

## Chapter 6 Results of Model Testing<sup>17</sup>

### 6.1 Introduction

This chapter presents the results of testing the two theoretical models hypothesized in this study. Section 6.2 describes the methodology used for testing the two theoretical models. Section 6.3 tests the theoretical model of TQM implementation and overall business performance. Section 6.4 presents the result of testing the theoretical model of TQM implementation constructs and overall business performance. Section 6.5 provides brief interpretations of model testing results. Finally, Section 6.6 summarizes this chapter with a number of conclusions.

### 6.2 Methodology

Structural equation modeling<sup>18</sup> (LISREL) was employed in testing the theoretical models hypothesized in this research. There are two ways of estimating a LISREL model. First, all paths of the measurement model and structural model are estimated simultaneously. Second, the paths of both models can be estimated separately, which is two-stage analysis. Many researchers are now proposing a two-stage process of structural equation modeling (Hair et al., 1992). In this research, however, the total observations were only 212, which was not sufficient for estimating the measurement and structural models simultaneously. Therefore, the two-stage analysis approach was selected for estimation. In this chapter, only the structural model is estimated.

The path analysis technique can be used to test the plausibility of putative causal relationships between one variable and another in non-experimental conditions. Path analysis is the basis for the empirical estimation of the strength of each causal relationship depicted in the path model, and is based on calculating the strength of the causal relationships from the correlation among the constructs. The procedure can be formulated as one of estimating the coefficients of a set of linear structural equations representing the cause and effect relationships hypothesized by researchers (Jöreskog and Sörbom, 1996). The system of relationships involves variables of two kinds: Independent (or cause) variables  $X_1, X_2, \dots, X_q$  and dependent (or effect) variables  $Y_1, Y_2, \dots, Y_p$ .

In this research, two theoretical models were hypothesized. One was to combine all of the 11 TQM implementation constructs into one independent variable, which was used to test the relationships between TQM implementation and overall business performance. The other model was to investigate the relationships between the 11 TQM implementation constructs and overall business performance. In this case, the 11 TQM implementation constructs are

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<sup>17</sup> Parts of this chapter were published in Zhang (2000c, 2000d, 2000e, 2000f).

<sup>18</sup> According to Hair et al. (1992), structural equation modeling is simply known by the name of LISREL analysis, which is the name of one of the more popular software packages.

independent variables. Estimating a path analysis model with LISREL is entirely straightforward. LISREL treats the model as a system of equations and estimates all the structural coefficients directly. The path coefficients ( $\gamma$ ,  $\beta$ ) are displayed in Figures 6.1 and 6.3.

### 6.2.1 Selection of Input Matrix Types

There are many discussions concerning which types of input matrices should be used for LISREL. The selection of an input matrix is highly dependent on the data types. Since social science data typically derive from attitudinal questionnaires or interviews that are structured in a Likert-type format, they are representative of an ordinal scale. Nonetheless, it has been common practice in structural equation modeling, if the number of response categories of a variable is greater than two, to treat these variables as if they were on a continuous scale (Byrne, 1998). However, according to Jöreskog and Sörbom (1996), ordinal variables are not continuous variables and therefore should not be treated as such. Ordinal variables have no metric; their means, variances, and covariances are not meaningful. As a result, data analysis using LISREL may produce biased estimates. When data comprise variables that are ordinal data or a combination of ordinal and continuous data, data analysis using LISREL should be based on the polychoric or polyserial correlation matrix (Jöreskog and Sörbom, 1996). In this research, however, the measurement and structural models are estimated separately. In addition, in estimating the theoretical models, independent and dependent variables in the two models are treated like directly observed variables (they are actually latent variables). In LISREL, a variable is assumed to be continuous if there are more than 15 values. In this study, most constructs were based on the sum of more than four item-scores and thus had more than 15 values. The employee satisfaction construct was measured between 0 and 10 to one place of decimal point. Thus, it had more than 15 values. Only one construct, that is, customer satisfaction was the sum of two items, and had nine values. If this variable was treated as ordinal data, then PRELIS could only calculate Pearson and polyserial correlation coefficients. If customer satisfaction was treated as continuous data, the PRELIS could only calculate Pearson correlation coefficients. Based on personal communication with Boomsma<sup>19</sup>, the data of the customer satisfaction variable could be treated as continuous. Therefore, the Pearson correlation matrix should be selected as the input matrix for LISREL instead of the combination of Pearson and polyserial correlations.

### 6.2.2 Model Estimation

LISREL 8.14 provides different methods for estimating structural models. Among them are the maximum likelihood (ML), the generalized least squares (GLS), and the generally weighted least squares (WLS). In this research, the Pearson correlation matrix was selected as the input matrix. According to Jöreskog and Sörbom (1996), the WLS estimation method should be used, however, the problem with this method is that a rather large sample is

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<sup>19</sup> On 5 March 1999, the author had an in-depth discussion with Mr. Boomsma (LISREL course lecturer) during the LISREL course. According to his suggestion, the data of customer satisfaction could be treated as continuous in this study.

required (Kemp, 1999). According to De Jong (1999), ML estimates are consistent (the probability that the parameter estimate approaches the true parameter value increases with the size of the sample), and ML estimates are efficient (they produce the most reliable estimates). Kemp (1999) and De Jong (1999) adopted the ML estimation method for testing their theoretical models, which produced reliable results. Therefore, it was decided that the ML estimation method would be used for testing the two theoretical models.

### **6.2.3 Assumptions**

The structural equation model shares three assumptions with the other multivariate methods: Independent observations, random sampling of respondents, and the linearity of all relationships. Furthermore, this model is more sensitive to the distributional characteristics of the data, particularly the departure from multivariate normality or a strong kurtosis or skewness in the data. A lack of multivariate normality is particularly troublesome since it substantially inflates the Chi-square statistic and creates upward bias in critical values for determining coefficient significance (Hair et al., 1992). For testing multivariate normality, PRELIS 2.14 can be used. Based on a rule of thumb that the skewness and kurtosis should not exceed the absolute value of 1 (Hair et al., 1992). The ML estimation method can produce the best estimates if the variables have a multinormal distribution.

### **6.2.4 Structural Model Fit**

LISREL provides not only estimated coefficients but also standard errors and calculated t-values for each coefficient. A hypothesis is confirmed if the estimated path coefficient is significant and has the hypothesized sign. In this study, one-tailed significance levels are used since the hypotheses formulate explicit predictions of the direction of the effect of one variable on another. A t-value larger than 1.282 corresponds to  $p < 0.10$  (weakly significant), a t-value larger than 1.645 to  $p < 0.05$  (moderately significant), and a t-value greater than 2.326 to  $p < 0.01$  (strongly significant) (Harnett and Murphy, 1985).

### **6.2.5 Overall Model Fit**

In theoretical model testing, a major issue is whether the theoretical model is in conflict with reality as observed in the sample; namely, how well the theoretical model fits the data (De Jong, 1999). Many indicators are calculated by LISREL 8.14, which can be used to evaluate the global model-fit. Five common measures for judging goodness-of-fit are the Chi-square ( $\chi^2$ ), the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the root mean square error of approximation (RMSEA), and the root mean square residual (RMR) (Byrne, 1998; Hair et al., 1992; Jöreskog and Sörbom, 1996).

The most fundamental measure of overall fit is the likelihood-ratio Chi-square statistic, the only statistically based measure of goodness-of-fit available in a structural equation model. A p-value larger than 0.05 is generally considered acceptable. An important criticism of the Chi-square measure is that it is too sensitive to sample size differences, especially in cases

where the sample size exceeds 200 respondents. As sample size increases, this measure has a greater tendency to indicate significant differences for equivalent models. Moreover, when the sample size nears 100 or goes even lower, the Chi-square test will show acceptable fit even when none of the model relationships are shown to be different ways to both small and large sample sizes (Hair et al., 1992).

The goodness-of-fit index (GFI) is a nonstatistical measure ranging in value from 0 (poor fit) to 1.0 (perfect fit), which measures the degree to which the actual input matrix is predicted by the estimated model. Higher values indicate a better fit, but no absolute threshold levels for acceptability have been established. The adjusted goodness-of-fit index (AGFI) differs from the GFI only in the fact that it adjusts for the number of degrees of freedom in the specified model. For both indices, a value larger than 0.90 is considered an acceptable, good fit (Byrne, 1998; De Jong, 1999; Hair et al., 1992; Kemp, 1999).

The fourth indicator, the root mean square error of approximation (RMSEA) takes into account the error of approximation in the population. The RMSEA value is the discrepancy per degree of freedom, and is measured in terms of the population, not just the sample used for estimation. The value is representative of the goodness-of-fit that could be expected if the model were estimated in the entire population, not just the samples drawn for estimation. It is commonly considered that values less than 0.05 indicate a good fit; values from 0.05 to 0.08 represent a fair fit; values ranging from 0.08 to 0.10 indicate a poor fit; and those greater than 0.10 indicate a very poor fit (Byrne, 1998; De Jong, 1999).

The fifth indicator is the root mean square residual (RMR), which is the square root of the mean of the squared residuals – an average of the residuals between observed and estimated input matrices. If a correlation matrix is used, the RMR is in terms of an average residual correlation (Hair et al., 1992). The standardized RMR therefore represents the average value across all standardized residuals, and ranges from 0 to 1.00. Byrne (1998) suggested that in a well-fitting model this value will be smaller than 0.05.

### **6.2.6 Model Modification**

Obtaining an acceptable level of fit does not assure that the best model has been found. Many alternative models may exist that provide an even better fit. A possible model modification should be conducted in order to improve the theoretical explanations or the goodness-of-fit of the model. As a means of evaluating the estimated model with alternative models, overall model comparisons can be performed. The most critical error in developing a theoretically based model is the omission of one or more key predictive variables, known as specification error. The implication of omitting a significant variable is to bias the assessment of the importance of other variables. Modification of the model should be based on theory; modifications to the original model should be made only after deliberate consideration (Hair et al., 1992).

### 6.3 Model of TQM Implementation and Overall Business Performance

In this hypothesized theoretical model, TQM implementation is an independent variable, the value of which can be calculated by summing the scores of all of the 78 items. There are four dependent variables: Employee satisfaction, product quality, customer satisfaction, and business performance. There is one item to measure employee satisfaction (0-10, to 1 place of decimal point), seven items to measure product quality, two items to measure customer satisfaction, and five items to measure strategic business performance. The four dependent variables can be represented as  $Y_1$ ,  $Y_2$ ,  $Y_3$ , and  $Y_4$ , respectively.

PRELIS 2.14 was used in calculating the Pearson correlation matrix and checking normality of inputting data. The correlation matrix calculated served as the input matrix for LISREL in estimating the hypothesized theoretical model. Table 6.1 lists the summary statistics of the five variables, and shows that the variables have a relatively normal distribution since the skewness and kurtosis do not exceed the absolute value of 1. Therefore, LISREL can be used to estimate the theoretical model.

Table 6.1 Summary Statistics for the Five Variables

Variables	Mean	St. dev.	Skew.	Kurt.	Min.	Freq.	Max.	Freq.
Employee satisfaction	7.51	2.07	-0.69	-0.35	0.50	1	10.00	23
Product quality	26.78	5.23	-0.22	-0.30	9.00	1	35.00	24
Customer satisfaction	8.09	1.49	-0.85	0.89	2.00	1	10.00	40
S.B. performance	13.63	4.64	-0.06	-0.73	5.00	10	25.00	1
TQM implementation	291.84	47.25	-0.34	-0.66	171.00	1	385.00	1

Note: S.B. performance means strategic business performance.

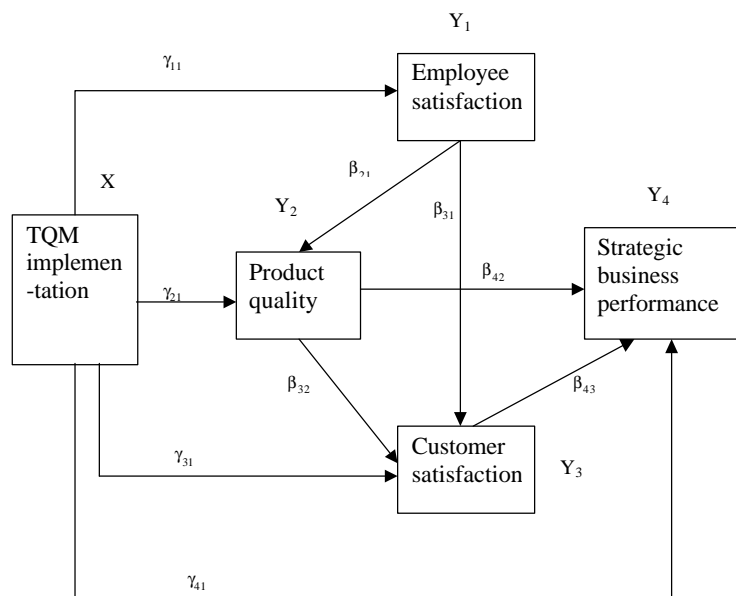
The theoretical model of TQM implementation and overall business performance incorporates nine hypotheses that will be tested simultaneously. A hypothesis is confirmed if the estimated path coefficient is significant. All the path coefficients are displayed in Table 6.2 and Figure 6.2. Seven hypotheses were strongly confirmed by the empirical data since the t-values were greater than 2.326. One hypothesis between employee satisfaction and customer satisfaction was moderately confirmed, since the t-value was 2.32. The relationship between customer satisfaction and strategic business performance was not significant since the t-value was only 1.11. Therefore, the hypothesis that customer satisfaction has a positive effect on strategic business performance was not confirmed. Table 6.2 also lists the overall goodness-of-fit statistics.

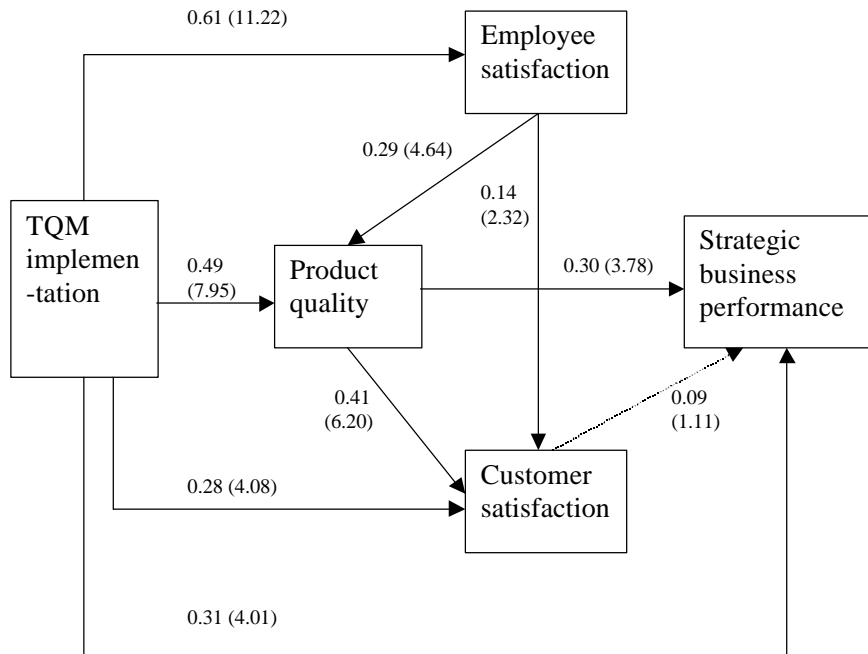
Table 6.2 Maximum Likelihood Estimates

Parameters	Coefficients	T-values
$\gamma_{11}$	0.61	11.22
$\gamma_{21}$	0.49	7.95
$\gamma_{31}$	0.28	4.08
$\gamma_{41}$	0.31	4.01
$\beta_{21}$	0.29	4.64
$\beta_{31}$	0.14	2.32
$\beta_{32}$	0.41	6.20
$\beta_{42}$	0.30	3.78
$\beta_{43}$	0.09	1.11
Chi-square	0.071	--
Degree of freedom	1	--
P-value	0.79	--
GFI	1.00	--
AGFI	1.00	--
RMSEA	0.00	--
RMR	0.0028	--

Note: The symbol "--" means not available.

Figure 6.1 Theoretical Model of TQM Implementation and Overall Business Performance





Notes: T-values are in parentheses.  
 A t-value larger than 1.645 corresponds to  $p < 0.05$ .  
 A t-value larger than 2.326 corresponds to  $p < 0.01$ .  
 Hypothesis were confirmed ( —————> ).  
 Hypothesis was not confirmed ( .....> ).

Figure 6.2 Testing the Theoretical Model of TQM Implementation and Overall Business Performance

#### 6.4 Model of TQM Implementation Constructs and Overall Business Performance

The hypothesized theoretical model consists of 11 TQM implementation constructs and four overall business performance constructs, and has 17 hypotheses that will be tested simultaneously by LISREL. The 11 TQM implementation constructs are treated as directly observed or measured variables, which are independent. The values of each construct can be calculated by summing the scores of each item in that construct.  $X_1, X_2, \dots, X_{11}$  are used to represent the 11 independent variables. There are four dependent variables: Employee satisfaction, product quality, customer satisfaction, and strategic business performance. There is one item to measure employee satisfaction (0-10, to 1 decimal point), seven items to measure product quality, two items to measure customer satisfaction, and five items to measure strategic business performance. The four dependent variables can be represented as  $Y_1, Y_2, Y_3,$  and  $Y_4,$  respectively.

Before running the LISREL 8.14 program, PRELIS 2.14 should be used to calculate the Pearson correlation matrix and check multivariate normality of inputting data. The correlation matrix can serve as the input matrix for LISREL in estimating the hypothesized theoretical model. Table 6.3 lists the summary statistics of the 15 variables and shows that they have a relatively normal distribution since the skewness and kurtosis do not exceed the absolute value of 1. Therefore, the inputting data meet the assumption needed for running LISREL.

Table 6.3 Summary Statistics for the Fifteen Variables

Variables	Mean	St. dev.	Skew.	Kurt.	Min.	F.	Max.	F.
Employee satisfaction	7.51	2.07	-0.69	-0.35	0.50	1	10.00	23
Product quality	26.78	5.23	-0.22	-0.30	9.00	1	35.00	24
Customer satisfaction	8.09	1.49	-0.85	0.89	2.00	1	10.00	40
S.B. performance	13.63	4.64	-0.06	-0.73	5.00	10	25.00	1
Leadership	40.00	31.22	5.55	-0.36	-0.63	18.00	2	
Supplier management	22.08	4.03	-0.42	-0.19	9.00	1	30.000	4
Vision and plan	30.61	5.94	-0.44	-0.59	15.00	2	40.00	9
Evaluation	36.82	6.52	-0.18	-0.56	20.00	1	50.00	4
Process control	25.70	4.59	-0.35	-0.44	12.00	1	35.00	3
Product design	29.08	4.86	-0.13	-0.34	15.00	1	40.00	3
Quality system	18.67	4.97	-0.34	-0.96	8.00	3	25.00	38
Employee participation	29.44	5.17	-0.17	-0.57	16.00	1	40.00	2
Recognition and reward	22.18	4.06	-0.27	-0.18	10.00	2	30.00	9
Education	22.05	4.17	-0.11	-0.91	13.00	1	30.00	6
Customer focus	23.99	3.87	-0.45	0.10	11.00	1	30.00	17

Note: S.B. performance means strategic business performance; F. means frequency.

The path coefficients are listed in Table 6.4 (second column) and Figure 6.4, respectively. Among the 17 hypotheses, eight were strongly confirmed by the empirical data ( $p < 0.01$ ), two were moderately confirmed ( $p < 0.05$ ), one was weakly confirmed ( $p < 0.10$ ). Six hypotheses were not confirmed. The overall goodness-of-fit indices are also listed in Table 6.4. The value of the goodness-of-fit index ( $GFI = 0.96$ ) is satisfactory since it is larger than the threshold value of 0.90. The value of the adjusted goodness-of-fit index ( $AGFI = 0.85$ ) is slightly below the threshold value of 0.90. The value of the root mean square error of approximation ( $RMSEA = 0.077$ ) is below the value of 0.08, which indicates a fair fit. The root mean square residual ( $RMR = 0.028$ ) is smaller than the value of 0.05, which indicates a better model fit. The Chi-square, 71.69 with 33 degrees of freedom, is significant ( $p = 0.00$ ), which indicates a bad model fit. This may be partly due to the sample size in this study being greater than 200. In a word, the overall model-fit of model  $M_0$  is mediocre. One thing should be mentioned here: The 11 TQM implementation constructs are related. In testing the model  $M_0$ , their relationships were taken into account. For clarity, their relationships (arrows) are not shown in the theoretical model.

However, an acceptable fit alone can never guarantee that another model will not fit even better. Opportunities for improving the model-fit can be obtained from the largest values of the standardized residuals, the modification index, and the expected change parameter.

In this research, the theoretical model  $M_0$  was changed once according to the information provided by LISREL. This was a sequential process; after each round of modification, the



results were analyzed and new changes introduced. During this sequential process of model modification, the Model  $M_0$  was used as a benchmarking model. On the basis of Model  $M_0$ , the largest standardized residual was 4.03 for quality system improvement and strategic business performance. LISREL suggested to add a path from quality system improvement to strategic business performance. Thus, the theoretical model  $M_0$  was modified by removing the non-significant paths and adding the new one. This change resulted in Model  $M_1$ . Table 6.4 shows the overall model-fit of Model  $M_1$  and path coefficients in comparison with Model  $M_0$ . The path coefficients are also presented in Figure 6.5. The values of the GFI, AGFI, and p-value increase. The values of the RMSEA, the RMR, and the Chi-square decrease. Therefore, Model  $M_1$  has a better model-fit compared with Model  $M_0$ .

Table 6.4 Maximum Likelihood Estimates for Models  $M_0$  and  $M_1$

Parameters	Model $M_0$	Model $M_1$
$\gamma_{11}$	0.33(3.69)	0.34(3.95)
$\gamma_{22}$	-0.05(-0.54)	--
$\gamma_{23}$	0.22(1.87)	0.26(3.16)
$\gamma_{24}$	0.05(0.41)	--
$\gamma_{25}$	0.23(2.41)	0.28(3.56)
$\gamma_{26}$	0.10(1.15)	--
$\gamma_{27}$	-0.02(-0.19)	--
$\gamma_{18}$	0.15(1.29)	0.15(1.45)
$\gamma_{19}$	0.18(1.91)	0.19(2.03)
$\gamma_{1\ 10}$	0.01(0.12)	--
$\gamma_{3\ 11}$	0.30(5.09)	0.30(5.09)
$\gamma_{41}$	0.27(3.83)	0.13(1.79)
$\gamma_{47}$	--	0.30(4.17)
$\beta_{21}$	0.29(4.83)	0.27(4.58)
$\beta_{31}$	0.15(2.47)	0.15(2.49)
$\beta_{32}$	0.42(6.67)	0.42(6.70)
$\beta_{42}$	0.34(4.28)	0.33(4.87)
$\beta_{43}$	0.10(1.25)	--
Chi-square ( $\chi^2$ )	71.69	57.48
Degree of freedom	33	38
P-values	0.0001	0.022
GFI	0.96	0.97
AGFI	0.85	0.89
RMSEA	0.077	0.051
RMR	0.028	0.022

Notes: T-values are in parentheses.

Symbol "--" means not available.

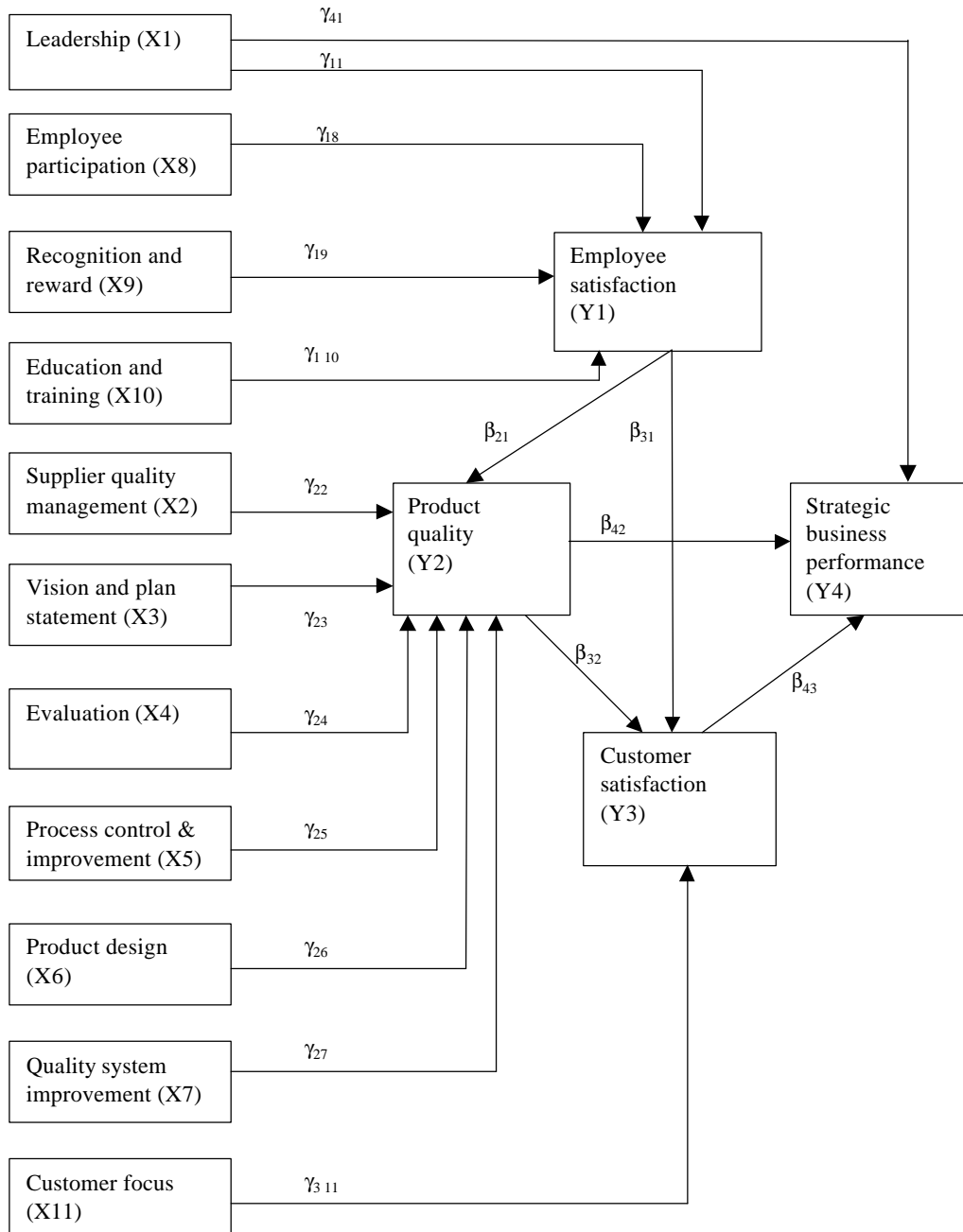


Figure 6.3 Theoretical Model of TQM Implementation Constructs and Overall Business Performance

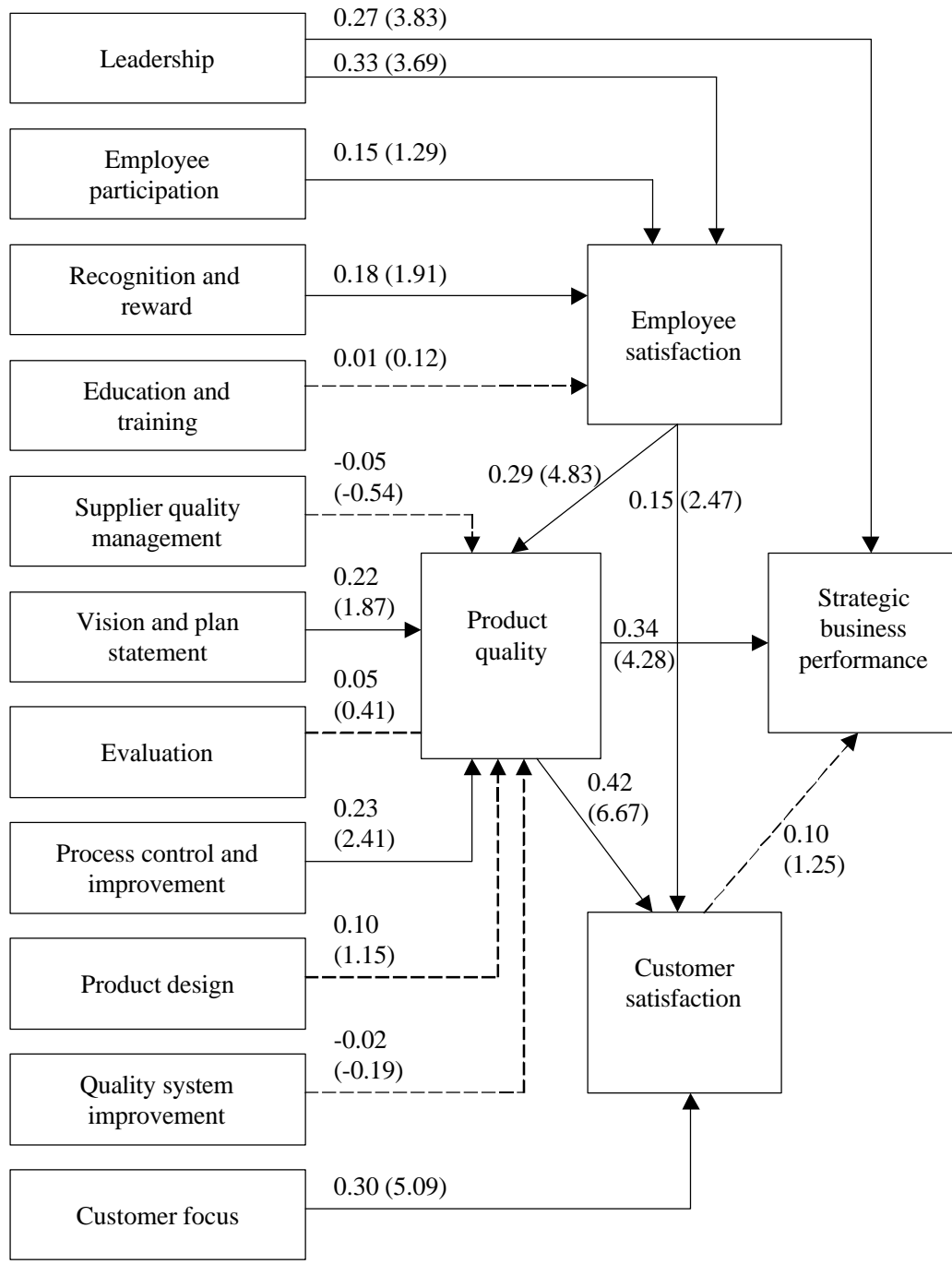


Figure 6.4 Testing the Theoretical Model of TQM Implementation Constructs and Overall Business Performance ( $M_0$ )

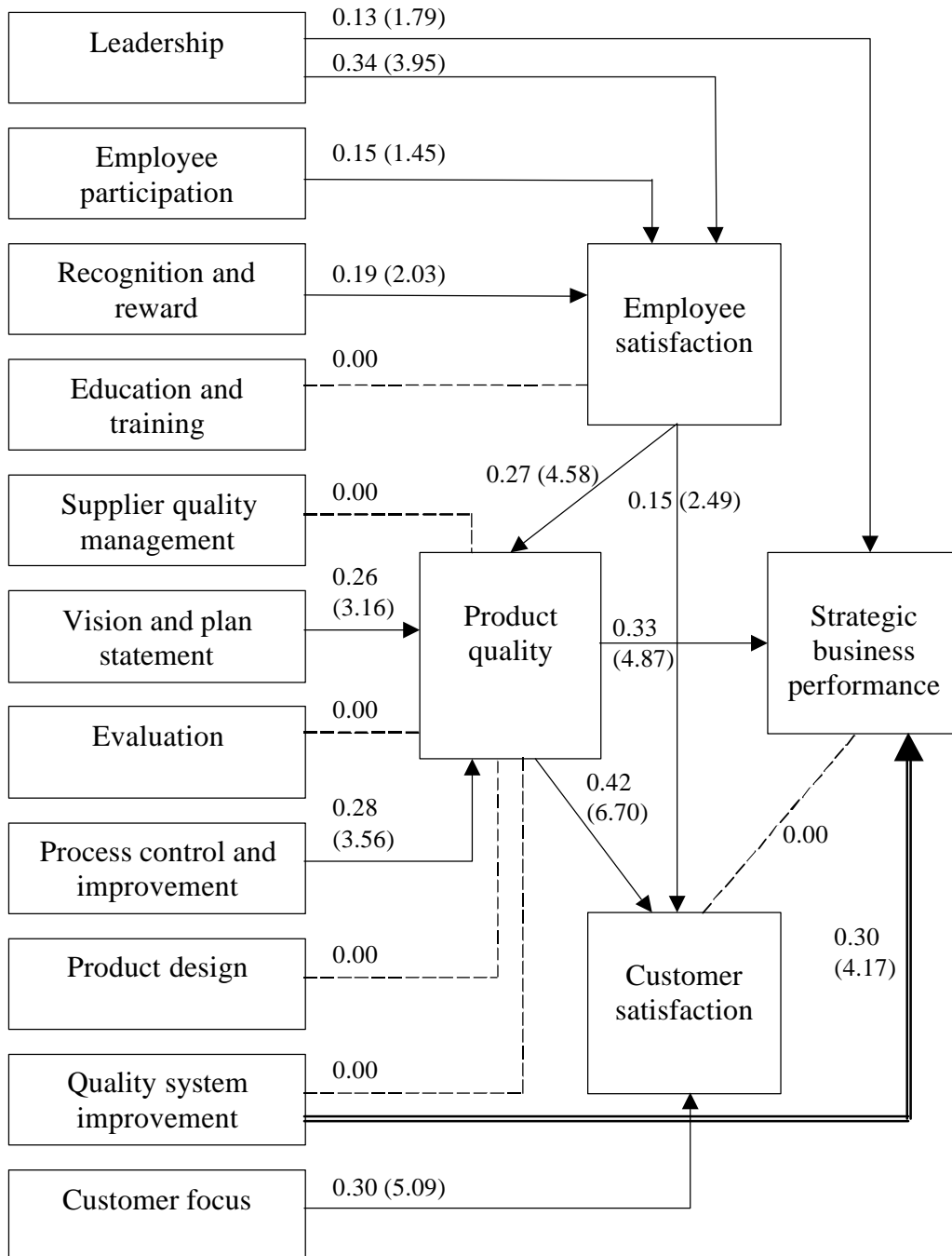


Figure 6.5 Testing the Theoretical Model of TQM Implementation Constructs and Overall Business Performance (M<sub>1</sub>)

## **6.5 Interpretations of Results**

One of the most interesting parts of conducting empirical research is to interpret the research findings, however, caution should be exercised in interpreting the results obtained from statistical data analysis (Madu, 1998). There may be a temptation to overstate the findings. In fact, interpretations should be based on a total view of the sampling frame. For example, the use of small samples may reduce the power of the test. Therefore, care should be taken not to overgeneralize the results. There are several inherent weaknesses in the questionnaire survey. When analyzing the data in questionnaires, it is important to keep in mind the following issues:

- The results might be affected by the position of the respondents in the firms. For example, in most cases the persons who had the most responsibilities for quality management completed the questionnaires. These respondents' views might be different from those of other persons in the firms.
- The results might be affected by the education and quality management knowledge of the respondents.
- Some respondents might tend to answer questions in a way that would show their firms in a positive light.
- Some respondents might tend to answer questions in a way that would show their firms in a negative light.

Thus, consideration should be given to these factors when interpreting research findings. In this study, the ten structured interviews and existing research findings were used to help the author interpret the questionnaire findings. Thus, the bias of interpretations might be avoided. More explanations were provided for the hypotheses that were not confirmed by the data.

### **6.5.1 TQM Implementation**

From the results of testing the model of TQM implementation and overall business performance, it can be concluded that TQM implementation has positive effects on employee satisfaction, product quality, customer satisfaction, and strategic business performance. Therefore, this research supports many findings from other researchers. It is not necessary to further discuss the effects of TQM implementation on overall business performance. Concerning the effects of the 11 constructs of TQM implementation on overall business performance, the following paragraphs provide detailed explanations.

#### **Leadership**

The questionnaire findings revealed that leadership has positive effects on employee satisfaction ( $P < 0.01$ ) and strategic business performance ( $P < 0.05$ ). If the characteristics of Chinese manufacturing firms are taken into account, it is much easier to understand the important roles of top management in Chinese firms. China is now trying to establish

modern firm systems. Various firms (including state-owned) have received more decision-making autonomy than ever before. Regarding day-to-day operations, the government has no direct administrative authority. Officially, state-owned firms are owned by “the whole of the people” whereas collective firms are owned by “part of the people”. In fact, a firm’s general manager is the person legally in charge of the firm under the Firm Manager Responsibility System. It is the role of top management to determine the firm’s vision, strategy, policy, long-term goals, and the way to achieve these objectives. Top management is in charge of managing employees, motivating them to participate in quality improvement activities, encouraging them to share in the firm’s vision, empowering them to solve quality problems, arranging resources for their education and training, and rewarding them for their quality improvement efforts. The ten interviews indicated that top management is the most important factor leading to the success of TQM implementation and strategic business performance. Although most interviewees stated that employees’ income was the most important factor affecting employee satisfaction, a few others indicated that employees being treated equally by top management was the most important factor for overall employee satisfaction. One interviewee said: “We do not want to ask more. We just want to be treated equally by top management.” According to the results of interviews, leadership is the second most important factor affecting employee satisfaction. As a result, the questionnaire findings are consistent with the results obtained from the structured interviews.

### **Supplier Quality Management**

The questionnaire survey findings did not provide significant statistical evidence to support the hypothesis that supplier quality management has a positive effect on product quality. The ten interviews helped the author explain this seemingly conflicting research finding. All interviewees stated that the long-term cooperative relations with their suppliers had not yet been established. They had to conduct inspection for purchased materials from their suppliers in order to ensure specified quality levels. Poor product quality from suppliers was one of the major factors impeding the improvement of product quality. Nine of ten interviewed firms had product quality problems because of poor quality products from their suppliers. Most interviewed firms had to purchase relatively low quality products since such products’ producers did not require buyers to pay immediately. Suppliers that can produce high quality products always require buyers to pay immediately, however, due to the problem of “Triangle debt” in China, the interviewed firms did not have sufficient money for immediate payment. On average, each of these firms owed RMB 88 (USD 10.6) million to their respective suppliers. Under such a circumstance, there was a desire for them to have more suppliers in order to ensure availability of supply and to provide purchasing leverage. According to the current practices of these firms, it was not necessary for them to participate in supplier quality management if suppliers could provide high quality products. They were only involved in supplier quality management if these suppliers provided low quality products. It is better to say that firms’ supplier quality management activities were always related to such suppliers that produced relatively low quality products. The more they were involved in supplier quality management, the more quality problems the suppliers had. Therefore, it is understandable that the hypothesis that supplier quality management has a positive effect on product quality was not confirmed by the data. One interviewee pointed out that because of the limited buying power for many consumers, and the far-from-perfect market, price was still the decisive factor in buying a product. Many inexpensive products,

while low in quality, still had quite a large market. Therefore, they believed that to survive in the short term, they had to sacrifice high quality for cheaper price. One interviewee said, "We can manufacture our product better in quality if we use imported materials. But the cost will be higher too. It will be very difficult to find the market for such products. What do you want: High quality for long term, or short term for survival?"

### **Vision and Plan Statement**

The questionnaire survey strongly confirmed the hypothesis that a vision and plan statement has a positive effect on product quality ( $p < 0.01$ ). Of the 10 firms interviewed, nine had vision statements that had been made mainly by top and middle management. Only three interviewees stated that their employees were involved in drawing up the vision statements. All of the firms had various plans such as strategic business performance plans, quality policies, quality goals, and quality improvement plans. In most cases, quality goals and strategic business performance plans were assigned by the administrative bureaus. However, these firms had their own objectives that were based on the plans from the administrative bureaus. Generally, top and middle management made these plans. On average, approximately 80% of employees knew their firms' vision and plan statements. According to the interviewees, their vision and plan statements effectively encouraged employees to work hard to improve product quality, reduce costs, and satisfy customers. Therefore, the results obtained from the questionnaire survey are consistent with those obtained from the structured interviews.

### **Evaluation**

The hypothesis that evaluation has a positive effect on product quality was not confirmed by the questionnaire survey data. All the quality managers interviewed said that various evaluation activities had been adopted in order to improve their competitive advantages. "Due to fierce market competition we are facing, we have to pay more and more attention to our product quality", one quality manager said. In fact, these firms did understand their problem areas through evaluation activities, however, how to solve these problems was another issue. One quality manager said, "It should be clear that identifying problems is much easier than solving these problems. A number of problems cannot be solved under the current situation. For example, our production equipment is very outdated, and cannot fully meet production requirements. We cannot innovate equipment because of a money shortage. We can improve our product quality if we buy high quality products from qualified suppliers. We cannot do that since we do not have enough money available to pay our purchasing materials immediately". When asked to describe the relationships among product quality, cost reduction, and customer satisfaction, quite a few interviewees regarded the three as equally important. Some believed that under certain circumstances cost reduction was the most important. One quality manager said, "We have to reduce costs in order to make our products more competitive in the marketplace. Price is still the decisive factor for selling a product in the market. China has different layers of consumers. Many cheaper products with relatively low quality still have quite a large market for low-income consumers." Another said, "We have a very formal organizational structure, which is the large number of staff sections with responsibilities overlapping those within production workshops. The major problem of this formal structure is that it seems everyone is

responsible, but no one is really responsible. Therefore, it is difficult to implement improvement actions.” According to these interviewees, the implementation was more difficult than the formulation. Evaluation activities cannot directly lead to improving product quality if improvement actions cannot be implemented effectively. One interviewee said, “Quality improvement plans can be implemented if money is not required. Quality improvement plans are more difficult to implement if money is needed”. It should be noted that evaluation activities cannot improve product quality automatically if no actions are taken. Some figures, for example, defective rate, only tell how many items of a given type were produced last month, with comparisons month to month and year to year. Such figures only tell management how things have been happening, but do not point the way to improvement. According to these interviewees, effective evaluation activities can contribute to product quality improvement if improvement actions formulated on the basis of evaluation activities can be taken in practice.

### **Process Control and Improvement**

The hypothesis that process control and improvement has a positive effect on product quality was strongly confirmed by the data ( $p < 0.01$ ). The results from interviews also support this questionnaire finding. According to the interviewees, they paid much attention to process control and improvement in order to ensure that their products performed the functions for which they were intended to meet manufacturing and safety requirements. They also stated that they adopted incoming, in-process, and final inspection in order to ensure that the finished products could meet the requirements of specifications. They used various quality tools and techniques such as statistical process control, the seven QC tools, and the PDCA cycle, which had positive effects on improving their product quality. Concerning process control and improvement, one problem was that their equipment was obsolete and sometimes could not meet production requirements. Much energy had to be spent on equipment maintenance. The other problem was that the work ethic was relatively undeveloped and skill levels as a whole were relatively low. Many employees still needed a great deal of supervision.

### **Product Design**

This questionnaire survey data provided no significant statistical support for the hypothesis that product design has a positive effect on product quality. The frame of respondent firms and the interviews were used to explain this disconfirmation, which is listed as follows. First, several respondent firms might not have their own research & development departments. Thus, they did not have their own product design activities. Such firms only produced products according to their customers’ requirements, generally using drawings from their customers. Therefore, the estimation between product design and product quality might have been biased to some extent. Second, it was not clear as to what kinds of products these respondent firms produced. If they produced standardized products, product design had less influential power on final product quality. For such firms, the main goal of product design was to meet the national standards for product quality. Thus, their product design did not tend to affect final product quality. Third, some firms could design products with high quality performance. The problem was that they could not produce such products using obsolete equipment and thus had to compromise between product design and production



capabilities. Fourth, production costs might be a reason affecting product design. For example, firms had to reduce design standards so that they could produce these products with less production cost. However, the ten structured interviews revealed that product design has positive effects on product quality. Why did this seemingly conflicting result emerge? The reason is as follows: Compared with the respondent firms for the questionnaire survey, these ten interviewed firms were above average in terms of their TQM implementation. All of the ten interviewed firms had their own R&D departments. They produced non-standardized products. Therefore, their product design activities greatly influenced their final product quality. Thus, it is not difficult to understand why the hypothesis that product design has a positive effect on product quality was not confirmed by the questionnaire survey data.

### **Quality System Improvement**

It was interesting to find that quality system improvement does not have a positive effect on product quality, while quality system improvement has a positive effect on strategic business performance ( $P < 0.01$ ). In this study, quality system improvement means to establish a quality system according to ISO 9000 requirements. ISO 9000 has been introduced nationwide in China since 1993. Undoubtedly, governmental policies and regulations have played a very important role in encouraging firms to implement ISO 9000. By the end of 1998, 8,117 firms in China had received ISO 9000 certification, 556 in Liaoning Province (CNACR, 1999).<sup>20</sup>

The hypothesis that quality system improvement has a positive effect on product quality was not confirmed by the questionnaire survey data. Several reasons might lead to this disconfirmation. First, it was estimated that most of the respondent firms had established their quality systems according to ISO 9000 requirements. A number of respondent firms had obtained ISO 9000 certification, however, the exact number of those implementing ISO 9000 and receiving ISO 9000 certification was unclear. Thus, the estimation between quality system improvement and product quality might have been biased to a certain degree. Second, it might be possible that some respondent firms had already been implementing TQM for a long time. These firms already had good quality systems in place. Implementing ISO 9000 or obtaining ISO 9000 certification could not improve such firms' product quality. Third, it might be possible that some certification bodies did not audit quality systems very well. Some certified firms did not effectively establish their quality systems according to ISO 9000 requirements. For such firms, implementing ISO 9000 and obtaining ISO 9000 certification were just a formality. This research finding was consistent with the results obtained from the state supervision and inspection of product quality. In the first quarter of 1996, the China State Bureau of Quality and Technical Supervision sampled 17 kinds of products for inspection from 16 manufacturing firms that had ISO 9000 certification. The

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<sup>20</sup> China has two ISO 9000 certification systems, one organized by the China State Bureau of Quality and Technical Supervision and the other by the China State Administration of Import and Export Commodity Inspection. The figures presented here are only from China National Accreditation Committee for Quality System Registration Bodies under the China State Bureau of Quality and Technical Supervision. The exact number of ISO 9000 certificates in the country remained unclear.

sample conformity rate was only 76.5%, and the average sample conformity rate in 1996 was 77%<sup>21</sup>. These figures showed that there was no difference in terms of product quality between firms with ISO 9000 certification and those without. This finding further revealed that ISO 9000 is not a guarantee of higher product quality.

This study found that quality system improvement has a positive effect on strategic business performance ( $P < 0.01$ ), possibly due to the following reasons: Before 1991, China had the programs of the Excellent-Quality Product Prize and the Quality Management Prize. If firms received such prizes, they were regarded as excellent. Unfortunately, the State Council terminated these award activities in 1991<sup>22</sup>. Thus, it seemed that no universal criteria existed for assessing firms' quality management. Since ISO 9000 was introduced in China in 1993, it has become a fad in Chinese industries. Due to misconceptions about ISO 9000, many practitioners thought that it was a panacea. ISO 9000 certification was regarded as a passport to the world market. Thus, more and more firms began to implement ISO 9000 even though some managers did not understand what it was. Some firms required their suppliers to implement it and obtain ISO 9000 certification. The Chinese government also made relevant policies to encourage firms to implement it. For example, firms without ISO 9000 certification were not permitted to tender for key state projects. Therefore, some firms had to implement it and finally obtained ISO 9000 certification. According to the firms interviewed, most of them had increased their annual sales, market share, profits, sales growth, and exports since they received ISO 9000 certification. According to these interviewees, if they had not obtained certification, their strategic business performance would have been declining. ISO 9000 certification is a strong marketing promotion tool in China.

### **Employee Participation**

The hypothesis that employee participation has a positive effect on employee satisfaction was weakly confirmed ( $p < 0.10$ ) by the questionnaire survey data. Chinese society has historically been dominated by respect for age and hierarchy of authority (Hofstede, 1980; Shenkar and Ronen, 1987), which may inhibit technical and organizational innovation. Face consideration may inhibit critical discussion of issues. The power/authority dynamic lies at the very heart of Chinese culture and society. According to Adler (1991), participatory management models are not appropriate for cultures with large power distance. This implies that it may not be appropriate to implement employee participation in China or it should perhaps be implemented differently.

According to the ten interviewed quality managers, employee participation in their respective firms was actually "forceful" and not based on the free will of the employees. This is a remarkable characteristic of Chinese employee participation, which is different from Western countries. Suggestion activities were normally organized by the trade unions, which are becoming increasingly involved in the day-to-day management of the firms. One of their principal tasks is to develop the employees' roles as masters of their firms. Employee participation can also be undertaken through workers' congresses, generally held twice a year

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<sup>21</sup> This was obtained from Zhang (2000b).

<sup>22</sup> This was obtained from Zhang (2000b).

in a firm. At these congresses, the firm's manager generally reports the business progress so far and proposes a plan for the next scheduled period. Representatives from different departments at the congress will discuss every detail of the manager's report, and decide whether to approve it. All representatives are encouraged to put forward their opinions, suggestions, and possible modifications about the report. The congresses also examine all rules and regulations issued in the firm, involve important decision-making, as well as check, supervise and appraise the firm's management. In Chinese firms, the workers' congress stands for the principle of "democratic management".

All of the ten interviewed firms used some type of teams as part of their TQM efforts. These teams included, for example, cross-functional teams, within-functional teams, and QC circles. Cross-functional teams were usually appointed by top management, while within-functional teams and QC circles were formed by different functional departments. In terms of the effects of these teams, cross- and within-functional teams were better than QC circles, as they usually dealt with some important issues. Therefore, management provided the teams with sufficient resources. QC circles, conversely, dealt with some unimportant issues. Compared with cross- and within-functional teams, they had less support from top and middle management. Concerning the effects of QC circles, different interviewees had different views. Seven interviewed firms stated that their QC circles had effects on improving product quality and financial profits. Three interviewees stated that they did not see such effects. However, one quality manager said, "Even though we do not see such effects, we still think it is still necessary to organize QC circle activities in our firm. QC circle participants can share their values and learn from each other. QC circles can enhance employees' enthusiasm for work and commitment to quality improvement activities." According to the most interviewees, employee participation activities as a whole have a positive effect on employee satisfaction.

### **Recognition and Reward**

The hypothesis that recognition and reward has a positive effect on employee satisfaction was moderately confirmed by the survey data ( $p < 0.05$ ). Although Deming (1986) argued persuasively that the focus on individual performance and related evaluation and reward practices causes major dysfunctions and organizational ineffectiveness, the research conducted by Jenner et al. (1998) suggested that it is very important for having a successful TQM implementation in Chinese firms if the contributions made by all employees toward TQM implementation is clearly linked to rewards. In fact, recognition and reward activities have been used extensively in various Chinese firms for many years. All the interviewed firms had regulations regarding recognition and reward. These activities included, for example, public recognition, salary increasing, promotion, bonus, non-monetary rewards (spirit rewards). According to the quality managers interviewed, these recognition and reward activities did motivate employees to enhance their commitment. However, attempts to motivate employees through ideology and politics have become increasingly less effective compared with some years ago. According to the ten interviewees, employee recognition and reward programs do contribute to employee satisfaction.

Contrary to recognition and reward, both monetary and non-monetary penalties have been used by the ten interviewed firms. China's firm reform is under way. The introduction of the

contract system in most Chinese firms means that their retained profits have become linked to economic returns, while employees' incomes have been tied to individual performance. A very high portion of employee income is dependent upon employees' performance. According to the ten interviewees, the penalty schemes forced employees to follow regulations, especially low educated employees who were lax in work discipline. Otherwise, employees could not realize the importance of quality. One interviewee said, "If we do not penalize employees who do not follow regulations, highly performed employees will be demotivated. In fact, penalties are special recognition and 'reward', that is, for poorly performing employees. Our firm's quality management is highly dependent on penalties. They do work." Since China began to establish the modern firm system, many firms have laid off excessive employees, especially in Liaoning province. Liaoning is an old industrial base in China created by the State through huge investments in the 1950s and 1960s. However, since the early 1990s, many state-owned firms have been pushed to the brink of bankruptcy due to serious debts. As a result, numbers of employees have been laid off. A survey of provincial departments indicated that about 2 million employees in the province were laid off from 1994 to 1998 as firms struggled to cut costs (Jiang, 1999). Therefore, if employees had not performed well, they would face being laid off.

### **Education and Training**

The questionnaire survey data did not support the hypothesis that education and training has a positive effect on employee satisfaction. According to the interviewees, the main objectives of their education and training programs were to improve employees' skills and enhance their commitment. Thus, employees had the capacity to do their jobs better. In fact, improving employee satisfaction was not the major goal of education and training. Compared with other TQM implementation constructs, such as leadership, recognition and reward, and employee participation, education and training had less influential power on employee satisfaction. These interviewees admitted that education and training is very important for the success of their TQM implementation. Their statements supported the research findings by other researchers. The study by Kassieh and Yourstone (1998) suggested that TQM training is a key to successful implementation of TQM along the dimensions of cost reduction and profit increase. Employee competencies on TQM principles and techniques are the basis of TQM's success. Green (1990) stated that if China is to become more competitive as a manufacturing locale, it must strive to educate its workforce, from management levels down, to integrate the concept of quality at all stages of production.

All firms interviewed had education and training programs related to quality management. These programs covered ISO 9000, quality consciousness, working discipline, statistical process control, and special job skills. Different firms had different training programs for various functional people, according to their job requirements. However, ISO 9000 was their training focus and all firms had ISO 9000 training programs. Employees were trained to follow documented procedures to perform their jobs. Consistent with the finding by Yu et al. (1998), three of the ten firms had training programs for statistical process control. Most had training programs of quality consciousness and labor discipline. However, one interviewee even said, "We used penalties instead of the programs of quality consciousness and labor discipline. Penalties are the best way to educate irresponsible employees." The

major problem regarding education and training in these interviewed firms was money shortage; six out of ten interviewees said money used for education and training was not sufficient. Money is the major limitation that impedes education and training in these firms.

It is no doubt that education and training is very important. However, its effects should not be overestimated. According to the interviewees, it has more positive effects on intellectuals than on production line operators in terms of job satisfaction. According to Cherrington (1995), when absenteeism and turnover are high and when employees express dissatisfaction, many managers think that the obvious solution is a firm-wide training program. Unfortunately, the benefits of training and education are sometimes overestimated. Training programs do not cure all organizational problems, although they certainly have the potential to improve many situations if conducted properly.

### **Customer focus**

The hypothesis that customer focus has a positive effect on customer satisfaction was strongly confirmed by the survey data ( $p < 0.01$ ). According to China Daily (July 13, 1999), the biggest state-owned firm in the Liaoning region departed the heaven of the planned economy and stepped into the market economy. Product quality, efficiency, and service became its top priorities. In this study, all the quality managers interviewed admitted that the implementation of a market economy in China has caused competitive pressures to increase. They have had to pay more attention to the quality of products and services. The current situation is totally different from several years ago. All the firms interviewed conducted market investigations and customer satisfaction investigations in order to improve their quality of products and services. All of them established formal feedback systems in order to collect customer complaint information and provided quality warranty and after-sales services in order to pursue customer satisfaction. Some even provided quality guarantee deposit. According to the interviewees, these customer-oriented measures contributed to customer satisfaction in one way or another. Therefore, the interviews support the questionnaire finding.

## **6.5.2 Overall Business Performance**

### **Effects of Employee Satisfaction**

The hypotheses that employee satisfaction has a positive effect on product quality and customer satisfaction were confirmed by the questionnaire survey data. Therefore, it is not necessary to provide more explanations here. In fact, within firms, employees are the ones who deliver satisfaction to their customers. They are a firm's eyes and ears for transferring customer needs and expectations into products and services. Employees are enablers of the firm's vision and strategies to deliver value to customers and make the firm competitive in the marketplace. The interviewees also admitted that satisfied employees could make more contributions to the improvement of product quality and customer satisfaction. To value customers, a firm must first value its employees.

### **Effects of Product Quality**

The questionnaire survey data confirmed the hypotheses that product quality has a positive effect on customer satisfaction and strategic business performance. These findings are consistent with the results obtained from the interviews. Therefore, it is not necessary to provide more explanations here. Quite a few interviewees stated that reducing costs and improving product quality were equally important. Customers would be satisfied if firms could provide high quality products with reasonable price. Firms' strategic business performance would be improved on the basis of cost reduction and product quality improvement. Firms can gain returns from their efforts to product quality.

### **Effects of Customer Satisfaction**

However, the hypothesis that customer satisfaction has a positive effect on strategic business performance was not confirmed by the questionnaire survey data. Some interviewees admitted that their efforts to improve customer satisfaction led to the success of strategic business performance. Quite a few interviewees had different opinions. One said, "Market competition is now very fierce. Sluggish demand on the global market has hampered exports of Chinese commodities, leaving supply larger than demand on the Chinese market. We have to increase local market share through providing excellent after-sales services. We have sales offices and after-sales service personnel in every province in China. This effort costs a lot of money every year. Although our customer satisfaction increases, our profits decrease. In the long run, we may gain benefits from our customer focus efforts." Another said, "Fierce price wars break out in the industrial sector. Many manufacturing firms faced with a slack market resulting from an oversupply of goods resort to price discounts to secure market share. However, instead of benefiting from heavy discounting, many firms, already tottering on the brink of bankruptcy, are dragged deeper into the mire. Customers get benefits from discounting. Firms lose profits." Currently, many organizations in China face the difficulties of a lack of money. Therefore, price is one of the most effective competitive weapons. Means of competition that reduces price among repeat buyers is therefore becoming increasingly important. In fact, today's customers are much harder than ever before; it is very difficult to delight them. They are smarter, more price-conscious, more demanding, less forgiving, and approached by more competitors with equal or better offers. If the firm increases customer satisfaction by lowering its price or increasing its services, the result may be lower profits or lower annual sales. Spending more to increase customer satisfaction might divert funds from increasing the satisfaction of other partners such as employees and suppliers.

Of the five indicators of strategic business performance, exporting is a different issue. It is highly dependent on a firm's policy, targeted markets, market competition, selected manufacturing areas, and international environments. Although the Chinese government strongly promotes manufacturing firms in exporting products to foreign countries (exporting firms can enjoy an approximately 15% tax rebate rate), many Chinese manufacturing firms have still sold their products in the local market. Of the 212 respondent firms, only half exported products to foreign countries. Thus, the estimation between customer satisfaction and strategic business performance might be biased. Exporting products is highly dependent on the international marketing environment. In fact, customer satisfaction is only one of the

factors that affect a firm's exports. Compared with other factors, it may have less influence on exports. Based on the interviews and analysis mentioned above, it can be concluded that customer satisfaction does not necessarily lead to increasing annual sales, sales growth, profits, market share, and exports. According to Fornell (1992), it is far from certain that market share and customer satisfaction are positively correlated. In fact, the opposite could well be the case. The impact of customer satisfaction on repeat business is not the same for all industries. All firms are not equally affected by customer satisfaction. If a firm serves a large number of customers, it is possible that it has some problems with customer dissatisfaction. It is more difficult for the firm with a large market share to have a high average level of customer satisfaction, especially if customer tastes are heterogeneous. Although the hypothesis that customer satisfaction has a positive effect on strategic business performance was not confirmed by the empirical data, it cannot be assumed that customer satisfaction is unimportant and can be ignored. However, in the long run, it is possible that customer satisfaction goes along with strategic business performance. The economic returns from improving customer satisfaction are not immediately realized (Anderson et al., 1994).

## **6.6 Conclusions**

Data from 212 Chinese manufacturing firms were used to test the two theoretical models. Contrary to what was hypothesized in the models, a number of hypotheses were not confirmed by the data. Several conclusions obtained from testing the hypothesized models are: (1) TQM implementation has positive effects on employee satisfaction, product quality, customer satisfaction, and strategic business performance; (2) Leadership has positive effects on employee satisfaction and strategic business performance; (3) Employee participation, recognition and reward have positive effects on employee satisfaction; (4) Education and training does not have a positive effect on employee satisfaction; (5) Supplier quality management, evaluation, product design, and quality system improvement do not have positive effects on product quality; (6) Vision and plan statement, process control and improvement have positive effects on product quality; (7) Quality system improvement has a positive effect on strategic business performance; (8) Customer focus has a positive effect on customer satisfaction; (9) Employee satisfaction has positive effects on product quality and customer satisfaction; (10) Product quality has positive effects on customer satisfaction and strategic business performance; and (11) Customer satisfaction does not have a positive effect on strategic business performance.

It is important to view this study in the context of its limitations. First, data used to test the model came from only 212 manufacturing firms with annual sales more than RMB 10 million in the Liaoning region. Strictly speaking, the generalization is limited. Second, customer satisfaction data were obtained from respondents rather than from customers. Thus, the data would not be very reliable and the research findings might have been biased to a certain degree. Third, the measure of perceived employee satisfaction in particular is relatively weak, because it asked respondents for their general perceptions of overall employee satisfaction in their respective firms. Thus, research findings might have been biased.

The research findings have some practical implications. First, TQM implementation has positive effects on overall business performance. Implementing TQM does payoff. Second, leadership is the decisive factor in determining the success of organizational overall business performance. In other words, without strong leadership, it is impossible for a firm to achieve good overall business performance. Third, the research findings can imply that it is not necessary for all the TQM elements to be present to ensure the success of the TQM programs and overall business performance. In other words, even if a few of the elements are not present, it is possible to obtain the required level of overall business performance. Finally, in this study, some hypotheses were not confirmed by the questionnaire survey data. This disconfirmation does not imply these constructs are unimportant or useless. Instead, firms should identify the problem areas of these constructs and implement them more effectively. For example, firms should pay more attention to balancing customer satisfaction and strategic business performance. They should emphasize the implementation of actions that are formulated on the basis of various evaluation activities. They should establish their quality management systems according to the requirements of ISO 9000 effectively. Thus, quality management systems will be effectively implemented in practice. Firms should implement different education and training programs in order to meet the requirements of different employees. They should emphasize supplier quality management in order to select suppliers on the basis of product quality rather than price alone.

In this study, the two theoretical models were formulated mainly on the literature that was developed in Western contexts. However, the models were tested using data from 212 Chinese manufacturing firms. Therefore, a theory of quality management related to Chinese manufacturing firms was developed. It was found that the research findings presented in this study support the quality management theory developed largely in Western contexts. Nevertheless, can quality management theory developed in Western countries actually be applicable in a Chinese context?

China differs from Western countries on a multitude of variables, such as culture, society, political, and economic systems (Shenkar and von Glinow, 1994). It potentially represents the most serious challenge to paradigms developed in the West. Shenkar and von Glinow suggested that organizational theories vary in their degree of applicability to the Chinese context. While some theories such as population ecology seem to be clearly inapplicable, others such as the equity theory of motivation are more suitable. However, no research findings have been reported concerning the universal applicability of quality management theory developed in Western countries in relation to China. In fact, the universal applicability of quality management theory is still the subject of debate. Recently, Rungtusanatham et al. (1998) replicated Anderson et al.'s (1995) empirical evaluation of a Deming-based theory of quality management in an Italian context. The results from their replication study do not fully support the findings obtained from the research conducted by Anderson et al. (1995) in an American context. Therefore, Rungtusanatham et al. (1998) implied that quality management theory developed in one country is best applicable to that country. According to Adler (1983), the conclusion that the results are universal based on a study of two cultures is unwarranted. Although the research findings in this study support the quality management theory developed largely in Western countries, it can be conservatively interpreted to be indicative of possible universality rather than confirming universality. In fact, quality management theory developed in Western countries cannot be universally applicable in a Chinese context due to culture differences. For example, Chinese society has historically



been dominated by respect for age and hierarchy of authority (Hofstede, 1980; Shenkar and Ronen, 1987). The power/authority dynamic lies at the heart of Chinese culture. According to Adler (1991), participatory management models are not appropriate for cultures with large power distance. This implies that it may not be suitable to implement participation, or participation should perhaps be implemented differently in China. This was supported by the results obtained from the interviews in the ten Chinese manufacturing firms. These structured interviews clearly showed that the firms implemented employee participation differently.

