

Chapter 8 A Case Study

8.1 Introduction

This chapter presents the results of the case study conducted in a Chinese state-owned manufacturing firm. Section 8.2 describes how the study was conducted according to its objective. Section 8.3 provides a brief introduction of the firm in which the study was conducted. Section 8.4 involves the evaluation of the firm's TQM implementation practices and overall business performance with the comparisons of the TQM implementation model. Section 8.5 presents the four categories of improvement possibilities obtained from the evaluation of the firm's TQM implementation and overall business performance. Section 8.6 provides the formulation of the improvement plan that can be implemented by the firm in order to improve its TQM implementation and overall business performance. Finally, Section 8.7 presents a number of conclusions along with brief discussion.

8.2 Case Study Description

The major aim of the case study was to provide a practical example of how to use the TQM implementation model in practice. To achieve this goal, it is necessary to present the model to a firm and investigate how the firm uses it in practice. Thus, according to the processes of implementing the TQM implementation model presented in Chapter 7, the firm should follow seven steps in implementing the model in practice. If this were done, it would take a long time to conduct the case study. Due to the time limitation, the study was conducted in such a manner that the firm was not asked to implement this TQM implementation model in practice, but only to support the author in evaluating the firm's TQM implementation and overall business performance based on the TQM implementation model. If the author could formulate an improvement plan that would be accepted by the firm's top management, it could be concluded that the TQM implementation model developed in this study is applicable in practice. The process of conducting the case study can provide a good example of using this TQM implementation model in practice.

According to the TQM implementation processes presented in the TQM implementation model, the first step is top management commitment. Through introduction by the author's friends, the top managers of the firm were committed to providing sufficient support for the author to conduct the case study in the firm. This step can be regarded as the first step in implementing the TQM implementation model. With the commitment from top management, the author easily obtained enough information for the case study purposes, as well as access to many people who were valuable in conducting the study. In other words, the author would not have been able to conduct the case study in the firm without top management commitment.

The second step of implementing the TQM implementation model is to formulate a TQM implementation team. In fact, during the whole process of conducting the case study, the author's role was like the "leader" of the "TQM implementation team". The "team"

consisted of three people: The author, one of the deputy general managers, and the coordinator. The coordinator was arranged by the firm in order to assist the author in conducting the study. The author generally asked the coordinator to arrange interviews with relevant interviewees. The coordinator also helped the author collect information needed for the study purposes.

The third step of implementing the TQM implementation model is to evaluate the firm's TQM implementation and overall business performance. To do so, the author interviewed relevant people in the firm using the assessment tools of TQM implementation practices and overall business performance. In order to have a better understanding of the firm's TQM implementation, the author also obtained many documents about the implementation, as well as overall business performance, over the past few years. Thus, the evaluation of the firm's TQM implementation and overall business performance was completed, the strengths and weaknesses of these areas were identified.

The fourth step is to formulate an improvement plan that can be implemented by the firm to improve its TQM implementation and overall business performance. This plan was formulated on the basis of the weaknesses of the firm's TQM implementation and overall business performance. The guidance for formulating an improvement plan, presented in the TQM implementation model, was used in this study. Through the evaluation, many weaknesses were identified and further categorized in terms of the four improvement possibilities: Structurally impossible, temporary barrier, ineffective, and feasible. Only feasible improvement possibilities were used in formulating the improvement plan. In fact, the firm could not implement these feasible improvement possibilities at one time; they had to be further analyzed and prioritized in terms of their potential contributions to the firm's targeted improvement areas of overall business performance. A firm's available resources should also be taken into account when formulating the improvement plan. In fact, in this study, the improvement plan consisted of a number of feasible improvement possibilities that could be implemented by the firm. In order to make the plan practical, a time schedule and major responsible departments involved in implementing the plan had to be determined. Naturally, the deputy manager was asked to be involved in formulating the improvement plan so it would better fit the firm. Finally, this improvement plan had to be accepted by the top management team. Otherwise, it would be nothing.

According to the TQM implementation processes presented in the TQM implementation model, there are another three steps to implementing the model. Due to the time limitation, this case study did not cover the practical implementation of the improvement plan formulated in the fourth step as it was beyond the scope of the study. Thus, after the four steps of implementing the TQM implementation model were complete, the case study was terminated.

8.3 A Brief Introduction of the Firm

The case study was conducted in a state-owned large-sized machinery firm that had been established in 1958. It is located in Shenyang, Liaoning Province, P.R.China, and was a key and backbone firm of the country in manufacturing rubber belt conveyers. Its market share ranked third in China. Its products involved various kinds, varieties, and specifications and had not only been sold across the country but also enjoyed a high reputation in Southeast Asia. The firm had been implementing TQM for a long time and obtained ISO 9001 certification in 1998. Due to its good quality management, the firm was awarded the “Quality Management Prize” by the Ministry of Machinery Building and the Liaoning Provincial People’s Government a number of years ago. In 1998, the firm was conferred “Shenyang Advanced Management Enterprise”. It had fixed assets (original value) RMB 118 million and occupied a piece of land with an area of 170,000 square meters. The firm had more than 400 various production machines and approximately 759 employees. In 1985, the firm imported foreign technologies from a German firm (KOCH) and an Italian firm (RULMECA). Its products can be used for mine exploration, coal industry, chemical industry, light industry, textile industry, and port construction and operation. The firm’s organizational structure and numbers of people working in different functional departments and workshops are displayed in Figure 8.1. Figure 8.2 displays the structure of workshops.

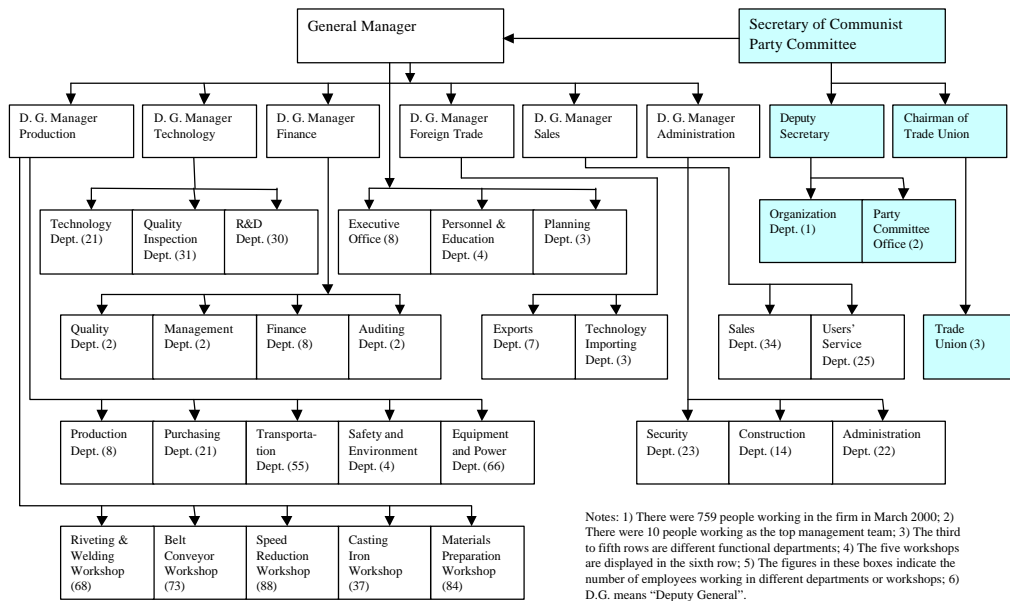


Figure 8.1 Organizational Structure

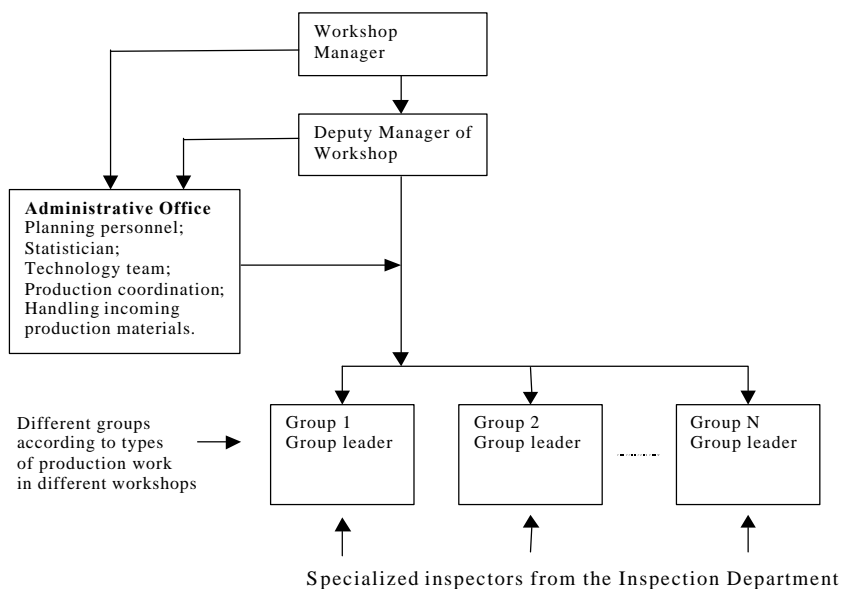


Figure 8.2 Workshop Structure

8.4 Evaluation of TQM Implementation and Overall Business Performance

The TQM implementation model was used in evaluating the firm's TQM implementation practices and overall business performance. The author conducted the evaluation guided by the assessment tools (see Appendix 5). The job titles of interviewees are listed in Appendix 6, though to preserve anonymity they are not referred to by name. Based on the evaluation, the current situations of the firm's TQM implementation and overall business performance were obtained. Appendix 5 presents the evaluation results, which were translated into scores according to the scoring methods, as well as the strengths and weaknesses of TQM implementation practices and overall business performance. In this section, only weak areas of the firm's TQM implementation and overall business performance are presented due to the text limitation. These weak areas can be used as possibilities for the firm to improve its TQM implementation and overall business performance, however, it should be noted that even its strong areas are not at all perfect. They still have room for improvement. Strong and average areas are just a relative sense compared with the firm's weak areas, though weak areas should receive more attention.

8.4.1 TQM Implementation

This subsection presents the weak areas of the firm's TQM implementation and the reasons leading to these weak areas. The assessment tool (see Appendix 5) was used to evaluate the firm's TQM implementation. The weak areas identified could be used by the firm to further improve its TQM implementation; they were regarded as potential improvement possibilities. Note that the identification of these weak areas was on the basis of unbiased, honest, and fact-based judgements.

Leadership

There was strong evidence that top management empowerment had not yet been implemented. The firm was centralized and hierarchical, and there was a strong tendency for employees to do things according to what they were told. They tended to wait for guidance from top managers or supervisors at all times. Thus, employees did not take any risk or responsibility if things went wrong; otherwise, they would be punished or fined. If things went wrong, employees tried to seek excuses to protect themselves in order to avoid being fined or criticized. Employees did not want to take any risk by doing things without permission.

Top management did not pursue long-term business success but focused instead on annual business success, which was their most important goal. Top management still viewed product quality as less important than cost. In addition, top managers often organized discussion meetings after quality problems had happened; how to prevent problems from happening was not given sufficient attention. Top managers were reluctant to accept or implement employee suggestions if money was needed for their implementation. The firm's many problems occurred due to its focus on immediate profits or short-term benefits.

Supplier Quality Management

Long-term partnership between the firm and its suppliers had not yet been established. The firm had a special policy of rewarding purchasing personnel who could purchase products without immediate payment or less immediate payment. This was due to the shortage of capital. Otherwise, the firm could not have sufficient materials to maintain normal production. Such practices caused the problem that the firm would have to pay more in the future. In China, many firms have such policies that a buyer can purchase products at a lower price if the buyer can pay immediately. If the buyer can not pay immediately, the purchasing price is always higher. One interviewee said that it was very difficult for the firm to organize production. For example, after a contract was signed, the customer generally paid approximately 20% of the product's selling price in advance. After receiving the product, the customer would pay another 70% of the payment²⁶. The remaining 10% was used as a quality guarantee deposit. If the product had quality problems, the customer would use the deposit for repairing, changing parts, and so on. Thus, the firm did not have much money available to purchase products from suppliers. In total, the firm owed its suppliers

²⁶ In most cases, the firm's customers did not pay immediately after they received the firm's delivered products.

approximately RMB 10 million. The firm always received complaints from its suppliers. Due to the lack of partnership with suppliers and as well as mutual trust, the firm had to implement strict non-value added incoming inspection.

Purchasing price was the most important factor in selecting suppliers, with product quality falling behind the price. Such a practice indicated that the firm selected such a supplier that could provide the lowest price for technically accepted products. In a few cases, purchased products could not be accepted technically. For example, qualified suppliers could provide carburization for gears at a price of RMB 16 per kilogram, provided that the buyer pay immediately. However, the firm selected a supplier that could provide the service at the price of RMB 3.5 per kilogram and did not ask the firm to pay immediately. Thus, it is not difficult to imagine what would happen to the firm's product quality. Since it considered price the first priority in selecting suppliers, quality problems inevitably happened during the process of production and in the operation of the final products. In fact, many of the firm's quality problems occurred due to poor purchased products.

Vision and Plan Statement

The firm had a long-term vision statement that had been drawn up several years ago. However, many employees were not clear as to what the vision statement was. In fact, the firm did not use it as a guide in formulating its business strategies. In this regard, the general manager did not have a clear long-term vision. The reason for this was that the general manager had been appointed by the administrative bureau to run the firm on a short-term basis, based on a contract. If he performed well, he would stay in the position longer. The decision made by the bureau in this regard was highly dependent on the firm's annual business performance. Therefore, the general manager focused on annual business performance rather than long-term business success. His target was to accomplish the annual business performance indices assigned by the administrative bureau. To do so, the firm had an annual policy statement to guide the firm in doing business. These annual policies varied year to year depending on the firm's internal and external environments. Before these policies were in force, they had to be approved by the workers' congress. The annual policies were well communicated to employees at different levels.

The firm did not have long-term overall business performance plans. Instead, it had only annual strategic business performance indices and product quality goals, which were formulated based on the assignments set up by the administrative bureau. This was because top management placed too much emphasis on short-term objectives. Although these plans were also presented to the workers' congress for discussion, they would not be changed since they had been set up by the bureau. The firm did not have specific plans regarding which levels of employee and customer satisfaction should be reached.

The firm actually drew up its quality improvement plans in terms of quality problems that it had. The information used in making the plans was mainly from customers' complaints and the firm's different departments or workshops. It was evident that quality improvement plans were easily implemented if little money was required; it would be problematic if much money were needed. In this regard, the firm did not provide sufficient resources for implementing quality improvement plans. The primary reason for this was that the firm tried

to achieve cost reductions to maintain the firm's profits. Thus, the firm's general manager could survive.

Evaluation

Although the firm tried to improve a number of job-related facets that might affect employee satisfaction, the employee satisfaction level as a whole remained unclear to some extent. In fact, the firm did not evaluate its employee satisfaction and did not have employee satisfaction data. In this regard, the issue of employee satisfaction did not receive much attention from the firm. This was because it was easy to recruit new employees from the labor market. Furthermore, the firm already had a redundant workforce, which it was considered a heavy burden.

Competitive benchmarking with its major competitors was not conducted by the firm. Thus, TQM implementation and overall business performance of its main competitors remained unclear to a certain extent. Thus, the firm lost opportunities for further improvement of its quality of products and services. In fact, this practice had actually not caught top management's attention.

The data on appraisal costs and prevention costs were not available. The firm mixed these two types of quality costs with the firm's normal overhead expenses. Thus, it was not clear as to how much money was spent on appraisal and prevention. It is no doubt that the firm spent a great deal of money on various inspection activities, as it had approximately 30 specialized inspectors. Many inspection activities were actually non-value added. In fact, the availability of appraisal costs and prevention costs was valuable to the firm in formulating effective improvement actions so as to reduce these costs.

The firm did not have an integrated computerized information system for collecting, processing, analyzing, disseminating, and storing relevant information. Information technology remained at a primitive level. Thus, it was difficult for different departments and workshops to share their information. The firm's major information flow was through handwritten documents. Therefore, working efficiency was low and some problems occurred due to the poor information system. The firm did not have such a computerized information system in place due to its pursuit of immediate profits and short-term benefits.

Process Control and Improvement

The firm did not pay sufficient attention to determining an appropriate temperature range, lighting intensity, noise level, and air quality. During the process of conducting the case study, the author observed that several windows were broken and a number of lights and electric fans were turned off. Such practices were due to the fact that these workshops wanted to reduce costs in order to increase profits. It was evident that various workshops tried their best to reduce any cost that they could²⁷.

²⁷ Each workshop had its quota of production costs, which had been set up by the firm. Thus, workshops had to reduce various costs.

The firm did not calculate its process capability index in order to understand whether a process was stable. Designers determined design specifications according to their previous experiences. If problems occurred during an inspection stage, then necessary actions would be taken. In this regard, the firm did not focus on preventing problems.

Effective equipment maintenance and innovation were not conducted by the firm. Every year it invested only RMB 0.1 million in equipment maintenance, which was not sufficient. If equipment had problems, then it would be maintained or repaired. Due to insufficient equipment maintenance, a number of components could not be produced precisely. Thus, product quality was difficult to ensure. Every month there were a number of equipment problems that affected normal production. Concerning equipment innovation, some equipment was obsolete and could not meet production requirements. For example, the problem of welding quality had never been thoroughly solved because the firm did not have good welding equipment.

The firm did not pay sufficient attention to reducing various inspection activities. Instead, inspection was emphasized more than ever before. Every year the firm spent many resources (e.g., human and capital) on conducting various inspection activities. For example, there were approximately 30 specialized inspectors engaged in inspections. In fact, many inspection activities were non-value added. High product quality could not be manufactured by after-event inspection.

The seven new QC tools had never been used by the firm due to a lack of understanding. Occasionally, the firm used the seven QC tools and statistical process control to solve quality problems, however, it did not use them extensively.

Product Design

Concurrent engineering for product design was not effectively implemented by the firm. Designing products through cooperation among different people from various functional departments, suppliers, or customers had not been achieved. Generally, only the R&D department was involved in product design and the technology department was in charge of auditing various drawings of product design. Contract review and design review were not sufficiently implemented. Thus, a number of quality problems occurred during production and with products in the field.

The firm did not focus on modular design in order to make the product more producible. Designers tended to change product design drawings constantly. Thus, it was inevitable that more problems would occur during production or with products on the customer's site. Because the firm did not adopt modular design, it also took a long time to design products. Designers tried to continually change their design to lower production costs.

The technique of experimental design for new product development was not used by the firm. Designers developed products based mainly on their previous experiences. In fact, the optimal design of the firm's products was not achieved; there was still much room for the firm to further improve its product design. Experimental design was not used because the designers did not understand how to use it.

Quality System Improvement

During the process of implementing its quality system documents, the firm sometimes did not follow these documents very well. For example, it was clearly written in the documents that the firm should calculate process capability and use experimental design. In reality, the firm did not use these quality tools. In this, the firm did not implement the quality system documents very well or they did not draw up the quality system documents according to their actual requirements.

Employee Participation

The firm did not have QC circles because it did not provide necessary rewards to employees to conduct QC circle activities, or a good environment to support them in doing so. The firm used within-functional teams instead of QC circles. According to one interviewee, the firm had a number of QC circles several years ago. Their effects were not as expected, therefore the firm terminated QC circle activities.

Employees did not have any intention of reporting their own working problems because they were afraid of being fined or laid off. As a result, the firm lost many opportunities for quality improvement. In fact, employee working performance was highly related to monthly pay. If employees had their own working problems, they would be penalized according to the firm's penalty rule.

The firm did not implement the system of job rotation as many working posts required operators with special qualification certification to do the work. Such regulations were stipulated by relevant governmental agencies. For example, lathe operators cannot operate cranes without qualification certification. Due to the money limitation, it was impossible for the firm to send many employees to different special job training activities. Therefore, employees lacked multi-disciplinary skills.

Recognition and Reward

In fact, the firm had already adopted the principle of "more work more pay". However, the pay gaps among different employees were not very large. During the period of the author's conducting of the case study, the salary list (February 2000) of employees working at the speed reductor workshop was checked. It was found that the lowest pay (salary plus bonus) was RMB 250 and the highest was RMB 656.50. It was clear that the pay gap was not big enough. Thus, employees' initiatives and potential could not be brought into full play. Due to the reason of low pay, more and more highly qualified employees left the firm. For example, the previous quality departmental manager had left the firm in 1999.

Education and Training

Sufficient resources for employee education and training were not provided by the firm. Every year it spent only approximately RMB 0.2 million in this area. That amount of money was not enough; sometimes, employees had to pay the tuition fee themselves if they attended training courses. The firm also did not provide subsidies for employees attending formal

education promotion programs. The firm regarded employees' self development as their own personal business.

Team learning in the firm was not effective. Members of within-functional teams or different production groups were reluctant to share their ideas, information, and knowledge. There was a strong tendency for these members to be on their guard against their colleagues. The reason for this was that members within one team or production group had competitive relations among themselves. They had a strong sense of crisis and were afraid of being laid off if they did not have unique skills. If everyone can do your work, then you are not valuable. There is a Chinese proverb: The master will die of hunger because his apprentices can do his work.

Quality awareness education was not sufficiently conducted even though top and middle managers often emphasized the importance of quality in various meetings. It is true that the firm already conducted many quality awareness education programs, however, employees' quality awareness was still at a relatively low level. A number of employees still lacked of a strong sense of responsibility.

Training for quality management knowledge was not sufficient. The firm did not train employees on how to use the seven QC tools, the seven new QC tools, or statistical process control; nor did it train designers on how to use tools such as experimental design. Due to the lack of sufficient knowledge, these quality tools were not effectively used in solving quality problems.

Employees were deficient in work skills due to insufficient job training. For example, a number of designers lacked the knowledge of technology, production, marketing, and shop floor experience. Therefore, a number of problems occurred during production and assembly. During newly recruited university graduates' first year, it was arranged that they do practical work in workshops. However, the firm did not arrange for them to do practical work in different workshops. Therefore, they did not have a good command of the whole situation of the firm's production activities, equipment performance, and various drawings. Thus, it was unavoidable that design problems would occur after these new graduates began working in the departments of R&D or technology.

Customer Focus

The firm did not fully conduct market investigation. For example, designers hardly went out to collect information for improving product design due to the lack of money. Designers also rarely visited customers in order to understand the performance of their products on site. Thus, information sources used for product design were very limited. Designers only made use of customer complaint information and customer requirements specified in contracts for designing products. Customer expectations, future requirements, and competitors' offerings remained unclear to a certain extent for designers. How to delight customers was not the focus of designing products.

The firm did not have customer satisfaction information on the quality of products and services from its competitors. Thus, customers' views on the firm's competitors were

unclear. In fact, such information would have been valuable to the firm in further improving its quality of products and services.

8.4.2 Overall Business Performance

The assessment tool presented in Appendix 5 was used to evaluate the firm's overall business performance. In fact, this performance reflected the effects of the firm's TQM implementation. The data of the firm's overall business performance could be used as input for formulating an effective improvement plan. Therefore, evaluating overall business performance was also an important part of TQM implementation.

Employee Satisfaction

The firm did not conduct employee satisfaction surveys in order to understand employee satisfaction levels. Thus, employee satisfaction as a whole remained unclear to a certain extent. During the process of conducting the case study, relevant interviewees were asked about their perceptions of employee satisfaction in the firm. The author presented these interviewees with facets that might affect employee satisfaction level. After these interviews were conducted, the author transferred these interviewees' perceptions into scores, which are listed in Appendix 5. These interviews indicated that employee pay was the most important factor affecting employee satisfaction. Currently, many Chinese firms, especially state-owned firms in the Liaoning region, had difficulties paying their employees due to various reasons. Although employees in the firm did not earn a great deal they could, however, have their salaries and bonuses per month. If the whole of China's machinery sector were taken into account, the investigated firm was doing well. In this regard, employees were satisfied. If compared with other industrial sectors or foreign-funded firms, the employees in the firm were not satisfied due to their relatively low pay. As a result, more and more qualified employees had left the firm to find well-paid jobs. It was very difficult for the firm to keep well qualified employees, which was a serious problem it faced. Table 8.1 lists the average annual pay between 1993 and 1999. The second most important factor affecting employee satisfaction was job security. Due to the long history of the planning economy in China, the firm employed a huge reservoir of surplus labor power. During that time, the firm was not permitted to dismiss employees. With the establishment of the socialist marketing economy in China, the firm now had the right to lay off surplus employees. For example, it implemented a "lay-off project" in 1999. As a consequence, 259 employees were laid off. The firm planned to lay off further redundant employees in the future. Thus, employees were not very satisfied with their job security.

Table 8.1 People's Pay Between 1993 and 1999

Pay	1993	1994	1995	1996	1997	1998	1999
Annual average pay per person (RMB)	3,846	6,420	7,236	7,865	7,657	8,004	9,931

Product Quality

The firm did regularly measure various product quality indices, such as conformity rate for finished products, internal defect rate for processing parts and casting iron, internal failure costs, and external failure costs. Products manufactured by this firm had their own specific standards in which technical specifications (e.g., welding quality, painting quality, quality requirements for different parts) and the parameters of performance, reliability, and durability were specified. Before finished products were delivered, their performance had to be examined; otherwise, they could not be delivered to customers. If finished products met the requirements of their technical specifications and performance indices, then the conformity rate for these products was 100%. Generally, the indices of reliability and durability could not be checked in advance but could be examined through practical application of products on site. In fact, the firm did get a number of complaints from customers about the reliability of their products, though rarely about its product durability. The internal defect rate for processing parts was measured in terms of processing time (time used to process defective components divided by time used to process all components). The internal defect rate for casting iron was measured in terms of weight (weight of defective casting iron divided by whole weight of casting iron). Internal failure costs included those of defects and rework. External failure costs involved those such as changing or repairing components, transporting components to customers, and travelling expenses for service personnel. Table 8.2 lists four of the seven product quality indices since 1996. From this table, it is evident that the indices of product quality were getting increasing better from year to year.

Table 8.2 Product Quality Indices Between 1996 and 1999

Indices	1996	1997	1998	1999
Conformity rate for final products (%)	100	100	100	100
Internal defective rate for processing parts (%)	0.4	0.2	0.19	0.094
Internal defective rate for casting iron (%)	5.0	5.1	4.39	4.14
Internal failure costs (Unit: RMB 10,000)	15.60	8.26	8.89	4.56
Annual output value (Unit: RMB 10,000)	6,045	6,076	7,110	5,307
Percentage (%)	0.258	0.136	0.125	0.086
External failure costs (Unit: RMB 10,000)	49.03	52.04	40.24	29.45
Annual sales (Unit: RMB 10,000)	4,713	6,732	6,848	5,315
Percentage (%)	1.040	0.773	0.588	0.554

In fact, the firm was one of the best in its industrial sector in China. Its product quality enjoyed high reputation in the country. Therefore, its relative product quality was very high compared with that other firms (see Appendix 5). However, this does indicate that the firm's product quality was superior. Actually, there was still room for the firm to improve its product quality. A number of interviewees admitted that the performance, reliability, and durability of their products fell behind the advanced world-level products. Through the assessment of the firm's product quality, a number of areas that led to product quality problems were identified. These areas could be used by the firm to formulate an

improvement plan in order to improve the firm's TQM implementation and product quality. These weak areas are presented below.

Top managers did not pursue long-term business success. Instead, reducing immediate production costs and increasing immediate profits were their major concern. Improving product quality fell behind costs and profits.

Products purchased from suppliers occasionally had quality problems that could not be completely detected by incoming inspection. Such defects would cause quality problems during production or operations in customers' fields. This was due partly to the fact that the firm selected its suppliers based mainly on price rather than quality.

Management means was backward. From time to time, employees read handwritten documents incorrectly because different people had different styles of handwriting. A number of product quality problems occurred due to handwritten documents.

Employees' quality awareness was not very high and employees still lacked a strong sense of responsibility. In addition, a number of employees were short of sufficient skills needed to perform their jobs well.

Some production equipment was obsolete and could not meet production requirements. The firm did not innovate its production equipment since it was short of capital and did not pursue long-term business success.

Customer Satisfaction

Customer satisfaction surveys were regularly conducted to understand customers' views on the firm's quality of products and services. The firm conducted the survey mainly through customer feedback forms, personal interviews, telephone surveys, and seminars. The information obtained from customer feedback forms and the number of customer complaints received were the major sources for the firm in understanding customer satisfaction level (see Appendix 5). Through conducting the assessment of customer satisfaction, the firm's quality problems of products and services were identified. Such information could be used in formulating an improvement plan to improve product and service quality. Customer complaints about product and service quality were identified as follows:

Customers had complaints about product quality related to painting, welding, and other outside appearances; oil leakage from speed reducers; broken axles of belt conveyors; vibration, and noise. Concerning customer complaints about service quality, the firm had the following problems: Necessary parts were not packed for delivery; a number of small parts were not fixed in packing boxes; electric motors were not protected against water and moisture; packing lists were not complete; packing materials had quality problems; and packing quality was not good enough. The major reasons leading to these problems of products and services were recognized as: Low quality raw materials from suppliers, obsolete production equipment, and employees' low sense of responsibility.

Strategic Business Performance

The firm regularly measured its annual sales, sales growth, profits, market share, and exports. These indices between 1996 and 1999 are listed in Table 8.3. Of the five indicators of overall business performance, only market share increased continuously. The other four indicators decreased almost year by year. Such information could be used by the firm to take appropriate actions in order to increase its strategic business performance. The reasons leading to decreased annual sales (annual sales growth), profits, and exports are presented below.

Table 8.3 Strategic Business Performance Between 1996 and 1999

Indices	1996	1997	1998	1999
Annual sales (million yuan)	47.13	67.32	68.48	53.15
Sales growth (%)	-19.9	42.8	1.7	-22.4
Profits (million yuan)	1.2	1.3	1.0	0.5
Market share (%)	25.6	31.5	35.92	38.2
Exports (million yuan)	4.81	6.19	4.35	0.88
Exports rate by annual sales (%)	10.21	9.19	6.35	1.66

Note: Market share was calculated by the firm's output volume divided by the whole output volume in Liaoning Province.

In recent years, due to the problem of the "Triangle debt" in China, the customers of the firm did not want to pay their purchases immediately. Thus, it was not easy to collect money from the customers for products sold. Before July 1999, customers owed the firm RMB 30 million. As a result, the firm suffered severe shortages of money. In order to maintain normal production, it had to borrow more money from banks. In return, the firm had to pay more interest back. As a consequence, production costs were pushed up. Due to keen market competition, the selling price for different products also fell in recent years. For example, the selling price for speed reducers reduced 30% compared with the price in 1993. The price for all kinds of assembled parts was also reduced by 15% compared with the price in 1993. Due to the price war in China, some small firms could make profits if they sold products at a relatively low price. For the investigated firm, it was impossible to make profits if the selling price was low. The firm's burden was heavy because it had approximately 300 retired workers, who still received their pensions from the firm. Currently, product price was the most important factor in attracting customers because many industrial firms did not have sufficient money to buy products. The firm's customers were also faced with a capital shortage. In order to achieve annual sales volume, the firm from time to time had to produce products even though it could not make a profit. Some contracts could only bring annual sales volume rather than profits. Sometimes the firm had to sell products, suffering losses to maintain sales growth. In order to achieve the profit index set up by the bureau, the firm had to lower production costs, cut money expenditures, and avoid all unnecessary expenses.

The firm also experienced difficulties in exporting products to foreign countries. In fact, the firm's products were exported mainly to Southeast Asian countries. Due to the financial crisis in this area in 1998, the exports volume had declined very rapidly over the past two years.

8.5 Four Categories of Improvement Possibilities

Through the assessment of the firm's TQM implementation and overall business performance, its weak areas of TQM implementation were identified. These weaknesses could be used as improvement possibilities for further improving the firm's TQM implementation. Based on a thorough investigation of these improvement possibilities, they can be categorized into four improvement possibilities: Structurally impossible, temporary barrier, ineffective, and feasible. The deputy general manager was involved in assisting the author to categorize these four improvement possibilities. The detailed explanations and analyses of these four categories are described below:

Structurally Impossible Improvement Possibilities

Structurally impossible improvement possibilities are very difficult for the firm to implement under the current situation. The major reason causing structurally impossible improvement possibilities was that the firm's top managers did not pursue long-term business success; immediate short-term profits were their major concern. Due to the institutional system, the general manager was contracted to run the firm under the contract system. The firm's administrative bureau behaves as the principal representing state ownership. The top managers were assumed to have some delegated rights in their operations, but should represent the owner's interest. Every year, the administrative bureau assigned indices of overall business performance to the firm. Profit was the most important index in evaluating the performance of the general manager, whereas annual sales volume was the second. In fact, profit was the veto index, which played a 40% role in evaluating top management performance. As a result, the general manager had to try his best to accomplish these indices. If he did, he could be financially rewarded by the administrative bureau. If he could not achieve these indices, he would be financially punished or would risk being dismissed by the bureau. Under such a system, it was impossible for the general manager to pursue long-term business success. His major focus was to concentrate on annual business success. Profits and annual sales volume were the primary targets. However, to reach these targets was not an easy task under the current situation. Due to the slack market in China, the firm did have some difficulties in achieving the target of annual sales. In order to realize this index, the firm had to sell products at lower price, sometimes suffering losses. As a consequence, the firm had difficulties in realizing its profit target. In order to make profits, the firm had to cut money expenditures. As a result, further development of the firm was hindered. Thus, it was not difficult to understand why some improvement possibilities were very difficult to implement currently. Of the previously identified improvement possibilities, structurally impossible improvement possibilities are listed as follows:

- Pursuit of long-term business success;
- Long-term partnership with suppliers;
- Long-term vision statement;
- Long-term overall business performance plan;
- Implementation of improvement plans;
- Computerized information system;
- Improvement of working environment on shop floor;
- Equipment maintenance and innovation;

- Sufficient resources for employee training.

However, with the deep reform of state-owned firms in China, such structurally impossible improvement possibilities would be implemented if top managers would pursue long-term business success.

Temporary Barrier Improvement Possibilities

There were a number of improvement possibilities that could be implemented in the near future adopting step-by-step approach. First, employee empowerment could be implemented. Currently, the firm organized all activities according to the firm's various rules, regulations, and quality system documents. Every employee had his or her functions and duties, having to do things according to such regulations and procedures. Otherwise, the firm would have trouble. However, with the continuous improvement of employee education, employee commitment and employee skills, employee empowerment would be implemented in the future, though it would take some time to fully implement it. Second, China's present situation was uncertain, with much turbulence. Employees had a strong crisis awareness for their future-they were truly afraid of being laid off. At present, more and more employees were being laid off due to the fact that many firms adopted the policy of laying off redundant employees to increase profits. Thus, employees had a strong consciousness for protecting themselves. As a result, they declined to report their own working problems that were caused by themselves. However, after all redundant employees were laid off and the firm's business went well, employees would be more willing to report their working problems. They would also have more chances to learn different skills for performing different jobs. Third, it was possible that the firm would try to reduce various inspection activities in the future. The approach to reducing inspection activities should be undertaken step by step. Fourth, the deputy general manager did not have confidence in using the seven new QC tools in practice, as he felt they were too complicated to be used at this moment. The seven new QC tools should be implemented in the future after employees accept sufficient training in their use.

Ineffective Improvement Possibilities

It was ineffective for the firm to organize QC circle activities. In fact, the firm's different departments and workshops had already formulated a number of within-functional teams. These teams, instead of QC circles, were used to solve quality management problems. In addition, production employees had their own working tasks according to their job descriptions. If they could not finish these tasks, they would have less pay. Therefore, employees only paid sufficient attention to producing more yields. In such an environment, it was ineffective to organize QC circle activities.

Feasible Improvement Possibilities

Concerning other improvement possibilities, the general deputy manager admitted that these did not receive much attention from the top management team. It is better to say that these improvement possibilities were ignored by the firm. Such improvement possibilities could

be implemented by the firm under the current situation. These feasible improvement possibilities are listed as follows:

1. Supplier selection criteria should be changed in order to ensure that purchased materials have less (or no) quality problems. The quality of purchased products should be regarded as the most important factor in selecting suppliers. Total costs (e.g., incoming inspection, internal failure costs, external failure costs, and late delivery) should be taken into account in selecting suppliers.
2. Data on appraisal costs and prevention costs should be collected and analyzed in order to understand how much money was spent on appraisal and prevention. Such information can be used in seeking solutions to reducing unnecessary costs.
3. Various internal job training courses should be effectively organized in order to make employees perform their jobs better. Experienced employees from different departments or workshops can be training lecturers.
4. Team learning should be further improved by arranging for skillful employees to report their working experiences, rotating team members to present their good ideas during the process of team activities, and rewarding team members who are willing to share their knowledge with other members.
5. Quality awareness education should be further emphasized in order to increase employees' quality awareness and sense of responsibility.
6. The pay gap should be further widened in order to improve the initiatives of well performing employees, well qualified employees, and sales personnel. Employees who make large contributions to the firm deserve to earn more.
7. Competitive benchmarking should be conducted in order to understand competitors' offerings. Such information will be valuable for the firm in improving product design, product quality, and service quality.
8. In-depth market investigations should be conducted in order to obtain customers' real expectations and potential needs. It is valuable to obtain customer satisfaction information on the quality of products and services from the firm's competitors. Such information can be used for product design and quality improvement.
9. Employees should accept training on how to use the seven QC tools and statistical process control in practice. Designers should accept training on how to use experimental design in product design.
10. The seven QC tools should be used extensively in analyzing and solving quality-related problems.
11. Experimental design, concurrent engineering, and modular design should be used in improving product design.
12. The evaluation of employee satisfaction should be conducted regularly. Such information can be used by the firm to further improve its employee satisfaction.
13. Statistical process control should be used in order to control the production process. In addition, process capability should be calculated in order to provide sufficient information for designers to determine design specifications.
14. Quality system documents should be further improved according to the firm's current practices and the ISO 9001 requirements. The firm should change its quality system documents in order to ensure "write what they do and do what they write".

8.6 Formulation of Improvement Plan

The 14 improvement possibilities mentioned above could be used by the firm to formulate its improvement plan. Due to its limited resources, the firm could not implement these improvement possibilities at the same time but had to choose some critical improvement possibilities essential to the firm. More importantly, the firm could implement them in practice. Which improvement possibilities to be implemented should be based on a thorough analysis of these feasible improvement possibilities and the firm's available resources. In addition, time schedules and major responsible departments involved in implementing the improvement plan should also be determined. Thus, the plan might be more practical and its implementation easily ensured. In order to reach this aim, the author consulted with the deputy general manager²⁸ concerning how to formulate a more effective improvement plan.

Based on the guidance in formulating an improvement plan presented in the TQM implementation model, the targeted improvement areas of the firm's overall business performance were used in ranking all the feasible improvement possibilities. In this firm, it was obvious that the first priority was given to increasing profits. Thus, increasing the firm's profits was used to prioritize the 14 feasible improvement possibilities. Note that the deputy general manager was involved in ranking these improvement possibilities in terms of their potential effects of these feasible improvement possibilities on improving the firm's profits. The ranking was based on the deputy general manager's perception and understanding of these feasible improvement possibilities. The ranked order is presented in Section 8.5. Note that the research findings obtained from the questionnaire survey could not be used in ranking these improvement possibilities, as they only showed whether TQM elements have effects on overall business performance. In addition, the questionnaire findings did not indicate the amount of contribution each TQM element makes. Furthermore, the questionnaire survey findings showed that a number of hypotheses were not confirmed by the data. Actually, these TQM elements do have effects on overall business performance if implemented effectively.

In terms of the firm's available resources, it was better to implement the first five ranked improvement possibilities. The other nine would be left for the next stage of improvement. These five possibilities were then transferred into three programs. Thus, the formulated improvement plan is composed of three programs: Employee learning, analysis of quality costs, and supplier selection based on total costs. The first two programs will start at the same time; the third will start three months later. Figure 8.3 displays the time dimension and major responsible departments involved in implementing this improvement plan, which was formulated on a yearly basis. In other words, within one year's period, implementing this improvement plan is the firm's focus of TQM implementation. After the three programs are practically implemented, their effects and immediate results should be periodically monitored and checked. Immediate actions will be taken to ensure that the improvement plan

²⁸ The general manager of the firm was dismissed by the administrative bureau on March 13, 2000. At that moment, the author was conducting the case study in the firm. Thus, the author missed the opportunity to discuss with him these improvement possibilities. The author also missed the opportunity to present him with the final improvement plan.

can be effectively implemented. After one year of implementing the improvement plan, the firm should formulate another improvement plan for the next year's implementation. The lessons learned and experiences gained from this year will be used in formulating the next year's plan. It is a never-ending process. It is worthy to note that having a better understanding of these feasible improvement possibilities and the firm's available resources are the primary determinants in formulating a more effective improvement plan. The detailed explanations of this improvement plan are presented in the following paragraphs.

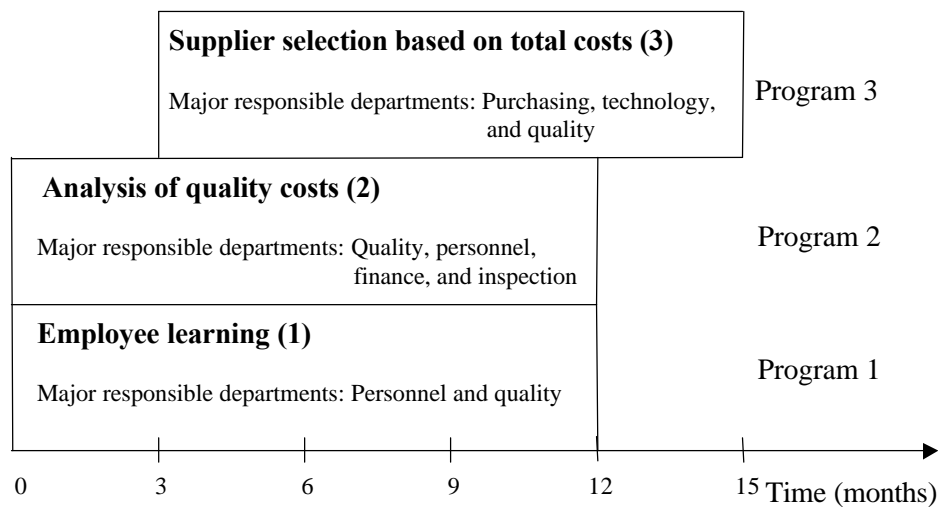


Figure 8.3 Three Programs of the Improvement Plan

Employee Learning (Program 1)

This program consists of three activities: Quality awareness education, internal job training, and team learning, which are explained as follows:

First, quality awareness education will be conducted in order to improve employees' quality awareness and sense of responsibility. It should be conducted on a regular basis (e.g., one time per month). All employees should accept such education. It can be expected that employees' sense of responsibilities will be improved; consequently, fewer quality problems will occur. Note that the contents of quality awareness education are essential to the success of this activity. It will be more effective to use facts to teach employees rather than only words. For example, the fact that money is lost each year due to employees' low quality awareness and lack of a sense of responsibility is a good example to teach employees. The effects of quality awareness education should be regularly monitored in order to continually improve the effectiveness of this activity.

Second, various internal job training courses will be organized to improve employees' skills. Competent employees from different departments or workshops can be asked to give training lectures. Thus, training costs will be reduced enormously. It is not always the case that

external job training is better than internal job training, or that external lecturers are better than internal ones. If qualified lecturers cannot be found within the firm in some cases, external trainers can be invited to give training lectures. Before conducting internal job training, it is essential to understand employees' skill levels. Note that different employees performing different jobs with different skill levels should accept different training. In this regard, internal job training courses should be well developed; otherwise, the training cannot be effective.

Third, the effectiveness of team learning will be further improved by arranging for skillful employees to report their working experiences, rotating team members to present their good ideas during the process of team activities, and rewarding team members who are willing to share their knowledge with other members. Such kinds of "compulsory" sharing ideas will be very effective.

To ensure the success of Program 1, two departments (personnel and quality) are mainly responsible for its implementation. Other departments or workshops should cooperate with these two major responsible departments. The personnel department is in charge of making the detailed time plan for conducting this program and drawing up reward policies to encourage team members to share their knowledge with other members. The quality department is responsible for selecting suitable personnel to give training lectures or present their working experiences. Program 1 will be initially conducted for one year. During the process of one year's implementation, the firm should monitor immediate results so as to take suitable action to ensure the success of this program. If Program 1 produces the expected results, the firm should integrate it into the firm's existing management systems. Thus, the system can ensure that employee learning can be continuously implemented. If this program does not produce the expected effect, then a new improvement program will be formulated on the basis of a careful examination of the one year's implementation of Program 1. Thus, the new improvement program will be more effective.

Analysis of Quality Costs (Program 2)

Various data related to quality costs will be collected and analyzed. Actually, there are four categories of quality-related costs: Internal failure, external failure, appraisal, and prevention. Internal failure costs are associated with defects found prior to transfer of products to the customer. Internal failure costs include, for example, scrap, spoilage, defectives, waste, rework, failure analysis, scrap and rework supplies. External failure costs are related to defects found after products are shipped to the customer, such as warranty charges, complaint handling, returned materials, and allowances. Appraisal costs are incurred in determining the degree of conformity to quality requirements. These costs include those caused by incoming inspection, in-process inspection, final inspection, and maintenance of testing equipment. Prevention costs are associated with those caused by quality planning, process control, quality audit, supplier quality assessment, and training. Note that to have data on quality-related costs is not enough to improve quality and reduce costs. Without carefully investigating the real causes leading to quality costs, actions cannot be effective and chronic deficiencies cannot be reduced. There are two ways of analyzing the data of quality costs. The first is to identify different segments of quality costs and rank these segments in terms of their sizes (amounts of money). In fact, the costs of quality do not exist

as a homogeneous mass. These segments are unequal in size, and a relative few account for the bulk of the quality costs. The second way to analyze the data is to investigate all reasons leading to quality costs and rank these in terms of their contributions to quality costs. Each segment of quality costs can be traceable to specific causes. Thus, different reasons leading to quality costs can be identified, especially those vital few reasons. In order to analyze data efficiently, Pareto analysis and cause-and-effect diagram should be used. It is worth noting that the largest segment of quality costs and the reason leading to the largest proportion of quality costs should be used as the primary input in formulating an improvement action. Such an action can be implemented in order to effectively reduce quality costs. Thus, it can be expected that the firm's profits will be improved. To ensure the success of this program, the departments of quality, personnel, finance, and inspection are mainly responsible for implementing this program. Other departments or workshops should cooperate with these major responsible departments. This program is designed for one year. After one year's trial, the firm should standardize its procedures through establishing a formal quality costing system to ensure that collection and analysis of quality costs is the normal life of the firm's evaluation activities.

Supplier Selection Based on Total Costs (Program 3)

The firm's many quality problems and losses were incurred by poor quality of purchased materials due to the fact that the firm selected suppliers based mainly on purchasing price rather than product quality. Of course, it is normal practice to balance between price and quality in order to pursue optimal purchasing. It is impossible for the firm to select its suppliers in terms of only one factor-quality. The firm's primary goal is to achieve the profit target set by the administrative bureau. Thus, supplier selection based on total costs should be adopted by the firm. From the analysis of quality costs (Program 2), the amount of quality costs caused by poor purchased products can be identified. This information can be used in optimizing supplier selection by balancing between quality and price. To do so, the firm can reduce total costs by selecting suitable suppliers. As a consequence, the firm's profits will be enhanced. In fact, it will take some time to collect and analyze the data of quality costs. Therefore, the program of supplier selection based on total costs will start three months later than that of analysis of quality costs. This program will be initially implemented for one year. Then, its effects on improving profits will be evaluated. If this program produces good results, the firm should continually implement it. If it does not have the expected effect, reason analysis should be conducted. A new improvement program concerning selecting suppliers will then be formulated, on the basis of the information obtained from the one year's implementation of supplier selection based on total costs. Note that external quality losses may not be identified in one year, but are most probably identified after that time. Therefore, the yearly evaluation of the effects of implementing this program should take this factor into account. The departments of purchasing, technology, and quality will be mainly responsible for implementing this program. Other departments or workshops should cooperate with these three major responsible departments.

During the process of formulating this improvement plan, the deputy general manager was personally involved. In fact, he agreed that this improvement plan would be implemented by the firm in practice. It should be noted that this plan was formulated on the basis of the 14

feasible improvement possibilities, the targeted improvement area of the firm's overall business performance (profits in this case), and the firm's available resources.

8.7 Discussion and Conclusions

Based on the evaluation, the strengths and weaknesses of the firm's TQM implementation and overall business performance were identified. The firm's current TQM implementation practices showed that it did not implement the full package of the TQM implementation model. It is better to say that this firm only implemented part of TQM, or that it was on the journey to full-fledged implementation of TQM. The weaknesses of the firm's TQM implementation and overall business performance provided opportunities for the firm to improve its TQM implementation. Based on these weaknesses, the firm's targeted improvement area of overall business performance, and the firm's available resources, an improvement plan was formulated. The firm's deputy general manager agreed that the firm would implement this improvement plan in practice. Thus, it can be concluded that this TQM implementation model can be used to evaluate the firm's TQM implementation and overall business performance, identify strengths and weaknesses therein, and assist the firm in formulating the improvement plan. Therefore, the TQM implementation model developed in this study is applicable to this firm.

Can this TQM implementation model be used in other Chinese manufacturing firms? In fact, the case study was conducted in only one Chinese state-owned manufacturing firm. Strictly speaking, the generalization was limited. However, it was safe to assume that no firms have implemented the full package of the TQM implementation model in practice. Firms' weak areas of TQM implementation and overall business performance can always be identified by comparison with this TQM implementation model. Weak areas can be used by firms to further improve their TQM implementation. Thus, the conclusion obtained from the case study can be generalized to other manufacturing firms in China. Therefore, the TQM implementation model developed in this study is applicable to all Chinese manufacturing firms.

The case study further shows that this TQM implementation model can be used to benchmark firms' continuous improvement, self-assess their quality improvement efforts, and measure their progress over time. Through using this model, firms can quickly identify which areas urgently need improvement. Thus, resources can be allocated more wisely. In fact, TQM implementation is a systematic approach. Different firms have different characteristics, histories, and backgrounds; adopt different technologies; have different TQM implementation maturity; serve different markets with different products; and employ people from different education levels. Different firms should adopt different approaches to TQM implementation on the basis of their own situations. No universal standard of TQM implementation exists. Firms should not follow the practices presented in this TQM implementation model strictly; when they start using it, they should combine their uniqueness with the practices of this model and consequently develop their own models and ways to excellence. Thus, firms can optimize the use of this model by blending with it and applying it to their own situations. Through this, their own models can suit their situations better. It is very important that firms adopt TQM practices that are valuable to their own

specific requirements. Additionally, firms need to develop their own measurement systems that can better measure employee satisfaction, product quality, customer satisfaction, and strategic business performance. Their own measurement systems can better fit their situations.

This case study also provides an example of how to use this TQM implementation model in practice. Firms that want to use this model can take this case study as an example. It should be noted that top management commitment is the most important prerequisite; without it, it is impossible to successfully implement this model in practice. To ensure the success of using the TQM implementation model, firms should understand their TQM implementation and overall business performance. Otherwise, weaknesses in these areas cannot be identified and effective improvement plans cannot be formulated. After improvement plans have been formulated, firms should implement them in practice, observe and check results, investigate and analyze the results, formulate new improvement plans again, and restart implementing new plans. In fact, implementing TQM is a continuous improvement process. It is a never-ending journey. Implementing this model does require patience, tenacity, and commitment from people at every level in firms. It is worth noting that there are no quick fixes. It will take some time to see the effects of implementing this model.

