

ABSTRACT

This dissertation addresses a number of issues related to flexibility in production system in manufacturing firms, such as the status of flexibility adoption, quantification of flexibility, and relationships between flexibility and product quality and production system performance. In consideration of recent research needs and scenarios in manufacturing firms as evidenced in the review of literature, the research work aims to identify the areas in which production system flexibility needs improvement so that different strategies may be adopted for different functions of flexibility.

A questionnaire survey is conducted among manufacturing firms in India in order to identify some of the best practices followed by firms and to study the roles of relevant activities, such as in-house development, supplier's development, installation of flexible equipments. The respondent firms are characterized based on number of employees, annual sales, and market share. Statistical analysis is carried out to provide useful relevant information from the data collected on each of the issues considered in the survey.

Three models are proposed in this dissertation. The objective of the first model is to measure and evaluate production system flexibility of the firm. It takes into consideration both the main and support functions of production system flexibility by using a unique approach involving mathematical measures. The study may be useful in improving the flexibility in production system by establishing control over various activities and monitor the changes in the flexibility measures from time to time. The second model aims to establish relationships between flexibility and quality of product. This model aims to find out the means to determine the flexibility level for a given product quality. The third model explores how performance in production system is related to flexibility. Both the above relationship models are intended to apply for variety intensive firms, and may be applied simultaneously in manufacturing firms to determine a balance between quality and performance.

All the three models are applied in variety-intensive manufacturing firms making bearings as well as three and four wheeler engines. Relevant data are collected from both the firms for the past five years to compute the selected input variables where the firms actively involve all the main functions and support activities of flexibility. In the first step, levels of flexibility at both the firms are estimated. Then, path models are developed for relating flexibility, quality and

performance by taking flexibility in various functions as response variables. The models may be used to monitor the level of flexibility over a planning period on a continuous basis.

The flexibility adoption practices identified in manufacturing firms through a questionnaire study, the proposed mathematical approach to quantify the contribution of the variables considered for flexibility study, the importance of various essential issues of flexibility for effectively monitoring product quality, the flexibility of path analysis approach to accommodate additional variables and issues, the approach to find a balance between flexibility and product quality as well as production system performance, and the comprehensiveness of measurement approach proposed for production system flexibility are some of the key contributions of the research work.

Key words: Flexibility, Flexible Production System, Status of Flexibility, Manufacturing Firms, Adoption Practices, In-house Development, Flexible Equipments, Flexibility Measures, Product Quality, Production System Performance, Path Analysis Approach.