THE IMPACT OF NEW TECHNOLOGY ON THE DIMENSIONS OF FLEXIBILITY AND COST EFFICIENCY IN A MANUFACTURING SYSTEM - AN EXPERIMENTAL INVESTIGATION -

ABSTRACT

Increased segmentation of markets have forced the firms operating in the batch manufacturing environment to achieve simultaneously the conflicting objectives of flexibility and cost efficiency. The role of Advanced Manufacturing Technology (AMTs) like GT, FMSs and CIM, in eliminating this traditional conflict of objectives has been a subject of considerable interest. Such manufacturing configurations are considered to proffer economies of scope, as opposed to economies of scale, which allow a firm to handle a wide spectrum of product-mix, while simultaneously attaining the goal of high cost efficiency in operation. High investment requirement for these AMTs call for judicious planning, while selecting the appropriate manufacturing configuration.

The research reported here is an attempt in this direction. It tries to evaluate in concrete terms, the impact of new technology on the dimensions of product-mix flexibility and cost efficiency in a manufacturing system. Specifically, it evaluates the effect of switching over to a cellular manufacturing system from a conventional process layout.

A generalized methodology has been developed which will enable the decision maker to compare produot-mix flexibility of alternative systems. Controlled experimentation on a simulation model of a real life manufacturing system is

carried out in order to compare the product-mix flexibility of process and GT layouts. Comparisons of the relative performance of both layouts on the dimension of cost efficiency are also made.

The research is divided into four stages.

i) The first stage is concerned with the development of the methodology. A simulator has been developed which models a real life manufacturing system within a MRP framework. Developed in SLAM II, a general purpose simulation language, the model evaluates the effect of a switch over to a cellular layout from a conventional process layout.

ii) The second stage addresses the planning aspects of process and GT layouts. Effects of different combinations of lot sizing rules and sequencing rules are studied.

iii) The third stage is concerned with the core aspect of this study. It investigates the effect of GT implementation on the dimensions of product-mix flexibility and cost efficiency.

iv) In the fourth stage, a detailed analysis of the base case models is carried out. The results of this study are compared with studies done along similar lines in the past. The main focus is on the evaluation of benefits accruable from GT.

The main findings of this research are -

1. There exists significant interaction effects between the lot sizing and sequencing decisions. This result indicates that these two decisions should always be made in combination at the production planning stage.

2. GT systems would be superior to a conventional process

layout on the dimensions of product-mix flexibility and cost efficiency, for production environments where,

i) It is possible to form independent machine-component groups.

ii) Changeover times across part families is high.

iii) A substantial reduction in material handling is achieved through GT.

iv) Higher scale of operation is envisaged.

3. An analysis of the base case model revealed that GT performed better on criteria such as total setup costs and total material handling costs. Process layout was superior in terms of the queue related statistics such as mean flow time (MFT), and WIP. On the criteria of overall cost efficiency, measured by Total Factor Productivity (TFP) of the system, GT was found to be superior than process layouts.