quality of the goods they produce (Hua *et al.*, 2000).

The short term focus on quantity and production efficiency rather than quality and customer satisfaction is changing. More and more, Chinese companies are realizing that in order to remain competitive in a global environment, quality and quality management need to be improved. Quality is considered to be a crucial strategic factor for them to

pursue to help them sustain their business and their competitive advantage (Hua *et al.*, 2000; Lee, 2004) and many companies are implementing practices to accommodate this change in focus.

2.5.2.5. Equipment

Another reason for poor quality in China is the equipment that is used in the manufacturing enterprises. For the most part, the production equipment that is used in China is obsolete (Li *et al.*, 2003; Zhang, 1998 & 2000; Zhao *et al.*, 1995). Zhang reports that only 13% of equipment used is at an international level with the remaining 87% ranging from backwards with respects to domestic standards to a domestically advanced level (1998). Li *et al.* report that only 33% of equipment is suitable for the production task with the other two-thirds ranging from problematic to usable. SMEs in China tend to use outdated machines, which can't meet production requirements, more often than their larger counterparts (Zhang, 2000). There are a number of reasons the companies in China use outdated equipment. Some typical reasons are: limited availability of equipment and cost of equipment. When state of the art equipment is available, it has been found that it isn't fully utilized due to the lack of knowledge of how to operate the equipment (Li *et al.*, 2003).

2.6. ISO 9001:2000

This section provides information regarding ISO 9001:2000. The information that is presented covers: a) Background to the ISO 9000:2000 Family of Quality Standards, b) Eight Main Principles of ISO 9000:2000 Family of Quality Standards, and c) Use of ISO 9000:2000 Quality Standards in China.

2.6.1. Background

The International Organization for Standardization (ISO) is a non-governmental organization that promotes the development of standardization worldwide. The ISO 9000 series of quality standards was first released in 1987. Since 1987, there have been two revisions of the standards, in 1994 and 2000, to make the standards more applicable to all industries (service and manufacturing). The ISO 9000:2000 family of quality standards consists of three groups of major standards. These standards are: ISO 9000:2000—fundamentals and vocabulary; ISO 9001:2000—quality management systems: requirements; and ISO 9004:2000—quality management systems: guidelines for performance improvement. Of the three groups of standards, the ISO 9001:2000 standards are the only standards that companies can receive certification for.

The ISO 9001:2000 standards are meant to verify that an organization is compliant with its QMS, and do not guarantee high-quality products (Boiral, 2003; Tricker, 2001; Grimes, 2003; Rufe, 2002). Being ISO 9001:2000 certified only verifies that a QMS is in place. The intent of the ISO 9001:2000 standards is that it can be used for all types and sizes of organizations regardless of the product category of the organization (Cianfrani *et al.*, 2001). Because of the standards' international acceptance, certification with the standards has become necessary for entry into international markets. Customers (commercial and consumer) recognize certified organizations as establishments with which they would like to do business. The ISO 9001:2000 standards were rewritten to have more of a customer focus. By emphasizing the customer more in a QMS, it is thought that an organization will be able to better meet and exceed its customers' needs.

The assumption customers have of ISO 9000 certified organizations is that a QMS is in place that results in high-quality goods. However, just because an organization is ISO 9000 certified does not mean that it is guaranteed to have exceptional product quality; ISO standards are meant to help maintain quality, not improve it (Boiral, 2003; Ho, 1994; Li *et al.*, 2003; Sun, 2000; Zhang, 1998 & 2000; Hua *et al.*, 2000; Zhang, 1999). An organization could be ISO 9000 certified with an inferior QMS in place, which would likely result in poor product quality. What the ISO 9000 standard requires for certification is concise documentation of all the procedures that take place in the QMS. The QMS should be made up of: a) a quality manual—describing how the organization meets the ISO 9001:2000 requirements, b) processes—describing the end-to-end activities involved in project management, c) quality processors—describing the method whereby the processes are managed, and d) work instructions—describing how the individual tasks and activities are to be carried out (Tricker, 2001). An organization does not need to change the structure of its QMS in order to become certified. However, the documentation for the QMS needs to cover all aspects from design to delivery of the product. In theory, everything that is documented is what actually goes on in the certified organization. This is not always the case, as was discussed by Sun (2000) in his comparison of quality practices between Shanghai and Norwegian manufacturing businesses and by Boiral (2003) in his study of ISO certified companies in Quebec.

The important role ISO 9000 plays is in maintaining the level of quality of an organization (Pun *et al.*, 2000a). Pun *et al.* (2000a) created a model of how ISO 9000 can aid an organization in maintaining its quality as it attempts to make the up-hill climb toward continuous improvement. The illustration of this model can be seen in Figure 1.

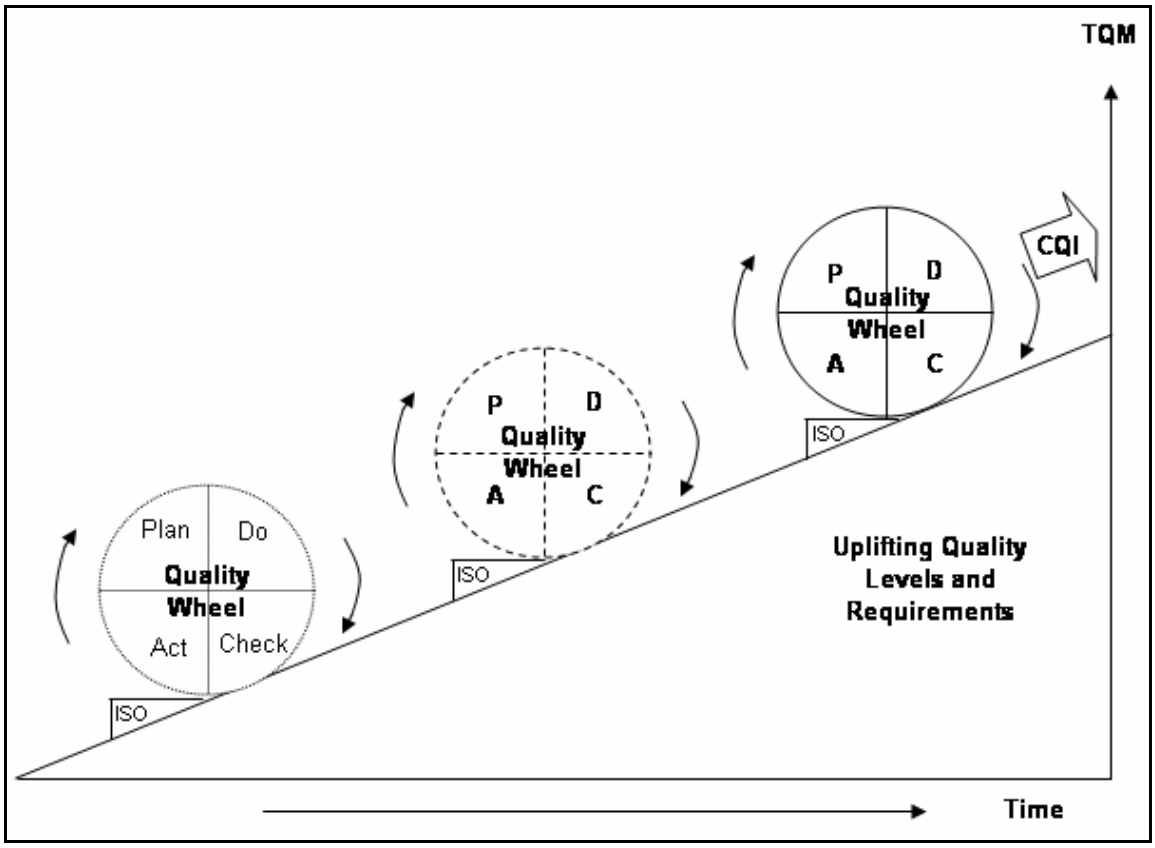

Figure 1 - ISO as a sustaining tool as abstracted from Pun *et al.* (2000a, p. 179)

Pun *et al.* (2000a) state that when an organization reaches a higher quality level, the ISO 9000 quality system would act as a reinforcing "wedge" to maintain the achieved performance. The ISO 9000 standards provide a foundation for pursuing quality goals.

A framework (survey) constructed with reference to select principles of the ISO 9000:2000 family of standards was used in this thesis to perform a comparison with the current quality practices of SMEs in Guangdong Province, China.

2.6.2. Eight Main Principles of ISO 9000:2000 Family of Standards

There are eight quality management principles identified that can be used by the leadership in a company to lead the organization to improved performance. The eight main principles were "input for developing the ISO 9000:2000 family of standards, but

they are not requirements of ISO 9001:2000" (Cianfrani *et al.*, 2001, p. 45). Cianfrani *et al.* suggest that these principles be used as a guide to policy development for the organization (2001). These principles are:

a) Customer focus

The customer is who defines quality. Customers should be the focus of organizations because of the dependence the organizations have on their customers. Organizations should understand their customers' needs (both current and future) and should meet those needs and work to exceed customer expectations.

b) Leadership

Leaders affect the culture and direction of the organization. They should create and maintain an environment in which employees can become fully involved in helping the organization achieve its objectives.

c) Involvement of people

People are the heart of an organization. The full involvement of people in the organization will enable their abilities to be used for the benefit of the organization. In order to obtain high-quality, the organization must train and empower its workers in the process. There must be an environment within the organization that encourages workers to participate and to continue to develop their skills.

d) Process approach

When activities and related resources are managed as a process, a desired result is achieved more efficiently. The ISO 9001:2000 standards identify

four major business processes for the process approach. These processes are: Management responsibility; Resource management; Product and/or service realization; and Measurement and analysis improvement.

e) System approach to management

Being able to identify, understand and manage the interrelated processes as a system will help contribute to the effectiveness and efficiency of the organization in achieving its objectives.

f) Continual improvement

Continual improvement of the organization's overall performance should be a permanent objective of the organization. Continually improving quality is a long-term strategy that requires a culture that is conducive to sticking to the plan. Such strategic planning needs to become a part of the overall business plan.

g) Factual approach to decision making

Data and information are integral in the decision making process. Effective decisions are based on the analysis of that data and information. The steady flow of accurate information is imperative for continuous improvement in an organization. Analysis of this information enables the leadership of an organization to make effective decisions in managing for quality.

h) Mutually beneficial supplier relationships

An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

Companies need to work together with their suppliers through training and education, and establishing a long-term relationship.

These eight quality management principles form the basis for the quality management system standards within the ISO 9000 family (ANSI/ISO/ASQ Q9000-2000), and two of these eight principles served as the framework of the survey used in this study.

2.6.3. Use of ISO 9000 Standards in China

The ISO 9000 series was officially adopted by the Chinese Government in 1988. Quickly after the adoption of the standards by the government, SOEs were encouraged to become ISO certified. China's first ISO 9000 certified company obtained certification in 1993 and by 1998, over 7,000 certificates had been issued (Chin *et al.*, 2001). With the increase in the number of ISO certified organizations, the Chinese Government strongly encouraged the organizations to implement CQI (Continuous Quality Improvement) efforts in their operations to strengthen the implementation of TQM. The initial movement for certification drove businesses to strengthen their quality management practices.

The affects of the excitement for certification, however, soon died out and ISO certification was looked upon more as an award than as a tool (Sun, 2000). Zhang (1998) found in his analysis of the data acquired from SSIPQ audits that the conformity rate of ISO certified companies that were surveyed was a shocking 76.5%. The ISO certified companies barely out-performed the average conformance rate for all companies that were surveyed in the ten year period (from 1986 to 1995). Whether or not their poor performance was due to non-conformance with the ISO standards is not made clear in the

study nor is the type of QMS in effect in each organization discussed. This does, however, illustrate the fact that ISO certified companies don't necessarily have high-quality products; the quality of product manufactured by certified companies is contingent on many factors including: type of QMS in place; culture of the organization; perception of quality; business strategy.

There is a concern, however, as to the legitimacy of the certifications obtained by businesses in China. There is a broad spectrum of products that are counterfeited in China, including ISO 9001:2000 certificates. Businesses in China are very aware of the impact that having an ISO 9001:2000 certificate has or can have on attracting customers. Many companies take alternate measures in obtaining the much sought after certification. An engineering manager with over twelve years of experience in business in China outlined a diagram that illustrates his perception of this problem (see Figure 2). According to the model he presented, the percentage of outright counterfeit ISO certificates in China is roughly 20% and rising. He projected that only 30% of the ISO 9001 certified companies in China obtained their certifications through legitimate means (G.B., 2005).

Even though the ISO 9000 standards have been utilized in China, there is still confusion regarding the purpose these standards serve. Several managers and employees suggested that being ISO certified means that their companies will produce high-quality goods. Some other organizations view the certification as an end-all and do not continue efforts to improve their quality operations. Organizations in Hong Kong, however, have a better understanding of how the ISO 9000 standards are to be used in obtaining greater quality.

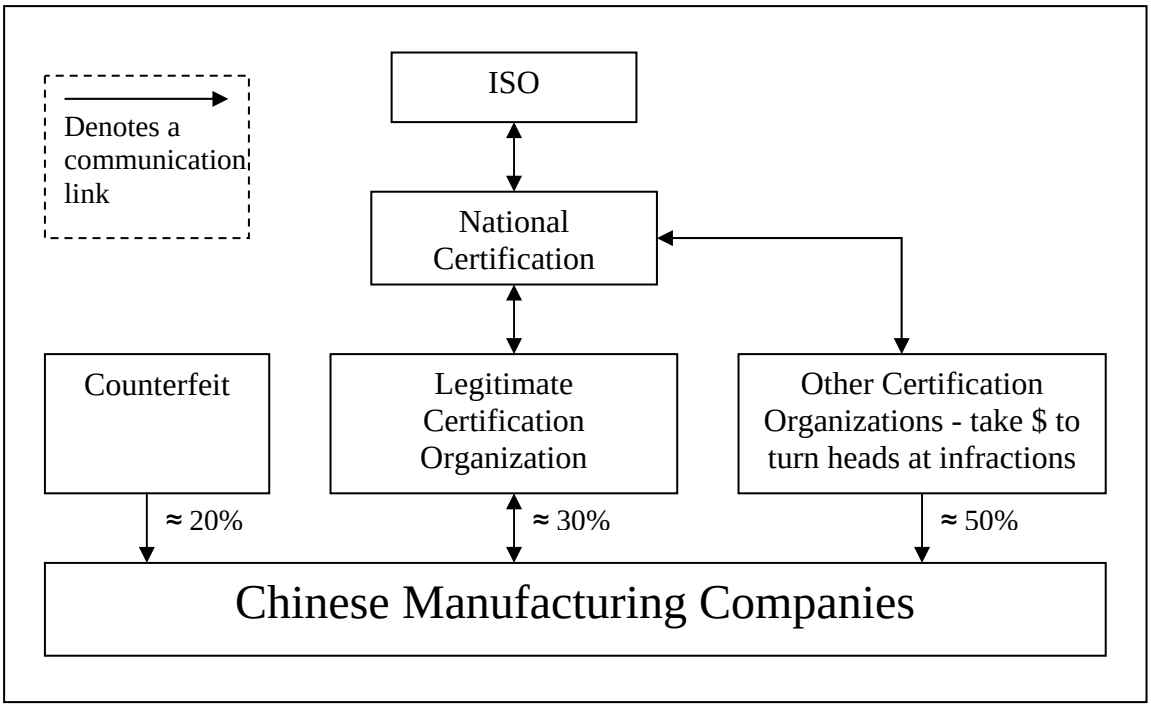

Figure 2 - Model of how ISO certifications are obtained in China (G.B., 2005)

Many of the manufacturing businesses in Hong Kong were in the same poor quality situation as China. In the 1990s, the Hong Kong government also promoted the ISO 9000 standards as a means to help improve product quality. Hong Kong has increased its level of quality through the use of the ISO 9000 standards and CQI efforts in a QMS geared toward TQM. Pun *et al.* (2000a) constructed a model of Hong Kong's efforts and state that the transformation of the quality framework from Hong Kong has been very significant in improving the quality in mainland China, although China's quality still lags behind that of Hong Kong. This model can be seen in Figure 3.

2.7. Conclusion

China has a rich history in quality management. From the Western Zhou Dynasty to today, importance has been stressed on the need for quality in the goods China

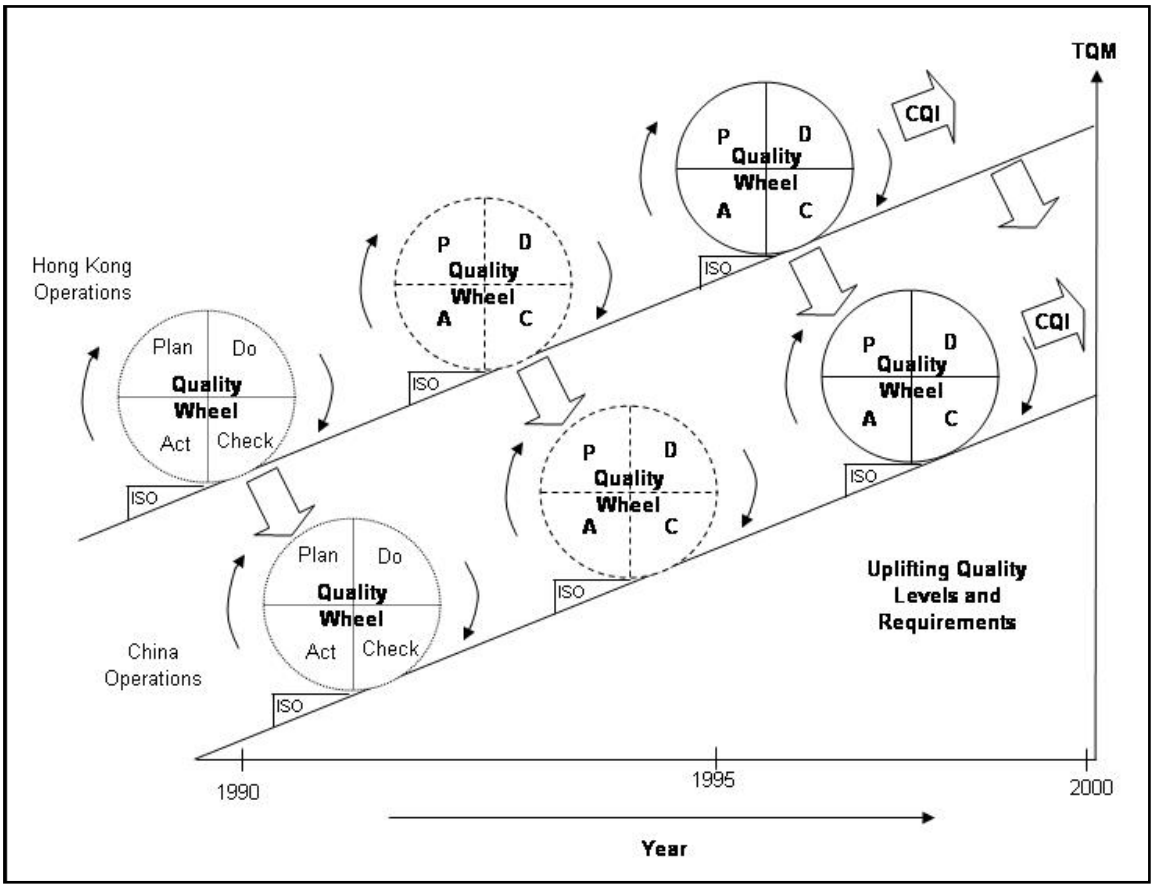

Figure 3 - Transfer of sustaining methods from Hong Kong to China as abstracted from Pun *et al.* (2000a, p. 180)

produces. Numerous approaches have been taken to improve and ensure quality; a few of these methods are: inspection, standardized measures and practices, SQC, ISO 9000, and TQM. Regardless of what has been done, it is evident that quality in China today is still relatively low in comparison to developed nations, but the quality level is improving rapidly in China. China's quality woes are a result of a) relaxed enforcement of quality standards, b) market confusion, c) encouragement of poor quality and fake goods by local government, d) consumers preferring low-quality and/or fake goods because of the low price, e) lack of leadership that has a knowledge of and encourages quality, f) a predominant culture at work where employees don't question things and only do as they

are told, g) lack of education and training of employees at all levels, h) a non-customer business focus, and i) inferior and outdated equipment. While these factors may plague China's current quality efforts, improved quality is not impossible for Chinese companies to obtain. Through continual efforts of Chinese businesses to improve quality by correctly implementing proven methods, the level of quality in China will increase.

The ISO 9000 standards for quality have played a role in China's efforts to ensure and improve product quality. The attainment of ISO 9000 certification started out as a motivating factor in helping companies improve the quality of their product(s). ISO 9000 certification has, however, become more of a formality than a strategy for manufacturing businesses in China. Companies that are ISO certified still experience quality problems in their operations. This may be due to certification becoming somewhat of a fad and a façade for companies to present to the world. With the ISO certification they appear to be world-class, but in fact, they lack the quality focus within the organization. It seems apparent that, if used correctly, ISO standards can help an organization achieve higher quality. If these standards are used as a means of maintaining the quality level, along with efforts to continually improve product quality, the quality level of Chinese manufacturing organizations should become world-class.

The following chapter will present the framework and survey used to determine how well the Chinese manufacturing SMEs in Guangdong Province, China are aligned with the first two main principles of the ISO 9000:2000 family of standards for quality, namely Customer Focus and Leadership, along with the general quality knowledge and practices of these organizations.

3. RESEARCH METHOD

3.1. Introduction

Specific information regarding quality and quality related issues in China is very hard to come by for interested parties outside of China (Zhang, 2000). For this reason, the researcher traveled to and administered a survey to manufacturing companies in Guangdong Province, China. Surveys were presented to the companies either through email or in person and were filled out by the companies prior to a possible visit where follow-up questioning took place. The data acquisition took place from 21 June 2005 – 22 July 2005. If allowed by the companies, observation of operations also took place. The surveying instrument was constructed from select fundamental principles of the ISO 9000:2000 standards for quality. Survey questions were formed to obtain information that correlates to the customer focus of the organization, leadership in the organization and the general quality practices of the organization. Survey questions from previous surveys administered to companies in China were utilized where overlying similarities in desired information existed. The people targeted to fill out the survey and with whom the researcher met with for follow-up questions was (were) the individual(s) responsible for quality management or most familiar with the quality management within the organization.

It had originally been anticipated that the surveying would take place in an interview format, but after learning that cold-calling on businesses wasn't a successful approach in China, the administered method was changed.

The research method used in data collection through the survey, interview, and observation process is qualitative in nature. The data obtained from the survey was used to measure the focus on quality in the companies. The information obtained from interviewing and observation provides additional helpful information to aid in the understanding of the state of manufacturing practices with respects to quality of manufacturing companies in Guangdong Province, China.

3.2. Justification

This section provides information that serves to justify the approach used in addressing the research question for this thesis.

3.2.1. Approach

The research was to originally focus on small manufacturing companies with up to 60 employees, but due to the heavily labor intensive manufacturing operations in Guangdong Province, China, all manufacturing companies were targeted. This approach proved to be good in that it provided an insight into the business practices of small, medium and large companies. However, the focus on small to medium-sized companies was retained in order to ensure a better understanding of in-country firms.

The original approach for gathering data was to perform the surveying in an interview fashion by finding companies and visiting with them the same day. This method proved to be ineffectual due to the language barrier and the business practice of

only allowing visitors who have an appointment or a business contact with an employee of the company to enter the premises of the company. Attempts were made to schedule appointments with companies. Unfortunately, appointments could not be made primarily due to the lack of a close relationship with companies being contacted. It was determined that a better approach would be to network through a person in a company that already had established relationships with other companies in the area. Help was requested from a number of individuals in companies located in the Guangdong Province with whom the researcher had a relationship. Most of the companies visited were referrals primarily from one company. This company agreed to provide a list of its suppliers that met the researcher's criteria. The company was also generous enough to have an employee of theirs contact the selected suppliers to make initial contact and ask the selected suppliers if they would be willing to fill out a survey and allow the researcher to visit the company. In order to streamline the data collection process and to maximize the amount of companies to survey within the limited time period, it was determined that sending the surveys to the companies electronically would be most effective. Sending the surveys electronically proved to be an effective means to gather data. Thirty six surveys were filled out and returned within twenty four days. Five additional surveys were received after the researcher returned from China. By sending the surveys to the companies beforehand, the companies were able to know on what the visit would focus. The researcher was also able to go over the returned surveys and compile a list of follow-up questions to gain a better understanding of the company's practices before visiting the company.

Sixty-three percent of the companies that were surveyed were visited by the researcher. Companies that agreed to allow a visit and that were within a close proximity, up to 2 hours away by taxi, were visited. Ten large companies, nine medium-sized companies and seven small companies were visited. A translator accompanied the researcher when visiting the companies. Meetings were generally held with any combination of one or more of the following employee(s): top management, mid-level management (marketing, sales, etc.), production supervisors, quality supervisors, and engineers. In the meetings, the companies would present a brief overview of their company, a question/answer session would follow and, if allowed, a tour of the plant operations would take place. During the question/answer session of the meetings, the researcher would ask a question that would then be translated into Chinese and the interviewed would respond to the question and the response would be translated back into English. As is expected when using such a process, some loss in meaning was encountered, but combined with the written survey, the method proved to be very effective in providing a better understanding of the company and its practices.

3.2.2. Qualitative Research

This section serves to justify the qualitative research method used for this thesis. An overview of the method is given followed by an explanation of the data collection processes used in qualitative research. Lastly, an explanation is given of how the qualitative method was applied to this thesis.

3.2.2.1. Overview

Qualitative research is an evolving research method that is used to gain new insights into phenomena. Its application has been mainly found in the social sciences, but is gaining more utilization in other areas such as organizational science and management (Merriam and Associates, 2002). Marshall and Rossman (1995) suggest that qualitative research is designed to (a) understand processes, (b) describe poorly understood phenomena, (c) understand differences between stated and implemented policies or theories, and (d) discover thus far unspecified contextual variables. Qualitative research seeks to answer questions about the complex nature of phenomena as observed through the experience(s) of the researcher (Leedy and Ormrod, 2005). The results of a qualitative study usually end with questions or hypotheses about what was observed by the researcher. Table 2 illustrates the general characteristics of a qualitative research approach.

3.2.2.2. Data Collection Methods

There are three major methods that are used to collect data in qualitative research. These methods include: interviews, observations and documents (Merriam and Associates, 2002). The selection of which method to use depends on the nature of the data that is required by the researcher. If it is possible, researchers are encouraged to use more than one method for data collection because more methods boost the validity of the findings (Merriam and Associates, 2002). Utilizing all three methods would be a way to enhance the validity of the study. This combination of methodologies is called triangulation. By triangulating the methods, the findings of the study would be considered more accurate and valid.

Table 2 - Characteristics of qualitative approach adapted from table in (Leedy and Ormrod, 2005, p. 96)

Question	Qualitative Research
What is the purpose of the research?	• To describe and explain • To explore and interpret • To build theory
What is the nature of the research process?	• Holistic • Unknown variables • Flexible guidelines • Emergent methods • Context-bound • Personal view
What are the data like, and how are they collected?	• Textual and/or image-based data • Informative, small sample • Loosely structured or non-standardized observations and interviews
How are data analyzed to determine their meaning?	• Search for themes and categories • Acknowledgment that analysis is subjective and potentially biased • Inductive reasoning
How are the findings communicated?	• Words • Narratives, individual quotes • Personal voice, literary style

Interviews can range from very formal and highly structured, where a specific set of questions is asked, to unstructured, where a topic area is explored without the questions or the order being set. Merriam and Associates suggest that most interviews fall somewhere in between the two (2002), resulting in a semi-structured interview. With semi-structured interviews, specific information might be sought with structured questions, but the exact order and wording of the questions is not predetermined. The interview is guided by the information that is sought after and the structured questions.

Observational data is obtained by having a firsthand encounter with the phenomena of interest. The observational approach ranges from being a complete observer, where the observer is unknown to those being observed, to being an active participant, where the observer might be a member of a group or an organization that is

participating in something while observing the phenomena (Merriam and Associates, 2002). Observation proves to be very effective for data collection when the phenomena can be observed firsthand, when a new perspective is wanted, or when the participants are unable or unwilling to discuss the phenomena that are being studied. Observation also provides a perspective for validation.

Documents can be written, oral, visual, or cultural artifacts. Documents provide insight for the researcher without intruding upon or altering the setting of the phenomena the way an interviewer might. Documents contain many insights and clues into the phenomena (Merriam and Associates, 2002).

3.2.2.3. Application

In order to validate the information gained, this study utilized all three methods to collect information regarding the quality presence and practices of Chinese manufacturers in Guangdong Province, China.

First, documents were sought and obtained to give the researcher insight into China and the quality methods utilized by Chinese manufacturing companies. The information obtained came from documents acquired from journals, books, the internet, and newspapers.

Second, interviews were conducted in two manners. Initially, contact was made and an electronic copy of the survey was sent to the participating company. This is a form of electronic interviewing. After the company answered the survey, a visit to the company ensued and a semi-structured interview was held. During this informal interview, questions were asked to follow up on the survey and to clarify other issues the researcher wanted to uncover. Informal interviews were also conducted with other

experts the researcher came in contact with to gain the perspective and insight they have on manufacturing and quality practices in China.

Third, if allowed by the company, a tour of the company's manufacturing operations took place. While touring the plants of the companies, the researcher observed the general operational and quality practices in use. Enquiries were made by the researcher when he desired clarification of the things he was observing. This type of observation is deemed to be that of active participant observation.

3.2.3. Selected Principles of ISO 9000:2000

This section serves to justify the selection of the principles of ISO 9000:2000 that were utilized in the survey instrument.

3.2.3.1. Justification

The ISO 9000:2000 family of standards is based on eight fundamental principles. These principles were outlined in the second chapter of this thesis. These principles include: customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making, and mutually beneficial supplier relationships. The first two principles, customer focus and leadership, were selected for the foundational role they play in any organization. Companies that are customer focused and have good leadership principles and practices should tend to give quality a priority for the product/service they provide to their customers. The remaining six principles seem to be based off these first two principles. Not only was information obtained regarding the highlighted two principles of ISO

9000:2000, but information was also collected regarding the company's general quality practices.

Questions were formulated for use in the survey to gather information that would help to illustrate the company's customer focus and leadership practices. Questions regarding the company's customer focus revolved around the ways the company knows it is providing what the customer wants. Leadership insight was gained through information obtained regarding employee training, meetings (frequency and topics), and leadership focus.

3.3. Survey Instrument

The survey instrument can be found in Appendix A.

3.4. Validation

The method chosen has been validated in a number of ways. First, a sample size of 41 companies was surveyed. The number of companies in each category (small, medium and large companies) is in good proportion. The overall sample size is large enough to gain an understanding of the phenomena and to draw conclusions from the data obtained and observed. Second, the data that was obtained from the survey/interview process was analyzed for patterns. The patterns were analyzed as a whole, for the entire sample population, and between groups. Finally, data obtained from observation provided insight for the researcher to compare the data that was collected through the surveys with what was actually being practiced. The data and observations were also compared to what was stated in the literature review to determine if any anomalies existed or if conclusions were congruent with the research.

3.5. Confidentiality

If the companies had any concerns about the confidentiality of sensitive information, and in order to encourage participation in the survey and to obtain candid and accurate responses to questions contained in the survey, confidentiality was guaranteed and maintained. The companies were made aware that the information that was obtained was for academic purposes only and would not be used to harm their organization in any way. If the interviewee required a written guarantee of confidentiality, one was provided. The interviewee understood that his/her identification would remain anonymous, as well as the company's identification. The names of the interviewees were not recorded. Information obtained from the survey was only used for analysis for academic purposes alone and was not passed on to governmental agencies. A general description of the industry type of the manufacturing companies was made known in the analysis, as well as the results obtained for each industry and each size category.

3.6. Summary

For interested parties outside of China, information regarding China's quality and manufacturing practices is hard to come by. Because of the limited information that is available, much of what goes on in Chinese manufacturing companies is often misunderstood to those not located within China. To discover, first-hand, what goes on in Chinese manufacturing companies, a qualitative approach was applied for this thesis. As was explained in this chapter, qualitative research methods are ideal for understanding processes, describing poorly understood phenomena, understanding differences between stated and implemented policies or theories and discovering thus far unspecified

contextual variables (Marshall and Rossman, 1995). This approach helped to uncover the customer focus, leadership, and general quality practices of small-, medium- and large-sized manufacturing companies in Guangdong Province, China. The methods that were utilized in this qualitative thesis were a review of available literature, surveying, interviewing, and observation. The information that was collected through these methods was then analyzed for patterns to validate the findings.

4. RESULTS

4.1. Introduction

The survey instrument constructed for this thesis was designed to collect information regarding the company's customer focus, leadership and general knowledge of and use of various manufacturing and quality practices. The instrument consists of 29 questions, with some questions having additional clarifying questions. The first ten questions were intended to gather basic demographic information regarding: a) the company's name, b) form of business ownership, c) when the company was founded, d) the company's size, e) type of product(s) manufactured, f) if the company supplies products directly to the United States, g) if the company supplies products to companies that later sell those products to the United States, h) if the company is familiar with ISO 9001 certification, i) if the company is ISO certified, j) and if the company is considering ISO 9001 certification. The information obtained from the demographic questions was used to form nine groupings of the data to analyze the data in different ways. The nine different groupings are: a) Size of Business, b) Year Started, c) ISO Certified (Y/N), d) Visited (Y/N), e) GI Supplier, f) GI Supplier & Size, g) U.S. supplier (Y/N), h) Business Ownership and i) General Industry Type. The scope of this thesis and the analysis focus primarily on size of business. The analyses of the additional eight groups were meant for informational purposes only and as a means to view the data from a different angle. The remaining questions served to collect information on the company's customer focus,

leadership, and knowledge of and use of various manufacturing and quality practices. Seven questions gathered information regarding aspects of customer focus, five questions captured information regarding leadership focus and the remaining seven questions captured data regarding knowledge of and use of various manufacturing and quality practices. Not all survey questions were answered for several reasons including: a) it was the first time for many of the individuals to take part in a survey – some individuals didn't know how to answer the questions being asked, b) misunderstanding the questions – which could have been due to a loss in translation, and c) not wanting to disclose certain information. The following sections will present the analysis of the data that was collected through the survey instrument, interviews and observations.

4.2. Demographics

This section gives a brief description of the overall demographics of the surveyed companies.

A total of 41 companies were surveyed. Of the companies surveyed, 14 are large (500 employees or more), 15 are medium (140 – 499 employees), and 12 are small (1 – 139 employees). Most of the companies are relatively new as 51% of the companies were started during or after the year 2000. One company did not report what type of ownership it was under. The ownership breakdown of the remaining 40 companies is as follows: State Owned Enterprise (SOE) – 1; Privately Owned Enterprise (POE) – 26; Joint Venture (JV) – 4; and Foreign Owned Enterprise (FOE) – 9. 71% of the companies reported that they are ISO 9001:2000 certified. Of the 39 companies that answered the question as to whether they are a direct supplier of the US or not, 82% of the companies reported they are direct suppliers of the US. The general industry description and

breakdown of the 41 companies is as follows: Computer and Electronic Manufacturing – 10; Precision Metal Manufacturing – 14; Plastic Products – 3; Machinery – 3; and Other – 11. The researcher visited 63% of the companies.

The fact that there was only one SOE that was surveyed may introduce a bias in the results when considering the significance of the Business Ownership factor in explaining the selection of answers to the survey questions. Table 3 summarizes the demographic information of the companies that were surveyed.

4.3. Customer Focus

This section presents the analysis performed on the data collected regarding the company's customer focus.

The survey instrument had seven questions that probe into the relationship of the company and its customer(s). The format for presenting the information obtained in this section and the leadership and manufacturing and quality practices sections is as follows: first a question is presented; next the analysis is presented; following all the questions in each main section is a section of observations made by the researcher.

Table 3 - Summary of demographic information

	Count
Size of Business	
Small	12
Medium	15
Large	14
Year Started	
< 2000	20
> = 2000	21
ISO Certified	
ISO	29
NON-ISO	12
Visited	
VISIT	26
NO VISIT	15
GI Supplier	
SUPPLIER	25
NON-SUPPLIER	15
GI Supplier & Size	
Small	9
Medium	9
Large	7
US Supplier	
U.S. SUPPLIER	32
NON-SUPPLIER	7
Business Ownership	
State Owned Enterprise (SOE)	1
Privately Owned Enterprise (POE)	26
Joint Venture (JV)	4
Foreign Owned Enterprise (FOE)	9
General Industry Types	
Computer and Electronic Product Mfg.	10
Precision Metal	14
Other	11
Plastic Products	3
Machinery	3

4.3.1. Survey Question 11

"How does your company know it is meeting its customers' needs (the higher the number, the more often the method is used)?"

Never					Very Regularly
1	2	3	4		5
(11a) We meet with our customers	1	2	3	4	5
(11b) We conduct customer satisfaction surveys	1	2	3	4	5
(11c) We conduct market research to collect suggestions for improving products	1	2	3	4	5
(11d) We collect extensive complaint information from our customers	1	2	3	4	5
(11e) Other:	1	2	3	4	5
(11f) Other:	1	2	3	4	5

4.3.1.1. Analysis

The aim of question 11 was to learn how Chinese manufacturing companies know their customers' needs. The methods listed are common means used to stay in touch with customers. Overall, of the methods listed in question 11, the methods reported least used by the companies are market research and collecting extensive customer complaint information. The method used most frequently by the companies to know their customers' needs is meeting with customers. The "Other" responses were "KPI (key performance indicator) meeting" and "US customer provides feedback".

A single-factor ANOVA was performed on the data to determine if any factors were significant in the way the companies selected their responses. The ANOVA showed only two factors to be significant in explaining how the companies answered question 11. These two factors are: Direct U.S. Supplier (Y/N) and Business Ownership. The factor of being a direct U.S. supplier or not was only significant for response 11c (conducting

market research). The ANOVA for this factor and response showed a p-value of .031. The form of business ownership factor was significant for responses 11c and 11d (collecting complaint information). The ANOVA for this factor and responses 11c and 11d showed p-values of .006 and .02 respectively. Table 4 shows the average ranking for each response for each of the nine different groupings of the companies.

4.3.2. Survey Question 12

"How often does your company meet with its customers?"

(Check the one that applies)

Twice a month	
Once a month	
Every three months	
Every six months	
Once a year	
Never	
Other:	

4.3.2.1. Analysis

With the information obtained from question 11 regarding the use of meeting with customers, question 12 sought to expound on the frequency of the meetings with customers that take place. The small companies meet with their customers more often than their counterparts. The "Other" responses that were received are more frequent than two times per month. Sixty seven percent of the small companies meet with their customers at least twice a month, compared to 46% and 38% of the medium and large companies respectively.

A single-factor ANOVA was performed on the data to determine if any factors were significant in the way the companies selected their responses. There was only one factor that was determined to be significant. The factor that was significant was Business

Table 4 - Averaged responses to survey question 11

	RESPONSE				
	11a	**11b**	**11c**	**11d**	**11e**
Size of Business					
Small	4.83	4.45	3.73	3.67	
Medium	4.47	4.50	4.14	3.93	
Large	4.43	4.21	3.71	4.00	5.00
Year Started					
< 2000	4.45	4.50	3.70	3.70	
> = 2000	4.67	4.26	4.05	4.05	5.00
ISO Certified					
ISO	4.52	4.46	3.86	3.83	5.00
NON-ISO	4.67	4.18	3.91	4.00	5.00
Visited					
VISIT	4.72	4.67	4.00	3.68	5.00
NO VISIT	4.27	3.93	3.71	4.13	5.00
GI Supplier					
SUPPLIER	4.72	4.67	4.00	3.68	5.00
NON-SUPPLIER	4.27	3.93	3.71	4.13	5.00
GI Supplier & Size					
Small	4.78	4.44	3.78	3.56	
Medium	4.78	4.88	4.25	3.78	
Large	4.57	4.71	4.00	3.71	5.00
US Supplier					
U.S. SUPPLIER	4.63	4.39	3.71	4.03	5.00
NON-SUPPLIER	4.43	4.17	4.33	3.29	
Business Ownership					
SOE	4.00	5.00	4.00	5.00	
POE	4.62	4.25	3.54	3.85	5.00
JV	5.00	4.50	4.75	3.75	
FOE	4.67	4.89	4.22	4.22	5.00
General Industry					
Computer and Electronic Product Mfg.	4.60	4.50	4.20	4.10	5.00
Precision Metal	4.57	4.25	3.33	3.50	
Other	4.36	4.27	4.18	4.09	5.00
Plastic Products	4.67	4.33	3.33	3.67	
Machinery	5.00	5.00	4.33	4.33	

Ownership. The p-value for this factor was determined to be .02. Table 5 shows the number of times each response was selected by each of the nine different groupings. The same information displayed in a percentage breakdown of organizations who meet at that frequency is seen in Table 6.

4.3.3. Survey Question 13

"What does your company discuss in the meetings with its customers (the higher the number, the more often the topic is discussed with the customer)?"

Never	Not very often	Sometimes	Regularly	Very Regularly
1	2	3	4	5

(13a) New product ideas	1	2	3	4	5
(13b) Possible improvements to current products	1	2	3	4	5
(13c) Product quality	1	2	3	4	5
(13d) Product specifications	1	2	3	4	5
(13e) Satisfaction of customer with your products/services	1	2	3	4	5
(13f) Customer expectations	1	2	3	4	5
(13g) Other:	1	2	3	4	5
(13h) Other:	1	2	3	4	5

4.3.3.1. Analysis

Survey question 13 was intended to learn how meetings with customers are used. If the listed answers were not appropriate, the option of "Other" was made available where the companies could expound on what they discuss. The "Other" responses received for this question are "increase cooperation" and "the delivery time that customers require". From the options listed, the two most discussed topics with customers are product quality and the customer's satisfaction with the product/service.

Table 5 - Count breakdown of groups for question 12

	RESPONSE					
	Twice a Month	**Once a Month**	**Every 3 Months**	**Every 6 Months**	**Once a Year**	**Other**
Size of Business						
Small	7	2	0	2	0	1
Medium	5	4	2	1	0	1
Large	5	5	1	1	1	0
Year Started						
< 2000	6	8	2	2	1	1
>= 2000	11	3	2	2	0	1
ISO Certified						
Yes	11	8	4	3	1	0
No	6	3	0	1	0	2
Visited						
Yes	13	7	3	0	1	1
No	4	4	1	4	0	1
GI Supplier						
Yes	10	7	1	4	0	0
No	6	4	2	0	1	2
GI Supplier & Size						
Small	6	1	0	2	0	0
Medium	2	3	1	1	0	0
Large	2	3	0	1	0	0
US Supplier						
Yes	15	8	3	4	1	0
No	2	1	1	0	0	2
Business Ownership						
SOE	1	0	0	0	0	0
POE	12	8	1	3	1	2
JV	2	0	1	0	0	0
FOE	2	3	1	1	0	0
General Industry types						
Computer and Electronic Product Mfg.	4	2	2	0	0	0
Precision Metal	5	5	0	2	1	1
Other	5	2	2	2	0	1
Plastic Products	1	1	0	0	0	0
Machinery	2	1	0	0	0	0

Table 6 - Percentage breakdown of groups for question 12

	RESPONSE					
	Twice a Month	**Once a Month**	**Every 3 Months**	**Every 6 Months**	**Once a Year**	**Other**
Size of Business						
Small	58%	17%	0%	17%	0%	8%
Medium	38%	31%	15%	8%	0%	8%
Large	38%	38%	8%	8%	8%	0%
Year Started						
< 2000	30%	40%	10%	10%	5%	5%
>= 2000	58%	16%	11%	11%	0%	5%
ISO Certified						
Yes	41%	30%	15%	11%	4%	0%
No	50%	25%	0%	8%	0%	17%
Visited						
Yes	52%	28%	12%	0%	4%	4%
No	29%	29%	7%	29%	0%	7%
GI Supplier						
Yes	45%	32%	5%	18%	0%	0%
No	40%	27%	13%	0%	7%	13%
GI Supplier & Size						
Small	67%	11%	0%	22%	0%	0%
Medium	29%	43%	14%	14%	0%	0%
Large	33%	50%	0%	17%	0%	0%
US Supplier						
Yes	48%	26%	10%	13%	3%	0%
No	33%	17%	17%	0%	0%	33%
Business Ownership						
SOE	100%	0%	0%	0%	0%	0%
POE	44%	30%	4%	11%	4%	7%
JV	67%	0%	33%	0%	0%	0%
FOE	29%	43%	14%	14%	0%	0%
General Industry Types						
Computer and Electronic Product Mfg.	50%	25%	25%	0%	0%	0%
Precision Metal	36%	36%	0%	14%	7%	7%
Other	42%	17%	17%	17%	0%	8%
Plastic Products	50%	50%	0%	0%	0%	0%
Machinery	67%	33%	0%	0%	0%	0%

The data indicates that the topics that are least discussed in meetings with customers are new product ideas and product specifications.

A single-factor ANOVA was performed on the data to determine if any factors were significant in the way the companies selected their responses. The ANOVA showed only two factors to be significant in explaining how the companies answered question 13. These two factors are: Direct U.S. supplier (Y/N) and Business Ownership. The factor of being a direct U.S. supplier or not was only significant for response 13d (product specifications). The ANOVA for this factor and response showed a p-value of .048. The form of business ownership factor was significant for responses 13a (new product ideas) and 13d. The ANOVA for this factor and responses 13a and 13d showed p-values of .042 and .007 respectively. Table 7 shows the average ranking for each response for each of the nine different groupings of the companies.

4.3.4. Survey Question 14

"How often does your company conduct customer satisfaction surveys?"

(Check the one that applies)

Once a month	
Every two months	
Every three months	
Every six months	
Once a year	
Other:	

4.3.4.1. Analysis

For the companies that suggested they used customer satisfaction surveys as a means to keep in touch with their customers' needs, survey question 14 sought to discover the frequency of conducting customer satisfaction surveys. Forty five percent of

Table 7 - Averaged responses of groups for question 13

	RESPONSE						
	13a	**13b**	**13c**	**13d**	**13e**	**13f**	**13g**
Size of Business							
Small	4.08	4.33	4.73	3.80	4.64	4.55	5.00
Medium	3.92	4.46	4.71	4.07	4.79	4.62	4.00
Large	4.36	4.14	4.50	3.86	4.36	4.07	
Year Started							
< 2000	4.05	4.05	4.50	4.00	4.45	4.25	
> = 2000	4.21	4.55	4.79	3.83	4.74	4.56	4.50
ISO Certified							
ISO	4.11	4.37	4.64	3.96	4.57	4.41	4.50
NON-ISO	4.17	4.17	4.64	3.80	4.64	4.36	
Visited							
VISIT	4.26	4.26	4.61	4.04	4.70	4.57	4.50
NO VISIT	4.00	4.33	4.73	3.79	4.60	4.36	
GI Supplier							
SUPPLIER	4.26	4.26	4.61	4.04	4.70	4.57	4.50
NON-SUPPLIER	4.00	4.33	4.73	3.79	4.60	4.36	
GI Supplier & Size							
Small	4.00	4.22	4.63	3.75	4.50	4.50	5.00
Medium	4.14	4.57	4.63	4.50	4.88	4.63	4.00
Large	4.71	4.00	4.57	3.86	4.71	4.57	
US Supplier							
U.S. SUPPLIER	4.23	4.39	4.63	3.80	4.53	4.30	4.50
NON-SUPPLIER	3.86	4.14	4.71	4.33	4.71	4.83	
Business Ownership							
SOE	5.00	5.00	5.00	5.00	5.00	4.00	
POE	4.00	4.38	4.69	3.72	4.50	4.23	5.00
JV	4.50	4.25	4.33	4.67	4.67	4.50	4.00
FOE	4.50	4.00	4.63	4.13	4.75	4.88	
General Industry Types							
Computer and Electronic Product Mfg.	4.40	4.20	4.50	4.20	4.60	4.67	4.00
Precision Metal	3.92	4.00	4.62	3.50	4.54	4.38	
Other	3.91	4.50	4.64	3.73	4.55	4.36	5.00
Plastic Products	4.00	4.67	5.00	5.00	4.50	3.00	
Machinery	5.00	5.00	5.00	4.67	5.00	4.67	

the small companies surveyed reported that they conduct their customer satisfaction surveys once a month, compared to 31% and 7% for the medium and large companies respectively. A majority of the companies conduct their customer satisfaction surveys at least once every six months.

A single-factor ANOVA was performed on the data to determine if any factors were significant in the way the companies selected their responses. There was only one factor that was determined to be significant. The factor that was significant was Business Ownership. The p-value for this factor was determined to be .004. Table 8 shows the number of times each response was selected by each of the nine different groupings. The same information displayed in a percentage breakdown is seen in Table 9.

4.3.5. Survey Question 15

"How often does your company conduct market research?"

(Check the one that applies)

Once a month	
Every three months	
Every six months	
Once a year	
Other:	

4.3.5.1. Analysis

For the companies that stated they utilize market research as a means to know what their customers' demands are, survey question 15 sought to quantify how frequent the companies conducted such efforts. The "Other" responses received stated that the companies did not conduct market research. The data indicates that medium sized businesses conduct market research more frequently than large or small sized companies.

Table 8 - Count breakdown of groups for question 14

	RESPONSE					
	Once a Month	**Every 2 Months**	**Every 3 Months**	**Every 6 Months**	**Once a Year**	**Other**
Size of Business						
Small	5	0	1	4	1	0
Medium	4	1	4	4	0	0
Large	1	0	3	7	3	0
Year Started						
< 2000	2	0	6	7	4	0
>= 2000	8	1	2	8	0	0
ISO Certified						
Yes	7	0	5	12	3	0
No	3	1	3	3	1	0
Visited						
Yes	7	1	3	11	3	0
No	3	0	5	4	1	0
GI Supplier						
Yes	6	0	4	11	2	0
No	4	1	4	4	1	0
GI Supplier & Size						
Small	3	0	1	3	1	0
Medium	3	0	1	4	0	0
Large	0	0	2	4	1	0
US Supplier						
Yes	6	1	6	14	3	0
No	3	0	1	1	1	0
Business Ownership						
SOE	0	0	0	1	0	0
POE	6	1	5	9	4	0
JV	2	0	1	0	0	0
FOE	2	0	2	5	0	0
General Industry Types						
Computer and Electronic Product Mfg.	3	0	4	2	1	0
Precision Metal	2	1	1	9	1	0
Other	2	0	3	4	1	0
Plastic Products	0	0	0	0	1	0
Machinery	3	0	0	0	0	0

Table 9 - Percentage breakdown of groups for question 14

	RESPONSE					
	Once a Month	**Every 2 Months**	**Every 3 Months**	**Every 6 Months**	**Once a Year**	**Other**
Size of Business						
Small	45%	0%	9%	36%	9%	0%
Medium	31%	8%	31%	31%	0%	0%
Large	7%	0%	21%	50%	21%	0%
Year Started						
< 2000	11%	0%	32%	37%	21%	0%
>= 2000	42%	5%	11%	42%	0%	0%
ISO Certified						
Yes	26%	0%	19%	44%	11%	0%
No	27%	9%	27%	27%	9%	0%
Visited						
Yes	28%	4%	12%	44%	12%	0%
No	23%	0%	38%	31%	8%	0%
GI Supplier						
Yes	26%	0%	17%	48%	9%	0%
No	29%	7%	29%	29%	7%	0%
GI Supplier & Size						
Small	38%	0%	13%	38%	13%	0%
Medium	38%	0%	13%	50%	0%	0%
Large	0%	0%	29%	57%	14%	0%
US Supplier						
Yes	20%	3%	20%	47%	10%	0%
No	50%	0%	17%	17%	17%	0%
Business Ownership						
SOE	0%	0%	0%	100%	0%	0%
POE	24%	4%	20%	36%	16%	0%
JV	67%	0%	33%	0%	0%	0%
FOE	22%	0%	22%	56%	0%	0%
General Industry Types						
Computer and Electronic Product Mfg.	30%	0%	40%	20%	10%	0%
Precision Metal	14%	7%	7%	64%	7%	0%
Other	20%	0%	30%	40%	10%	0%
Plastic Products	0%	0%	0%	0%	100%	0%
Machinery	100%	0%	0%	0%	0%	0%

A single-factor ANOVA was performed on the data to determine if any factors were significant in the way the companies selected their responses. The ANOVA showed only two factors to be significant in explaining how the companies answered question 11. These two factors are: Direct U.S. supplier (Y/N) and Business Ownership. The ANOVA showed a p-value of .03 for the factor of being a direct U.S. supplier or not and a p-value of .00014 for the factor of the form of business ownership. Table 10 shows the number of times each response was selected by each of the nine different groupings. The same information displayed in a percentage breakdown is seen in Table 11.

4.3.6. Survey Question 16

"On average, how many complaints from customers does your company receive per month?" _____

4.3.6.1. Analysis

The aim of survey question 16 was to aid in understanding the relationship each company has with its customers – to know whether feedback is given and received or not. The average of the responses for large, medium and small sized businesses was calculated to be: 7.42, 1.60 and 1.05 respectively. The reason for such a disparity between the sizes of business and throughout the rest of the groupings is that two large companies stated that they receive an average of 50 and 10.5 customer complaints per month. The overall median response was 1 customer complaint per month and the overall modal response was 0.5 customer complaint per month. Table 12 shows the average number of complaints received by the various groupings.

Table 10 - Count breakdown of groups for question 15

	RESPONSE				
	Once a Month	**Every 3 Months**	**Every 6 Months**	**Once a year**	**Other**
Size of Business					
Small	2	3	2	2	2
Medium	7	3	2	0	1
Large	5	1	5	2	1
Year Started					
< 2000	7	3	6	1	3
>= 2000	7	4	3	3	1
ISO Certified					
Yes	13	4	6	2	2
No	1	3	3	2	2
Visited					
Yes	8	4	6	4	2
No	6	3	3	0	2
GI Supplier					
Yes	8	4	6	2	2
No	6	3	3	2	1
GI Supplier & Size					
Small	2	2	2	1	1
Medium	4	1	1	0	1
Large	2	1	3	1	0
US Supplier					
Yes	10	4	9	4	2
No	3	2	0	0	2
Business Ownership					
SOE	1	0	0	0	0
POE	6	5	7	3	4
JV	2	0	1	0	0
FOE	5	1	1	1	0
General Industry Types					
Computer and Electronic Product Mfg.	8	0	1	0	1
Precision Metal	1	3	5	2	1
Other	4	2	2	2	1
Plastic Products	0	0	1	0	1
Machinery	1	2	0	0	0

Table 11 - Percentage breakdown of groups for question 15

	RESPONSE				
	Once a Month	Every 3 Months	Every 6 Months	Once a year	Other
Size of Business					
Small	18%	27%	18%	18%	18%
Medium	54%	23%	15%	0%	8%
Large	36%	7%	36%	14%	7%
Year Started					
< 2000	35%	15%	30%	5%	15%
>= 2000	39%	22%	17%	17%	6%
ISO Certified					
Yes	48%	15%	22%	7%	7%
No	9%	27%	27%	18%	18%
Visited					
Yes	33%	17%	25%	17%	8%
No	43%	21%	21%	0%	14%
GI Supplier					
Yes	36%	18%	27%	9%	9%
No	40%	20%	20%	13%	7%
GI Supplier & Size					
Small	25%	25%	25%	13%	13%
Medium	57%	14%	14%	0%	14%
Large	29%	14%	43%	14%	0%
US Supplier					
Yes	34%	14%	31%	14%	7%
No	43%	29%	0%	0%	29%
Business Ownership					
SOE	100%	0%	0%	0%	0%
POE	24%	20%	28%	12%	16%
JV	67%	0%	33%	0%	0%
FOE	63%	13%	13%	13%	0%
General Industry Types					
Computer and Electronic Product Mfg.	80%	0%	10%	0%	10%
Precision Metal	8%	25%	42%	17%	8%
Other	36%	18%	18%	18%	9%
Plastic Products	0%	0%	50%	0%	50%
Machinery	33%	67%	0%	0%	0%

Table 12 - Average number of complaints from customers per month

	RESPONSE
Size of Business	
Small	1.05
Medium	1.60
Large	7.42
Year Started	
< 2000	4.76
>= 2000	1.71
ISO Certified	
Yes	3.93
No	0.72
Visited	
Yes	4.35
No	0.73
GI Supplier	
Yes	3.36
No	2.55
GI Supplier & Size	
Large	10.42
Medium	1.28
Small	1.00
US Supplier	
Yes	3.67
No	1.25
Business Ownership	
SOE	10.50
POE	3.46
JV	3.25
FOE	1.15
General Industry Types	
Computer and Electronic Product Mfg.	2.90
Precision Metal	5.00
Other	1.80
Plastic Products	0.00
Machinery	0.83

4.3.7. Survey Question 17

"Which of the following are the main reasons for customer complaints your company receives?"

(Check all that apply)

Late Delivery	
Product Failure	
Poor Product Quality	
Incorrect Product	
Incorrect Quantity	
Other:	
Other:	

4.3.7.1. Analysis

Survey question 17 was intended to learn about the most frequent complaints companies receive. If the company did not agree with any of the listed complaints, the option of "Other" was given for them to fill in the most common complaint(s) they receive from their customers. The "Other" response that was given dealt with the products being broken during shipment. Overall, the top three complaints received by the companies are: (1) Late delivery, (2-tie) Product failure and (2-tie) Incorrect quantity. From the data, large companies reported that they receive more complaints regarding product quality than the medium or small companies.

A single-factor ANOVA was performed on the data to determine if any factors were significant in the way the companies selected their responses. The ANOVA determined two factors to be significant. The two factors are: Business Ownership and General Industry Type. The p-value for these factors were determined to be .021 and .044 respectively. Tables 13 and 14 show a count and percentage breakdown, respectively, for each of the nine different groupings.

Table 13 - Count breakdown of reasons for customer complaints

	RESPONSE					
	Late Delivery	**Product Failure**	**Poor Product Quality**	**Incorrect Product**	**Incorrect Quantity**	**Other**
Size of Business						
Small	5	0	1	0	1	1
Medium	4	3	1	1	3	0
Large	6	4	3	0	3	0
Year Started						
< 2000	5	4	2	1	5	0
>= 2000	10	3	3	0	2	1
ISO Certified						
Yes	9	7	4	1	4	0
No	6	0	1	0	3	1
Visited						
Yes	12	6	5	0	4	1
No	3	1	0	1	3	0
GI Supplier						
Yes	7	1	2	1	4	0
No	8	5	2	0	3	1
GI Supplier & Size						
Small	3	0	1	0	1	0
Medium	2	1	1	1	1	0
Large	2	0	0	0	2	0
US Supplier						
Yes	14	6	5	1	4	0
No	1	1	0	0	2	1
Business Ownership						
SOE	1	1	1	0	0	0
POE	10	3	2	1	6	1
JV	3	0	0	0	0	0
FOE	1	2	2	0	1	0
General Industry Types						
Computer and Electronic Product Mfg.	4	3	1	0	2	0
Precision Metal	5	2	1	0	2	1
Other	3	2	3	1	3	0
Plastic Products	1	0	0	0	0	0
Machinery	2	0	0	0	0	0

Table 14 - Percentage breakdown of reasons for customer complaints

	RESPONSE					
	Late Delivery	Product Failure	Poor Product Quality	Incorrect Product	Incorrect Quantity	Other
Size of Business						
Small	63%	0%	13%	0%	13%	13%
Medium	33%	25%	8%	8%	25%	0%
Large	38%	25%	19%	0%	19%	0%
Year Started						
< 2000	29%	24%	12%	6%	29%	0%
>= 2000	53%	16%	16%	0%	11%	5%
ISO Certified						
Yes	36%	28%	16%	4%	16%	0%
No	55%	0%	9%	0%	27%	9%
Visited						
Yes	43%	21%	18%	0%	14%	4%
No	38%	13%	0%	13%	38%	0%
GI Supplier						
Yes	47%	7%	13%	7%	27%	0%
No	42%	26%	11%	0%	16%	5%
GI Supplier & Size						
Small	60%	0%	20%	0%	20%	0%
Medium	33%	17%	17%	17%	17%	0%
Large	50%	0%	0%	0%	50%	0%
US Supplier						
Yes	47%	20%	17%	3%	13%	0%
No	20%	20%	0%	0%	40%	20%
Business Ownership						
SOE	33%	33%	33%	0%	0%	0%
POE	43%	13%	9%	4%	26%	4%
JV	100%	0%	0%	0%	0%	0%
FOE	17%	33%	33%	0%	17%	0%
General Industry Types						
Computer and Electronic Product Mfg.	40%	30%	10%	0%	20%	0%
Precision Metal	45%	18%	9%	0%	18%	9%
Other	25%	17%	25%	8%	25%	0%
Plastic Products	100%	0%	0%	0%	0%	0%
Machinery	100%	0%	0%	0%	0%	0%

4.3.8. Overall Customer Focus Score

An overall customer focus score was compiled using Likert style questions 11 and 13. Question 11 focused on the methods companies use to know their customers' needs and question 13 focused on what the companies discuss with their customers when they meet together. The performance scale for the overall customer focus score was calculated using the numbers selected from the Likert scale. The higher the number selected, the better the performance score the group will receive. Likert scores 1 and 2 were grouped together and assigned the rating of "Poor". Likert score 3 was formed into its own group and assigned the rating of "Average". Likert scores 4 and 5 were grouped together and assigned the rating of "Above Average to Excellent". The resulting score is relative to the responses received from the companies that were surveyed, not to an industry standard or "Best Practice". The responses to questions 11 and 13 were averaged and broken down into the nine different groupings.

4.3.8.1. Analysis

There isn't a remarkable difference in scores within or between any of the groups. The greatest difference in score was between the Precision Metal and Machinery industry types with a calculated range of .74. The overall average computed score is 4.37. The companies reported using most of the methods listed in the survey on a fairly frequent basis. Table 15 details the scores achieved by the various groups.

Table 15 - Customer focus score according to Likert responses

	Customer Focus Score
Size of Business	
Small	4.35
Medium	4.33
Large	4.24
Year Started	
< 2000	4.17
> = 2000	4.43
ISO Certified	
ISO	4.35
NON-ISO	4.32
Visited	
VISIT	4.42
NO VISIT	4.26
GI Supplier	
SUPPLIER	4.42
NON-SUPPLIER	4.26
GI Supplier & Size	
Small	4.29
Medium	4.46
Large	4.40
US Supplier	
U.S. SUPPLIER	4.35
NON-SUPPLIER	4.28
Business Ownership	
SOE	4.70
POE	4.32
JV	4.45
FOE	4.53
General Industry Types	
Computer and Electronic Product Mfg.	4.41
Precision Metal	4.06
Other	4.38
Plastic Products	4.22
Machinery	4.80

4.3.9. Observations

The companies visited ranged from very proactive in efforts to ensure customer satisfaction to very reactive in efforts to ensure customer satisfaction. The smaller companies tended to rely more heavily on the visits of customers to tell them what they needed to do to meet their demands. The visits would entail audits or walk-throughs by the customer to make sure the company is doing what it needs to do to ensure a quality product. While this method ensures that the company knows what the customers' needs are, such an approach can stress the business-customer relationship. The smaller companies were not the only companies with such a reactive approach. There were medium and even some larger sized companies that seemed to act in such a way.

The companies that had direct business with the United States, the majority of which were large companies, did seem to have more of a focus on pleasing their customers. They were open to new ways of doing things and expressed their willingness to have their customers come in and tell them of newer/better ways of doing things. The researcher was told that if he had visited China a couple years earlier, he would have found the companies more resistant to change and more set in their old ways of doing things. All the companies visited expressed an interest in obtaining ISO 9001:2000 certification (if they did not already have it) citing reasons of better being able to meet customer needs.

There was an interesting issue brought to the researcher's attention while visiting with two of the large companies. Several individuals the researcher talked with mentioned the way Chinese companies would tell their foreign customers what they want to hear, but in reality, things were not always as the picture they painted for their

customers. One plastic injection mold making company said that they have a hard time telling their foreign customers when something is going wrong, and that they would rather not keep the customer informed of issues the company is facing – a sort of saving face mentality. The data collected with the survey concerning customer focus centered primarily on how the companies went about receiving feedback from their customers. Customer relationships are, however, a two way street. Communication needs to go both ways. Interviews and observations brought to light another part of the customer satisfaction arena – that of being proactive and open in communication when things are not going as planned or if there are issues that are having an affect on quality and meeting deadlines. Through the interviews of the two large companies and conversations with other manufacturing leaders in China, the researcher collected information that suggested that the Chinese manufacturing companies are not totally open and proactive in their communication with their customers.

Overall, companies in China are doing what they can to keep in touch with their customers. Many companies are having struggles with trying to keep the long-distance relationship alive and are growing more accustomed to the ways of business in the "Western World".

4.4. Leadership

This section presents the analysis performed on the data collected regarding the company's leadership.

The survey instrument has five questions that delve into the manners in which the company's management is involved in promoting a quality aware company.

4.4.1. Survey Question 18

"Which of the following are methods that the management of your company uses to stay current on principles and concepts of quality (the higher the number the more the method is used to help management keep current)?"

Never				All the time
1	2	3	4	5

(18a) Top management reads regularly about how to improve quality	1	2	3	4	5
(18b) Top management subscribes to a quality publication that describes quality improvement practices; name of publication _____	1	2	3	4	5
(18c) Top management meets and discusses product quality	1	2	3	4	5
(18d) Top management meets and discusses quality practices	1	2	3	4	5
(18e) Top management receives training on quality management and practices; the training is: Internal or External	1	2	3	4	5
(18f) Other:	1	2	3	4	5
(18g) Other:	1	2	3	4	5

4.4.1.1. Analysis

Survey question 18 was used to discover what management from each company does to keep up to date on quality practices. The rationale behind this question is that the more methods each company's management uses to keep up to date, the more emphasis management puts on quality within the organization. Overall, the two most used methods reported by the companies are: (1) Top management meets and discusses quality practices, and (2) Top management meets and discusses product quality. These methods are the ones most used by the small and medium sized companies. Large companies indicated that their top two methods used are management meeting and discussing quality

practices, followed by having top management receive training on quality management and practices. Overall, the method least used by the companies' management to keep up on quality principles and concepts is subscribing to a quality publication.

An ANOVA was performed to determine the significance of any of the factors. The ANOVA showed two of the factors to be significant. The two factors are: Direct U.S. supplier (Y/N) and Business Ownership. The factor of being a direct U.S. supplier or not was only significant for response 18b (management subscribing to quality publication). The p-value that was determined for this factor and response was .024. The factor of business ownership was significant for three of the responses to question 18. Business ownership was found to be significant for responses 18a (top management reading regularly about how to improve quality), 18b and 18e (top management receiving training on quality management and practices). The p-values for the three responses and the factor of business ownership were determined to be .02, .01 and .04 respectively. Table 16 presents the averaged data of the responses received from the surveyed companies.

4.4.2. Survey Question 19

"How often does management discuss quality related issues in management meetings?"

(Check the one that applies)

Once a week	
Twice a month	
Once a month	
Never	
Other:	

Table 16 - Averaged responses of groups for question 18

	RESPONSE				
	18a	**18b**	**18c**	**18d**	**18e**
Size of Business					
Small	4.27	3.90	4.36	4.45	4.00
Medium	4.00	3.75	4.67	4.79	4.47
Large	4.00	3.08	4.43	4.29	4.31
Year Started					
< 2000	3.90	3.16	4.45	4.40	4.26
> = 2000	4.26	4.00	4.55	4.63	4.32
ISO Certified					
ISO	4.00	3.42	4.48	4.46	4.39
NON-ISO	4.27	3.89	4.55	4.64	4.00
Visited					
VISIT	4.35	3.91	4.67	4.70	4.46
NO VISIT	3.87	3.08	4.33	4.40	4.00
GI Supplier					
SUPPLIER	4.35	3.91	4.67	4.70	4.46
NON-SUPPLIER	3.87	3.08	4.33	4.40	4.00
GI Supplier & Size					
Small	4.38	4.25	4.38	4.38	4.13
Medium	4.38	4.00	4.89	5.00	4.56
Large	4.29	3.43	4.71	4.71	4.71
US Supplier					
U.S. SUPPLIER	4.10	3.41	4.61	4.57	4.27
NON-SUPPLIER	3.71	3.83	3.86	4.14	4.33
Business Ownership					
SOE	5.00	4.00	5.00	5.00	4.00
POE	4.00	3.64	4.46	4.44	4.04
Joint Venture	4.67	4.50	5.00	5.00	4.67
FOE	4.33	3.33	4.78	4.78	4.78
General Industry Type					
Computer and Electronic Product Mfg.	4.10	3.22	4.70	4.70	4.20
Precision Metal	4.08	3.55	4.50	4.46	4.31
Other	4.00	3.64	4.36	4.45	4.70
Plastic Products	3.00	3.00	4.00	4.00	4.00
Machinery	5.00	4.33	4.67	4.67	3.33

4.4.2.1. Analysis

Survey question 19 was used to find out if management stresses quality in the regular meetings in which they take part. The "Other" response received is "two times per week". Sixty three percent of the companies reported that their management discusses quality related issues in management meetings at least once a week.

An ANOVA was performed to determine the significance of the factors. As a result of the ANOVA, none of the factors were determined to be significant to explain the responses to question 19. Tables 17 and 18 present the data obtained from the companies in response to survey question 19.

4.4.3. Survey Question 20

"How many times per month are meetings held where quality is discussed in the following groups:"

(20a) By upper management
(20b) By workers and management
(20c) By management & customer
(20d) By workers only
(20e) Other:

4.4.3.1. Analysis

Survey question 20 was used to quantify the frequency of meetings held where quality is discussed and the level of discussion in the organization.

The researcher wasn't able to perform substantial analysis on the data received from this survey question because of the way many of the companies filled out their answers to this question. Many of the responses were marked as an "X". Other responses that weren't numbers were statements such as: "depends," "anytime,"

Table 17 - Count breakdown of groups for question 19

	RESPONSE				
	Once a Week	**Twice a Month**	**Once a Month**	**Never**	**Other**
Size of Business					
Small	7	2	2	0	1
Medium	9	2	4	0	0
Large	9	2	3	0	0
Year Started					
< 2000	12	4	4	0	0
>= 2000	13	2	5	0	1
ISO Certified					
Yes	16	5	8	0	0
No	9	1	1	0	1
Visited					
Yes	17	2	6	0	1
No	8	4	3	0	0
GI Supplier					
Yes	15	4	6	0	0
No	9	2	3	0	1
GI Supplier & Size					
Small	5	2	2	0	0
Medium	5	2	2	0	0
Large	5	0	2	0	0
US Supplier					
Yes	19	4	8	0	1
No	4	2	1	0	0
Business Ownership					
SOE	0	0	1	0	0
POE	18	3	4	0	1
JV	3	1	0	0	0
FOE	4	2	3	0	0
General Industry Types					
Computer and Electronic Product Mfg.	5	4	1	0	0
Precision Metal	7	1	5	0	1
Other	8	0	3	0	0
Plastic Products	3	0	0	0	0
Machinery	2	1	0	0	0

Table 18 - Percentage breakdown of groups for question 19

	RESPONSE				
	Once a Week	Twice a Month	Once a Month	Never	Other
Size of Business					
Small	58%	17%	17%	0%	8%
Medium	60%	13%	27%	0%	0%
Large	64%	14%	21%	0%	0%
Year Started					
< 2000	60%	20%	20%	0%	0%
>= 2000	62%	10%	24%	0%	5%
ISO Certified					
Yes	55%	17%	28%	0%	0%
No	75%	8%	8%	0%	8%
Visited					
Yes	65%	8%	23%	0%	4%
No	53%	27%	20%	0%	0%
GI Supplier					
Yes	60%	16%	24%	0%	0%
No	60%	13%	20%	0%	7%
GI Supplier & Size					
Small	56%	22%	22%	0%	0%
Medium	56%	22%	22%	0%	0%
Large	71%	0%	29%	0%	0%
US Supplier					
Yes	59%	13%	25%	0%	3%
No	57%	29%	14%	0%	0%
Business Ownership					
SOE	0%	0%	100%	0%	0%
POE	69%	12%	15%	0%	4%
JV	75%	25%	0%	0%	0%
FOE	44%	22%	33%	0%	0%
General Industry Types					
Computer and Electronic Product Mfg.	50%	40%	10%	0%	0%
Precision Metal	50%	7%	36%	0%	7%
Other	73%	0%	27%	0%	0%
Plastic Products	100%	0%	0%	0%	0%
Machinery	67%	33%	0%	0%	0%

"regularly," "anytime if necessary," "every time we meet with customers," "not definite," and "not fixed, we often have such kind of meetings according to the situation". However, the responses to question 20 suggest that most of the companies meet on a fairly regular basis to discuss quality and quality related issues. Table 19 shows the response rate, max, min and average for all of the responses and for the size of businesses.

Table 19 - Breakdown of responses for question 20

	RESPONSE			
	20a	**20b**	**20c**	**20d**
Overall				
Response Rate	88%	83%	59%	59%
Max	16.00	30.00	4.00	30.00
Min	1.00	0.50	0.33	0.00
Avg.	3.08	8.50	1.55	5.33
Large				
Response Rate	100%	86%	71%	64%
Max	4.00	30.00	4.00	10.00
Min	1.00	1.00	1.00	0.00
Avg.	2.78	10.78	1.80	3.83
Medium				
Response Rate	87%	80%	53%	60%
Max	16.00	30.00	2.00	16.00
Min	1.00	4.00	0.33	0.00
Avg.	3.56	8.22	1.10	5.22
Small				
Response Rate	75%	83%	50%	50%
Max	8.00	30.00	4.00	30.00
Min	1.00	0.50	1.00	0.00
Avg.	2.88	5.93	2.50	7.30

4.4.4. Survey Question 21

"How does top management encourage employees to be involved in quality management and improvement activities and/or solve quality problems (the higher the number, the more frequent the method is used)?"

Never					Very Frequently
1	2	3	4		5
(21a) On-site education	1	2	3	4	5
(21b) Off-site education	1	2	3	4	5
(21c) Self-education	1	2	3	4	5
(21d) Other:	1	2	3	4	5

4.4.4.1. Analysis

Survey question 21 was to determine how management provided training within their organization. The "Other" responses were "subsidize skill training," "change position education," and one was left blank with no explanation for choosing "Other". From the data, overall, the three methods were ranked by the companies as follows: (1) On-site education, (2) Self-education and (3) Off-site education.

An ANOVA was performed to determine the significance of any of the factors. The ANOVA determined two of the factors to be significant: Direct U.S. supplier (Y/N) and Business Ownership. Both factors were deemed to be significant for response 21b only. The p-value for the factor of Direct U.S. supplier (Y/N) was calculated to be .01 and the p-value for the factor of Business Ownership was calculated to be .008. Table 20 presents the averaged data obtained for each group in response to question 21.

Table 20 - Averaged responses of groups for question 21

	RESPONSE			
	21a	21b	21c	21d
Size of Business				
Small	4.58	2.80	3.90	
Medium	4.86	3.00	4.08	4.33
Large	4.50	3.78	4.31	
Year Started				
< 2000	4.47	3.07	4.21	
> = 2000	4.81	3.24	4.00	4.33
ISO Certified				
ISO	4.68	3.15	4.23	4.33
NON-ISO	4.58	3.18	3.78	
Visited				
VISIT	4.71	3.33	4.38	4.33
NO VISIT	4.67	3.08	3.85	
GI Supplier				
SUPPLIER	4.71	3.33	4.38	4.33
NON-SUPPLIER	4.67	3.08	3.85	
GI Supplier & Size				
Small	4.56	2.71	4.14	
Medium	4.75	3.14	4.29	4.33
Large	4.86	4.75	4.71	
US Supplier				
U.S. SUPPLIER	4.66	3.25	4.29	4.33
NON-SUPPLIER	4.57	2.67	3.50	
Business Ownership				
SOE	4.00		5.00	
POE	4.54	2.91	3.87	5.00
Joint Venture	5.00	4.00	5.00	3.00
FOE	4.88	4.50	4.88	5.00
General Industry Type				
Computer and Electronic Product Mfg.	4.60	3.83	4.67	3.00
Precision Metal	4.71	3.27	4.08	5.00
Other	4.50	3.00	3.38	
Plastic Products	4.67	2.00	4.50	
Machinery	5.00	3.00	4.33	

4.4.5. Survey Question 22

(22a) "How many times per year are education and training programs on quality offered in your company? _____

- (22b) How often are other education and training programs offered in your company? _____. (22c) What do the other training/education programs pertain to?

  _____."

4.4.5.1. Analysis

Survey question 22 quantifies the frequency of which training programs take place within the organization. It also serves to discover what areas are stressed within the organization to help the company to be successful.

The data collected for this survey question is found in Tables 21 – 23. The data has been broken out by responses for each size of business (large, medium and small). From the data, it can be seen that training is offered on a fairly regular basis and focuses on aspects that are important to the success of a business.

4.4.6. Overall Leadership Score

An overall leadership score was compiled using Likert style questions 18 and 21. Question 18 focused on the methods that management within the company use to keep up to date on the latest in quality and management practices. Question 21 focused on the ways management promotes training and education efforts within their respective companies. The performance scale for the overall leadership score was calculated using the numbers selected from the Likert scale. The higher the number selected, the better

Table 21 - Large company responses to question 22

RESPONSE		
22a	**22b**	**22c**
Not Sure	One time per month	Production/process and management skill
We provide different training and education according to different classes	At least 4 times	Finance, logistics, market, HR
3		
10	One month	
12	Half a month	
2		
1	Depends	Career development
We provide training depending on the yearly training plan.		
Quality training for new staff and more than once a month for every month later	Every Month	Processing, operating
20	Every Month	HR, Technology specialists
6	2 Months	Position skills
2		ISO
6	Not sure.	
4		

Table 22 - Medium company responses to question 22

RESPONSE		
22a	**22b**	**22c**
10	3 months	It belongs to the educational training that refers to the workers' health on body and mind.
We often provide education on the production line.	No, we haven't the training at the present	
2	Once a month	Training on pre-working
3	4 months	
4		QC training (1 - 2 times/month); SPC training (1 time/3months)
4	Once per a quarter of a year	skill training
4	Every Month	Safety & Philosophy
2	2 bigger trainings per year	Function, computer skill and foreign language trainings
9	Every month	Safety and sanitation
50	Every Month	Knowledge about management
5		
4.5	Every half year	5S, production target and quality management
4		
5		operating and safety

Table 23 - Small company responses to question 22

RESPONSE		
22a	**22b**	**22c**
24	Monthly	Production skill, production safety, fire
4	Half a year	Safety production
We provide a week regular training to new employees.	Half a year	the training about making employees know the importance of quality
20	two - three per month	Personal capability and fundamental skills
50	1/week	quality idea and inspection means, processing technology
ISO 9001:2000	Half a year	Team spirit and correct attitude
50	Once per year	Other training belong to skill such as theory of moulding technology, the correctness of counter; training on quality management such as ISO 9001 & ISO 14000
8	2 months	The other education is education about law, rules and safe production
20	Every 20 days we have one.	they're mainly about security, skill, etc.
Anytime	Anytime	quality requirements, work instruction about products
Customer visits twice a week to check up on status of project and to address any issues		
6	2 months	Studying Mandarin, because this is a Hong Kong company and their official languages are Cantonese and English

the performance score the group will receive. Likert scores 1 and 2 were grouped together and assigned the rating of “Poor”. Likert score 3 was formed into its own group and assigned the rating of “Average”. Likert scores 4 and 5 were grouped together and assigned the rating of “Above Average to Excellent”. The resulting score is relative to the responses received from the companies that were surveyed, not to an industry standard or “Best Practice”. The responses to questions 18 and 21 were averaged and broken down into the nine different groupings.

4.4.6.1. Analysis

The overall average score for leadership is 4.17. There isn't a substantial difference between the scores calculated for the first three groups (size of business, year started and ISO certified). The remaining six groups have a greater difference in scores. The greatest difference in scores was between Plastic Products and Machinery industry types with a calculated range of .65. It appears that the newer companies have leadership that is more involved and proactive in facilitating a culture that is conducive to quality and continuous improvement. U.S. supplier companies also outperformed their counterparts in this scoring. Table 24 details the scores achieved by the various groups.

4.4.7. Observations

A common theme from the review of literature was that of the Chinese workers not questioning their leadership. The researcher observed that there is still a feeling of not questioning what management says and of saving the face of management at all costs in the companies the researcher visited. If the managers felt that something was important to them, that thing would become an important part of the organization. Managers are becoming more and more aware that they need to keep their best skilled and best performing employees around because of the learning curve effect. This means that as employees become more experienced with a certain task, they become more efficient at performing that task. New employees will require more time to be able to match the performance level of the experienced employees.

Employees are very hard working, and are becoming more and more aware of the possibility of moving around to different companies if they do not feel they are being

Table 24 - Leadership score according to Likert responses

	Leadership Score
Size of Business	
Small	4.03
Medium	4.22
Large	4.09
Year Started	
< 2000	3.99
> = 2000	4.24
ISO Certified	
ISO	4.13
NON-ISO	4.11
Visited	
VISIT	4.31
NO VISIT	3.91
GI Supplier	
SUPPLIER	4.31
NON-SUPPLIER	3.91
GI Supplier & Size	
Small	4.11
Medium	4.37
Large	4.52
US Supplier	
U.S. SUPPLIER	4.16
NON-SUPPLIER	3.83
Business Ownership	
SOE	4.57
POE	4.10
Joint Venture	4.54
FOE	4.58
General Industry Types	
Computer and Electronic Product Mfg.	4.11
Precision Metal	4.22
Other	4.00
Plastic Products	3.65
Machinery	4.29

treated fairly. Managers try to offer their best performers extra incentives to keep them from moving to different companies in search of higher compensation. Some of the things they mentioned were training, responsibilities, and money. Every manager with which the researcher visited expressed the importance of having a well-trained workforce and said that they do what is within their means to try to facilitate the necessary training the employees need. Some of the ISO-certified companies showed training schedules that are used in keeping their workforce up to date on the latest practices. The training schedules were very comprehensive in the scope of things covered. The smaller companies did not have the same level of training their larger counterparts did. All of the managers expressed the importance of having or obtaining ISO certification to attract business to their company and to help standardize the efforts of the company.

4.5. Manufacturing and Quality Practices

This section presents the analysis performed on the data collected regarding the general knowledge and use of various manufacturing and quality practices.

The survey instrument has seven questions that learn about the various manufacturing and quality methods each company is familiar with and utilizes in its operations. The seven questions are survey questions 23 – 29.

4.5.1. Survey Question 23

"Given the following conditions would you choose to stop production to fix a quality problem or continue production and address the problem later?"

(23a) Problem arises during heavy pressure from a customer to deliver	Stop	Continue
(23b) Problem arises during regular daily production (without pressure from customer)	Stop	Continue
(23c) Customer calls with a problem on a part in current production	Stop	Continue
(23d) Management requests a problem be addressed immediately	Stop	Continue
(23e) A line worker identifies a problem and suggests it be addressed	Stop	Continue

4.5.1.1. Analysis

Survey question 23 aids in understanding if the company stresses quality or quantity. Companies would tend to be more positive on this question thus the reason for providing different operating conditions, that of under pressure and not under pressure. If a company chooses to continue under each circumstance, the company would seem to have a tendency for preferring quantity to quality. The question also sheds some light on the operational practices of each company, that is, whether they are reactive or proactive in their improvements.

Noteworthy observations of the data were limited to groups with a sample size of at least ten. The following breakdown highlights the most noticeable differences in responses received from the companies.

Response 23a – Pressure from customer to deliver

Twenty percent of smaller companies reported that they would continue production if a problem arose while they were receiving heavy pressure from a customer

to deliver compared to 8% and 9% of the large and medium sized companies respectively. A greater percentage of ISO-certified companies reported that they would continue production if a problem arose and they had pressure from a customer to deliver compared to non-ISO certified companies (13%-ISO certified compared to 10%-non-ISO certified). A greater percentage of companies that are GI suppliers reported that they would continue operations under the same conditions previously listed compared to the companies that are not GI suppliers (18% compared to 10%).

Response 23b – Regular daily production (no pressure from customer)

Thirty three percent of medium sized companies reported that they would continue production if a problem arose during daily operations without pressure from a customer to deliver compared to 0% and 9% of the large and small companies respectively. Twenty seven percent of non-ISO certified companies responses reported that they would continue operations under the conditions of 23b compared to 8% for ISO-certified companies. Seventeen percent of GI suppliers' responses indicated that they would continue operations under 23b's conditions compared to 9% of non-GI suppliers.

Response 23d – Management requests a problem be addressed immediately

Large companies reported that they would stop operations if management requested that a problem be addressed immediately compared to 23% and 27% of the medium and small companies respectively that indicated they would continue operations. 26% of the newer companies (started during or after the year 2000) indicated they would continue operations compared to 6% of the companies that were started prior to the year 2000. 27% of non-ISO-certified companies' responses reported that they would continue operations compared to 12% of responses received from the ISO-certified companies.

25% of responses received from non-GI suppliers indicated they would continue operations compared to 13% of responses received from GI suppliers.

Response 23e – Line worker identifies a problem and suggests it be addressed

The responses from this question showed a greater percentage of companies choosing to continue operations. Twenty five percent of large and medium companies and 18% of small companies reported that they would continue operations. Twenty five percent of ISO-certified companies and 18% of non-ISO-certified companies reported that they would continue operations. Thirty three percent of the companies the researcher visited reported they would continue operations. Twenty seven percent of the companies that are direct U.S. suppliers reported that they would continue production under the scenario of 23e compared to 0% of companies that are not direct U.S. suppliers.

Tables 25 and 26 show the responses of the companies to the situations presented to them in survey question 23.

4.5.2. Survey Question 24

(24a) "What is your scrap rate (% or number per 1000 pieces produced)?
_____

(24b) What is your measurement method?
_____"

4.5.2.1. Analysis

Survey question 24 helps to determine the degree of control each company has on its manufacturing processes. The higher the scrap rate, the less control a company has on its processes. Scrap rates do vary between industries, but in general, the better the quality then the lower the scrap rate will be. The small sized companies reported the highest

Table 25 - Count breakdown of groups for question 23

	RESPONSE									
	23 a		23 b		23 c		23 d		23 e	
	Stop	Cont.	Stop	Cont.	Stop	Cont.	Stop	Cont.	Stop	Cont.
Size of Business										
Small	8	2	10	1	11	0	8	3	9	2
Medium	10	1	8	4	12	1	10	3	9	3
Large	11	1	13	0	12	1	13	0	9	3
Year Started										
< 2000	16	2	16	2	17	1	17	1	14	4
>= 2000	13	2	15	3	18	1	14	5	13	4
ISO Certified										
Yes	20	3	23	2	24	2	23	3	18	6
No	9	1	8	3	11	0	8	3	9	2
Visited										
Yes	17	3	19	3	21	2	18	5	14	7
No	12	1	12	2	14	0	13	1	13	1
GI Supplier										
Yes	19	2	20	4	23	1	21	3	18	5
No	9	2	10	1	11	1	9	3	8	3
GI Supplier & Size										
Small	7	1	8	1	9	0	7	2	8	1
Medium	6	1	5	3	7	1	7	1	5	3
Large	6	0	7	0	7	0	7	0	5	1
US Supplier										
Yes	25	3	27	4	29	2	26	5	22	8
No	3	1	4	0	5	0	4	1	4	0
Business Ownership										
SOE	1	0	1	0	1	0	1	0	0	1
POE	22	3	21	4	24	1	20	5	20	5
JV	1	1	2	1	3	1	3	1	2	1
FOE	5	0	7	0	7	0	7	0	5	1
General Industry Types										
Computer and Electronic Product Mfg.	6	1	7	1	8	1	8	1	5	2
Precision Metal	10	2	12	1	12	1	9	4	10	3
Other	9	0	7	2	9	0	8	1	8	1
Plastic Products	2	0	2	1	3	0	3	0	2	1
Machinery	2	1	3	0	3	0	3	0	2	1

Table 26 - Percentage breakdown of groups for question 23

	RESPONSE									
	23 a		23 b		23 c		23 d		23 e	
	Stop	Cont.	Stop	Cont.	Stop	Cont.	Stop	Cont.	Stop	Cont.
Size of Business										
Small	80%	20%	91%	9%	100%	0%	73%	27%	82%	18%
Medium	91%	9%	67%	33%	92%	8%	77%	23%	75%	25%
Large	92%	8%	100%	0%	92%	8%	100%	0%	75%	25%
Year Started										
< 2000	89%	11%	89%	11%	94%	6%	94%	6%	78%	22%
>= 2000	87%	13%	83%	17%	95%	5%	74%	26%	76%	24%
ISO Certified										
Yes	87%	13%	92%	8%	92%	8%	88%	12%	75%	25%
No	90%	10%	73%	27%	100%	0%	73%	27%	82%	18%
Visited										
Yes	85%	15%	86%	14%	91%	9%	78%	22%	67%	33%
No	92%	8%	86%	14%	100%	0%	93%	7%	93%	7%
GI Supplier										
Yes	90%	10%	83%	17%	96%	4%	88%	13%	78%	22%
No	82%	18%	91%	9%	92%	8%	75%	25%	73%	27%
GI Supplier & Size										
Small	88%	13%	89%	11%	100%	0%	78%	22%	89%	11%
Medium	86%	14%	63%	38%	88%	13%	88%	13%	63%	38%
Large	100%	0%	100%	0%	100%	0%	100%	0%	83%	17%
US Supplier										
Yes	89%	11%	87%	13%	94%	6%	84%	16%	73%	27%
No	75%	25%	100%	0%	100%	0%	80%	20%	100%	0%
Business Ownership										
SOE	100%	0%	100%	0%	100%	0%	100%	0%	0%	100%
POE	88%	12%	84%	16%	96%	4%	80%	20%	80%	20%
JV	50%	50%	67%	33%	75%	25%	75%	25%	67%	33%
FOE	100%	0%	100%	0%	100%	0%	100%	0%	83%	17%
General Industry Types										
Computer and Electronic Product Mfg.	86%	14%	88%	13%	89%	11%	89%	11%	71%	29%
Precision Metal	83%	17%	92%	8%	92%	8%	69%	31%	77%	23%
Other	100%	0%	78%	22%	100%	0%	89%	11%	89%	11%
Plastic Products	100%	0%	67%	33%	100%	0%	100%	0%	67%	33%
Machinery	67%	33%	100%	0%	100%	0%	100%	0%	67%	33%

scrap rate with one company reporting a scrap rate of 6%. Overall, however, the scrap rates for all three groups (small, medium and large companies) are very similar ranging from <1% - 5%. Tables 27 – 29 show the responses of large, medium and small companies.

4.5.3. Survey Question 25

"How familiar is your company with the following manufacturing practices (the higher the number the more familiar your company is with the method)?"

Not Familiar at All					Very Familiar
1	2	3	4		5
(25a) Statistical Process Control (SPC)	1	2	3	4	5
(25b) Lean Manufacturing	1	2	3	4	5
(25c) Toyota Production System	1	2	3	4	5
(25d) Total Quality Management (TQM)	1	2	3	4	5
(25e) Kanban	1	2	3	4	5
(25f) Quality Circles	1	2	3	4	5
(25g) Just in Time Manufacturing (JIT)	1	2	3	4	5
(25h) Design of Experiments (DOE)	1	2	3	4	5
(25i) Bottle-neck Concept	1	2	3	4	5

4.5.3.1. Analysis

Survey question 25 illustrates the familiarity of each company with common methods that are used world-wide in driving continuous business and operational improvements. Four of the methods listed in question 25 are related: Lean Manufacturing, Toyota Production System, Kanban, and Just in Time Manufacturing (JIT). Three of the terms are synonymous in describing the same manufacturing methodology: Lean Manufacturing, Toyota Production System and JIT. Kanban is a manufacturing/inventory management practice that is used as a part of Lean

Table 27 - Responses of large companies for question 24

RESPONSE	
24a	**24b**
0.10%	Collect the data from IPQC
	To measure the system by the cost of quality
1%	MRP system
0.50%	
.001/1000	
0.05%	
1%	
1%	
0.50%	Caliper, filler gauge, height gauge, CMM
0.25%	outgoing reports
3 - 5 %	
0.5 - 0.7 %	Customer supplied information
1 to 2 per 1000	by CMM

Table 28 - Responses of medium companies for question 24

RESPONSE	
24a	**24b**
< 5%	By Statistic Data
2-3%	AQL numerical value or scale
3/1000	
0.10%	
15.2	Scrap Qty./Production Qty. X 100
0.30%	Projector or altifect
0.06%	Sampling
1%	Data statistics
1%	Statistics
5%	Measure directly according to the standard
3%	Examine by precise equipment according to the quality requirement.
5%	
Not clear	Not clear
1.50%	

Table 29 - Responses of small companies for question 24

RESPONSE	
24a	**24b**
1 - 3 %	High precision testers if possible
1%	Use precise measuring instruments, height measurement, computer 3D surveying instruments and projector
0.10%	Vernier Scale
6%	More than 30 means in plastic measurement
0.10%	(Standard products/all the products) X 100
< 3.5%	Gather data from production line to do Cpk so as to evaluate the machines' stability
Aim of 0%	Choose TMS PG DG MMDN, achieve precision by the requirement of drawing standard
0.10%	Data
< 1%	
0 - 2%	Common statistic data such as rejected rate.
0.10%	MIL - SID - 105 - E 0.65%

Manufacturing. The reason for including all four related items was to see with which method the Chinese manufacturing companies are more familiar.

Overall, small, medium, and large companies reported being least familiar with the Toyota Production System with average ratings of 2.5, 2.27 and 3.46 respectively. Small companies reported being the most familiar with Total Quality Management (TQM) with an average rating of 4.60. Medium companies reported being the most familiar with SPC and TQM with equal average ratings of 4.36. Large companies reported that they were most familiar with SPC with an average rating of 4.43. For all the groupings, the least familiar manufacturing method is the Toyota Production System/Lean Manufacturing. The most familiar methods reported by all the groups are TQM and SPC. Table 30 shows the averaged responses of the companies to survey question 25.

Table 30 - Averaged responses of groups for question 25

	RESPONSE								
	25a	**25b**	**25c**	**25d**	**25e**	**25f**	**25g**	**25h**	**25i**
Size of Business									
Small	3.82	3.50	2.50	4.60	4.40	4.10	3.90	3.22	3.56
Medium	4.36	2.83	2.27	4.36	4.29	4.00	3.38	3.50	3.09
Large	4.43	3.64	3.46	4.14	4.00	4.00	4.21	3.86	3.71
Year Started									
< 2000	4.47	3.42	3.18	4.17	4.06	3.88	3.94	3.56	3.29
> = 2000	4.00	3.24	2.40	4.50	4.35	4.15	3.74	3.58	3.65
ISO Certified									
ISO	4.46	3.50	2.83	4.41	4.19	4.08	3.85	3.78	3.44
NON-ISO	3.64	2.90	2.75	4.18	4.27	3.91	3.82	3.00	3.56
Visited									
VISIT	4.38	3.50	2.68	4.65	4.48	4.27	4.04	3.50	3.43
NO VISIT	3.93	3.08	3.17	3.93	3.86	3.64	3.46	3.64	3.75
GI Supplier									
SUPPLIER	4.38	3.50	2.68	4.65	4.48	4.27	4.04	3.50	3.43
NON-SUPPLIER	3.93	3.08	3.17	3.93	3.86	3.64	3.46	3.64	3.75
GI Supplier & Size									
Small	4.00	3.75	2.33	4.50	4.25	4.38	4.13	3.29	3.29
Medium	4.50	3.14	2.43	4.75	4.50	3.88	3.50	3.50	3.14
Large	4.71	3.57	3.33	4.71	4.71	4.67	4.57	3.71	3.86
US Supplier									
U.S. SUPPLIER	4.25	3.30	2.86	4.47	4.34	4.00	3.88	3.55	3.53
NON-SUPPLIER	4.33	3.80	2.67	3.80	3.40	4.20	3.50	4.00	3.33
Business Ownership									
SOE	5.00	4.00	3.00	4.00	3.00	4.00	4.00	4.00	2.00
POE	3.92	3.13	2.45	4.25	4.04	3.67	3.67	3.17	3.14
Joint Venture	5.00	2.00	1.67	5.00	5.00	5.00	4.00	3.75	3.33
FOE	4.63	4.50	4.43	4.75	4.88	4.71	4.50	4.38	4.50
General Industry Types									
Computer and Electronic Product Mfg.	4.80	3.67	3.50	4.50	4.60	4.33	4.00	4.20	4.00
Precision Metal	3.62	3.00	2.75	4.25	4.00	4.00	3.83	3.00	3.25
Other	4.30	3.78	2.71	4.00	4.00	4.40	4.10	4.33	3.43
Plastic Products	5.00	2.33	2.33	4.67	3.67	3.00	3.00	2.33	2.00
Machinery	4.00	3.33	1.50	5.00	5.00	3.00	3.33	2.67	4.33

4.5.4. Survey Question 26

"In collecting and analyzing data from your processes, does your company use (the higher the number, the more frequently the method is used):"

Never				Used Very Frequently
1	2	3	4	5

(26a) Statistical Process Control (SPC)	1	2	3	4	5
(26b) Control Charts	1	2	3	4	5
(26c) Pareto Charts	1	2	3	4	5
(26d) Tables	1	2	3	4	5
(26e) Other:	1	2	3	4	5
(26f) Other:	1	2	3	4	5

4.5.4.1. Analysis

Survey question 26 lists common methods used to analyze and interpret data collected from manufacturing operations. If the company used different methods than those listed, the option of "Other" was provided for them to describe the method they use to analyze and interpret data they collect. The "Other" response that was given was "fishbone chart".

The most commonly used method used to analyze and interpret data collected from manufacturing operations reported by small, medium and large companies was "Tables" with average ratings of 4.30, 4.64 and 4.55 respectively. "Tables" was also reported the most for all groupings as the method used most often for analyzing and interpreting data. The method reported least used by small companies was Pareto Charts, which had an average rating of 3.50. The method reported least used by medium and large companies was Control Charts, which had average ratings of 4.07 and 4.31 respectively. Overall, all methods listed seemed to be used frequently by large

companies – their average responses had a range of .24. Table 31 displays the averaged responses the companies gave for question 26.

Table 31 - Averaged responses of groups for question 26

	RESPONSE				
	26a	**26b**	**26c**	**26d**	**26e**
Size of Business					
Small	3.60	3.91	3.50	4.30	
Medium	4.14	4.07	4.36	4.64	4.00
Large	4.54	4.31	4.38	4.55	
Year Started					
< 2000	4.00	3.67	3.94	4.47	
> = 2000	4.25	4.50	4.30	4.55	4.00
ISO Certified					
ISO	4.42	4.26	4.31	4.54	
NON-ISO	3.45	3.73	3.73	4.45	4.00
Visited					
VISIT	4.04	4.21	4.00	4.59	
NO VISIT	4.23	3.92	4.38	4.42	4.00
GI Supplier					
SUPPLIER	4.04	4.21	4.00	4.59	
NON-SUPPLIER	4.23	3.92	4.38	4.42	4.00
GI Supplier & Size					
Small	3.75	4.11	3.63	4.63	
Medium	3.75	3.88	3.88	4.50	
Large	4.71	4.71	4.57	4.67	
US Supplier					
U.S. SUPPLIER	4.19	4.16	4.26	4.45	4.00
NON-SUPPLIER	4.20	4.17	3.80	4.80	
Business Ownership					
SOE	5.00	4.00	5.00		
POE	3.79	3.72	3.88	4.29	4.00
JV	5.00	5.00	4.75	5.00	
FOE	4.57	4.86	4.43	5.00	
General Industry Types					
Computer and Electronic Product Mfg.	4.56	4.00	4.44	4.86	
Precision Metal	4.08	4.23	4.25	4.42	4.00
Other	4.30	4.60	4.20	4.90	
Plastic Products	3.67	3.33	3.33	4.00	
Machinery	3.00	3.00	3.33	3.33	

4.5.5. Survey Question 27

"How often do you collect data on your processes? _____"

4.5.5.1. Analysis

Responses to question 27 will vary between industries and between companies that have high production volume vs. low production volume. Companies that have high production volume will tend to collect data more frequently than companies that have low production volume. Some industries may have standards that dictate how often they are to collect statistical data. The answers that were received were varied from percentages to detailed explanations. It is anticipated that some of the answers may have lost their meaning due to translation. Tables 32 – 34 show what the responses were for large, medium and small companies.

Table 32 - Responses of large companies for question 27

RESPONSE
Question 27
2 hours per time
At any time
At least one time every 5 minutes; once a day for a while.
5
5
Everyday
We collect information an hour at a time or 2 hours/4hours a shift according to different products, customers or technology.
Weekly
Once every two hours
Every piece manufactured
Some are live
30%

Table 33 - Responses of medium companies for question 27

RESPONSE
Question 27
We often collect material
High frequency
5
1 piece/30 minutes
Quality record
We collect it everyday
Once per day
Every work time
Every time
Often.

Table 34 - Responses of small companies for question 27

RESPONSE
Question 27
Try every possibility to get information from all aspects such as drawings, processing, notices for products…
80%
Sometimes
100%
Half an hour
Every day
Once a week
Once a week
Often
3 Hours

4.5.6. Survey Question 28

"How do you collect data on your processes? _____"

4.5.6.1. Analysis

The intent of this question was to clarify what processes the companies go through to analyze their manufacturing processes for improvement. The responses

received for this question varied from very general to somewhat detailed. Some of the answers seem as if they do not fit the question, which may have been caused due to a loss in translation of the question and/or the response. Tables 35 – 37 show the responses for large, medium and small manufacturing companies.

4.5.7. Survey Question 29

(29a) "What data do you collect? _____

- (29b) Why this data? _____
- (29c) Who uses the data? _____
- (29d) How is it reported (charts, tables, etc.)? _____
- (29e) Where is it posted? _____
- (29f) Who sees it? _____"

4.5.7.1. Analysis

Survey question 29 was used as a follow-up question to survey question 28. Question 29 illustrates the importance of information within an organization and also discovers who gets involved with the data throughout the company. Tables 38 – 40 depict the responses given to this question by large, medium and small companies.

4.5.8. Overall Manufacturing and Quality Practices/Exposure Score

An overall manufacturing and quality exposure/practices score was compiled using Likert style questions 25 and 26 which pertained to various operational and quality management practices. Question 25 focused on the operational and continuous improvement methods that are used or known of within the organization. Question 26 focused on the methods the companies use to analyze data from their processes.

Table 35 - Responses of large companies for question 28

RESPONSE
Question 28
IPQC
Dissimilate system, partly count by hand
We collect information about present production managing system.
Report forms
SPC & Controlling Charts
Use the great 7 means
Fill out forms and add up data.
By mgmt. of product & monitoring of employees
Measure one whole mould product
Station to station
Some are direct from the measuring device
Via form

Table 36 - Responses of medium companies for question 28

RESPONSE
Question 28
Record data, analyse, then get information
Reference material, document and business standard
Go to the present place to collect information
Production report forms
Take 1 sample per 30 minutes and measure the item
The information are added up by the QC and recorded in the document of quality department
By listening, watching and operating by hands
Use the production data, works procedure wastage data and flow data which are provided by the spot management.
By the forms finished by every department
To inspect link by testing
Combine practice w/theory

Table 37 - Responses of small companies for question 28

RESPONSE
Question 28
Confirm drawings, incoming inspection reports, BOM, test instruction, production and assembly inspection records.
Follow the tracks of production
Consult the international standard
Processing control
QC get the data from production
First copy related data then arrange them at least summarize and make analysis.
IQC, IPQC, QA…daily report of production and quality
We have special quality controller to collect the material
Getting the production reports, site observation, summary.
"10 pieces every time and 5 hours alternation"

The performance scale for the overall manufacturing and quality knowledge/practices score was calculated using the numbers selected from the Likert scale. The higher the number selected, the better the performance score the group will receive. Likert scores 1 and 2 were grouped together and assigned the rating of “Poor”. Likert score 3 was formed into its own group and assigned the rating of “Average”. Likert scores 4 and 5 were grouped together and assigned the rating of “Above Average to Excellent”. The resulting score is relative to the responses received from the companies that were surveyed, not to an industry standard or “Best Practice”. The responses to questions 25 and 26 were averaged and broken down into the nine different groupings.

Table 38 - Responses of large, medium and small companies for 29a and 29b

	29a	29b
Large	Defect issues	Do some analysis for the quality
	Quality and the progress of production	
	Information about present production quantity and the rate of defective goods.	To improve quality and response time.
	Quality, Environment, & Operating	For continuous improvement
	Production efforts, characteristics of products and processing	Needs of processing and products
	Received materials reports & final inspection reports, SPC, & qualified inspection report	Reduce risk of quality & improve quality of products
	Dimension	To ensure quality
	Rejects, rework, specifications	
	Dimensions, torques, motor currents, surface roughness	Critical to product performance
	Various forms	Have direct reflection and control on the products
Medium	Information that can improve processing efficiency: a. Customers' requirements, b. products' processing and supply, c. technology about processing, d. competitors, e. development of new products.	To understand & satisfy customers' need
	Information about reference material, document and business standard	For reference and comparison
	All data on production	Requirement of production.
	Important inspection data	According to the drawing and quality plan
	Quality record	Because the material can reflect the problem of the products.
	Information about technology defection, material quality, equipment breakdown, the workers' mind or attitude and the environmental conditions.	Because it's the five great elements: manpower, material, method, machine and environment
	Production data, quality classification data and working procedure wastage data	The proper production data, which can insinuate the other departments' working conditions reflects the whole production practical conditions to a greatest extent
	Information about the rate of finished products, the damaged products and the ratio between them.	The information is comprehensible, systematic and true.
	Parameter index	For SPC analysis
	Quality efficiency	Can help improve products
Small	Drawings, records, lists, spec., etc…	Required for production and quality
	Testing report, employees' working record and the production technology flow	More effective and comprehensive
	Firmware creation design, processing, the standard of application and production technique	
	Processing tables	For monitoring, inquiring and feedback
	Dimension, angle, turns and length	For evaluating the stability of production
	Information about parameter of moulding , raw material, moulding record, quality record, quality, cost, etc.	
	Production and quality data	Because the information can help us make the management systematic and standardized. In the end, we can ensure the quality of the products.
	NG rate, trouble shooting reports	To realize the production and progress
		They are all key data

Table 39 - Responses of large, medium and small companies for 29c and 29d

	29c	29d
Large	Process engineer	Chart and Excel report
	Grass roots managing people	Mainly in forms of chart and some of them in forms of description with character.
	Engineering, quality, manufacturing departments use the information	By computer
	All management	Documents, illustrations, forms and pictures
	CFT	SPC Chart
	Quality officer, engineers, department supervisors	Pareto analysis, column charts, x-y scatter plots
	For ourselves and customers	SPC & CPK
	Production manager	Charts & numbers
	Manufacturing teams, sometimes customer	All (charts, tables)
	Management	Forms
Medium	Directly used by sales, then expand to all factory	Intranet, prints
	Quality, production and design departments use the material	Chart, form
	All departments on production.	Chart, form, record.
	IPQC, Leader	X bar and R chart, X chart
	Managers of quality, production and engineering departments use the material.	Chart, form
	All the employees use the material	Report and form with instructions
	All the relevant departments use these material.	Daily departmental forms, daily productoin statistics, weekly and monthly statistics.
	Person in charge	Data and chart
	QC	Control Chart
	The ministry of finance	Form
Small	Chiefly for Engineering, QC, Purchasing and production	Flow chart, forms and small books
	Quality and production departments	Document chart
	Production managing people	
	Production, technology and quality	Schematics and forms
	QC supervisor	Cpk level
	All the staff, customer and related government department use the information.	Statistical chart, controlling chart and Bola chart.
	The managers of production department, quality department and all other supervisors of the company read the information	Control charts, end product testing chart and bar charts
	Related supervisors	Forms
	Management	Drawings

Table 40 - Responses of large, medium and small companies for 29e and 29f

	29e	29f
Large	Production line	Production manager and operator
	Dissimilating system (SFC)	Grass roots managing people read the material. Top management mainly reads the results of monthly or weekly statistical analysis.
	Computer	Employees of manufacturing, engineering and quality departments read the information.
	Public board	All staff
	Production lines	All relative production people
	Public board	All the employees
	Public board	All staff & customers
	Weekly meetings	
	Near the relevant processes; on the network; on the internet	Production and quality personnel in manufacturing. In one case, customer.
	Meeting	Management team
Medium	Intranet or publish it out	Separate for different group
	Intranet and OA system	All the employees and relevant people
	Notice Board.	All the related supervisors.
	Production lines	Operator, technician, QC leader and supervisor
	Public board	All the employees
	Network - kanban	All the employees
	Kanban, written report and e-mail.	Management and those to whom the information pertains.
	Meeting about quality	Related leaders and managers of production line, people in charge, QC
	Monthly periodical	Management
	Computer	Top management
	Public board	Quality and marketing departments
Small	Public board, broadcast in meeting, documents	All staff
	Announcing column of the company	All the employees
	Quality Dept.	G.M., product manager, sales, production, technology, quality control
	On the machines in workshops	PQC
	On quality showing board, production process board and notice board.	All staff.
	In workshop	All the supervisors read the information
	Forward or get by themselves	Related supervisors
	Meeting Room	Management and manufacturing employees

4.5.8.1. Analysis

The overall average score for manufacturing and quality practices/exposure is 3.91. The greatest differences in scores occurs in five of the nine groups: Company Size,

ISO Certified (Y/N), GI Supplier & Size, Business Ownership, and General Industry Types. The calculated ranges for each of these groups are: .33, .33, .55, .97 and .98 respectively. Computer and Electronic Product Mfg. companies had the highest score of all with a calculated score of 4.27. Plastics Products companies had the lowest score of all with a calculated score of 3.28. Table 41 details the scores achieved by the various groups.

4.5.9. Observations

The researcher was able to tour the manufacturing operations of 24 of the companies that were visited and talked with many leaders within the companies. Inside the factories the researcher witnessed the following:

- A lot of inventory – implicates a push style of manufacturing and causes an inability to be able to pinpoint when/where in process something went wrong.
- Modern machinery – both production and quality inspection. All sizes of companies had very modern machinery, and a lot of it. This is contrary to what was presented in the journal articles on SMEs and developing countries and the state of manufacturing in these circumstances and may indicate that poor quality is a result of process problems rather than poor equipment.
- Most of the facilities practiced 100% inspection – this could be due to customer requirement or relying on quality control to catch quality problems and of not having manufacturing processes that are mistake-proof that ensure quality of products.

Table 41 - Manufacturing & quality practices/exposure score according to Likert responses

	Manufacturing & Quality Practices/Exposure Score
Size of Business	
Small	3.76
Medium	3.81
Large	4.10
Year Started	
< 2000	3.85
> = 2000	3.94
ISO Certified	
ISO	4.00
NON-ISO	3.67
Visited	
VISIT	3.98
NO VISIT	3.82
GI Supplier	
SUPPLIER	3.98
NON-SUPPLIER	3.82
GI Supplier & Size	
Small	3.85
Medium	3.80
Large	4.35
US Supplier	
U.S. SUPPLIER	3.95
NON-SUPPLIER	3.85
Business Ownership	
SOE	3.92
POE	3.65
JV	4.19
FOE	4.63
General Industry Types	
Computer and Electronic Product Mfg.	4.27
Precision Metal	3.76
Other	4.08
Plastic Products	3.28
Machinery	3.45

It was also discovered that Six Sigma programs do exist in China. Three large companies mentioned they have a six-sigma program going and already have some black and green belts. The companies that had six-sigma programs were those that were either owned by US companies or did direct business with US companies. All three of the companies were computer and electronic component manufacturers.

Chinese manufacturers do use statistical analysis to determine the capability of their processes. The degree of understanding and application was not readily apparent in all of the companies the researcher visited. The researcher got into a discussion with a company that mentioned it used Cpk to determine the capability of its processes. The researcher asked the employee what the value of their Cpk was and was told that it is not a calculation. This indicates that such concepts are not fully understood by Chinese companies or that the term may have a different meaning and/or application for that particular company.

The companies the researcher visited stated a strong desire to continue to improve the quality and performance of their organizations. Much of the management within the smaller companies faced roadblocks in not knowing what to do to take their companies to the next level of performance.

4.6. Additional Observations

There are other observations the researcher made that must be mentioned. This section reveals additional insights that were learned by the researcher while observing manufacturing and interviewing leaders of the various companies.

4.6.1. ISO Certification

The main underlying reason cited by company leaders to obtain ISO 9001:2000 certification was to attract customers for more business. Many of the companies were required by their major customers to become certified. All of the companies that were not certified stressed how they were working hard for certification. Companies all over Guangdong Province, China advertised the fact that they have ISO 9001:2000 certification. The validity of the certifications that the businesses had was brought into question after talking with a few well-informed individuals concerning the matter. It was brought to the researcher's attention that many of the certifications that the Chinese companies had were outright counterfeits (see pp. 40 – 41). One engineering manager suggested that only 30% of the certifications were legitimate. The remaining 70% of the certifications were either counterfeit or money was exchanged to overlook any shortcomings.

4.6.2. Safety

While walking through many of the companies, the researcher noticed many safety hazards/issues. Machinery did not have proper guarding in most cases. Operators did not have the proper safety equipment to prevent bodily harm. One instance was noticed where an operator was performing a drilling operation with a welding operation being performed next to her. The drilling operator was not wearing any eye-protection and was not protected in any way from the welding flash that was occurring right next to her. From the observations made it appeared that more emphasis is placed on producing as much as possible without consideration for the welfare of the employee performing the operations.

4.6.3. Communication

On at least two occasions, leaders stressed the importance for foreign customers to keep close tabs on the relationship they have with their Chinese supplier. They said that it is "the Chinese way" to tell the customer what they want to hear even when the reality of some situations is different. A Chinese plastic mould making company leader admitted that they will tell their customers that a project for them is going well without making mention of many aspects that are crucial to the success of the project are going awry. A leader from another company said that in his experience with other Chinese manufacturers, if things are "close" or "good enough" that is considered fine, even if it is not exactly what their customers ordered or specified.

5. CONCLUSIONS/RECOMMENDATIONS

5.1. Introduction

The data collected revealed that there is no significant difference with respect to business size and alignment with the principles of customer focus and leadership. However, there were a few factors that were found to be statistically significant for various questions and answer options. A summary of the significant factors along with the questions and answer options they are significant for can be seen in Table 43. The data collected through the survey and by observation confirmed the findings of previous research and also brought forth some different findings than those presented in previous research. A summary table of the confirmed research and the differing insights can be found in Table 42. The following five sections present the significant factors followed by the differing insights gained in the areas of: a) Quality of Products, b) Customer Focus, c) Quality & Operations Knowledge/Practices, and d) Miscellaneous Items.

5.2. Significant Factors

Business Ownership was determined to be a significant factor for all the questions listed in Table 43. Direct U.S. Suppliers was the second most frequent significant factor followed by General Industry Type.

Table 42 - Summary of findings

	Literature Review		Personal Observation, Interviews and Data from Survey		
Item #	**Description**	**Source**	**Confirmed**	**Questioned**	**Notes**
1	Quality of products manufactured by small and medium sized businesses is worse than the quality of products manufactured by large companies.	Zhang, 1998 & 2000; Li et al., 2003; Lee and Zhou, 2000; Zhang et al., 2000		X	Although the degree of product quality was not determined with this thesis, the results of survey question 17 may indicate that this isn't necessarily true.
2	Chinese businesses have forgotten their customers.	Sun, 2000; Li et al., 2003; Hua et al., 2000	X	X	This is confirmed through the information obtained by question 23 regarding quantity vs quality. Other information obtained through interviews brought to light an issue of not being straightforward with customers when things are going wrong. A different insight was gained through the results of questions 11 - 15 which indicated that the Chinese companies were working hard to keep in touch with their customers and to provide what their customers want.
3	Poor quality is due to the lack of education, experience, skill and recognition management has with respect to quality and quality management.	Sun, 2000; Zhang et al., 2000; Chin et al., 2001; Zhang, 1998 & 2000; Pun et al., 2000a; Zhao et al., 1995	X		The most commonly used method selected by the respondents regarding what their management does to keep up on quality practices was meeting and discussing quality practices and product quality. The large companies were the only ones that indicated that their management receives formal training on quality management practices.
4	Manufacturing businesses in China are more concerned about quantity and production efficiency than quality and customer satisfaction.	Li et al., 2003	X		The results of survey question 23 confirm this item.
5	Employees are not fully empowered in Chinese manufacturing companies.	Pun et al., 2000b	X		The results of survey question 23 confirm this item.
6	SSIPQ is a means by which the Chinese Government regulates the quality of products manufactured by manufacturing companies within China.	Zhang, 1998 & 2000		X	Personal conversations with well informed and experienced managers bring a differing insight that questions the actual existence of SSIPQ.
7	Factor contributing to poor quality in China is obsolete equipment.	Li et al., 2003; Zhang, 1998 & 2000; Zhao et al., 1995		X	Personal observation offers a different insight. New, state of the art equipment was observed in all sizes of companies.

Table 43 - Significant Factors

Significant Factors			
Question #	**Topic**	**Answer Option**	**Factor**
11	How company knows it is meeting its customers' needs.	c - conducting market research	- Direct US Supplier - Business Ownership
		d - collecting complaint information	- Business Ownership
12	How often company meets with its customers.	N/A	- Business Ownership
13	What company discusses in meetings with its customers.	a - new product ideas	- Business Ownership
		d - product specifications	- Direct US Supplier - Business Ownership
14	How often company conducts customer satisfaction surveys.	N/A	- Business Ownership
15	How often company conducts market research.	N/A	- Direct US Supplier - Business Ownership
17	Reasons for customer complaints.	N/A	- Business Ownership - General Industry Type
18	Methods used by management to stay current on quality principles and concepts.	a - top management reading regularly about how to improve quality	- Business Ownership
		b - management subscribing to quality publication	- Direct US Supplier - Business Ownership
		e - top management receiving training on quality management and practices	- Business Ownership
21	How top management encourages employees to be involved in quality improvement.	b - off site education	- Direct US Supplier - Business Ownership

There are some cautions. The data could be biased in one or more ways. For example: a) some of the companies thought the researcher was there to evaluate them for more business which could have resulted in painting a better picture than is accurate; b) 63% of the companies are suppliers of GI – GI is ISO 9001:2000 certified, and as such, it must make sure that its suppliers are ISO certified or are working toward ISO certification – this might not be representative of the population; c) translation errors – questions and responses could have lost their intended meanings due to the language differences present; d) the Shenzhen area has experienced a boom in the number of

manufacturing companies located there – companies that can dictate the layout of their facilities before the buildings are constructed might not be representative of the manufacturing population in all of Guangdong Province, China; e) there was only one SOE in the sample which may have biased the significance found for the factor of Business Ownership.

5.3. Quality of Products

The literature review established the overall state of quality in Chinese manufacturing companies as poor, especially among the SMEs (Zhang, 1998 & 2000; Li *et al.*, 2003; Lee and Zhou, 2000; Zhang *et al.*, 2000). However, data collected from the survey offer a different insight and suggest that this may be changing. Survey questions 16 and 17 sought information from the companies regarding the number of complaints they receive from their customers and what their customers are complaining about. For survey question 17, the companies were given six options to choose from that described the nature of the customer complaints they receive: 1) Late Delivery, 2) Product Failure, 3) Poor Product Quality, 4) Incorrect Product, 5) Incorrect Quantity and 6) Other. The results of question 17 found that the most common customer complaint was late delivery, followed by product failure and incorrect quantity. These results can be seen in Figure 4 and Figure 5. The "Other" complaint received deals with the product breaking during shipment.

Large companies reported receiving the complaint of poor product quality more often than the medium and small companies. If customers defined product quality based on its performance, product failure and poor product quality could arguably be considered the same thing. Under this assumption, the percentage of customer

complaints received by the large and medium companies for poor product quality (including product failure) is substantially larger than the percentage of customer complaints received by the small companies for the same category: Large – 44%, Medium – 33%, and Small – 13%. If this is a true indication of product quality or perception of product quality in Guangdong Province, China today, then the product quality tables have been turned with the small companies having better quality than their larger counterparts.

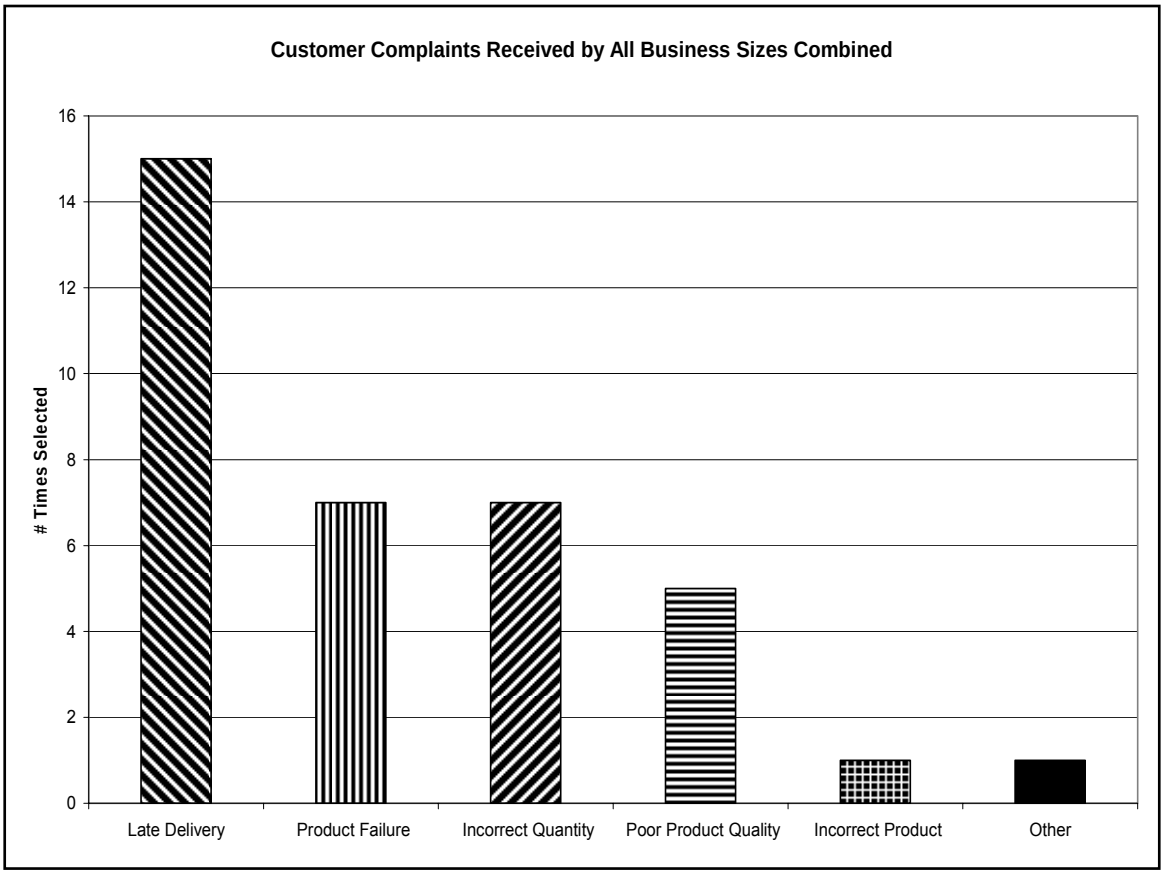

Figure 4 - Overall customer complaints received

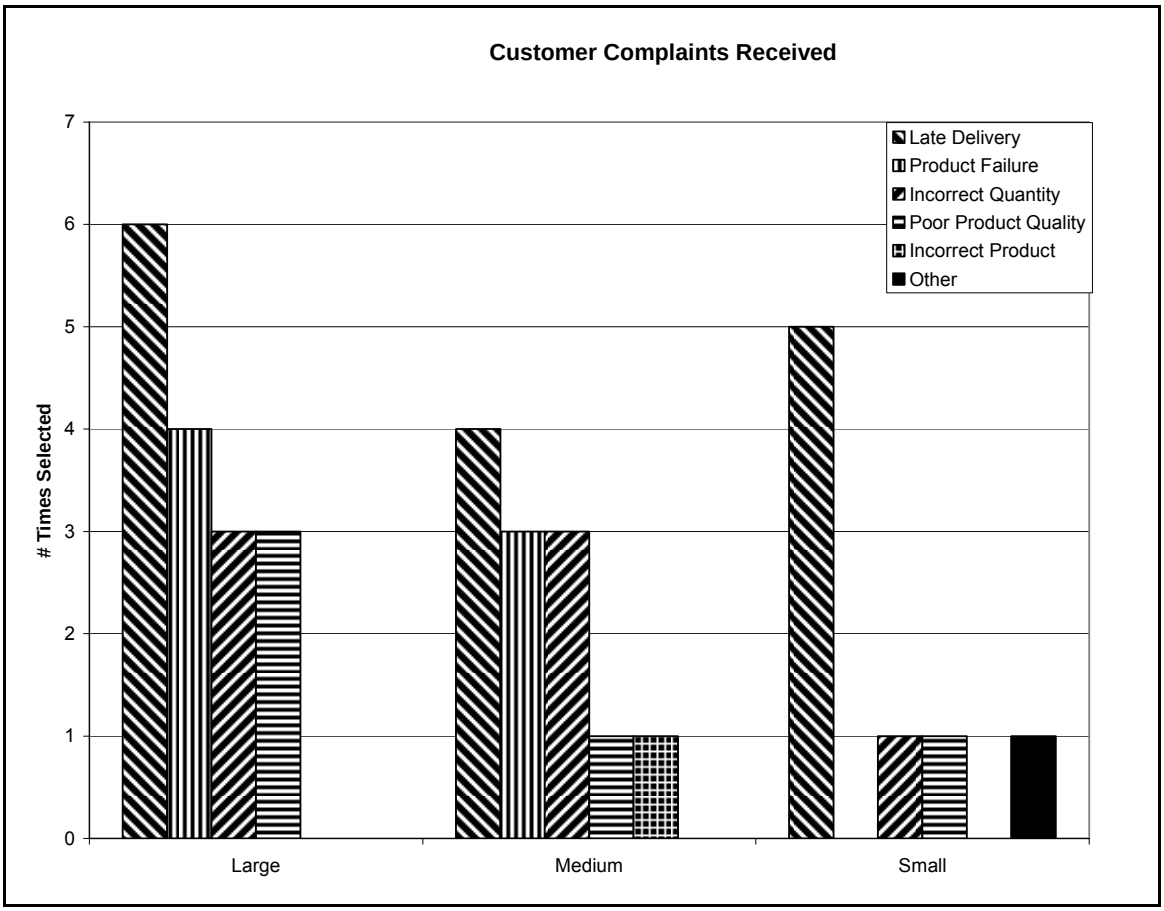

Figure 5 - Customer complaints by business size

China has many laws regarding quality that have been written with the aim of helping to encourage, ensure and enforce good product quality (see Table 1 on page 23). Li *et al.* stated that an environment has been created where quality awareness isn't taken seriously partly due to the non-enforcement of laws (2003). However, data from the study suggests that Chinese manufacturing companies are concerned with product quality. Every executive and manager with which the researcher talked stressed their concerns of improving product quality and stated that product quality is taken very seriously in their operations. Seventy one percent of the companies the researcher surveyed are ISO 9001:2000 certified. Even though a majority of the companies are GI

suppliers, which may provide the primary motivation for ISO certification, there will still be a ripple effect with other companies as the push for quality increases. The remaining 29% stated that they are either in the process of becoming ISO 9001:2000 certified or are considering the certification. This doesn't necessarily mean that all of the companies take quality seriously, because most companies cited obtaining ISO 9001:2000 certification as a means of gaining a bigger customer base, not as a means of helping to ensure product quality. Still, several of the companies also said that they thought obtaining the certification would give them better product quality. Though this desire indicates a misunderstanding of the role of the ISO 9001:2000 standards, every company visited stressed the important role quality management plays in their operations.

Several authors stated that one of the problems hindering the quality abilities of Chinese manufacturers is due to the production equipment being obsolete (Li *et al.*, 2003; Zhang, 1998 & 2000; Zhao *et al.*, 1995). This is no longer the case, at least in Guangdong Province, China. The researcher observed that all sizes of companies had modern production and quality inspection equipment. Just because these companies have modern equipment, however, does not mean that they necessarily know how to properly operate the equipment or that they will experience greater quality.

Whether product quality in Chinese manufacturing companies has improved or not was not in the scope of this thesis, rather, it was to gain insights to the understanding and alignment to quality knowledge and practices. The results indicate that Chinese manufacturers are gaining ground in their abilities to produce quality products and take quality management very seriously in their operations. However, an important question emerged during collection of data in China. That question deals with whether the

Chinese companies have the same qualifications for a quality product as do their international customers. Several examples were given of how getting things "close enough" was considered still meeting their customer's demands and a good quality product. This "close enough" mentality will need to be changed if Chinese companies expect to play on the world stage.

5.4. Customer Focus

Several authors have stated that Chinese businesses have forgotten their customers and need to establish better relationships with their customers and gain a better understanding and awareness of their customers' demands (Sun, 2000; Li *et al.*, 2003; Hua *et al.*, 2000). Data from the survey suggest that Chinese businesses may be beginning the establishment of better relationships with their customers. Meeting with customers and conducting customer satisfaction surveys were determined to be the most frequently used methods to know their customers' needs. It was found that small companies meet with their customers more frequently than their larger counterparts – 67% of small companies meet with their customers at least one time per month compared to 46% of medium companies and 38% of large companies. The smaller companies tended to rely more heavily on the visits of customers to tell them what they needed to do to meet their demands. While this indicates a less proactive approach to improvement, it does indicate a concern for customers. Visits would entail forms of audits or walk-throughs by the customer to make sure the company is doing what it needs to do to ensure a quality product. This finding might be expected due to the inclination of outsourcing companies to manage their vendors by visiting frequently to ensure everything is running smoothly. While this ensures that the company knows what its

customers' needs are, such an approach can be very exhaustive on the business-customer relationship. Smaller companies were not the only companies with such a reactive approach. Many medium and even some larger sized companies also act in such a way. Overall, however, it was found that as the size of the company increased, the intensity of the relationship with customers decreased with respect to meetings with customers and conducting customer satisfaction surveys.

The companies that had direct business with the United States, the majority of which were large companies, did seem to have more of a focus on pleasing their customers and were open to new ways of doing things. They expressed willingness to have customers come in and tell them of newer/better ways of doing things. Some contacts stated that a visit to China a couple years earlier, would have found companies more resistant to change and more set in old ways of doing things.

Overall, companies in China feel that they are doing what they can to keep in touch with their customers. Many companies are having struggles with trying to keep the long-distance relationship alive with their overseas customers and are growing more accustomed to the ways of business in the "Western World". What "Western" companies need to keep in mind, however, is that the customer relationship will likely need to be driven by them (the customer) in order to ensure things are really going as they expect. A rule of thumb would be to never assume anything. Always follow up and verify what is really going on, at least until a good relationship is established and trust can be afforded.

5.5. Quality & Operations Knowledge/Practices

Li *et al.* stated that manufacturing businesses in China are more concerned about quantity and production efficiency than quality and customer satisfaction (2003). Data

collected confirmed this finding, but also brought to light some additional insights for the companies while facing varying scenarios of production. Survey question 23 presented five different scenarios a manufacturing company may experience while producing their goods. Each scenario gave the company an opportunity to select whether they would stop or continue if presented with that particular scenario. If a company chose to continue under each circumstance, the company would seem to have a tendency for preferring quantity to quality. The question shed some light on the operational practices of each company, that is, whether they are reactive or proactive in their improvement efforts. When a problem arises in production, the companies react this way under these conditions (survey question 23):

Heavy pressure from customer

- 20% of small companies would continue
- 9% of medium companies would continue
- 8% of large companies would continue
- 13% of ISO certified companies would continue
- 10% of non-ISO certified companies would continue

Regular daily production (no pressure from customer)

- 33% of medium companies would continue
- 9% of small companies would continue
- 0% of large companies would continue
- 27% of non-ISO certified companies would continue
- 8% of ISO certified companies would continue

Management requests a problem be addressed immediately

- 0% of large companies would continue
- 27% of small companies would continue
- 23% of medium companies would continue
- 26% of newer companies (est. in 2000 or later) would continue
- 6% of older companies (est. prior to 2000) would continue
- 27% of non-ISO certified companies would continue
- 12% of ISO certified companies would continue

Line worker identifies a problem and suggests it be addressed

- 25% of large companies would continue
- 18% of medium companies would continue
- 18% of small companies would continue
- 25% of ISO certified companies would continue
- 18% of non-ISO certified companies would continue
- 0% of non-US supplying companies would continue

Overall

- 33% of companies visited would continue
- 27% of US supplying companies would continue

The results of survey question 23 confirm Li *et al.*'s findings and bring to light several interesting insights. One insight is that small companies tend to be more focused on quantity rather than quality when they are under pressure from their customers to deliver compared to their larger counterparts. Under normal operating conditions without pressure from customers, medium companies tend to be more concerned with getting

product out the door than stopping production to address problems. If management requests that a problem be addressed immediately, all the large companies reported that they would stop. A large percentage of the medium and small companies reported that they would continue (23% and 27% respectively). This may suggest that management in large companies have more influence in what goes on in their operations than their counterparts in medium and small companies, or that the management in larger companies is better respected than the management in small and medium companies. Twenty five percent of large companies reported that they would continue if a line-worker discovered a problem and suggested that it be addressed. Eighteen percent of medium and small companies reported the same. This seems to confirm that employees are not fully empowered in Chinese manufacturing companies and may also be a contributing factor for employees not providing feedback (Pun *et al.*, 2000b). The following points highlight the takeaways from the findings of survey question 23 for manufacturing companies located in Guangdong Province, China:

- The companies are not completely proactive in their management for quality in their operations
- Leadership in small and medium sized companies do not have as much influence on the production practices as their counterparts in large companies
- Employee feedback and insight is not as valued or taken seriously in large companies as it is in small and medium companies

5.6. Miscellaneous Items

The miscellaneous items contained in this section are subjects that were covered in the review of literature, but were not directly addressed in the survey phase of data collection. The areas of interest brought forward in this section are: a) SSIPQ and b) ISO Certifications. New insights concerning these topics were brought to light through interviews with individuals that have been conducting business in China for decades.

5.6.1. SSIPQ

SSIPQ was presented as a means by which the Chinese Government regulates the quality of products manufactured by manufacturing companies within China (Zhang, 1998 & 2000). Leaders that have been doing business in China for decades were asked what they knew of the SSIPQ. They said that they have never heard of such an effort and said that it is only a way for the Government to appease the scrutinizing international eyes that are on Chinese manufacturers. The lack of familiarity with or knowledge of the presence of the SSIPQ may be due to the excessive industrial growth that has taken place in China over the last two decades or to the proximity Guangdong Province is in relation to Beijing. The findings question the actual existence of the SSIPQ.

5.6.2. ISO Certification

The main underlying reason cited by company leaders to obtain ISO 9001:2000 certification was to attract customers for more business. Many companies were required by their major customers to become certified. All companies that were not certified stressed how they were working hard for certification. Companies all over Guangdong Province, China advertised the fact that they have ISO 9001:2000 certification. The

validity of the certifications that the businesses had was brought into question after talking with a few well-informed individuals concerning the matter. Some suggest that many of the certifications that the Chinese companies had were outright counterfeits (see Figure 2 on page 41). One engineering manager suggested that only 30% of the certifications were legitimate. The remaining 70% of the certifications were either counterfeit or money was exchanged to overlook any shortcomings. Companies that are considering to do business with Chinese manufacturers need to do their homework and find out what certifying body awarded the ISO 9001:2000 certification of the companies they are contemplating for business.

5.7. Recommendations

Based on the work presented in this thesis, the following may be avenues for further research:

China Specific Recommendations

- Study the relationship between the different ISO 9001 registrars in China and the companies they certified and look at the performance of the companies.
- Does ISO 9001 offer a competitive advantage for companies operating in China, that is, is it worth the cost and the hassle of going through the certification process?
- Manufacturing companies in China could be surveyed to see if they align with the other eight main principles of the ISO 9000:2000 family of standards for quality.

- Many of the companies have no idea about Lean Manufacturing. Many of the factories that were visited had too much inventory tied up in the system and could benefit greatly from Lean Manufacturing implementation. Research could be done to discover the understanding the Chinese manufacturing companies have of Lean Manufacturing and to see if the companies are capable of lean implementation.

General Recommendations

- Follow-up research could be performed on the organizations that stated they intended on obtaining ISO 9001 certification and cited that it would improve their quality. Case studies could be performed to see whether ISO 9001 made an impact on the various companies' quality performance or not.
- Does ISO 9001 help the quality of an organization?
- Does ISO 9001 help the quality of an organization involved in international trade?
- Does ISO 9001 enable better communication between companies?

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7. APPENDIX A – Survey Templates

Survey Conducted by:

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1. What is the name of your company?

2. Under what type of ownership is your company?
   - State Owned Enterprise
   - Privately Owned Enterprise
   - Collectively Owned Enterprise
   - Joint Venture
   - Other: _____

3. When was your company founded?
   Year:

4. How many employees work for your company?

5. What type of products does your company manufacture?

6. Does your company manufacture for United States companies?

7. Does your company supply products to other companies that ship their products to the United States?

8. Is your company familiar with ISO 9001 certification?
   - Yes
   - No

9. Is your company ISO 9001 certified?
   Yes
   No

10. Has your company ever considered becoming ISO 9001 certified?
    Yes: Why?

_____
_____
_____

No: Why?

_____
_____
_____

11. How does your company know it is meeting its customers' needs (the higher the number, the more often the method is used)?

Never				Very Regularly
1	2	3	4	5

We meet with our customers	1	2	3	4	5
We conduct customer satisfaction surveys	1	2	3	4	5
We conduct market research to collect suggestions for improving products	1	2	3	4	5
We collect extensive complaint information from our customers	1	2	3	4	5
Other:	1	2	3	4	5
Other:	1	2	3	4	5

12. How often does your company meet with its customers?

(Check the one that applies)

Twice a month	
Once a month	
Every three months	
Every six months	
Once a year	
Never	
Other:	

13. What does your company discuss in the meetings with its customers (the higher the number, the more often the topic is discussed with the customer)?

Never	Not very often	Sometimes	Regularly	Very Regularly
1	2	3	4	5

New product ideas	1	2	3	4	5
Possible improvements to current products	1	2	3	4	5
Product quality	1	2	3	4	5
Product specifications	1	2	3	4	5
Satisfaction of customer with your products/services	1	2	3	4	5
Customer expectations	1	2	3	4	5
Other:	1	2	3	4	5
Other:	1	2	3	4	5

14. How often does your company conduct customer satisfaction surveys?

(Check the one that applies)

Once a month	
Every two months	
Every three months	
Every six months	
Once a year	
Other:	

15. How often does your company conduct market research?

(Check the one that applies)

Once a month	
Every three months	
Every six months	
Once a year	
Other:	

16. On average, how many complaints from customers does your company receive per month?

_____

17. Which of the following are the main reasons for customer complaints your company receives?

(Check all that apply)

Late Delivery	
Product Failure	
Poor Product Quality	
Incorrect Product	
Incorrect Quantity	
Other:	
Other:	

18. Which of the following are methods that the management of your company uses to stay current on principles and concepts of quality (the higher the number the more the method is used to help management keep current)?

Never				All the time
1	2	3	4	5

Top management reads regularly about how to improve quality	1	2	3	4	5
Top management subscribes to a quality publication that describes quality improvement practices; name of publication _____	1	2	3	4	5
Top management meets and discusses product quality	1	2	3	4	5
Top management meets and discusses quality practices	1	2	3	4	5
Top management receives training on quality management and practices; the training is: Internal or External	1	2	3	4	5
Other:	1	2	3	4	5
Other:	1	2	3	4	5

19. How often does management discuss quality related issues in management meetings?

(Check the one that applies)

Once a week	
Twice a month	
Once a month	
Never	
Other:	

20. How many times per month are meetings held where quality is discussed in the following groups:

By upper management
By workers and management
By management & customer
By workers only
Other:

21. How does top management encourage employees to be involved in quality management and improvement activities and/or solve quality problems (the higher the number, the more frequent the method is used)?

Never				Very Frequently
1	2	3	4	5

On-site education	1	2	3	4	5
Off-site education	1	2	3	4	5
Self-education	1	2	3	4	5
Other:	1	2	3	4	5

22. How many times per year are education and training programs on quality offered in your company? _____

- How often are other education and training programs offered in your company? _____. What do the other training/education programs pertain to?

  _____

23. Given the following conditions would you choose to <u>stop</u> production to fix a quality problem or <u>continue</u> production and address the problem later?

Problem arises during heavy pressure from a customer to deliver	Stop	Continue
Problem arises during regular daily production (without pressure from customer)	Stop	Continue
Customer calls with a problem on a part in current production	Stop	Continue
Management requests a problem be addressed immediately	Stop	Continue
A line worker identifies a problem and suggests it be addressed	Stop	Continue

24. What is your scrap rate (% or number per 1000 pieces produced)?

_____

What is your measurement method? _____

25. How familiar is your company with the following manufacturing practices (the higher the number the more familiar your company is with the method)?

Not Familiar at All				Very Familiar
1	2	3	4	5

Statistical Process Control (SPC)	1	2	3	4	5
Lean Manufacturing	1	2	3	4	5
Toyota Production System	1	2	3	4	5
Total Quality Management (TQM)	1	2	3	4	5
Kanban	1	2	3	4	5
Quality Circles	1	2	3	4	5
Just in Time Manufacturing (JIT)	1	2	3	4	5
Design of Experiments (DOE)	1	2	3	4	5
Bottle-neck Concept	1	2	3	4	5

26. In collecting and analyzing data from your processes, does your company use (the higher the number, the more frequently the method is used):

Never				Used Very Frequently
1	2	3	4	5

Statistical Process Control (SPC)	1	2	3	4	5
Control Charts	1	2	3	4	5
Pareto Charts	1	2	3	4	5
Tables	1	2	3	4	5
Other:	1	2	3	4	5
Other:	1	2	3	4	5

27. How often do you collect data on your processes? _____

28. How do you collect data on your processes? _____

29. What data do you collect? _____

- Why this data? _____
- Who uses the data? _____
- How is it reported (charts, tables, etc.)? _____
- Where is it posted? _____
- Who sees it? _____

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1. 请问贵公司的名称是什么？

2. 企业性质为:
   - 国营企业
   - 私营企业
   - 集资企业
   - 合资企业
   - 其它: _____

3. 贵公司是何时建立的？

4. 贵公司现有多少员工？

5. 贵公司生产的是什么产品？

6. 贵公司的产品是否为美国公司生产产品？

7. 贵司是不是将产品提供给其它公司，然后再由他们将产品运至美国？

8. 贵公司是否熟悉ISO9001认证体系？
   a. 是
   b. 否

9. 贵公司是否已通过ISO9001认证？
   a. 是
   b. 否

10. 贵公司是否有考虑通过ISO9001的认证？

是：为什么？_____

_____

_____

_____

否：为什么？

_____

_____

_____

11. 贵公司是如何知道贵司的产品是否满足了客户的需求（数字越高，表示所使用方法的频率越高）？

从不				经常
1	2	3	4	5

通过与客户的会面。	1	2	3	4	5
进行客户满意度调查。	1	2	3	4	5
做市场调查，以收集有关产品改进的建议。	1	2	3	4	5
从客户处大量收集有关投诉。	1	2	3	4	5
其它：	1	2	3	4	5
其它：	1	2	3	4	5

12. 贵司与客户会面的频率如何？

（在适合的地方作选择）

每月两次	
每月一次	
每三个月一次	
每半年一次	
每年一次	
从不	
其它：	

13. 贵司与客户会面时讨论什么问题(数字越高，表示就此与客户商讨的频率越高)?

从不	不太经常	有时	定期	经常
1	2	3	4	5

新产品思路	1	2	3	4	5
当前产品改进的可行性	1	2	3	4	5
产品品质	1	2	3	4	5
产品规格	1	2	3	4	5
客户对贵司产品/服务的满意度	1	2	3	4	5
客户期望	1	2	3	4	5
其它:	1	2	3	4	5
其它:	1	2	3	4	5

14. 贵公司多长时间做一次客户满意度调查?

(在合适的地方作选择)

每月一次	
每两个月一次	
每三个月一次	
每半年一次	
每年一次	
其它:	

15. 贵公司多长时间做一次市场调查?

(在合适的地方作选择)

每月一次	
每三个月一次	
每半年一次	
每年一次	
其它:	

16. 贵司平均每月收到多少客户投诉?

_____

17. 贵公司主要收到下面哪些方面的客户投诉？

(在合适的地方作选择)

不准时交货	
产品失效	
产品品质低劣	
交错产品	
数量错误	
其它:	
其它:	

18. 就品质原则与观念，贵公司管理层是如何来让自己与时代同步的（数字越高，表示使用该方法的频率越高）？

从不				始终
1	2	3	4	5

高层管理人员经常阅读了解如何提高品质。	1	2	3	4	5
高层管理人员订阅了有关提高产品品质的出版物; 出版物的名称是:	1	2	3	4	5
高层管理人员会面讨论产品品质的问题。	1	2	3	4	5
高层管理人员会面讨论品质策略问题。	1	2	3	4	5
高层管理人员参加有关品质管理和策略的培训。培训是: 外部培训或内部培训。	1	2	3	4	5
其它:	1	2	3	4	5
其它:	1	2	3	4	5

19. 在高层管理会议上讨论有关产品品质问题的频率是多少？

(在合适的地方作选择)

每周一次	
每月两次	
每月一次	
从不	
其它:	

20. 为讨论有关品质的问题，每月有多少次会议是由下面几组人员召开的？

由高层管理召开的会议
由工人及管理层召开的会议
由管理层及客户召开的会议
单由工人召开的会议
其他:

21. 公司高层是如何鼓励员工参与到品质管理与改进和/或解决品质问题的（数字越高，表示该方法使用的频率越高）？

从不				经常
1	2	3	4	5

在岗教育	1	2	3	4	5
离岗教育	1	2	3	4	5
自我教育	1	2	3	4	5
其它:	1	2	3	4	5

22. 贵公司每年提供多少次有关品质方面的教育和培训？

_____

- 贵公司多长时间举行一次其它的教育和培训项目？_____.
  其它培训/教育属于什么？

_____.

23. 在出现下面几种情况时，您是选择停止生产来解决这一品质问题还是选择继续生产过后再来解决？

在客户紧急催货时出现问题	停止	继续
在常规生产时出现问题（没有来自客户的压力）	停止	继续
客户电话告知当前的生产出现产品问题	停止	继续
管理层要求立即解决的问题	停止	继续
生产线上的工人发现问题并建议给予解决	停止	继续

24. 贵公司报废率是多少（千分之多少或百分之多少）？ _____

贵公司测量方法是什么？ _____

25. 贵公司与下列制造实践方法熟悉程度是（数字越大表示贵公司越熟悉此方法）？

根本不熟悉				非常熟悉
1	2	3	4	5

统计过程控制-SPC	1	2	3	4	5
精益生产- Lean Manufacturing	1	2	3	4	5
丰田生产系统	1	2	3	4	5
全面品质管理-TQM	1	2	3	4	5
看板管理- KanBan	1	2	3	4	5
品质循环- Quality Circles	1	2	3	4	5
及时生产-JIT	1	2	3	4	5
实验设计-DOE	1	2	3	4	5
瓶颈理念- Bottle-neck Concept	1	2	3	4	5

26. 在贵公司加工过程中收集和分析资料，是否用（数字越大，使用此方法的频率就越大）：

从不				经常使用
1	2	3	4	5

统计过程控制SPC	1	2	3	4	5
控制图表	1	2	3	4	5
柏拉图表	1	2	3	4	5
表格	1	2	3	4	5
其它:	1	2	3	4	5
其它:	1	2	3	4	5

27. 您在加工过程中收集资料的频率是多少？_____

28. 您怎样在加工过程中收集资料？_____

29. 您收集什么资料？_____

- 为什么是这些资料？

  _____

- 谁用这些资料？_____
- 以什么报告形式出现的（图表，表格等）？_____
- 在什么地方公布？_____
- 谁阅读？_____