

Exploring the Causal Relationships in the Criteria for Excellence Performance of China

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Abstract

Since the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China published the GB/T19580-2004: Criteria for Excellence Performance of China, many enterprises in China have adopted the Criteria to enhance their organization business management and to assess or self-assess organization performance. On the bases of both the Criteria for Excellence Performance of China and the survey data from China Association for Quality (CAQ), this paper systematically explores the relationships among 'leadership', 'strategy planning', 'customer and market', 'information, analysis and improvement', 'resources management', 'process management', and 'performance results' by using structural equations modeling and validates some of the anecdotal beliefs in quality management. This quantitative analysis provides a guideline for organizations in China to identify causal linkage among core value of total quality management and to identify strengths, deficiency, and opportunities to enhance competitive advantages and ensure the future business success.

Key Words: Performance Results, Structural Equation Modeling, Questionnaire, Data and Analysis

1. Introduction

With the development of global economic, quality has become one of the main successful

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factors for survival and further obtaining competitive advantages in today's business environment. Since China introduced total quality control in 1978, the level of quality management, product quality and service quality have made great progresses. In order to comprehend China enterprises quality management status quo and explore the relationships of core values of total quality management, China Association for Quality (CAQ) organized experts and practitioners in quality management to design questionnaires, which are based on the GB/T 19580-2004: Criteria for Excellence Performance of China (GB/T-19580-2004: 2004). This paper explores the relationships among the criteria model, which is composed of seven categories, such as, 'leadership', 'strategy planning', 'customer and market', 'information, analysis and improvement', 'resources management', 'process management', and 'performance results', by using structural equations modeling. In section two, the Excellence Performance model of China, published by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China in 2004 is introduced, and survey questionnaires that designed by CAQ (one author is the designer) is given. In section three, we analyze the relationships in the Excellence Performance of China by using structural equations modeling. In section four, we present main research results and further problems to be solved.

2. Theory Model and Designed Questionnaires

2.1 The Excellence Performance Model of China

An organization in the process of business improvement can follow a model to obtain competitive advantages, such as Deming Prize (Kondo, 1995), Malcolm Baldrige National Quality Award (NIST, 2007), and European Quality Award (Conti, 1995). Those models provide a way for assessment, self-assessment and diagnosis to improve business performance. In order to steer China enterprises focus on product and service quality, inspire enterprises in pursuit of excellence business results, push enterprises learning and practice criteria for excellence performance, and enhance enterprises participating in globe competitiveness, the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China published GB/T-19580-2004: Criteria for Excellence Performance of China and GB/Z-19579-2004: Assessment Guidelines for Excellence Performance of China (GB/Z-19579-2004, 2004), those are used to assess China quality management award and organizations self-assessment. The model of GB/T19580-2004 is shown in Figure 1.

The model is composed of seven categories, including 'leadership', 'strategy planning', 'customer and market', 'measurement, analysis and improvement' 'resources management', 'process management', and 'performance results', which bears an analogy to the Malcolm Baldrige National Quality Award. In Figure 1, the left three categories, that is, 'leadership',

‘strategy planning’, and ‘customer and market’, are called leadership term, which constitutes an organization driver. In the same way, the right three categories, as such, ‘resources management’, ‘process management’ and ‘performance results’, are called results term, which constitutes an organization results. Both the leadership term and the results term are based on ‘measurement, analysis and improvement.’ The model is carried out by process method, which is composed of four steps: that is, approach, deployment, learning and integration. In addition, the model constitutes a continuous improvement circle. In Figure 1, the parentheses express the scores.

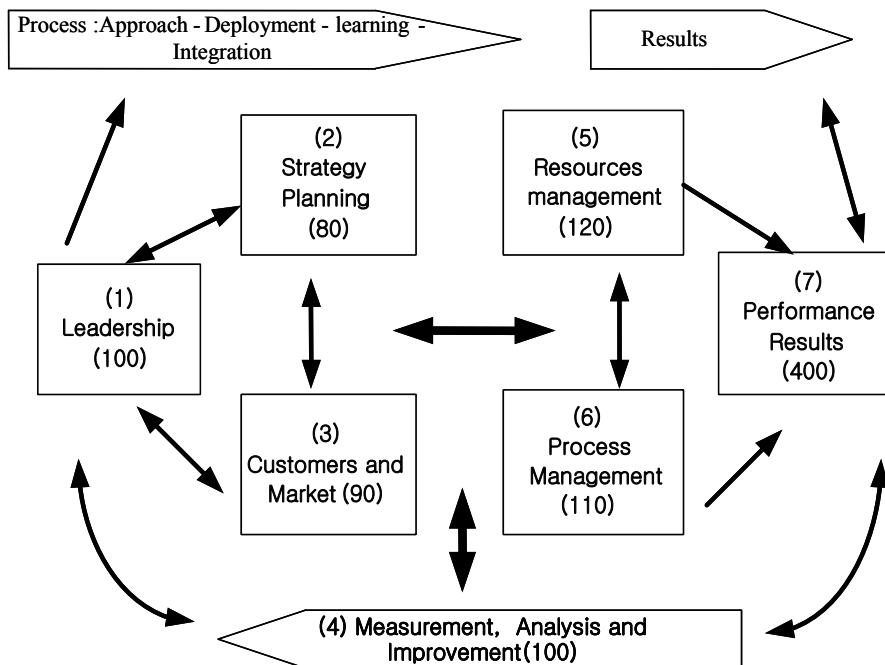


Figure 1. The model of the Criteria for Excellence Performance of China: GB/T19580-2004

2.2 The Design of Survey Questionnaire

According to the Criteria for Excellence Performance of China, the research group designed the questionnaires (the research group, 2007). For leadership category, the research group adopts 10 indicators to describe the characteristics of leadership. In the same way, there are 11 indicators to describe ‘strategy planning’, 8 indicators to describe ‘customer and market’, 9 indicators to describe ‘measurement, analysis and improvement’, 11 indicators to describe ‘resources management’, 22 indicators to describe ‘process management’, and 16 indicators to describe ‘performance results.’ Take ‘leadership’ category as an example, the leadership examines how do you, as a senior leader, lead the organization? And how do you

govern and address social responsibilities? The following ten indicators can be used to describe senior leadership, governance and social responsibilities.

- Senior leaders communicate organizational vision and values to all levels employees.
- Senior leaders communicate organizational vision and values to key suppliers and partners.
- Senior leaders promote an environment that fosters and requires legal and ethical behaviors
- Senior leaders create an environment for empower, innovation and learning.
- Senior leaders regularly review organizations performance and objectives, and transform assessment results into improvement action.
- Organizational governance system can ensure accountability for management's action, and protection of stakeholder and stockholder interests.
- Senior leaders in person guide and encourage employees to participate in organizational quality improvement.
- Organization addresses long term partner relationship with suppliers.
- Senior leaders predict and take measures to reduce any adverse impacts on society of organizational products, services, and operation.
- Senior leaders actively support and take part in local community services, education, health, and environment protection.

Other categories, readers can refer to the appendix, which provides a complete questionnaire. In the appendix, every mark in corresponding category is line with the following analysis.

In order to conveniently analyze sample data, sometimes, we call category as variable.

3. Survey Results and Analyses

3.1 Survey Data

The survey data index from a part of the project, that is, the survey on China enterprises' quality management status quo, which is supported by CAQ. There are 1681 questionnaires returned, of 1647 valid (usable rate 97.9%). Among the respondents, 13.31% is common employees, 56.05% is primary managers, and 30.63% is middle and senior managers. Among survey organizations, 47.8% is manufacturing enterprises, 14.02% is construction enterprise, 28.29% is service organizations and 9.89% is other organizations. The respondents distribute the whole country. The questionnaire used a six-point Likert scale (1 = strongly disagree; 2 = disagree, 3 = little disagree, 4 = little agree, 5 = agree, 6 = strongly agree).

3.2 Descriptive Analyses of Samples

Table 1 presents descriptive analyses for the 1647 valid samples. In Table 1, x_1, x_2, \dots, x_{10} , present 10 indicators of the variable “leadership”, respectively; $x_{11}, x_{12}, \dots, x_{21}$ present 11 indicators of the variable “strategy planning”, respectively; $x_{22}, x_{24}, \dots, x_{29}$ present 8 indicators of the variable “customer and market”, respectively; and $x_{30}, x_{31}, \dots, x_{38}$ present 9 indicators of the variable “measurement, analysis and improvement”, respectively. In the same way, y_1, y_2, \dots, y_{11} present 11 indicators of the variable “resources management”, respectively; $y_{12}, y_{12}, \dots, y_{27}$ present 16 indicators of the variable “performance results”, respectively; and $y_{28}, y_{29}, \dots, y_{49}$ present 22 indicators of the variable “process management”, respectively. In the type

Table 1. Descriptive analyses of sample data

indicators	mean	Standard deviation	indicators	mean	Standard deviation	indicator	mean	Standard deviation	indicator	mean	Standard deviation
X ₁	4.02	1.317	X ₂₆	4.25	1.317	Y ₁	4.07	1.285	Y ₂₆	4.38	1.151
X ₂	4.08	1.274	X ₂₇	4.16	1.351	Y ₂	4.03	1.311	Y ₂₇	4.21	1.195
X ₃	4.52	1.250	X ₂₈	4.02	1.358	Y ₃	3.97	1.303	Y ₂₈	4.11	1.336
X ₄	4.07	1.310	X ₂₉	4.49	1.236	Y ₄	3.93	1.329	Y ₂₉	3.90	1.348
X ₅	4.12	1.392	X ₃₀	4.23	1.303	Y ₅	3.96	1.337	Y ₃₀	4.18	1.381
X ₆	4.23	1.332	X ₃₁	4.05	1.343	Y ₆	3.94	1.337	Y ₃₁	4.09	1.342
X ₇	4.28	1.330	X ₃₂	4.22	1.268	Y ₇	4.42	1.251	Y ₃₂	4.43	1.229
X ₈	4.13	1.364	X ₃₃	4.00	1.329	Y ₈	4.34	1.249	Y ₃₃	3.94	1.396
X ₉	4.58	1.242	X ₃₄	4.16	1.346	Y ₉	4.00	1.362	Y ₃₄	4.08	1.335
X ₁₀	383.	1.367	X ₃₅	4.13	1.335	Y ₁₀	4.19	1.250	Y ₃₅	4.10	1.322
X ₁₁	4.15	1.388	X ₃₆	3.61	1.352	Y ₁₁	3.89	1.319	Y ₃₆	3.87	1.343
X ₁₂	4.11	1.376	X ₃₇	3.47	1.351	Y ₁₂	4.27	1.097	Y ₃₇	3.87	1.438
X ₁₃	3.79	1.311	X ₃₈	3.91	1.361	Y ₁₃	4.17	1.087	Y ₃₈	3.51	1.424
X ₁₄	3.89	1.343				Y ₁₄	4.22	1.102	Y ₃₉	3.87	1.325
X ₁₅	4.10	1.372				Y ₁₅	4.27	1.068	Y ₄₀	4.23	1.318
X ₁₆	3.97	1.349				Y ₁₆	4.35	1.099	Y ₄₁	3.89	1.395
X ₁₇	3.89	1.452				Y ₁₇	4.09	1.123	Y ₄₂	4.03	1.329
X ₁₈	4.59	1.242				Y ₁₈	4.15	1.122	Y ₄₃	3.80	1.390
X ₁₉	4.05	1.371				Y ₁₉	4.06	1.113	Y ₄₄	4.00	1.367
X ₂₀	3.94	1.386				Y ₂₀	4.06	1.131	Y ₄₅	3.77	1.430
X ₂₁	4.04	1.386				Y ₂₁	4.05	1.115	Y ₄₆	3.79	1.313
X ₂₂	3.97	1.348				Y ₂₂	4.11	1.069	Y ₄₇	4.07	1.350
X ₂₃	4.26	1.288				Y ₂₃	4.12	1.112	Y ₄₈	4.19	1.302
X ₂₄	4.17	1.272				Y ₂₄	4.17	1.150	Y ₄₉	4.02	1.381
X ₂₅	4.26	1272.				Y ₂₅	4.22	1.152			

of X variables, The mean of x_{18} is the largest one (the mean value is 4.59), which shows organization take quality as the most important criterion for selecting suppliers, and the mean of x_{37} is the smallest one (the mean value is 3.47), which also shows it is not good to share in data and information among suppliers, partners and customers. In the type of Y variables, the mean of y_{32} is the largest one (the mean value is 4.43), which explains organizations focus on maintaining clean and tidy work environment to enhance efficiency, and the mean of y_{38} is the smallest one (the value is 3.51), which also explains Suppliers don't participate in organization's projects at the stage of product/service design.

In order to ensure indicators of each variable correlation, we conduct a reliability analysis of the scales. The reliability coefficients for 'leadership', 'strategy planning', 'customer and market', 'measurement, analysis and improvement', 'resources management', 'process management', and 'performance results' are listed in Table 2. Each of Cronbach's α is greater than 0.80. Therefore, we conclude that the multi-indicators are reliable measures and can use them for subsequent analysis presented later in this article.

Table 2. Reliability coefficients for variables

Variables	Cronbach's α
Leadership	0.831
Strategy planning	0.860
Customer and market	0.837
Measurement, analysis and improvement	0.817
Resources management	0.860
Process management	0.874
Performance results	0.876

3.3 Structural Equation Model and Research Hypotheses

Structural equation model is composed of measurement model and structural model (Kaplan, 2000). Measurement model describes the relationship between the indicators and latent variables. It can be expressed as:

$$X = A_x \xi + \delta \quad Y = A_y \eta + \varepsilon \quad (1)$$

Where X and Y are vectors consisting of exogenous indicators and endogenous indicators, respectively. A_x is the relation matrix between exogenous indicators and exogenous variables. A_y is the relation matrix between endogenous indicators and endogenous variables. δ and ε are X's and Y's error vector, respectively, and the mean of them both are zero. ξ and η are exogenous latent variables and endogenous latent variables, respectively. And δ has non-

correlation to ξ , ε has no-relation to η .

Structural model describing the relationship between latent variables can be expressed as:

$$\eta = B\eta + \Gamma\xi + \zeta \quad (2)$$

Where B is a coefficient matrix expressing the relation between endogenous latent variables. Γ is also a coefficient matrix describing exogenous variables' effect on endogenous variables', and ζ is error vector, it also reflects endogenous variables that could not explained in structural model, and $E(\zeta) = 0$. In the model, the exogenous variables are independent, while endogenous variables are dependent variables that could not explained in structural model, and $E(\zeta) = 0$. In the model, the exogenous variables are independent, while endogenous variables are dependent.

In our research, we consider 'leadership', 'strategy planning', 'customer and market', and 'measurement, analysis and improvement' as exogenous latent variables, and denoted by ξ_1 , ξ_2 , ξ_3 , ξ_4 respectively. So do 'resources management', 'performance results', and 'process management' as endogenous latent variables, and denoted by η_1 , η_2 , η_3 , respectively. At the same time, we make the following hypotheses.

- H₁: 'leadership' has correlation with 'strategy planning';
- H₂: 'leadership' has correlation with 'customer and market';
- H₃: 'leadership' has correlation with 'measurement, analysis and improvement';
- H₄: 'leadership' has significant effect on 'resources management';
- H₅: 'leadership' has significant effect on 'process management';
- H₆: 'leadership' has significant effect on 'performance results';
- H₇: 'strategy planning' has correlation with 'customer and market';
- H₈: 'strategy planning' has correlation with 'measurement, analysis and improvement';
- H₉: 'strategy planning' has significant effect on 'resources management';
- H₁₀: 'strategy planning' has significant effect on 'process management';
- H₁₁: 'customer and market' has correlation with 'measurement, analysis and improvement';
- H₁₂: 'customer and market' has effect on 'process management';
- H₁₃: 'customer and market' has effect on 'performance results';
- H₁₄: 'measurement, analysis and improvement' has effect on 'resources management';
- H₁₅: 'measurement, analysis and improvement' has effect on 'process management';
- H₁₆: 'resources management' has effect on 'performance results';
- H₁₇: 'process management' has effect on 'performance results';
- H₁₈: 'resources management' has effect on 'process management';

Based on theory analyses and hypotheses, we construct a path diagram (Figure 2). In Figure 2, seven ellipses present seven latent variables, where ξ_1 , ξ_2 , ξ_3 , and ξ_4 are exogenous

variables, respectively, and η_1 , η_2 and η_3 are endogenous variables, respectively. Rectangles present the reflective indicators of those latent variables.

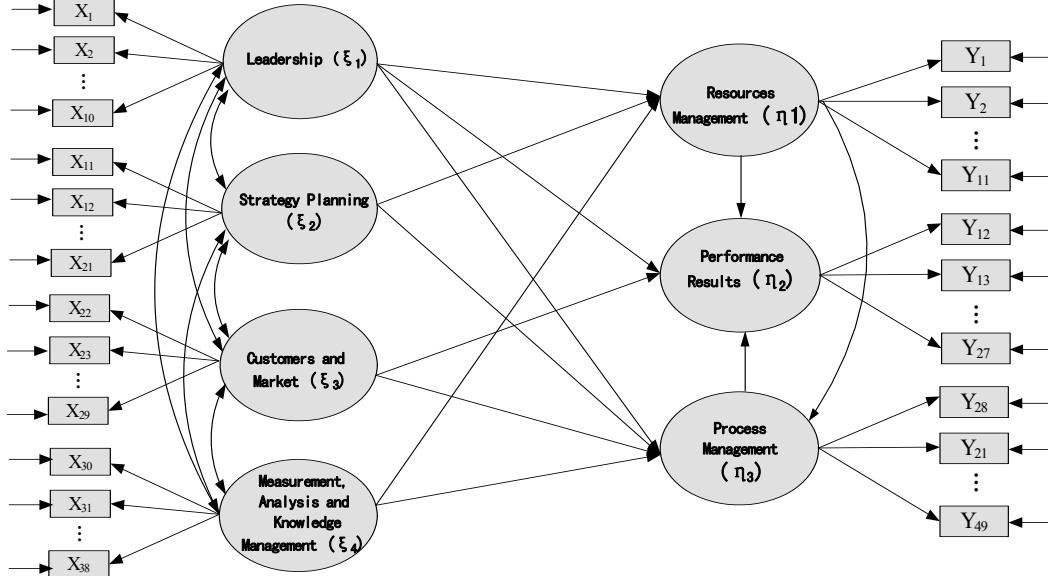


Figure 2. Theory model of structure equation for excellence performance of China

3.4 Analyses of Model

In our research, latent variables, at least, have more than eight indicators. Therefore, the measurement model can be identified. In addition, the parameters in the model to be estimated meet basic condition, the structural model also can be estimated. We applied the LISREL 8.70 four times to estimate, assess and modify the model, and finally, we obtain the structural model. Figure 3 presents the path diagram of standardized coefficients, and Figure 4 presents the T-test values diagram of standardized coefficient. In both Figure 3 and Figure 4, KSI 1, KSI 2, KSI 3 and KSI 4 are exogenous variables ξ_1 , ξ_2 , ξ_3 and ξ_4 , respectively, and ETA 1, ETA 2 and ETA 3 are endogenous variables η_1 , η_2 and η_3 , respectively. From Figure 4, we can find that T-tests are significant at level $\alpha = 0.05$. So, the hypotheses H_1 , H_2 , H_3 , H_4 , H_6 , H_7 , H_8 , H_9 , H_{10} , H_{11} , H_{13} , H_{14} , H_{15} , H_{16} , H_{17} , and H_{18} are verified, whereas hypotheses H_5 , and H_{12} are refused.

3.5 Model of Validity and Reliability Analyses

When analyzing the validity of indicators, we first should check three aspects: (1) each variance is not negative. (2) The standard coefficient does not exceed or approximate one. (3) The standard parameters are significant. Our model satisfies the three basic conditions.

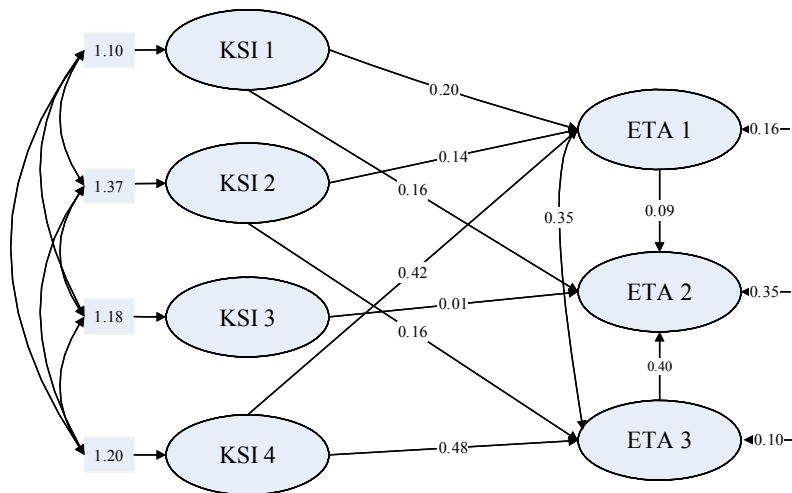


Figure 3. The path diagram of standardized coefficients

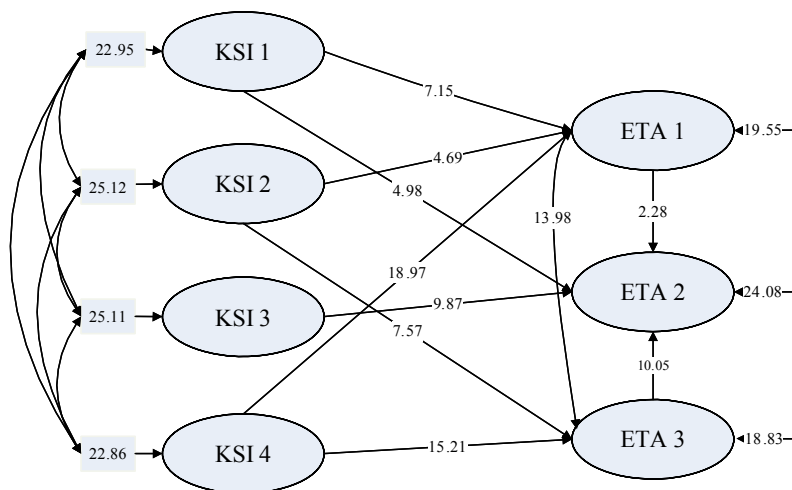


Figure 4. T-test values diagram of standardized coefficient

For the validity of model, we comprehensively adopt absolute fit measure such as root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR), incremental fit measure, such as non-normed fit index (NNFI), comparative fit indicator (CFI), and parsimonious fit measure, such as parsimony normed fit index (PNFI), parsimony goodness of fit index (PGFI). Fit measures of the model meet standards. Detailed results are show in Table 3. In addition, the expected cross-validation index (ECVI) equals to 13.08, which is smaller than both of independent model value index (ECVI = 1231.49) and saturation model value index (ECVI = 13.28), therefore, the cross-validation of the model meets requirements.

In the structural equation model, reliability (R^2) of individual observed indicator is greater than 0.5, which means indicators system is satisfactory. Composite reliability (CR) of the latent variables is greater than 0.9, which mean the reliability of latent variables is excellent. In addition, R^2 of individual observed indicator are listed in Table 4, and composite reliability (CR) and average variance extracted (AVE) of latent variables are listed in Table 5.

Table 3. The results of model fit measures and standards

Fit measure	p-value	Absolute fit measure		Incremental fit measure		Parsimonious fit measure		Adjusted Goodness of Fit Index
		RMSEA	SRMR	PNFI	PGFI	NNFI	CFI	AGFI
Standard	< 0.5	< 0.08	0.05	> 0.50	> 0.50	> 0.90	> 0.90	> 0.90
Our model	0.0	0.055	0.029	0.96	0.73	0.99	0.99	0.901

Table 4. R^2 of individual observed indicators

Variable	R^2	Variable	R^2	Variable	R^2	Variable	R^2
X ₁	0.63	X ₂₃	0.72	Y ₇	0.63	Y ₂₉	0.66
X ₂	0.64	X ₂₄	0.68	Y ₈	0.65	Y ₃₀	0.63
X ₃	0.64	X ₂₅	0.72	Y ₉	0.72	Y ₃₁	0.70
X ₄	0.67	X ₂₆	0.72	Y ₁₀	0.65	Y ₃₂	0.56
X ₅	0.68	X ₂₇	0.63	Y ₁₁	0.69	Y ₃₃	0.63
X ₆	0.63	X ₂₈	0.63	Y ₁₂	0.69	Y ₃₄	0.69
X ₇	0.64	X ₂₉	0.52	Y ₁₃	0.71	Y ₃₅	0.64
X ₈	0.60	X ₃₀	0.67	Y ₁₄	0.71	Y ₃₆	0.68
X ₉	0.52	X ₃₁	0.69	Y ₁₅	0.71	Y ₃₇	0.66
X ₁₀	0.50	X ₃₂	0.56	Y ₁₆	0.70	Y ₃₈	0.56
X ₁₁	0.71	X ₃₃	0.51	Y ₁₇	0.70	Y ₃₉	0.69
X ₁₂	0.70	X ₃₄	0.62	Y ₁₈	0.73	Y ₄₀	0.66
X ₁₃	0.66	X ₃₅	0.69	Y ₁₉	0.73	Y ₄₁	0.68
X ₁₄	0.73	X ₃₆	0.68	Y ₂₀	0.74	Y ₄₂	0.74
X ₁₅	0.74	X ₃₇	0.61	Y ₂₁	0.69	Y ₄₃	0.52
X ₁₆	0.74	X ₃₈	0.61	Y ₂₂	0.78	Y ₄₄	0.73
X ₁₇	0.71	Y ₁	0.70	Y ₂₃	0.77	Y ₄₅	0.65
X ₁₈	0.65	Y ₂	0.64	Y ₂₄	0.75	Y ₄₆	0.63
X ₁₉	0.64	Y ₃	0.64	Y ₂₅	0.74	Y ₄₇	0.65
X ₂₀	0.69	Y ₄	0.72	Y ₂₆	0.69	Y ₄₈	0.69
X ₂₁	0.73	Y ₅	0.71	Y ₂₇	0.66	Y ₄₉	0.62
X ₂₂	0.71	Y ₆	0.72	Y ₂₈	0.67		

Table 5. CR and AVE of latent variables

Variable	Composite reliability	Average variance extracted
ξ_1	0.99	0.98
ξ_2	0.99	0.98
ξ_3	0.99	0.98
ξ_4	0.99	0.98
η_1	0.99	0.98
η_2	0.99	0.97
η_3	0.99	0.98

3.6 Research Results

Based on our hypotheses and structural equation model, we should refuse hypotheses H₅, and H₁₂, while accept H₁, H₂, H₃, H₄, H₆, H₇, H₈, H₉, H₁₀, H₁₁, H₁₃, H₁₄, H₁₅, H₁₆, H₁₇, and H₁₈. Therefore, we can summarize main research results as follows:

1. There are significant correlations among ‘leadership’, ‘strategy planning’, ‘customer and market’, and ‘measurement, analysis and improvement’, all correlation coefficients are greater than 0.85. That accords with experience theory. Among them, leadership is a decisive factor in pursuing excellence, affecting strategy development and strategy deployment, and focusing on customer and market. All of them are based on information, analysis and improvement.
2. ‘Leadership’ has direct effect on both ‘resources management’ and ‘performance results.’ Organization’s work system and employee learning and motivation are dependent on leadership. Without leadership, it is impossible to pursue excellence performance results.
3. ‘Strategy planning’ has direct effect on both ‘resources management’ and ‘process management.’ Organization’s strategy planning, of course, affects resource planning and process management.
4. ‘Customer and market’ has effects on ‘performance results.’
5. ‘Measurement, analysis and improvement’ has direct effects on ‘resources management.’ That explains the former play an important role in resource management.
6. Both ‘resources management’ and ‘process management’ have direct effect on ‘performance results.’ It explains ‘resources management’, especially human resource is an important factor in pursuing excellence performance results.
7. ‘Resources management’ also has effect on ‘process management.’
8. ‘Measurement, analysis and improvement’ has effect on ‘process management.’
9. ‘Leadership’ has no direct effect on ‘process management.’ However, ‘leadership may be effect ‘process management’ by ‘strategy planning.’

10. 'Customer and market' has no effect on 'process management.' The former may be effect the later by 'measurement, analysis and improvement.'

4. Conclusion and Future Research

Based on criteria for excellence performance of China (GB/T 19580-2004) and survey data from China enterprises quality management status quo, we systemically analyze the relationship among 'leadership', 'strategy planning', 'customer and market', 'information, analysis and improvement', 'resources management', 'process management', and 'performance results.' Research results show some of these linkages are direct, and some of them are indirect. We find 'leadership' and 'strategy planning' that play an important role in 'resources management', while 'resources management', 'process management' and 'customer and market' are decisive factor in performance results. For China enterprises, it is should focus on 'process management' and 'resources management' to obtain excellence performance results. Of course, 'customer and market' also has direct effect on 'performance results.'

'Measurement, analysis and improvement' has direct effect on both 'resources management' and 'process management.' While former has strong relationship with 'customer and market.'

In our research, we find both 'leadership' and 'customer and market' have no direct effect on 'process management.' This conclusion needs to be validated further. In addition to, we take the total China enterprises as a whole to research. In fact, there are great differences between manufacturing enterprises and service enterprises, so does the regions among the eastern, central, and the western of China. We will subdivide organization types, as well as different regions, to obtain more detailed results.

References

1. Baldrige National Quality Program(2007), 2007 Criteria for Performance Excellence(www.baldrige.nist.gov)
 2. Conti, T.(1995), "Improving the Model: European Quality," European Quality Award Special Issue.
 3. GB/T-19580-2004: Criteria for Excellence Performance of China(2004), The General Administration of Quality Supper vision, Inspection and Quarantine of the People's Republic of China (In Chinese).
 4. GB/Z-19579-2004: Assessment guidelines for Excellence Performance of China(2004), The General Administration of Quality Supper vision, Inspection and Quarantine of the People's Republic of China (in Chinese).
-

5. Kaplan, D.(2000), "Structural Equation Modeling: Foundations and Extension," Sage Publications, Thousand Oaks, CA.
 6. Kondo, Y.(1995), "Companywide Quality Control: Its Background and Development," 3A Corporation, Tokyo.
 7. The research group(2007), "The Survey Report on China Enterprise' Quality Management Status Quo," *China Quality* (Special Issue), Vol. 2, pp. 1-80.
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Appendix

Survey questions organized by CAQ

This questionnaire is a part of ‘the survey on China enterprises’ quality management status quo.’ The following seven categories are used as latent variables in the structural equation modeling.

(1) Leadership

Leadership is composed of senior leader and social responsibility. The following 10 indicators (x_1, x_2, \dots, x_{10}) can be used to describe variable leadership.

1. Senior leaders communicate organizational vision and values to all levels employees.
2. Senior leaders communicate organizational vision and values to key suppliers and partners.
3. Senior leaders promote an environment that fosters and requires legal and ethical behaviors
4. Senior leaders create an environment for empower, innovation and learning.
5. Senior leaders regularly review organizations performance and objectives, and transform assessment results into improvement action.
6. Organizational governance system can ensure accountability for management’s action, and protection of stakeholder and stockholder interests.
7. Senior leaders in person guide and encourage employees to participate in organizational quality improvement.
8. Organization addresses long term partner relationship with suppliers.
9. Senior leaders predict and take measures to reduce any adverse impacts on society of organizational products, services, and operation.
10. Senior leaders actively support and take part in local community services, education, health, and environment protection.

(2) Strategy planning

Strategy planning is composed of strategic planning and strategy deployment. The following 11 indicators ($x_{11}, x_{12}, \dots, x_{21}$) present variable strategy planning.

11. The company establishes strategy planning based on key business factors and information.
 12. The company has established distinct plan, goal and timetable for product and service quality.
 13. Employees can effectively present their suggestions for strategic plans and goals by “bottom-up.”
 14. Strategic goals are able to respond company’s challenges and trade off stakeholder
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requirements.

15. The action plans and human resources plans are effectively aligned with the overall key strategy plans.
16. The company has established distinct plan, goal and timetable for organization change.
17. The company has a comprehensive and structured process that regularly sets and reviews short and long term goals.
18. The company considers quality as an important criterion for selecting suppliers.
19. The company adopts performance indicator to track progress and compare it with competitors.
20. The company invests sufficient resources to achieve strategy plans and goals.
21. The company systematically communicates strategy plans and goals by “top-down.”

(3) Customer and market

Customer and market is composed of comprehension of customer and market, customer relationship and customer satisfaction. The following 8 indicators(x_{22} , x_{24} , ..., x_{29}) describe the variable.

22. The company classifies customers and subsection market to better define and comprehend customer requirements.
23. The company systematically harkens and comprehends the requirements and preference of different customers and subsection market.
24. The company defines the characteristics of products or services by the voices of customers.
25. The company continuously improves service processes for resolving customers' complaints.
26. The company systematically measures customer satisfaction as a method to initiate improvements.
27. The company has a detailed plan to develop new products and services.
28. The company actively establishes partnership with customers.
29. Senior leaders regularly interviews customer to know customers requirements and suggestions.

(4) Measurement, analysis and improvement.

'Measurement, analysis and improvement' is composed of measurement and analysis, information management and improvement. The following 9 indicators (x_{30} , x_{31} , ..., x_{38}) describe the variable.

30. The company systematically collects data and information to track, review and improve company performance.
 31. The company uses collected performance data to innovate products or services.
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32. Senior leaders analyze data to support strategy planning and decision making.
33. The company feeds back the results of performance to work units and functional departments.
34. The company communicates with suppliers promptly for the key characteristics of products and design change.
35. Employees can expediently obtain and use company data and information.
36. The company actively helps suppliers participate in quality improvement.
37. Suppliers, partners and customers can share in the company data and information.
38. The company obtains knowledge from employees, customers, suppliers and partners, and shares the knowledge in the company.

(5) Resources Management

Resources management is composed of work system, employee learning and development, employee's rights and satisfaction. The following 11 indicators (y_1, y_2, \dots, y_{11}) describe the variable.

1. Employees at the company are able to effectively communicate and share in skills.
2. The company enhances performance and focuses on customers by prompting system.
3. The company has procedures to recruit suitable employees.
4. The company inspires employees' potential and helps them to achieve career development goals.
5. The company has an organization-wide training process to meet employees' requirements.
6. The company's education and training programs are in line with company's strategy plans and goals.
7. The company advocates teamwork and encourages cooperation.
8. The company devotes to improving work system.
9. The company's culture helps to empower and innovation.
10. Employee satisfaction is formally and regularly measured.
11. The company sets up priority improvement goals based on employee rights, satisfaction results and key business results.

(6) Process management

Process management is composed of key processes and support processes. The following 22 indicators ($y_{28}, y_{29}, \dots, y_{49}$) describe the variable.

28. The company has well-established and measurable indicator to key manufacturing or service processes.
 29. The company designs processes used information from customers, suppliers and partners.
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30. The company has standardized and documented operating procedures.
31. The company designs processes used new technology and knowledge.
32. The company maintains neatness work environment to enhance work efficiency.
33. The company uses statistical method to monitor the variability of manufacturing or service processes.
34. The company considers cycle time, productivity and cost in designing manufacturing or service processes.
35. The company encourages every front-line employee to participate in process improvement.
36. Improvement results can be shared at the company.
37. The company implements continuous improvement by project team.
38. Suppliers participate in the company's projects at the design stage.
39. The company monitors and improves processes used information from customers, suppliers and partners.
40. Senior leaders take change important improvement projects.
41. The company uses information technology to innovate manufacturing or service processes.
42. Resource collocation is reasonable in the company.
43. The company encourages employees to innovate.
44. The company arranges manufacturing or service processes based on collecting and analyzing quality data.
45. The company has well-established procedures to support the development of products or services.
46. Employees in the company actively participate in processes improvement.
47. The company regularly maintains, evaluates and updates equipments.
48. The company enhances the capability of technology innovation.
49. The company ensures quality starting from design stage.

(7) Performance results

Performance results are composed of products and services, customer satisfaction, market performance, financial performance, human resources, operation performance, organization governance and social responsibility. In this part, every indicator not only needs to describe measurable index, but also current situation, trend, and comparison with competitors. The following 16 indicators (y_{12} , y_{13} , ..., y_{27}) describe the variable.

12. Quality of products or services (for example, reliability, safety, variability).
 13. Cost of products or services (for example, price, value).
 14. Delivery of products or services (for example, delivery cycle, delivery way).
 15. Customer satisfaction (for example, customer satisfaction degree).
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16. Customer perceptual value (for example, customer retention rate, relationship with customer)
 17. Financial performance (for example, net income, profits, profit margins)
 18. Market performance (for example, market share, sale volume)
 19. Efficiency and effectiveness of work system (for example, employee turnover, employee retention)
 20. Learning and development of employee (for example, number of employee suggestions)
 21. Employee satisfaction (for example, employee absenteeism, and employee grievance)
 22. Creating value processes (for example, productivity, and production cycle, and performance relating to suppliers and partners).
 23. Supporting processes (for example, productivity, production cycle, and performance relating to suppliers and partners).
 24. Account auditing.
 25. Ethic and stakeholder credit
 26. Complying with legal and ethical behaviors.
 27. Community involvement.
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