

Human Related Issues on the Development of Cellular Manufacturing:

A Study in Sri Lankan Apparel Industry

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Introduction

In modern manufacturing systems such as agile and flexible manufacturing systems, there is an increasing demand for customized products. Therefore, there appear to be an increased focus on finding new methods that have the most of the strategic advantages of a job shop but also can provide some of the operational advantages of an assembly line (Esmaelian & Hamed 2012). Cellular Manufacturing (CM) gained more attention in this manner.

CM is an approach for organizing machines and people into groups to produce a variety of parts in part families. CM offers an opportunity to combine the efficiency of product flow layouts with the flexibility of functional layouts (Anbumalar & Sekar 2015).

It is widely accepted that CM will bring much benefits such as reducing delivery lead times, set up time, lot size, work-in-process inventory and defects, while improving product quality, worker productivity, & process improvements. Within these enablers there is no doubt that organizations are willing to apply CM in their organizations. However according to Udo & Ehie (1996) only half of those companies adopting CM ever attain successful implementation.

The investigation is then open to explore why organizations couldn't get the full benefits of CM. The main reason for that is, previous studies in CM focus on cell design and technical factors while pay no attention on human factors. Because both are much important to gain the fullest benefits of CM, this study has been done to study the impact of human behavior on developing CM system in the organization.

Critical Review of Literature

In the initial study of CM, Wemmerlov and Johnson (1997) revealed that manufacturing cells can provide substantial benefits; however, implementing CM is not merely an issue of rearranging the factory layout, but more importantly an issue that involves and affects the organizational and human aspects of the manufacturing firm. The authors found that the number of comments about 'soft' (people) issues exceeded the number about 'hard' (technical) ones.

Dixit and Guptha (2013) in their study current status, enablers and barriers of implementing CM in Indian industries found that the most common problem related to the production are high lead time, high set up time, and high inventory storage and the most common problem faced by firms in CM were related to workers resistance.

Research Methodology

Fifteen garment factories where lean manufacturing/ CM has already been implemented were selected as the sample. Purposive sampling procedure was being applied to select four executives from the departments of cutting; production, inspection, and packing. Accordingly, the researcher surveyed 60 executives from selected garment factories.

The questionnaire was developed based on the existing literature. Most of these questions were framed on a 5 point Lickert scale. A total of 60 questionnaires together with the covering letter and the confidential letter were sent through email and personally to different garment factories. All questionnaires were returned with a 100% of response rate.

Data was analyzed using SPSS version 19 software package. Factor analysis was done in order to measure construct validity of the instrument. All components have got more than 0.7 Cronbach's alpha value indicated higher degree of reliability.

Statistical measures such as mean, standard deviation and percentages were used. Multiple regression analysis was used to measure the impact of human barriers/ obstacles on the dependent variable of benefits of CM.

Results and Discussion

Reasons for Applying CM

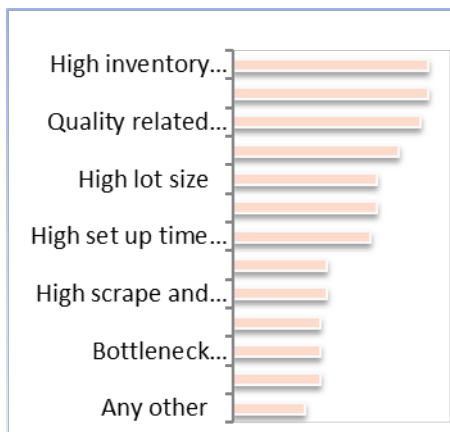


Figure 01: Production related problems faced by the respondents

According to analysis, high inventory storage and high lead time is the severe production related problem in those factories. It is also important to point out that quality problems and as well as worker dissatisfaction is also play as a motivational force in applying CM system. It is also worth to note that respondents ranked more value on high lot size, high wastage level and high set up time/ changeover time.

Benefits Gained from CM

Table 1: Benefits of CM

Benefits of CM	Mean	SD
Workers' skills and flexibility has increased	4.7	0.38
Worker productivity has increased	4.7	0.41
Reduce the level of inventory	4.6	0.31
Reduce production and quality control cost	4.4	0.47
On time delivery reduce overdue orders	4.3	0.37
Reduce throughput time	4.3	0.37
Improve resource utilization	4.3	0.27
Reduce set up time	4.1	0.56
Reduce lead time	4.1	0.57
Improve the quality of the product	4.0	0.57
Reduce lot size	3.9	0.53
Improve production process stability and capability	3.9	0.47
Reduce space for storage and product line	3.8	0.78
Production flow become more visible	3.7	0.72

Multiple benefits have been recognized as the motives for applying CM and several of these are critical because the average respondents' view is not less than 4. The main benefit of CM is increasing the worker productivity, skills and flexibility. It is also seen that reduction of inventory level, production and quality control cost, throughput time, set up time, and lead time while increasing resource utilization, product quality, and on time delivery are the most important enablers for applying CM.

Barriers / Obstacles in Applying CM

Table 2: Barriers / Obstacles in Applying CM

Barriers / Obstacles	Mean	SD
Workers' resistance to change	1.2	0.31
Lack of knowledge about CM principles and techniques	1.3	0.14
Lack of training and education in the use of CM technique	1.3	0.11
Lack of involvement from top management	1.4	0.23
Communication barriers with employees	2.2	0.45
Managers' resistance	2.3	0.31
Inter-department communication barriers	2.4	0.16
Influence of trade unions	2.6	0.22

The workers' resistance is the most significant barrier faced by the organizations when applying CM system (mean = 1.2 and SD = 0.31). Lack of knowledge about CM principles and techniques and as well as lack of training and education in the use of CM techniques is also identified as major obstacles in applying CM system. Similar results were found in another study conducted by Dixit and Gupta in 2013.

Multiple Regression

Multiple regression is used to analyze the impact of human related barriers on the success (benefits) of the CM system. That is 89.2% of the variance of the success (benefits) of the CM system is explained by the independent variables concerned. Independent variables are worker resistance to change (WR), Lack of knowledge about CM principles and techniques (LK), Lack of training and education (LTR), Influence of trade

unions (TU), Inter-department communication barriers (DC), Communication barriers with employees (CB), Lack of involvement from top management(TOP), Managers' resistance (MR).

Benefits = 60.458 – 0.361WR – 0.243LK – 0.233LTR – 0.012TU – 0.051DC – 0.112CB – 0.198TOP – 0.095MR

Conclusion and Recommendations

When applying CM, organizations need to provide keen attention on human resource issues such as resistance to change, knowledge and training on CM technique, top management involvement, employee stress, job dissatisfaction, pay dissatisfaction, turnover or absenteeism to get the fullest benefits. Change disrupts the status quo and often leads to stress, discomfort, and for some even dislocation. These conditions motivate people to resist change. Attempts to implement change are more likely to be successful if leaders understand the reasons behind employees' resistance to change. The most common reasons why people resist change are; threat to one's self interest, Uncertainty, lack of confidence that change will succeed, lack of conviction that change is necessary, distrust of leadership, threat to personal values, fear of being manipulated. So, it is recommended to minimize employee resistance by applying several techniques such as; effective communication before, during and after the application of CM, effective training and development, empowering employees, employee involvement programmes, establishing supportive reward structure, and as well as upgrading top managers' involvement.

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