Productivity Measurement of Manufacturing System

Govind Singh Rawat\textsuperscript{a}, Dr. Ashutosh Gupta\textsuperscript{b,}, Chandan Juneja\textsuperscript{c}

\textsuperscript{a,b,c}Department of Mechanical and Production Engineering, Govind Ballabh Pant Engineering College Ghurdauri Pauri Garhwal, Pauri - 246194, Uttarakhand, India.

Abstract

As industrialization has taken a great place in our world and also the competitiveness among industry is increasing day by day, so every industry is in a way of manufacturing products of high quality at low cost with a priority of delivering product to customers in stipulated time span. Every industry uses a system to manufacture the product. Therefore, industry needs a manufacturing system which is capable to produce the high quality product in the minimum input. This can be achieved by keeping the manufacturing system productivity high. Hence Productivity measurement is essential to measure the performance of the manufacturing system. In this present work we are developing the methodology to measure the productivity of manufacturing systems. Therefore, we are proposing a mathematical model for productivity measurement of manufacturing system such as dedicated system, cellular system and flexible manufacturing system which are capable of producing mass and batch type product. Further the productivity is considered as one of the significant factor for performance measurement of manufacturing systems. The present work include the development of model for the measurement of productivity for the three manufacturing system followed by the case study for the application of the proposed model.

1. Introduction

The advancement of economy of any country is sustained by development of its manufacturing industries. Currently the manufacturing firms are passing through a period of very strong competition. Now a day’s industries are using different manufacturing system, these are such as Dedicated Manufacturing system, Cellular Manufacturing System and Flexible Manufacturing system. The output of the manufacturing system depends upon the various factors. These factors include the production rate, the quality of the product and flexibility of the system. The production rate is greatly depends upon the productivity of the system, where as the quality is related with the conformance of
produced product with the available quality standards. The system flexibility is greatly depends upon the responsiveness of the system with respect to changeover in the product or product specification therefore these factors are considered as the performance parameters for measuring overall performance of the manufacturing system. As stated above the productivity is to be considered as one the key factor or measuring the performance of the manufacturing system.

Lieberman and Kang [1] showed that public financial data can establish productivity measure to give a suitable measure of industrial performance than profit rates only. four decades ago POSCO was established by Korean steelmaker which is considered as world’s most profitable and well-organized steel producer, and their analysis shows that POSCO has better record of good profitability and labor productivity. They applied productivity methods to assess the historical performance record of POSCO. David N. card [2] discusses the key considerations for defining on effective productivity measure. It also explore the relationship between quality and productivity. Sonand Park [3] quantified and incorporated the Productivity, quality and flexibility measures. The conventional productivity measure was developed so that it could be used in integrated manufacturing production systems. These three measures were integrated for the evaluation of a manufacturing system. They improved the conventional productivity measures for use in IMPS as a whole. Tangen [8] concluded that performance measures like, profitability, productivity, efficiency, effectiveness and performance can be measured by different methods and advantage and disadvantages of different performance measures are also explained. Park and Kim [9] developed costing procedures for numerous manufacturing activities under ABC systems, and these procedures are integrated into the recommended multistage investment decision model. They showed a case study which was based on AMS system and they have given a decision model which found that opportunity cost plays more significant role for cost accounting system. Ali Emrouznejad [10] gives technique such as decision-making units (DMUs) using data envelopment analysis (DEA) techniques by using optimization measures in SAS/OR software for calculation of productivity and efficiency. E. Balla et al[11] that conformist measures of productivity development can be used as measure of commercial performance which neglects exterior or public output, are predisposed. This technique is very common and may possibly be applied to measure commercial public responsibility.

**Types of manufacturing system**

*Dedicated Manufacturing System*

In dedicated FMSs, exceptionally dedicated machines are devoted to a fine range of parts. Sequential and random FMSs are mentioned according to the direction of flow of parts through machines, and the manufacturing cell (MC) refers to a cluster of numerically controlled machines functioned by robot. Dedicated manufacturing systems are centered on fixed automation and yield a company’s core products or parts at large production. As DML has low flexibility but high productivity, therefore it is cost effective when it functions at full capacity that signifies that demand should be higher than supply. When the number of the variants is high then it is not suitable system.

*Flexible manufacturing system*

A flexible manufacturing system has been demarcated in several contexts through different terminologies but all come close to each other in recognizing the characteristics common to most of these systems. FMSs can be defined as follows: Flexible Manufacturing Systems are caused, computer controlled manufacturing process that can adjust automatically to random changes in product design formations, models or styles. The system will always attempt to optimize production output and work-in-process inventory.

*Cellular manufacturing system*

Cellular Manufacturing Systems (CMS) have developed the conventional idea for conveying the structural problems in manufacturing system. The connection could be based on the constraint of machines, the system arrangement, the design qualities such as shape or the size the resources are important. Range of similar measurements are working for this idea. A distinctive manufacturing system creates different set of goods. These goods in turn are joined from different parts, which are not completely created in the industry. Although a designer has two choices of designing a part through CMS. The first choice is built up the cells based on the machine information and the second choice is to consider the important part for the designing of the products to complete its task at initial phase. The main
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