SHOP-FLOOR COMMUNICATION AND PRACTICES FOR OPERATIONAL PERFORMANCE: AN EMPIRICAL ANALYSIS OF QUALITY MANAGEMENT

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ABSTRACT

This paper aims to provide a research framework for studying the role of communication in supporting quality management (QM) practices at the shop floor level to obtain high operational performance. It attempts to investigate the relationship between shop-floor communication and QM practices and their impact on operational performance. The result shows the shop-floor communication has an indirect impact on operational performance mediated by the implementation of QM practices on the shop floor.

Keywords: communication, quality management, operational performance, shop floor, structural equation modeling

INTRODUCTION

The empirical research on quality management (QM) has evolved over the last two decades. Numerous studies have investigated the relationships among QM practices and organizational performance on various levels. Even though the existing literature of quality management (QM) and various quality awards have regarded communication as an important factor for the successful implementation of QM, there are little attempts to link communication and QM practices in achieving high operational performance.

Some researchers, though have emphasized the significance of communication and information management in successful implementation of QM [1, 2], did not propose any analytical frameworks for further empirical investigation. Forza [3] pioneered this effort through studying the role of quality information systems in QM from a perspective of information flow. Later on, Forza and Salvador [4] proposed a comprehensive framework for analyzing the information flows taken place within process communication network in supporting the implementation of management best practices (total quality management, just-in-time etc.), which lent a strong foundation for further empirical study. Sila and Ebrahimpour [5], having conducted an intensive review of the critical factors in the existing QM literature, pointed out the scarcity of studies dealing with the role of communication in effective QM implementation in detail. They also suggested three areas on this issue that need more studies: the mechanisms or channels to communicate QM; the types of communication methods and their role in QM; and the impact of the Internet technologies on QM.

Responding to this need, this study aims to provide a research model to study the role of communication in supporting QM practices to obtain high operational performance, at the shop floor level. In particular, it attempts to answer the following research questions:

RQ1. What is the relationship between communication and QM practices at the shop floor level?

RQ2. How do shop-floor communication and QM practices on the shop floor impact on operational performance?

This study contributes to the literature by extending our understanding of the role of communication in QM implementation on the shop floor and enriching our knowledge of how to achieve and improve operational performance through leveraging communication.

RESEARCH MODEL

Figure 1 shows a research model for studying the role of communication in supporting QM practices with the objective of attaining high operational performance. The model contains the following three dimensions: shop-floor communication, process management, and operational performance.

The dimension "shop-floor communication" considers communication directed to the shop floor to support the shop-floor personnel to improve quality performance. It includes three types of communication as follows.

Teamwork: group communication taken place on the shop floor in order to solve quality problems

Feedback: provides the shop-floor personnel with information regarding their performance in a timely and useful manner.

Training: instructive communication directed to the shop-floor personnel providing skills, knowledge, expertise, etc. for their proper execution of multiple tasks or jobs.

The dimension "process management" represents activities and approaches typical of QM practices on the shop floor. It includes three practices as

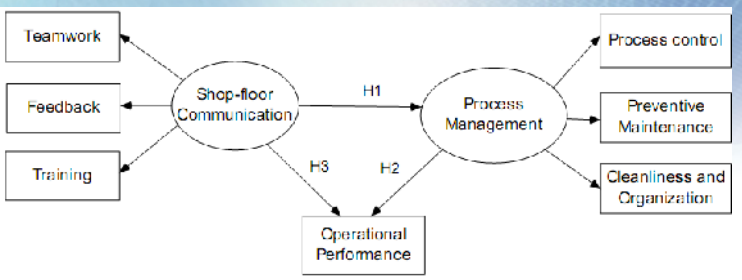

Figure 1: The hypothesized model

follows:

Process control: the use of statistical process control to maintain control over production processes in order to reduce variance.

Preventive maintenance: a schedule of planned maintenance actions aimed at the prevention of breakdowns and failures.

Cleanliness and Organization: steps are taken to organize the work-place and maintain it in order to help employees accomplish their jobs faster and instill a sense of pride in their work-place.

The dimension "operational performance" includes four performance measures in the context of manufacturing plants: unit cost of manufacturing, conformance to product specifications, on-time delivery performance and flexibility to change volume. These items were summed up to form an overall operational performance.

HYPOTHESES

In order to implement and promote the process management effectively, the results related to detected process variations and quality problems need to be intensively discussed, analyzed and shared on the shop floor to solve the problems [7]. This needs the facilitation through communication activities such as shop-floor information feedback, group communication, instructive communication, etc. Therefore, the following hypothesis is suggested:

H1: Shop-floor communication is positively related to process management.

Effective process management is expected to reduce process variation, enhance process capability, and thus decrease the likelihood of defective parts [6]. As the defective is reduced, less time and money will be spent on rework and inspection at the machine shop, allowing the production run faster and more smoothly and thus leading to better operational performance. Thus, we propose that

H2: Process management is positively related to operational performance.

Shop-floor communication enables a direct and effective communication between workers, fostering not only information exchange, but also the exchange of their feelings [8]. As a result, workers are expected to work more effectively in a cooperative environment and execute better tasks with fewer defectives. This lead to the following hypothesis:

H3: Shop-floor communication is positively related to operational performance.

METHODOLOGY

The primary research instruments for this study are rigorously validated measurement scales and survey data collected through an extensive questionnaire. Data are acquired from 184 manufacturing plants in 6 countries: the United States, Japan, Italy, Australia, Korea, and Germany during 2003-2004. Those plants belong to three industries: electrical & electronics, machinery, and transportation equipment. The six scales for shop-floor communication and process management were evaluated by people at eight different positions through perceptual question items on the seven-point Likert scale, where a value of one indicated 'strongly disagree' and a value of seven indicated 'strongly agree.' Meanwhile, the measures of operational performance were judged by the plant manager on the five-point Likert scale.

All the measurement scales were tested for reliability and validity through calculating the Cronbach's alpha and the confirmatory factor analysis. The items which undermined the validity or reliability were eliminated.

DATA ANALYSIS

Structural equation modeling was used to test the Hypotheses followed by a regression model to test the linkages among the three constructs at a more detailed level. A number of indices were used to determine the fit of the data to the model (Table 1). An analysis of the t-value revealed that the relation between "shop-floor communication" and "operational performance" is not statistically significant (t-value=1.311; standardized estimate of the coefficient=1.125), and so is between "process management" and "operational

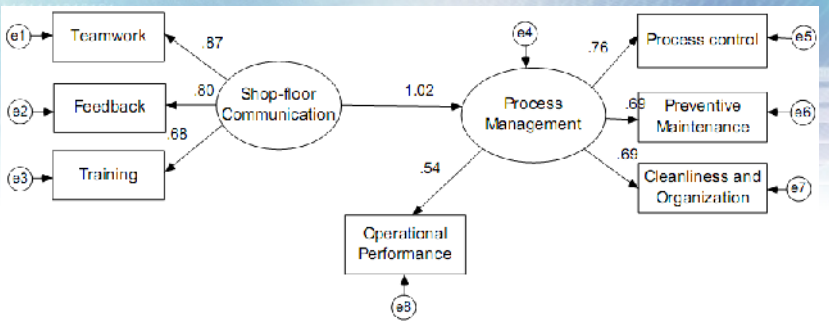

Fig. 2: The revised model

Table 1: Fit measures of overall model

Fit index	Chi-square test statistic	Degrees of freedom	Normed chi-square	RMSEA	CFI	PNFI
Hypothesized structural model	59.091	12	4.924	0.146	0.925	0.390
Revised structural model	61.925	13	4.763	0.143	0.922	0.421

Table 2: Regression results

Dependent Variables	R2	Adjusted R2	F	Sig	Independent variables	Beta	t-value	Sig
Process Control	.591	.584	86.731	.000	(Constant)	.651	1.896	.060
					Teamwork	.154	1.956	.052
					Feedback	.619	9.360	.000
					Training	.063	.983	.327
Preventive Maintenance	.436	.426	46.317	.000	(Constant)	1.001	2.923	.004
					Teamwork	.253	2.729	.007
					Feedback	.233	3.002	.003
					Training	.284	3.804	.000
Cleanliness and Organization	.425	.415	44.304	.000	(Constant)	2.134	5.790	.000
					Teamwork	.472	3.067	.000
					Feedback	.156	2.728	.049
					Training	.089	1.729	.238
Operational Performance	.239	.222	14.100	.000	(Constant)	1.256	3.061	.003
					Process control	.175	1.855	.066
					Preventive Maintenance	.196	2.177	.031
					Cleanliness and Organization	.224	2.373	.019

performance" (t-value=-0.670; standardized estimate of the coefficient=-0.571). According to SEM theory, the non-significant path from "shop-floor communication" to "operational performance" was deleted, while other paths still remains to keep the meaning of this conceptual

model. The standard coefficients for the revised structural model are shown in Figure 2. All of the coefficients are significant at the 1% level, making the research model meaningful despite the mediocre fit indicated by fit measures (Table 1).

Regression analysis was then conducted to test the relationship remained in the revised structural model in detail: the impact of shop-floor communication on process management and that of process management on operational performance (Table 2). The results can be summarized as follows:

Teamwork and feedback positively and significantly impact on all dimensions of the process management.

Training positively and significantly impacts only on preventive maintenance, and has a positive but non-significant impact on other two dimensions of the process management.

Process management, particularly cleanliness & organization and preventive maintenance, positively and significantly impact on operational performance.

Thus, the above analysis supports hypothesis H1 and hypothesis H2, while it rejects hypothesis H3.

CONCLUSIONS

This study highlights the role of communication in supporting QM practices to achieve operational performance at the shop floor level. First, we can find that the implementation of QM practices on the shop floor strongly associates with shop-floor communication in terms of group communication (teamwork), instructive communication (training) and feedback. This finding empirically supports the claim that the successful implementation of best management practice such as QM heavily dependents on effective communication [1]. Further, we confirm the positive relationship between QM practices and operational performance, which is in line with previous QM studies [6, 9]. To be more important, our study detects that the shop-floor communication does not have a direct impact on operational performance, but has an indirect impact on operational performance mediated by the implementation of shop-floor QM practices. This indicates that shop-floor communication, instead of being implemented alone, needs to be jointly implemented with shop-floor QM practices in order to achieve higher operation performance.

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