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Profiling Quality Management in Systems Development: An Empirically Study

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Introduction

The critical role of information systems in organizations has focussed attention on the need to manage quality in systems development. Existing quality management practices have been found inadequate to meet the escalating demands in systems delivery performance (Cusumano, 1991; Matsumoto, 1987). Problems such as poor quality, low productivity, cost over runs, late deliveries and user dissatisfaction have become common in systems development (Hamid & Madnick, 1989). These problems highlight the critical need to reengineer the systems delivery process (Rockart & Hofman, 1992).

Several IS organizations have responded to this challenge by adopting Total Quality Management (TQM) practices. Success of TQM initiatives in organizations like Corning Inc (Shrendick et al, 1993) and Dun & Bradstreet suggests a positive relationship between quality management practices and quality performance. However, the reported failures of TQM programs in organizations like Florida Power and Kodak (Grant et al, 1994) suggest that systematic study is necessary to develop a richer understanding of how TQM works and when it is effective.

The quality management literature adopts an universalistic perspective that TQM involves a set of principles and practices that are applicable across organizations (Juran, 1986). However, recent empirical studies (Bensen et al, 1991; Flynn et al, 1994) and theoretical work (Sitkin et al, 1994) highlight that quality management is context-dependent and organizations that have recognized this have been relatively successful in implementing TQM programs (Ernst & Young, 1992).

This contingent perspective which is rooted in systems theory suggests that quality management practices vary across organizations. Understanding these variations is perhaps the first step towards theory development in this area. Accordingly, this study focuses on developing a descriptive profile of quality management practices in the context of systems development. The rest of the paper is organized as follows: first, a description of the empirical study is presented; this is followed by a discussion of the data analysis; next the results and findings of the study are presented and their implications are discussed.

The Empirical Study

A national survey was conducted to gather data for the study. A mailing list comprising of top IS executives was constructed from the *Directory of Top Computer Executives*.

The organizations chosen belong to the fortune 500 and six non-industrial sectors and a randomly chosen set of government agencies. A total of 710 questionnaires were mailed. 123 responses were received after three follow up mailing resulting in a response rate of 17.32% (Table 1).

Measures

Tables 2 & 3 depict the variables used in the study. Quality performance is conceptualized to comprise of three dimensions - delivering customer value, process effectiveness and process efficiency with multiple items to measure each dimension. The critical factors of quality management have been synthesized by integrating past literature in quality management (Saraph et al, 1989; Flynn et al, 1994; Garvin, 1992). Existing instruments (Saraph et al, 1989; Flynn et al, 1994; Powell, 1995) have operationalized these factors in the context of manufacturing or service operations. In this study quality management factors have been operationalized in the context of systems development. Items constituting quality performance and critical factors of quality management were measured using a seven point Likert-type scale with values ranging from 'strongly disagree' to 'strongly agree'.

Data on key contextual and structural factors were also collected. Respondents were classified into three industry groups - manufacturing, service and not-for-profit (1 - manufacturing, 2- service, 3 - not for profit). A unidimensional response matrix listed three structural arrangements - functional (1), by applications (2) and matrix (3) with a brief description of each and respondents were asked to check off the one that described the structure of their IS unit. In addition, respondents were asked to indicate if a separate quality function existed (0 - no, 1 - yes) within their IS units and the responsibilities this functional unit. The position of the CIO in the organization was assessed by asking the respondents to indicate the number of levels below the CEO is the CIO ranked. The time elapsed since adoption of TQM was assessed using a unidimensional time scale with five intervals ranging 'not yet started' to > 5 years.

Factor Analysis

Items constituting quality performance were factor analyzed to yield a clean structure (cutoff loading .50) with three factors - customer value, process effectiveness and process efficiency. The factor structure confirms our conceptualization of quality in terms of outcome and process dimensions. The process dimension is further split into effectiveness and efficiency which is also consistent with our conceptualization.

Factor analysis of items pertaining to quality management yielded 12 factors (cutoff loading .50). These factors also map well with the factors used in other empirical studies in quality management (Saraph et al, 1989; Flynn et al, 1994).

Cluster Analysis

To develop a descriptive profile of quality management practices the organizations were cluster-analyzed over the twelve quality management factors using a non-hierarchical procedure. The analysis yielded three clusters as depicted in Table: 4. Cluster 2 comprises mainly of manufacturing firms with relatively high TQM experience and success. Clusters 1 & 3 comprise of firms with relatively low TQM experience and success. Of these, cluster 1 consists of primarily service organizations while cluster 3 consists of manufacturing organizations.

Results and Discussions

The mean differences between the three clusters indicate that TQM has a significant impact on quality performance. Group 2 which has the highest mean values for all quality management factors also has the highest mean values for all three dimensions of quality performance. A similar conclusion can be arrived at by examining the mean values of the other two clusters as well.

Cluster 2 has a higher experience in TQM implementation (median 3 years) as compared to Clusters 1 & 3. This suggests that TQM practices require a gestation period to yield results and a long term perspective is necessary in adopting these practices. Similar results have been reported by other studies as well (Ernst & Young, 1992; Powell, 1995). For example, Ernst & Young (1992) in an international survey found that organizations that have persisted with their quality initiatives for more than three years reported significant performance improvements. Powell (1995) reported similar findings in a survey of medium and large organizations.

The higher quality performance of firms in cluster 2 as compared to those in cluster 3, despite similarities in quality management practices (such as IS leadership, empowerment, user involvement and vendor involvement) offers some interesting insights. It is possible that because of learning effects (due to longer experience) firms in cluster 2 are more effective in implementing TQM than those in cluster 3. It is also possible that successful adoption of a few aspects of TQM may not yield results as TQM encompasses a set of mutually complementing processes (Dean & Bowen, 1994). The uniformly high mean values across all factors in cluster 2 as compared to cluster 3 highlights this point.

Structural factors indicate that the level of chief of IS does not significantly vary across the groups. This can be expected given that the sample comprises of only fortune 500 organizations where IS executives form part of the top management team. Most firms in cluster 2 have a matrix structure in their IS units. It is conceivable that a matrix structure facilitates adoption of innovations due to the increased communication among organizational members (Rai & Howard, 1993). It is also seen that a separate quality function does not have any relationship with quality performance or TQM adoption. This reinforces the notion that quality management should be integral to core processes and cannot be treated as a support function. The contextual factors highlight that manufacturing firms have been more successful in adopting TQM practices that service

and no-for-profit organizations. This fnding is consistent with similar findings by Powell (1995).

Table 1: Profile of Respondents by Industry

Industry	Effective No. of Questionnaires Mailed	No. of Responses Received	Response Rate %
Manufacturing	338	64	18.93
Insurance	34	6	17.65
Utilities	34	6	17.65
Transportation	29	6	13.79
Retail	32	5	15.63
Banks	61	8	13.11
Financial Services	25	5	20.00
Div. Services	52	5	9.62
Government	105	18	17.14
Total	710	123	17.32

Table 2: Descriptive Statistics - Contextual Variables

Variables	No. of Items	Median
Years Since Adoption of TQM	1	2
Industry	1	1
Level of Chief of IS	1	2
Structure of IS unit	1	2
Presence of Separate Quality Function within IS unit	1	0

Table 3: Descriptive Statistics - Independent and Dependent Variables

Variables	No. of Items	Cronbach's Alpha	Mean	S.D.
Quality Management Factors				

IS Leadership for Quality	3	.804	5.62	1.99
Quality Policy	4	.800	4.44	1.20
Training	3	.705	5.02	1.19
Quality Based Reward Schemes	4	.696	3.55	1.12
Empowerment of Analysts	2	.525	4.44	1.29
Empowerment of Team Members	2	.687	4.94	1.20
Fact Based Management	6	.880	3.86	1.16
Continous Improvement	5	.950	4.31	1.42
Design for Quality	6	.830	4.70	1.08
User Involvement	4	.830	5.78	.90
Quality Emphasis with Vendors	2	.485	4.74	1.16
Vendor Involvement	2	.713	4.89	1.31
Quality Performance				
Delivering Customer Value	5	0.856	5.17	1.1
Process Effectiveness	3	0.742	3.41	1.3
Process Efficiency	2	0.935	4.13	1.6

Table 4: Clustering IS Units on TQM Practices

Factors	Median/Mean			Multiple	Comparisons	
	Cluster 1 (n=16)	Cluster 2 (n=54)	Cluster 3 (n=50)	1 - 2 p	1 - 3 p	2 - 3 p
Contextual Factors						
Years Since Adoption of TQM	1*	3*	1*	.027	ns	.025
Industry	2*	1*	1*	ns	ns	ns
Level of Chief of IS	2*	2*	2*	ns	ns	ns
Structure of IS unit	2.5*	3*	1*	ns	ns	.018
Presence of Separae Quality Function within IS unit	0*	0*	0*	ns	ns	ns
Quality Management						

Factors						
IS Leadership for Quality	4.42	6.27	5.31	.0001	.0028	.0001
Quality Policy	3.17	5.19	4.03	.0001	.0023	.0001
Training	4.04	5.73	4.57	.0001	.0670	.0001
Quality Based Reward Schemes	2.29	4.32	3.13	.0001	.0008	.0001
Empowerment of Analysts	3.84	4.80	4.24	.0088	ns	.0250
Empowerment of Development Team Members	3.50	5.47	4.82	.0001	.0001	.0018
Fact Based Management	2.33	4.70	3.44	.0001	.0001	.0001
Continuous Improvement	2.50	5.21	3.91	.0001	.0001	.0001
Design for Quality	3.96	5.32	4.47	.0001	.0001	.0001
User Involvement	4.78	6.06	5.78	.0001	.0001	.0780
Quality Emphasis with Vendors	3.47	5.36	4.48	.0001	.0004	.0001
Vendor Involvement	3.50	5.44	4.73	.0001	.0003	.0019
Quality Performance						
Delivering Cusotmer Value	4.59	5.53	4.96	.0013	ns	.0050
Process Effectiveness	2.83	3.82	3.16	.0057	ns	.0075
Process Efficiency	3.75	4.63	3.70	.0517	ns	.0004