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Full Length Research Paper

Assessment of the implementation of continuous improvement strategies in manufacturing industry of northern India

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Continuous improvement strategies are the way of making small incremental improvements in the manufacturing system processes. Manufacturing organizations are implementing many such strategies to enhance the performance of their manufacturing operations. These organizations are in a constant need to maintain a low cost of quality, reduce waste, trim production lines and speed up manufacturing to achieve an maintain competitiveness. So, the continuous improvement of the manufacturing operations has become necessary. This study attempts to assess the importance level implementation of continuous improvement strategies in continuous improvement approach in manufacturing industry of Northern India. Results indicated that Customer relationship plays a vital role in implementing continuous improvement strategies and working continuously with supplier's plays a least important role in implementing these.

Keywords: Continuous improvement (CI) strategies; Manufacturing Organizations; Customer relationship and Supplier.

INTRODUCTION

Kaizen is a Japanese word that has become common in many Western Companies; the word indicates a process of continuous incremental improvement of the standard way of work (Chen et al., 2000). It is translated in the west as ongoing, continuous improvement (Malik et al., 2007). It is a compound word involving two concepts: KAI (change) and ZEN (for the better) (Palmer, 2001). Most of the manufacturing organizations are currently encountering a necessity to respond to rapidly changing customer needs, desires, and tastes. To compete in this continuously changing environment, these companies must seek out new methods allowing them to remain competitive and flexible simultaneously, enabling their companies to respond rapidly to new demands (Black, 1991). With increased global competition, attention has been shifted from increasing efficiency by means of economies of scale and internal specialization to meeting market conditions in terms of flexibility, delivery performance and quality (Yamashina, 1995). The changes in the current business environment are characterized by intense competition on the supply side and heightened volatility in customer requirements on the demand side. These changes have left their unmistakable marks on the different facets of the manufacturing organizations (Gomes et al., 2006). To meet the challenges posed by the contemporary competitive environment, the manufacturing organizations must infuse quality and performance improvement initiatives in all aspects of their operations to improve their competitiveness (Pintelon et al., 2006). In order for these companies to remain competitive, retain their market share in this global economy, and satisfy both external and internal economy, and satisfy both external and internal customers, continuous improvement of manufacturing system processes has become necessary (Shingeo, 1988). Competition and continuously increasing standards of customer satisfaction have proven to be endless driver of organizational performance improvements. The CI approach constantly seeks to identify and implement

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ongoing enhancements in a firm's products, services and processes (Reid, 2006).

Modern manufacturing organizations are focusing towards increased profitability by improving the manufacturing system processes using management techniques like continuous improvement, total quality management and total productive maintenance. Continuous Improvement is a widely practiced by manufacturing firms to improve quality, reduce lead times, reduce price, reduced lead times, reduce price and improve delivery reliability. It is one of the core strategies for manufacturing excellence and is considered vital in today's competitive environment (Dean and Robinson, 1991). This paper investigates the level of importance of eight (8) CI strategies including Supplier Development, Process (JIT), People (Total Involvement), Total Quality Management, System (Support Core Work), Leadership, Total Productive Maintenance and Customer Relationship in implementing continuous improvement approach and also on the basis of sub-strategies of continuous improvement approach.

Literature review

Soderquist (1996) investigated continuous improvement and innovation practices in French SMEs. In this survey, they examine the drivers for change and the short and long-term goals, the sources of innovation and the nature of innovation management in French SMEs. Respondents are asked to consider a recent and successful innovation in product and then to indicate just how important a number of items are used as a source of particular innovation. The top nine sources of innovation that have been found include introduction of the new product, continuous improvement of work processes, radical change (e.g. through business process reengineering), increased focus in marketing/sales efforts, reduction in indirect staff numbers, improvement on staff competence, improved quality of product and services, improving the quality of management, efforts to improve supplier performance. The survey identifies two groups of SMEs. The first group has reported satisfaction with their organization's performance in product innovation and has also reported that their organizations have a strategic approach to innovation. The second group comprises SMEs, which are satisfied with current actions for improving short-term performances. Further analysis shows that the second group is more likely to report a stronger emphasis on performance management approach.

Bessant (2000) presented a survey that has been conducted by continuous improvement research advantage (CIRCA) at UK firms. Survey suggests that 65% of companies consider CI (continuous improvement) to be strategic importance, around 50% have instituted some form of systematic programme to apply these concepts, 19% claims to have a wide spread and sustained process of CI in operation, and of those firms using CI. 89% claims that it has impact on productivity, quality, delivery performance or combination of these.

Hongming et al. (2000) carried out a survey in Chinese companies that not all companies that have carried out CI activities achieve desired results. It has significant impact on companies in which CI implementation requires adequate input on company capital human resource and organizational activities. It is a challenge for companies in the organizational structure business principle and operations methods.

Mackle (2000) presented a survey conducted by KAIZEN institute that has been designing and implementing various continuous improvement programs in most of companies in UK. Institution has conducted a survey with all of their UK clients. Outcomes of the survey show that organizations have not successfully implemented these improvement programs. The opportunities for improvement are also identified in this survey. .

Gonsalves (2002) performed a survey about the effect of ERP and CI (continuous improvement) on the performance in 500 manufacturing companies. He concludes that CI implementation has positive influence on BPR (business process reengineering) execution. Integrated CI and BPR have positive effects on the company's performance.

Malik and YeZhuang (2006) performed a survey in 105 Spanish and 50 Pakistani companies to analyze the outcome of continuous improvement practices carried out in these industries. Questionnaire is circulated to different industries. 12 continuous improvement tools have been investigated. Result shows that Spanish industries utilize these tools more than Pakistani industries. Spanish industries are comparatively more experienced and advanced from Pakistani industries.

Tseng et al. (2006) investigated the effects of continuous improvement and cleaner production on the operational performance. A total of 223 responses have been obtained after the distribution of questionnaire. Sample for study has been collected via a survey of Taiwan electronic manufacturing firms. The direct and indirect influences of independent variables on dependent variables are tested by SEM (structural equation modeling) technique. The result shows that the continuous improvement might not be able to directly improve the operational performance. However, continuous improvement plays a significant role in cleaner production implementation.

Yan-jiang et al. (2006) conducted a survey by using data of the global continuous innovation network to analyze the influencing factors of continuous improvement. This survey designs 18 questions to describe the reasons why companies are implementing continuous improvement activities, 13 questions to describe the company's external environment and 11

questions to describe the situation of continuous improvement activities in functional departments of the companies. Result shows that the internal motivation factors are responsible for popularization of continuous improvement activities and have varying degree of influence on these activities.

Malik et al. (2007) conducted a survey by comparative analysis between two Asian developing countries, China and Pakistan, by investigating how they are deploying continuous improvement practices. The questionnaire consists of 18 selected blocks of questions related to organization and its operation of CI, supporting tools used in improvement activities, effects of improvement activities and company background and its characteristics. Result shows that industries in both of the countries are deploying continuous improvement methodologies, but with different proportions.

RESEARCH DESIGN

Research Methodology

The Research methodology used for the research work in the steps given below:

Step 1: Extensive Literature Survey
Step 2: Identification of CI Strategies
Step 2: Preparation of Questionnaire
Step 3: Pilot testing of Questionnaire
Step 4: Data Collection
Step 5: Statistical Analysis
Step 6: Results
Step 7: Conclusions

For this survey, a questionnaire has been designed which consists of two different section, first section consists of questions related to general organizational information, name and designation of respondent, Types of products manufactured, whether they are applying CI strategies or not. The measurement of other sections is done on five point Likert scale i.e. level of importance is determined on the scale (1=Not at all Important, 2=least Important, 3=Not so Important, 4=Very Important, 5=Most Important. A total of 38 questions have been included in the questionnaire. The survey instrument is pre-tested for content validity and clarity by two experienced researchers and managers of an Industry. This process yielded a survey instrument that was judged to exhibit high content validity.

Data Collection

The final structure questionnaire has been sent to 120 manufacturing organizations randomly selected from among the membership of the confederation of Indian Industry (CII) and Directorate of Industries. The questionnaire has been sent to the companies via post, along with a cover letter and pre-paid reply envelope. A total of 48 responses have been obtained after the distribution of questionnaire to different manufacturing enterprises, representing a response rate of 37.5%. Survey suggests that 54% of the total manufacturing enterprises surveyed are applying continuous improvement strategies and 46% are not applying these strategies. Different types of manufacturing organizations have been surveyed based on the product manufactured including auto parts (58.33%), cycle parts (25%) and cold rolled products (16.67%). The majority of respondents of organizations include Management Representatives (20.8%), Managers (33.3%), Assistant Managers (8.4%), Senior Engineers (20.8%), and Engineers (16.7%).

RESULTS AND DISCUSSION

Analysis of Eight CI Strategies

Sample size for this survey is 26. For small sample sizes, *t* distribution is applicable. For the analysis of data, student *t*-test has been applied. Analysis is done on the basis of eight (08) CI strategies and also on the basis of sub- strategies of CI. The level of importance has been calculated on the value of mean and the level of significance has been tested on basis of *t*-test. Table 2 shows the results of the student *t*- test for the eight (8) CI strategies.

Discussion of the findings 1

Customer Relationship is rated most important (mean= 4.386) followed by Total Productive Maintenance (mean=4.287), People (Total Involvement) (mean=4.201), Total Quality Management (mean=4.181), System (Support Core Work) (mean=3.988), Leadership (mean=3.939), Process (Just in Time) (mean=3.936) and Supplier Development (mean=3.803).

Analysis of Sub-Strategies of Continuous Improvement

Table 3 shows the result of student *t*-test applied for different strategies in terms of eight (08) main CI strategies

Discussion of the findings 2

The sub-strategy “Total Cost Management” is rated most important (Mean=4) and “Value Stream Analysis” is rated least important (Mean=3.59) in terms of Supplier Development; strategy “Process Flow Analysis” is rated most important (Mean=4.272) and “Cell Formation” is

Table 2. Results of the student *t*- test for the eight (08) CI strategies

CI strategies	Mean	S.D	*t*-Statistics	Hypothesized Mean(μ)
Supplier Development	3.803	1.055	-1.27*	
Process (Just in Time)	3.936	1.025	-0.705*	
People (Total Involvement)	4.201	0.827	0.627*	
Total Quality Management	4.181	1.051	0.407*	
System (Support Core Work)	3.988	1.044	-0.457*	
Leadership	3.939	1.035	-0.684*	
Total Productive Maintenance	4.287	0.739	1.251*	
Customer Relationship	4.386	0.753	1.841**	4.091

*Significant at 5% level *t*n-1(0.05) =1.72
**Significant at 1% level, *t*n-1(0.01) =2.52,
***Not Significant

Table 3. Results of Student *t*-test

Strategies	Sub-Strategies	Mean	S.D	*t*-Statistics	Hypothe-sized Mean(μ)
	Total Cost Management	4	1.112	0.831*	
Supplier Development	Value Stream Analysis	3.59	1.098	-0.906*	3.803
	Value Analysis	3.81	0.957	0.074*	
	Process Flow Analysis	4.272	0.882	1.787**	
	Cycle Time Reduction	4.045	0.898	0.569*	
Process	Material and Information Flow	3.863	0.833	-0.409*	
(Just in Time)	Theory of Constraints	3.909	1.019	-0.125*	
	Cell Formation	3.591	1.368	-1.184*	3.936
	Principles of KAIZEN	4.045	0.785	0.144*	
	Internal Training and Monitoring	4.363	0.789	2.033**	
	Self-Discipline	4.227	0.751	1.285*	4.201
	Suggestion System	4.181	0.852	0.882*	
	Manager Development	4	0.975	-0.102*	
People (Total	Small Group Activities	4.227	0.869	1.111*	
Involvement)	Team based Improvement	4.363	0.789	2.033**	
	5S	4.727	0.455	5.612***	
	Error Proofing Analysis	4.454	0.595	2.147**	
Total Quality	Six Sigma	3.727	1.351	-1.577*	4.181
Management (TQM)	Failure Mode Effect Analysis (FMEA)	3.591	0.973	1.095*	
	Casual Analysis	4.409	1.181	-2.345**	
System (Support	Support and Administration KAIZEN	3.863	1.125	-0.521*	
Core Work)	Process Flow Mapping	3.909	1.019	-0.366*	
	Total Cost Management	4.136	1.037	0.668*	
	Finance	4.045	1.045	0.254*	3.988
	Vision Alignment and Direction	3.863	1.206	-0.294*	
	Policy Deployment	4	0.925	0.307*	
Leadership	Recognition	3.954	0.998	0.071*	3.939
	Preventive Maintenance	4.591	0.503	2.824***	
Total Productive	Equipment Restoration	4	0.925	-1.458*	
Maintenance	Minor Stoppage Elimination	4.272	0.631	-0.112*	4.287
	Quality Function Deployment	4.409	0.734	0.145*	
Customer Relationship	Customer Quality, Cost, Delivery Analysis (QCD)	4.363	0.789	-0.135*	4.386

*Significant at 5% level, *t*n-1(0.05) =1.72, ***Not Significant,
**Significant at 1% level, tn-1(0.01) =2.52

rated least important (Mean=3.59) in terms of Process (Just In Time); strategy "Internal Training and Monitoring" and "Team based Improvement" are rated most difficult (Mean=4.636) and "Manager Development" are rated least important (Mean= 4) in terms of People (Total Involvement); strategy "Error Proofing Analysis" is rated most important (Mean=4.454) and "Failure Mode Effect Analysis" is rated least important (Mean=3.591) in terms of TQM (Total Quality Management); strategy "Total Cost Management" is rated most important (Mean=4.136) and "Support and Administration KAIZEN" is rated least important (Mean=3.863) in terms of System (Support Core Work); strategy "Policy Deployment" is rated most important (Mean=4), and strategy "Vision Alignment and Direction" is rated least important (Mean=3.863) in terms of Leadership; strategy "Minor Stoppage Elimination" is rated most important (Mean=4.2727) and strategy " Equipment Restoration" is rated least important (Mean=4) in terms of Total Productive Maintenance (TPM); strategy "Quality Function Deployment" is rated more important (Mean=4.409) than strategy "QCD" (Mean=4.363) in terms of Customer relationship

CONCLUSIONS

Results of investigation indicated that customer relationship is rated most important and supplier development is rated least important in carrying out continuous improvement activities in the manufacturing organizations. Managing the financial outcomes of the activities is most effective and seeking the opportunities for improvements by directly observing the flow of material is least effective in identifying the opportunity for making continuous improvement. Checking the step-by-step flow of a process is most effective and grouping of the products having similarities in their design and manufacturing attributes is least effective in making continuous improvement. Adequate training and collective team efforts are most effective and improving the manager's skills by exposing them to learning opportunities is least effective in involving them fully in improvement activities. Operator mistakes or error proofing analysis is the most effective TQM technique for carrying out improvement activities and analysis of potential failure modes by determination of the failure effect on the system is least important in carrying out improvement activities effectively. Deployment of policy goals by effective leadership is rated most important tool in achieving goals of continuous improvement and vision alignment and direction is rated least important in terms of leadership. Elimination the minor stoppages that arises for short period of time or minor stoppage elimination is the most important maintenance technique for carrying out improvement activities. Disassembling and rechecking the equipment or equipment restoration is the least important maintenance technique for carrying out improvement activities effectively. Translating the customer requirement at the design stages is more effective and developing the key performance indicators through continuous feedback from the customer is less effective in making continuous improvement.

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