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Deployment Readiness Assessment of TPM and TQM Systems (Case Study: Pars Khodro Automaker Company in Iran)

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ABSTRACT

Deployment of maintenance and quality management systems comprehensively (TPM and TQM) have an important role in improving the productivity of manufacturing industries. Results of studies confirmed that implementation of TPM and TQM systems in many industries have not been successful. This research evaluated TPM and TQM deployment readiness in the Iranian prominent automaker, Pars Khodro, by appointing three different enablers. Research findings indicate that General and TPM enablers in Pars Khodro are desirable, while TQM enablers should be boost.

Introduction

Total Quality Management (TQM) and Total Productive Maintenance (TPM) systems are ways of managing to improve the effectiveness, flexibility and competitiveness of a business as a whole. It is also a method of removing waste by involving everyone in improving the way things are done. These techniques can be applied throughout a company so that people from different departments with different priorities and abilities communicate with and help each other (Hamzah and Ho, 1994; Ho and Fung, 1994).

TQM is a manufacturing program aimed at continuously improving and sustaining quality products and processes by capitalizing on the involvement of management, workforce, suppliers and customers in order to meet or exceed customer expectations.TPM is a manufacturing program designed primarily to maximize equipment effectiveness throughout its entire life through the participation and motivation of the entire work force. Thus, applying TQM and TPM simultaneously can be the best way that helps managers to keep their organization in stable and good condition (Cua et al, 2001).

Asian Productivity Organization (APO) introduces TPM and TQM as main tools to achieve higher productivity in Green Productivity (GP) philosophy (Johannson, 2006).

The result of both TQM and TPM deployment in long term leads to decrease the price and increase the quality of output that can be the key factor to keep up the organization with competitors. Additionally, this situation follows by improved customer satisfaction and then increasing the profit of organization, which salaries of workforces can be gone up and causes the higher job satisfaction level (Roghanian et al, 2012).

Total Quality Management History

There are many definitions of TQM. Tobin defines TQM as a totally integrated effort for gaining competitive advantage by continuously improving every facet of organizational culture. Wilkinson and Witcher define TQM as (Hamzah and Ho, 1994):

- Total: every person in the firm is involved (and, where possible, its customers and suppliers).
- Quality: customer requirements are met exactly.
- Management: senior executives are fully committed.

The idea of TQM started in the United States around 1945 in the form of statistical training. Generally, TQM refers to a management system in which the focus is shifted to the customer. Hence, the spirit of TQM is found in corporate activities designed to create products and services that are attractive to consumers, competitive in markets and safe from the stage of new product planning. All departments improve or maintain quality, cost, yield, procedures, and systems to give customers a product or service that is most economical, useful, and of the best quality. While TQM had its birth in the US, its growth as a tool for innovation occurred in Japan, and was adopted by other Asian nations. A successful TQM system is one where business processes are standardized under quality control in order to make use of cross-functional ways of managing and apply this to daily practices following the PDCA cycle in conjunction with basic quality tools (Johannson, 2006).

Total Productive Maintenance History

In 1971, the Japan Institute of Plant Maintenance (JIPM) defined TPM as a system of maintenance covering the entire life of the equipment in every division, including planning, manufacturing, maintenance, and all other divisions. It involves everyone from top executives to shop floor workers and promotes productive maintenance through morale-building management and small group activities in an effort to maximize equipment efficiency. Because of its targeted achievement, the term TPM is sometimes also known as total productive management (Hamzah and Ho, 1994).

The concept of 'Productive Maintenance' as a means to improve productivity is thought to have originated in General Electric, USA in 1954. In the late 1960s, Nippondenso, a Japanese manufacturer of automotive electrical parts, was known for its TPM success. Seiichi Nakajima, an officer with the Institute of Plant Maintenance in Japan is credited with defining the concepts of TPM and seeing it implemented in hundreds of plants in Japan. TPM ushered a positive meaning in maintenance culture and widened the understanding of its importance to productivity to all concerned. The entire work force must first be convinced that upper level management is committed to the program (Johannson, 2006).

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Literature Review

Researches have been done on the deployment of TPM and TQM systems simultaneously can be divided into three general models:

1)SIRIMEX model.
2)LETQMEX model.
3)TQM, TPM and JIT Relationship model.

Following parts show detailed explanation of these models.

SIRIMEX model

The Malaysian Government implemented its Umbrella Project in 1990, with the aim of upgrading technical levels and product quality among the SMIs (Small and Medium Industries), through SIRIM (Standards and Industrial Research Institute of Malaysia). This project aims to promote the gradual introduction of quality systems among SMIs based on ISO 9000 with the technical assistance of foreign affiliates and other advanced manufacturing companies. It hopes to encourage quality management by the SMIs by promoting the application of such systems under the Quality Improvement Scheme (QIP) and to tap those companies accredited under the QIP as suppliers to the main manufacturing companies cooperating under the aegis of the Umbrella Project (Hamzah and Ho, 1994).

SIRIMEX stands for "Standards and Industrial Research Institute of Malaysia Excellence Model" in which a substantial number of techniques have been known for quality management. Seven steps of TQM implementation in this model are: 5S, MPPC, QCC, QIP, ISO/MS ،TPM and TQM (Hamzah and Ho, 1994).

1)5S: Five Ss, Seiri, Seition, Seiso, Seiketsu, Shitsuke
2)MPPC: Marketing ,Production, Purchasing, Control
3)QCC: Quality Control Circles
4)QIP: Quality Improvement Practices
5)ISO/MS: ISO 9000 and Malaysian Standards
6)TPM: Total Productive Management
7)TQM: Total Quality Management

SIRIMEX model has been shown in figure 1.

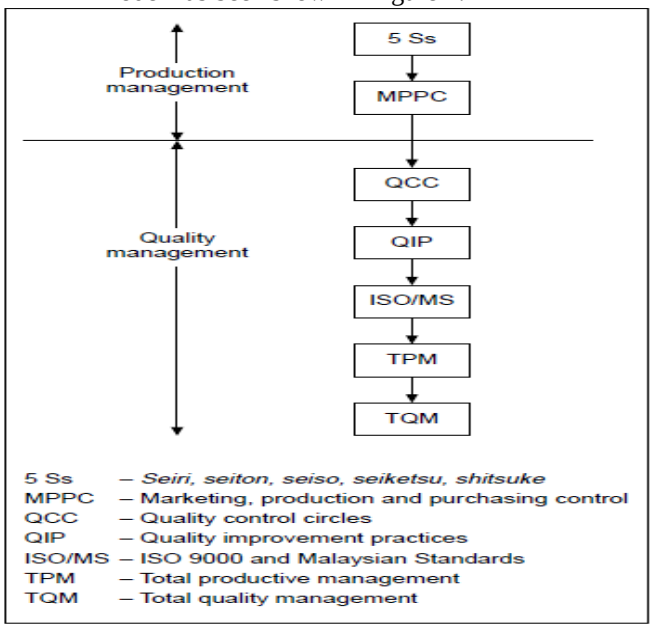

Figure 1. The SIRIMEX Model

LETQMEX model

LETQMEX stands for "Leicester Business School TQM Excellence Model" in which a substantial number of techniques have been known for quality management. Six steps of TQM implementation in this model are: 5S, MPPC, QCC, ISO ،TPM and TQM (Ho and Fung, 1994).

1)5S: Five Ss, Seiri, Seition, Seiso, Seiketsu, Shitsuke
2)MPPC: Marketing ,Production, Purchasing, Control
3)QCC: Quality Control Circles
4)ISO: ISO 9000
5)TPM: Total Productive Maintenance
6)TQM: Total Quality Management

LETQMEX model has been shown in figure 2.

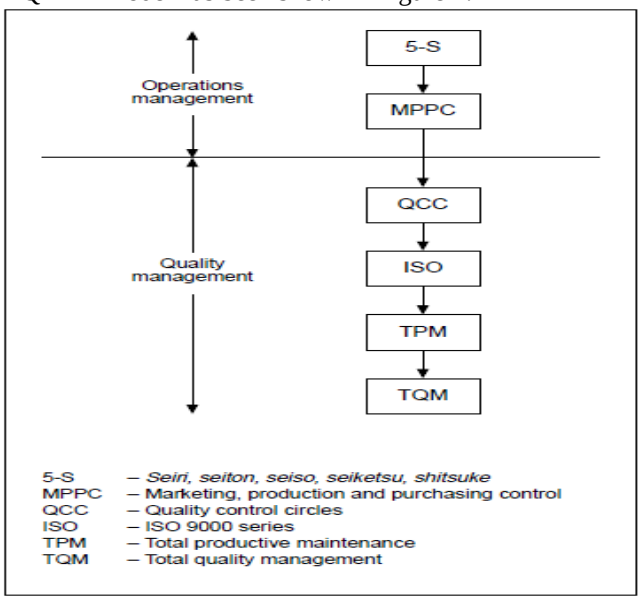

Figure 2. The LETQMEX Model

TQM, TPM and JIT Relationship model

Framework of this model considers the relationship among the basic TQM, JIT and TPM techniques and the human and strategic-oriented practices maintenance. In fact, the different emphases of TQM, JIT and TPM on waste reduction and elimination are complementary, yet may affect specific performance measures in different ways (Cua et al, 2001).

TQM, TPM and JIT Relationship model has been shown in figure 3.

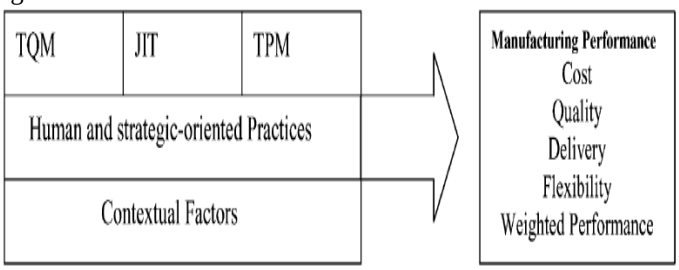

Figure 3. The TQM, TPM and JIT Relationship Model

Research background in the areas of TQM deployment is summarized in table 1.

Research hypotheses

According to studies, a model benchmarked from Cua et al (2001) TQM, JIT and TPM implementation relationships model with three system enablers:

1)General Enablers.
2)TPM Enablers.
3)TQM Enablers.

The research hypotheses are as follows:

H1 - General Enablers in Pars Khodro are desirable.
H2 - TPM Enablers in Pars Khodro are desirable.
H3 - TQM Enablers in Pars Khodro are desirable.

Table 1. Summary of research background in the areas of TPM and TQM deployment

Researcher	Subject	Industry	Country
Cua et al, (2001)	TQM, JIT and TPM effects on manufacturing performance	Electronic, Mechanic and Transport industries	Germany, Italy , Japan, England and USA
Ho and Fung, (1994)	TQM Developing	Industrial Companies	England
Hamzah and Ho, (1994)	TQM Training and Developing	Small and Medium Industries	Malaysia

Table 2. Reliability of General, TPM and TQM Enablers

Enablers	Number of Questions	Mean	Standard Deviation	Cronbach's alpha
General	20	3.1724	0.6616	923%
TPM	12	3.3652	0.6213	904%
TQM	12	3.1051	0.7343	895%

Table 3. Reliability of General Enablers

General Enablers Codes	General Enablers Areas	Number of Questions	Cronbach's alpha
G1	Committed leadership	6	858%
G2	Strategic Planning	2	755%
G3	Cross-functional training	2	975%
G4	Employee involvement	5	840%
G5	Information and feedback	5	799%

Table 4. Reliability of TPM Enablers

TPM Enablers Codes	TPM Enablers Areas	Number of Questions	Cronbach's alpha
P1	Autonomous and planned maintenance	4	782%
P2	Technology emphasis	4	825%
P3	Proprietary equipment development	4	757%

Table 5. Reliability of TQM Enablers

TQM Enablers Codes	TQM Enablers Areas	Number of Questions	Cronbach's alpha
Q1	Process management	4	834%
Q2	Cross-functional produc design	2	692%
Q3	Supplier quality management	2	781%
Q4	Customer involvement	4	890%

Table 6. Status of research hypotheses

Variable	t	Standard Deviation	Upper Limit	Lower Limit	Status (Accept or Reject)
H1	3.1724	0.6616	3.3089	3.0379	Desirable (Accept)
H2	3.3652	0.6213	0.5477	0.1828	Desirable (Accept)
H3	3.1051	0.7343	0.3207	-0.1106	Not Desirable (Reject)

Research methodology

The nature of this research is practical and descriptive-survey type. The data gathered from 94 maintenance and quality managers and experts by using a 44-items questionnaire. Research questionnaire is 44-items questionnaire based on Cua et al (2001) TQM, JIT and TPM implementation relationships model that modified several times after translation and then finalized. Five-point Likert scale (From 1 = very low to 5 = very high) is used to answer the questions. The data collected during August 2012. Validity of study questionnaire is content validity and verified by research director and advisor. Reliability of questionnaire confirmed by using Cronbach's alpha. The reliability of each enabler is presented in tables 2 to 5.

Research findings

In order to test research hypotheses (H1 to H3) one sample t-test is used. H1 and H2 hypotheses are confirmed with a confidence level greater than 95% due to the significance level of the test and the calculated values. The results are presented in table 6.

Conclusion and suggestions

One sample t-test results indicated that TQM enablers in Pars Khodro should be promoted. Practical suggestions are submitted here:

- Using statistical techniques to reduce variance in the process.
- Using different charts to control processes.
- Using statistical process control (SPC) on statistical processes.
- Enhancing team working activities to for new products and product modifications.
- Using different organizational units such as marketing and production for new products
- Assessing suppliers' competency in terms of technical.
- Communicating with customers.
- Getting customers comments about delivery, performance and quality of products.
- Responding to customers comments.
- Recognizing customers' needs, wants and demands.

Researchers can study this model in other companies both in products or services industries. Researchers can calculate impact of financial performance and the market of this model both in products or services industries.

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