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Quality management framework for public management decision making

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Abstract

Purpose – This paper aims to explore the practice of quality management framework as a strategic tool for public management.

Design/methodology/approach – The paper starts with a basic process-based model; it then enhances the model with the quality management principles for continuous improvement. With identification of concerned factors from the literature, it examines their usefulness in the quality management system.

Findings – An empirical analysis on the framework identifies eight factors: factual approach to decision making, use of quality tools, customer focus, leadership, involvement of people, process approach, mutually beneficial supplier partnership and internal results. The framework shows that leadership and customer focus are much more important than previously anticipated for successful implementation of quality management system.

Research limitations/implications – Managers in public organizations must realize that all high performance organizations, whether private or public, are by principle customer-driven. In addition, it is imperative for them to enhance their leadership as it is essential for effective quality improvement.

Originality/value – While the effect of adopting a quality management system on organizational performance has been well documented, the underlying mechanism about how the system works has yet to be empirically identified. This paper contributes to the literature by addressing such a gap and presenting a causal model for quality management principles.

Keywords ISO 9001, Process-based quality management system, Public management decision making, Performance, ISO 9000 series, Continuous improvement

Paper type Research paper

1. Introduction

Organizations are similar in a way that they are all keen to adopt the best practice in work settings. Total quality management (TQM) and ISO 9001 quality management system are standards set for improving performance through quality management. The International Organization for Standardization (2010) reports that 982,832 organizations have been certified to ISO 9001 in 176 countries and economies and the number of certificates issued to public organizations has been increasing steadily over the past two decades. Indeed most government agencies and public organizations

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today would look for ISO9001-compliant suppliers when they award contracts. Studies related to organizational performance and implementation of quality standards in public organizations have been conducted in the USA (Kapucu *et al.*, 2011; Milakovich, 1990), the UK (Douglas *et al.*, 1999), The Netherlands (Singels *et al.*, 2001), Australia (Singh and Mansour-Nahra, 2006; Navaratnam and Harris, 1994), Taiwan and other Asian countries (Chu *et al.*, 2001; Ham and Williams, 1986; To *et al.*, 2011). The results of these studies on public organizations are consistent with those reported in private organizations (Abraham *et al.*, 2000; Chow-Chua *et al.*, 2003; Dawson and Patrickson, 1991; Hendricks and Singhal, 1997; Lee, 2005; Lee *et al.*, 2009; Li *et al.*, 2001; Reed *et al.*, 1996).

Unfortunately, there is a dearth of research confirming how the system works. Kapucu *et al.* (2011) propose a specification of building blocks for high performance organizations while Kanji (2008) presents a system for measuring business excellence. Yet little empirical evidence has been available to support those ideas. Without a thorough understanding about how the relationships between quality subsystems (or management principles) are related, practitioners are likely to face difficulties in diagnosing problems and allocating resources to maximize performance. Also it would be a challenge to assess the implementation of quality management principles due to the lack of standardized measurement scales. To solve this problem, a number of researchers (Conca *et al.*, 2004) have adapted the TQM survey items from Ahire *et al.* (1996), Grandzol and Gershon (1998), and Rao *et al.* (1998) while others (Yahya and Goh, 2001) employed the 20 clauses documented in ISO 9001:1994 to characterize the implementation status. Nonetheless, the latest versions of ISO 9001 including ISO9001:2000 and 2008, are very different and based on a process model.

Therefore, the objectives of this research are to review the characteristics of ISO quality management principles and to propose a causal model that links quality management principles logically. The causal model was tested using the responses collected from managers and executives working in public organizations in Macao, China. The paper concludes with discussions about the implications, limitations and future research of the study.

2. Literature review and hypotheses development

The early version of ISO 9001 served as a guideline for manufacturers and engineering companies to produce goods with consistent quality. It was a family of standards that:

- defined the guiding principles of quality management;
- listed the certification requirements; and
- provided guidelines on how to establish systems for managing procedures, processes, and product quality.

The system comprised of three standards (ISO 9001:1987, ISO 9002:1987 and ISO 9003:1987) for quality management and facilitated the manufacturing industry's day-to-day activities. The standards were updated in 1994 with emphases on quality assurance via preventative actions, use of statistical techniques, and consideration of a process approach (Zhang, 1999). However, it was difficult to apply the 1987 and 1994 versions in service-oriented organizations because certain critical elements were poorly linked to service organizations' activities (Magd and Curry, 2003). Lately, ISO 9001:2000 suggested a process approach to manage organizational activities while the

1987 and 1994 versions were superseded. Since then, many service organizations have adopted the ISO 9001:2000 and 2008. As of December 2009, almost a million ISO 9001:2000 certificates were issued (ISO, 2010). China tops the country list with over a quarter of the total number of certificates issued in which Macao has 134 organizations certified to ISO 9001:2000/2008.

To promote the process approach, ISO 9001:2000/2008 depicts eight quality management principles. They are:

- (1) customer focus;
- (2) leadership;
- (3) involvement of people;
- (4) process approach;
- (5) system approach to management;
- (6) continual improvement;
- (7) factual approach to decision making; and
- (8) mutually beneficial supplier partnership (ISO, 2011).

ISO 9001:2000/2008 takes a process-orientation approach and adopts the Deming cycle of plan-do-check-act (Seaver, 2001). Within this framework, activities in organizations can be considered as chains of interlinked processes. The public sector is of particular interest since in this sector organizations are of considerable scale and are subject to the policy laid by the corresponding jurisdictions and citizens who have the ability, through political means, to influence the policy (Kanji, 2008). Also most policies and ISO 9001:2000/2008 implementations are administered top-down, how to execute such a quality system and make better public management decision is crucial for everyone.

The process-based quality management system (QMS) model is shown in Figure 1. This system covers four of the eight main clauses of ISO 9001:2000/2008 related to the implementation of the process approach.

- Management responsibility (Clause 5 as described in ISO 9001:2000/2008). This clause emphasizes top management commitment on quality products and services. Top management shall establish the quality policy, plan major activities and define goals for keeping and improving all aspects of QMS in the organization. As illustrated in the clause, one major management responsibility is “leadership.” Kapucu *et al.* (2011) stress that this and customer focus are of particular importance to performance improvement.
- Resource management (Clause 6). This clause covers the management of people, infrastructure, equipment, material resources, information, financial resources, and suppliers. To achieve conformed services, resource management shall focus on the assignment of competent personnel, training, provision of adequate facilities and work environment. In addition, partnerships with suppliers and involving suppliers in design and development activities are also critical in implementing ISO 9001:2000/2008. In short, this clause can be represented by two quality management principles as defined in ISO 9001:2000/2008: “involvement of people” and “mutually beneficial supplier relationship.”

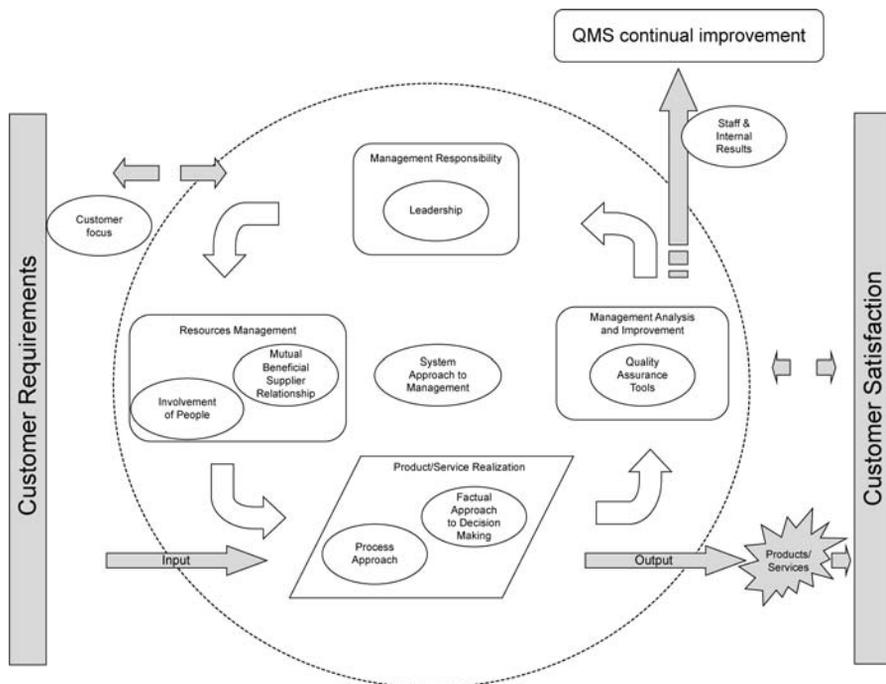


Figure 1.
Process model of ISO
quality management
system and its
management principles

- Product/service realization (Clause 7). This clause deals with processes related to customer requirements, design and development of products, services, and the control of production and operational processes. Thus, “process approach” and “factual approach to decision making” are the two quality management principles covered in this clause.
- Measurement, analysis and improvement (Clause 8). This clause concerns with the conformity of semi-finished and finished products and services, conformity of production and/or service delivery processes and management systems, and continual improvement of all processes in the QMS. To this end, applicable methodologies such as statistical process control and quality planning tools shall be utilized to collect and analyse the information collected from various sources. Eventually, the application of this clause should lead to continuous improvement of QMS. Although none of the eight quality management principles of ISO 9001:2000/2008 can properly represent this clause, the use of quality tools as described in the TQM literature (Besterfield *et al.*, 2003) could be a proxy indicator and it covers the use of quality assurance tools, quality planning tools, and quality management tools.

At the centre of Figure 1 is the principle of system approach to management. This principle oversees and coordinates the above clauses. It also helps to monitor performance for continuous improvement over time.

One way of accurately assessing the effectiveness of the system would be by conducting a longitudinal analysis (Kanji, 2008). However, for on-going business with

diverse experiences and levels of implementations across organizations, such approach would not be feasible. An alternative would be to employ a cross-sectional approach that takes measurements at a snapshot in time. The measurements may comprise of indicators concerning internal administration efficiency (O'Neil, 1998; Chen *et al.*, 2001), cost of quality (Besterfield *et al.*, 2003), and employee turnover rate (Guimaraes, 1997). In fact Taylor and Parkinson (1998) and de Waal and Nhemachena (2006) suggest that staff and internal results could serve as a suitable proxy indicator of organizational performance especially for public sector organizations.

2.1 Hypotheses formulation

Figure 1 illustrates the relationships between the eight quality management principles and the process-model of ISO 9001:2000/2008. Based on this model, the following hypotheses are proposed:

- H1.1.* Leadership is directly positively associated with involvement of people.
- H1.2.* Leadership is indirectly positively associated with involvement of people through mutually beneficial supplier partnership.
- H1.3.* Involvement of people is positively associated with (a) process approach and (b) factual approach to decision making.

Measurement and analysis are critical to monitor the correctness of decisions. In this case, the concept of factual approach to decision making would depend on the use of different quality tools to analyse facts and related data. However, process approach is not related to measurement and thus, the following hypothesis is formulated:

- H1.4.* Factual approach to decision making is positively associated with use of quality tools.

The use of quality tools is likely to increase the chance of making the right decisions and improving organizational performance, i.e. staff and internal results (Zhang, 1999). Hence, the following hypothesis is proposed:

- H1.5.* The use of quality tools is positively associated with staff and internal results.

For better presentation, the original QMS is transformed and presented in Figure 2. It ends with staff and internal performance under the conceptual model. The bold arrows represent the hypotheses described above.

The above hypotheses are developed based on the basic process-model only. The relationship between quality management principles should also be explored. Customer focus is the primary driver for establishing QMS. In the service sector, customer-contact employees play a significant role in creating and delivering quality services (Bowen and Lawler, 1992; Bowen and Schneider, 1993; Hartline and Ferrell, 1996). Yet customer-contact employees, especially in the public sector, are necessary but not sufficient to provide the required services most of the time. Strategic partners and suppliers of the organizations also play important roles in supporting services. Therefore, the following hypotheses are formulated.

- H2.1.* Customer focus is positively associated with (a) involvement of people and (b) mutually beneficial supplier relationship.

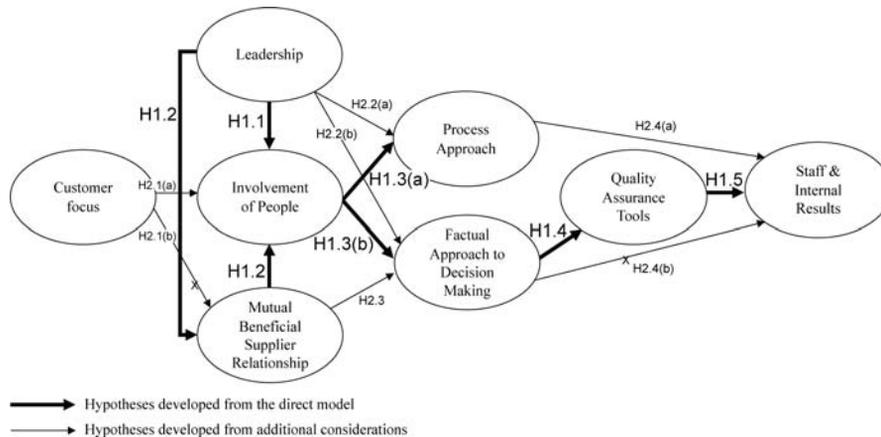


Figure 2. Conceptual model of quality management chain derived from ISO9001:2000

Leadership is not only about people but also the establishment of processes and proper decision making procedures (Betts, 2004). It is a driving factor for management by facts and works as a process (Kanji, 2008). In this connection, the following hypotheses are proposed.

H2.2. Leadership is positively associated with (a) process approach and (b) factual approach to decision making.

Besides the provision of semi-finished products and services for input, suppliers should also provide accurate and reliable information to public organizations for decision making in a properly managed supply chain (Lee *et al.*, 1997). Therefore, the following hypothesis is formed.

H2.3. Mutually beneficial supplier partnership is positively associated with factual approach to decision making.

Pfannerstill (2006) suggests that desirable results can be better achieved when activities and related resources are managed as a process. In addition, ISO 9001:2000/2008 states that factual approach to decision making is related to “effective decisions that are based on the analysis of data and information.” Thus, the following hypothesis is proposed.

H2.4. Process approach and factual approach to decision making are positively associated with (a) staff and (b) internal results.

Methodology

3.1 Sample

Survey data were collected from the public sector of Macao, China. Among the 134 private and public organizations certified to ISO 9001:2000/2008 in Macao, 27 of them were public organizations and their employees were the target population of our study. These organizations were selected because on one hand, their customers are citizens and on the other hand, these organizations have diverse background and different

levels of ISO 9001:2000/2008 implementation. In this context, the empirical analysis in these organizations could reveal the links among quality management principles. Rather than involving only top management, the survey was interested in examining the practitioners' perspectives and an evaluation of their opinions could contribute to public management decision making and reform initiatives. A research team contacted each of the 27 ISO 9001:2000/2008 certified public organizations and 18 of them agreed to participate in the survey. Key respondents were identified by their seniority; they were management representatives, managers and officers responsible for implementing ISO 9001:2000/2008. A package containing a cover letter stating the purpose of the survey, instruction sheets, and 20 printed copies of questionnaires was delivered to each organization.

3.2 Measurement scale

Yahya and Goh (2001) suggested characterizing the implementation status of ISO 9001:1994 by using the ISO 9001 clauses. The major advantage of such approach was that it directly reflected the states of ISO 9001:1994 implementation. Since the update in 2000, little research has been conducted to characterize the implementation status of ISO 9001:2000/2008. This research therefore utilized the ISO 9001:2000/2008 clauses as the basis for measurement. The measurement scale was developed following the four-phase methodology proposed by Churchill (1979) and Ping (2004).

Phase 1 of the methodology focuses on domain specification. In this study, it was realized by conducting a literature review on ISO 9001:2000/2008. Domain experts were involved in reviewing the draft questions and they examined the appropriateness of the questions for evaluating the ideas as described by the ISO documentations. In Phase 2, dimensional identification, measurement items were grouped around the dimensions depicted in the ISO 9001:2000/2008-QMS model. The initial generation of items included the eight quality management principles and the use of quality tools. Phase 3 deals with content and face validity. ISO provides typical examples when quality management principles are employed. During this phase, items quoted in the ISO quality management document (ISO, 2011) were adapted and endorsed by two domain experts who participated in in-depth interviews. This ensures the content validity of the instrument, i.e. the degree to which an instrument represents a correct sample of the theoretical content domain of constructs (Nunnally and Bernstein, 1994). The result of the process was an extensive list of 61 items. To reduce the number of items, Delphi technique (Anastasi, 1988) was employed and ten practitioners from different ISO 9001:2000/2008 certified public organizations were invited to comment on the original list. A number of items were excluded or deleted with consent and the refined instrument was subject to a pilot test from managers or executives in 45 service organizations (Lee *et al.*, 2009). Based on the comments and the pilot test, some items were eliminated from the list including the principle for "Continual Improvement", "System Approach to Management" (which was found similar to items in "Continual Improvement"), and "Customer Feedback" (which covers the improvement on customer satisfaction and organizational image). Similarly, the item on "The organization uses check sheets to collect data." was removed from the list because this process is no longer practiced.

The final measurement scale was an instrument of 30 items covering seven quality management principles (To *et al.*, 2011) and eight items covering the use of quality

tools. The Appendix (Table AI) shows the 38-item scale measuring ISO 9001:2000/2008 implementation and the use of quality tools as well as a 4-item scale to measure organizational performance. All items were measured in a seven-point Likert scale. Phase 4 involves data collection.

4. Results and analysis

Out of the 360 questionnaires distributed to the 18 public organizations, 120 completed questionnaires were returned, yielding a response rate of 33.3 per cent. Of these respondents, 101 of them (84.2 per cent) were working in organizations employing more than 200 staff. All participating public organizations have a history of five years or above and around two thirds of them have been in operation for over 20 years. 13 of the public organizations have received the ISO9001 certificates for five years or more.

The dimensionality of the scale was assessed by principal components analysis (Hair *et al.*, 2005). Table I presents the results for the seven quality management principles and the use of quality tools using varimax with Kaiser Normalization. Nine components were identified. Rotation converged in 13 iterations and seven principal components emerged with each containing three or more items. The results left two orphan items. For this principal components analysis, 14.4 per cent of the total variance could be explained by the first component, implying the problem of common method bias is unlikely to arise (Podsakoff and Organ, 1986). Thus, the identified components were considered acceptable for subsequent analyses.

Items of each identified component were then subject to reliability tests as shown in Table I. Most values of the corrected item-total correlation are greater than 0.5, reflecting the usefulness of an item as a measure of the respective construct. For the very same reason, the last item of component 5 should be eliminated (Trochim, 2001). Among the seven identified components, most of them emerged as originally expected and “System approach to management” dissolved into other components. The left column in Table I shows the groupings with their factor numbers. The reliability of all seven components is considered acceptable with a 0.7 Cronbach’s alpha benchmark (Litwin, 1995). All eight items under the use of quality assurance tools and quality planning and management tools (Besterfield *et al.*, 2003) were factored into one component with a high Cronbach’s alpha value. The organizational performance construct, represented by Staff and Internal results, was also subject to reliability test. Its Cronbach’s alpha value is 0.837 and the values of the corrected item-total correlation and factor loadings ranged from 0.516 to 0.830 and 0.710 to 0.908, respectively. Thus, the reliability of this construct is also considered acceptable.

Table II shows the descriptive statistics and correlations between the constructs. Correlations between the constructs do not exceed 0.8 which primarily implies discrimination (Bagozzi, 1994). To further test for discriminant validity, the extracted and shared variances were compared. For each construct, the percentage of variance extracted should exceed the construct’s shared variance with every other construct (i.e. the square of the correlations). This condition is satisfied for all constructs as presented in Table III. For example, the extracted variance for Customer Focus is 0.676, exceeding its maximum shared variance of 0.541 with Management.

Table IV shows the hierarchical regression analyses for the hypotheses. The hierarchical analysis was organized in a way that the main effects, as depicted by the

Factor	Principle	Item descriptive statistics			Corrected item-total correlation	PCA results Factor loading (after item examination)	Cronbach's alpha
		Item	Mean	SD			
1	Customer focus	P1_Q13	4.008	0.912	0.734	0.825	0.903
		P1_Q12	3.700	0.894	0.715	0.810	
		P1_Q11	3.758	0.799	0.800	0.863	
		P1_Q15	3.825	0.904	0.752	0.837	
		P1_Q14	4.133	0.809	0.736	0.817	
2	Quality planning and management tools	P1_Q22	3.808	0.873	0.677	0.780	0.909
		P1_Q36	2.942	0.929	0.771	0.829	
		P1_Q34	2.975	0.930	0.786	0.840	
		P1_Q35	3.008	0.921	0.682	0.758	
		P1_Q38	3.025	0.930	0.797	0.849	
		P1_Q37	2.983	0.917	0.691	0.765	
		P1_Q31	3.142	1.095	0.732	0.810	
3	Process approach	P1_Q32	3.100	1.032	0.655	0.746	0.907
		P1_Q33	3.158	1.037	0.576	0.684	
		P1_Q18	3.683	0.809	0.740	0.822	
		P1_Q19	3.600	0.760	0.791	0.855	
		P1_Q16	3.742	0.783	0.750	0.826	
		P1_Q17	3.683	0.907	0.780	0.858	
		P1_Q06	3.817	0.850	0.693	0.792	
4	Leadership	P1_Q20	3.608	0.910	0.718	0.816	0.864
		P1_Q01	3.842	0.898	0.790	0.874	
		P1_Q04	3.508	0.944	0.713	0.828	
		P1_Q03	3.400	0.911	0.652	0.783	
		P1_Q05	3.675	0.972	0.665	0.800	
5	Involvement of people	P1_Q02	3.617	0.801	0.610	0.739	0.840
		P1_Q07	3.333	0.964	0.524	0.809	
		P1_Q10	3.533	0.869	0.528	0.829	
		P1_Q08	3.567	0.867	0.552	0.834	
		P1_Q09	3.600	0.854	0.532	0.820	
6	Supplier partnership	P1_Q21	3.558	2.916	0.294		0.748
		P1_Q29	2.975	0.965	0.583	0.843	
7	Factual approach to decision making	P1_Q28	3.208	0.732	0.566	0.778	0.897
		P1_Q27	3.183	0.869	0.599	0.83	
		P1_Q24	3.833	0.873	0.800	0.911	
		P1_Q25	3.708	0.864	0.814	0.917	
		P1_Q23	3.858	0.919	0.779	0.906	
Others	P1_Q30	P1_Q30	3.358	0.877			
		P1_Q26	3.275	1.077			

Table I.
Principal component analysis of the seven quality management principles and the use of quality tools

QMS, were first tested before examining the hypotheses formulated based on the additional considerations from the literatures.

Model 1 shows that Involvement of people is positively affected by Leadership and Mutually beneficial supplier relationship. The addition of Customer focus on Model 2 confirms its usefulness for Involvement of people with a significant *F* change. Thus, Models 1 and 2 provide evidence to support *H1.1*, *H1.2* and *H2.1(a)*.

Factor	Description	Mean	S.D.	1	2	3	4	5	6	7	8
1	Customer focus	3.872	0.711	1.000	0.384*	0.701*	0.638*	0.594*	0.275*	0.735*	0.533*
2	Use of quality tools	3.042	0.763	1.000	1.000	0.294*	0.368*	0.254	0.169	0.395*	0.348*
3	Process approach	3.689	0.693	1.000	1.000	1.000	0.708*	0.699*	0.350*	0.595*	0.569*
4	Leadership	3.608	0.730	1.000	1.000	1.000	1.000	0.618*	0.373*	0.640*	0.501*
5	Involvement of people	3.508	0.731	1.000	1.000	1.000	1.000	1.000	0.390*	0.580*	0.575*
6	Mutually beneficial supplier relationship	3.122	0.702	1.000	1.000	1.000	1.000	1.000	1.000	0.413*	0.248*
7	Factual approach	3.800	0.807	1.000	1.000	1.000	1.000	1.000	1.000	1.000*	0.424*
8	Staff and internal results	3.238	0.718	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Note: * Correlation is significant at the 0.01 level (two-tailed)

Table II.
Descriptive statistics and
correlations for the
measures

Table III.
Shared variance for the
measures

Factor	Description	Key	Number of items	Extracted variance	1	2	3	4	5	6	7	8
1	Customer focus	CustFosc	6	0.676	0.148	0.148	0.492	0.407	0.353	0.076	0.541	0.284
2	Use of quality tools	UseQTools	8	0.621	0.148	0.148	0.086	0.136	0.065	0.029	0.156	0.121
3	Process approach	ProcAppr	6	0.687	0.492	0.086	0.492	0.501	0.488	0.122	0.353	0.323
4	Leadership	Leadersh	5	0.650	0.407	0.136	0.501	0.382	0.139	0.139	0.410	0.251
5	Involvement of people	PeoplInvo	4	0.678	0.353	0.065	0.488	0.382	0.152	0.152	0.336	0.331
6	Mutually beneficial supplier relationship	SuppPrtn	3	0.670	0.076	0.029	0.122	0.139	0.152	0.170	0.170	0.061
7	Factual approach	FactAppr	3	0.830	0.541	0.156	0.353	0.410	0.336	0.170	0.170	0.179
8	Staff and internal results	InteResu	4	0.679	0.284	0.121	0.323	0.251	0.331	0.061	0.179	0.179

Model	Independent variable(s)	Dependent variable	Hypothesis	Beta	t	R square	Adjusted R square	R square change	Change statistics F change
1	Leadersh SuppPrtn	PeopInvo	H1.1	0.549	7.181***	0.411	0.401	0.029	5.839*
2	Leadersh SuppPrtn	PeopInvo	H1.2	0.185 0.346	2.416* 3.809***	0.474	0.461	0.063	13.938***
3	SuppPrtn CustFosc	SuppPrtn	H2.1(a)	0.171 0.327	2.351* 3.733***	0.139	0.132	0.139	19.071***
4	Leadersh CustFosc	SuppPrtn	H1.2	0.373 0.333	4.367*** 2.996**	0.141	0.127	0.002	0.311
5	PeopInvo PeopInvo	ProcAppr	H2.1(b) H1.3(a)	0.062 0.699	0.558 10.604***	0.488	0.484	0.488	112.438***
6	Leadersh PeopInvo	PeopInvo	H1.3(a)	0.423 0.447	5.764*** 6.09***	0.611	0.605	0.123	37.084
7	PeopInvo Leadersh	FactAppr	H2.2(a)	0.58	7.733***	0.336	0.331	0.336	59.796***
8	PeopInvo Leadersh	FactAppr	H1.3(b)	0.298 0.456	3.464** 5.306***	0.465	0.456	0.129	28.151***
9	PeopInvo Leadersh	FactAppr	H2.2(b)	0.258 0.423	2.973** 4.908***	0.485	0.471	0.02	4.399*
10	SuppPrtn FactAppr	UseQTools	H2.3	0.154	2.097*	0.156	0.149	0.156	21.765***
11	FactAppr ProcAppr	UseQTools	H1.4 (Dummy)	0.395 0.092	4.665*** 0.87	0.161	0.147	0.005	0.757
12	UseQTools ProcAppr	InteResu	H1.5	0.348	4.03***	0.121	0.114	0.121	16.237***
13	UseQTools ProcAppr	InteResu	H2.4(a)	0.198 0.51	2.554* 6.593***	0.359	0.348	0.238	43.464***
14	ProcAppr FactAppr	InteResu	H2.4(b)	0.181 0.473	2.232* 5.116***	0.362	0.346	0.003	0.543

Notes: *Correlation is significant at the 0.05 level; ** correlation is significant at the 0.01 level; *** correlation is significant at the 0.001 level

Table IV. Regression analysis of the hypothesised models

Model 3 supports *H1.2*. Change in F value between Models 3 and 4 is not significant and thus, *H2.1(b)*, from the additional considerations, is not supported. Consequently, only Leadership serves as an influential factor for Mutually beneficial supplier relationship.

Models 5 and 6 show that Involvement of people and Leadership positively affect Process approach. In fact Leadership, as an additional consideration, serves as a stronger factor in affecting Process approach in decision making, as indicated by a higher beta value.

Models 7 to 9 examine the factors for Factual approach to decision making. The results show that Involvement of people, Leadership, and Mutually beneficial supplier relationship affect Factual approach to decision making and that Leadership plays a highly important role in implanting ISO 9001:2000/2008.

Model 10 shows the effect of Factual approach to decision making on the Use of quality tools. Model 11 is a dummy model and does not bear a significant F change from Model 10. Model 11 shows that Process approach is irrelevant to the Use of quality tools as argued in the hypothesis formulation.

Model 12 in principle confirms the relationship between the Use of quality tools and Internal staff performance. Model 13 shows that Process approach to decision making is indeed a highly influential factor for Internal staff performance. The insignificant F change of Model 14 shows that Factual approach to decision making is unimportant for performance improvement (i.e. *H2.4(b)* not confirmed).

5. Discussion

Decision makers are sometimes more concerned with organizational issues than customers' and employees' needs (Duxbury and Haines, 1991). Ironically, in the principal component analysis, items of "System approach to management" dissolved into other constructs. This suggests that practitioners seem to have a rather vague idea about "System approach to management" and therefore decision makers in the public sector should not focus solely on high level organizational issues. Instead the analyzed results suggest that more attention should be paid to leadership, customer focus, and quality or continuous improvement culture (Abraham *et al.*, 2000; Kanji, 2008). Specifically in the analysis, "The organization continually improves the system through measurement and evaluation" was grouped into the customer focus which is an important concept in ISO 9001:2000/2008:

[...] (an organization should) aim to enhance customer satisfaction through the effective application of the system, including processes for continual improvement of the system and the assurance of conformity to customer and applicable regulatory requirements.

The results confirm the process approach as advocated by ISO 9001:2000/2008 initiative, an interesting but not surprising finding. Out of the 14 hypotheses developed, all the seven hypotheses developed from the QMS model are confirmed. Nevertheless, only five out of seven of the hypotheses developed from additional considerations are confirmed. This suggests that the ISO 9001:2000/2008 implementation guideline is substantiated.

In sum, the study validated the process-based QMS model for public organizations and illustrated the links among quality management principles.

6. Conclusion and managerial implications

The findings of the study suggest that the evaluation of ISO 9001:2000/2008 can be based on its quality management principles. The analyzed results indicate the importance of leadership and customer focus (i.e. human factors) in implementing a quality system. In line with Kanji's Business Excellence Measurement System (2008), leadership is confirmed as the primary driving force for quality improvement. Leader attitude would promote the successful deployment of other quality management principles, resulting in better management decision making and positive internal performance. The model developed in the study shows that the quality management principles are inter-related and the focus of implementing quality management principles should follow a logical manner. Certain confirmed hypotheses generated from the additional considerations suggest the importance of upstream variables. For instance, both Leadership and Mutual beneficial supplier relationship positively influence Factual approach to decision making and the former plays a more important role than the QMS-dictated Involvement of people. This shows that Kanji's Business Excellence Measurement System (2008) turns out to be a credible system. Public organizations, thus, should pay more attention to this antecedent – leadership – in order to implement Factual approach to decision making. This will also lead to the successful implementation of other ISO 9001:2000/2008 principles downstream and eventually to better management decision making and internal performance. Public organizations are advised to invest resources on staffing and training their leaders.

Similarly, public organizations must realize that service excellence is customer-driven. A customer-focused culture must be instilled into the mindset of every employees particularly frontline-employees.

Moreover, public organizations may also strive to strengthen the implementation of Process approach to decision making since it is an important factor for internal results. This, as shown in the analysis, can be enhanced by Leadership and People involvement. However, process itself is passive and success depends on the human factor. One way to achieve this would be by articulating a focused purpose in a project. A process approach such as Ishikawa's cause and effect method to create quality objectives would be helpful in this respect (Owens, 2005).

6.1 Limitations and future research

Like other cross-sectional self-reported studies, the current study has two major limitations. First, a cross-sectional study cannot reveal changes on the implementation of ISO 9001:2000/2008 over time. Therefore a longitudinal approach would be desirable in future research in order to assess ISO 9001:2000/2008 implementation over time. Second, it is possible that data from a self-reported study with a relatively small sample size may be affected by non-response bias. Despite this, two-thirds of all ISO 9001:2000/2008 certified public organizations in Macao participated in our study and with the many validity tests, the sample was found to be reasonably representative and valid for the public sector. Nevertheless, the manufacturing-based industry and private service organizations may behave differently. Therefore a much larger scale of survey should be conducted in order to generalize the applicability of the QMS model across industries. Future research may also examine the links with other quality-related variables such as failure rate or organizational performance, or even expand the measurement model to investigate other quality systems.

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Leadership

1. Management establishes a clear vision of the organization's future	P1_Q01
2. Management sets challenging targets	P1_Q02
3. Management creates shared values at all levels	P1_Q03
4. Management provides people with the required resources	P1_Q04
5. Management provides people with the required training	P1_Q05

Involvement of people

6. Employees understand their role in the organization	P1_Q06
7. Employees do not blame others for problems	P1_Q07
8. Employees accept responsibility for solving problems	P1_Q08
9. Employees seek opportunities to enhance their competence	P1_Q09
10. Employees share knowledge openly	P1_Q10

Customer focus

11. The organization analyses customer needs	P1_Q11
12. The organization publicises customer needs to all employees	P1_Q12
13. The organization measures customer satisfaction periodically.	P1_Q13
14. The organization acts on customer complaints/feedback	P1_Q14
15. The organization has systems to manage customer relationships	P1_Q15

Process approach

16. The organization systematically defines the activities necessary to obtain a desired result	P1_Q16
17. The organization establishes clear responsibility for managing key activities	P1_Q17
18. The organization measures the capability of key activities	P1_Q18
19. The organization analyses the capability of key activities	P1_Q19

System approach to management

20. The organization has a structured approach that integrates processes	P1_Q20
21. The organization tries to reduce cross-functional barriers	P1_Q21
22. The organization continually improves the system through measurement and evaluation	P1_Q22

Factual approach to decision making

23. The organization has a system to ensure that data and information are accurate and reliable	P1_Q23
24. The organization makes data accessible to those who need it	P1_Q24
25. The organization analyses data and information using valid scientific methods	P1_Q25

Supplier partnership

26. The organization has a small number of key suppliers	P1_Q26
27. The organization shares information with key suppliers	P1_Q27
28. The organization encourages key suppliers to participate in new product/service development	P1_Q28
29. The organization rewards suppliers' contributions	P1_Q29

Quality assurance tools

30. The organization uses "check sheets" to collect data	P1_Q30
31. The organization uses "histograms", "Pareto diagrams" or "scatter diagrams" to present data	P1_Q31
32. The organization uses "control charts" or "statistical descriptions" to indicate the dispersion of data	P1_Q32
33. The organization uses "cause-and-effect diagram" or "process flow diagram" to remedy problems	P1_Q33

(continued)

Table AI.
Quality management
principles, use of quality
tools, and organizational
performance of service
organizations

MD 50,3	<i>Quality planning and management tools</i>	
	34. The organization uses “affinity diagrams” or “interrelationship digraphs” in brainstorming activities	P1_Q34
438	35. The organization uses “tree diagrams” to analyse the hierarchical relations of activities	P1_Q35
	36. The organization uses “matrix diagrams” or “prioritisation matrices” in decision-making	P1_Q36
	37. The organization uses “process decision program charts” to prepare for “what-if” scenarios	P1_Q37
	38. The organization uses “activity network diagrams” or “critical path methods” in project planning	P1_Q38
	<i>Staff and internal results (over the years after ISO implementation, ...)</i>	
	1. Employees hours spent in education and training increase	P2_Q01
2. Employees’ satisfaction increases	P2_Q02	
3. Turnover rate of employees decreases	P2_Q03	
4. The productivity of per employee per month increases	P2_Q04	

Table AI.

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