Manufacturing Flexibility for Productivity in Engineering Industry

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Abstract

The Indian engineering industry has emerged as a dynamic sector in the country's industrial economy. From a modest beginning, the engineering industry now produces a very wide range of products like commercial vehicles, earth-moving equipment, machine tools, and a large number of other industrial goods and consumer durable. Today, the Indian engineering industry produces goods worth over Rs. 623 billion. It accounts for over 31% of total output of the country. This sector of industry employs over 2.4 million people. At present, investment in engineering industry is estimated to be around Rs. 389 billion. The engineering industry has been identified as one of the thrust areas for export promotion in the post- independence era, the industry has not only achieved significant enlargement of production capacity, but has also attained a high degree of technical competence, sophistication, and product diversification.

Keywords:-Productivity, Industries, Manufacturing, Flexibility**.**

1. Introduction

The impressive growth is, by and large, the result of planned industrialization programmes under the national plans and import substitution efforts put in by the industry. Public sector has also played a key role in the development of engineering industry in India, particularly in the fields of heavy engineering industrial machinery, and machine tools. The giant engineering undertakings setup in the public sector have contributed a great deal to the development of core and key sectors of industry, which in tum, facilitated the overall growth of the company. Although the engineering industry in India has progressed, as mentioned above, yet the growth rates and present status leave much to be desired. Compared to the giant leaps made by Japan and some other countries, India has considerably lagged behind. In addition, it has been observed that some sectors and areas have developed reasonably well while others have not. The uneven growth trends in the constituent sectors of the engineering industry point towards several impediments that have hampered their progress. Same and medium scale engineering enterprises play a significant role for achieving the objective of higher industrial production. From the socio-economic point of view, the key features of these sectors are their low capital intensity and high employment potential. However, these enterprises will have to make enormous efforts to achieve greater productivity.

2. Present Scenario

With liberalization in India, products and processes are undergoing a lot of changes. In today's industrial environment of unprecedented competition coupled with acute resource crisis especially of energy and material, resources need to be utilized economically. Enhancement in productivity is a key to success. To achieve this, there is a need to reduce set-up times and change-over times, and cut down the product cost by avoiding wastage of a kinds. Achieving

higher productivity levels also requires analysis of the productivity trends, and their comparison with a productivity datum to have an assessment of the performance of each year. A large number of models are available for measuring productivity. [1] applied various models like total productivity model (TPM), total factor productivity model (TFPM), and partial factor productivity model (pFPM) for measuring productivity of a manufacturing company. Having assessed the productivity levels and identified the reasons of low productivity, efforts can be directed to systematically achieve higher levels of productivity.

The existing conventional techniques for productivity improvement have been fairly successful in the past. But these have their own limitations while dealing with the changed manufacturing systems. Owing to a large variety of products being made, the manufacturing systems have become very complex. A variety of materials, machines, tooling, and other inputs have to be employed in a production system. Still more, market uncertainties add to the decision-making complexities in the manufacturing systems. Emphasis is now shifting from mass production to production of some batches because of rapid changes in product design brought about by technological advancements. Due to short product life-cycles, firms have to quickly capitalize on narrow windows of market opportunities. Introduce new products in rapid succession, and respond in real time to remain competitive and market dynamic. This complex environment demands the system to rapidly adjust itself to complexities. uncertainties, and changes. Thus, flexibilities needed in the manufacturing systems.

3. Flexibility

Simply stated, flexibility is the capability of a system to react to and accommodate changes. To be truly flexible, the flexibility must exist during the entire life cycle of a product, from design to manufacturing to distribution. [2] state that flexibility of a manufacturing system is its capability to cope with internal and external changes effectively. Internal changes include breakdown of equipment, variability in processing times, workers' absenteeism, and quality problems Typical external changes are changes in design, demand, and product mix. A manufacturing system can have varying degree of flexibility depending on the versatility of the equipment and the way the equipment is managed. [3] states that flexibilityis the ability to do things differently or do something else should the need arise. On one side, flexibility implies the ability to be versatile, while on the other side, flexibility refers to qualities such as robustness' or 'resilience' which enable an enterprise to endure when negatively affected by changes. All these different senses of flexibility are useful for the survival and success of a company. [4] defines flexibility as the ability to change or react with little penalty in time, effort, cost, or performance. [5] advocates the concept of systemic flexibility, which is defined as 'exercise of free will or freedom of choice on the continuum to synthesize the dynamic interplay of thesis and antithesis in an interactive manner, capturing the ambiguity in systems, and expanding the continuum with minimum time and efforts.' [6] outline multiple types of flexibilities such as product flexibility, process flexibility, operation flexibility, volume flexibility, machine flexibility, routing flexibility, expansion flexibility, and

production flexibility [7] classify flexibility into a total of II elements - flexibility for sequential investment, flexibility for project abandonment, flexibility for new project adaptation, flexibility for continuous improvement, flexibility for trouble control, flexibility for workforce control, flexibility for work-in-process control, flexibility for changes in product mix, flexibility for new item introduction, flexibility for under demand control, and flexibility for overdemand control.

4. Management of flexibility

The introduction of flexibility in manufacturing leads to higher machine utilization, improved operational control, reduced processing times, and lesser set-up times. These factors greatly contribute to reduction of product cost and enhanced productivity. Notwithstanding the fact that a higher degree of flexibility will lead to higher productivity, there is a limit put on the level of flexibility to be achieved and the way it is to be achieved. Cost-benefit analysis of the situation has to be carried out to justify the level of flexibility to be achieved. Generally, higher degrees of automated flexibility require large investments in the form of flexible machines, multi-skilled personnel, and flexible procedures and practices. This suggests a need for adopting a cautious, effective, and economically viable approach towards achieving flexibility for increased productivity.

A review of the literature on different aspects of flexibility indicates that many enterprises are in the midst of fundamental changes in organizational design and management practices. Adler (1988) states that a shift towards greater flexibility generates challenges for management. The primary challenge posed by new flexible technologies is their higher 'knowledge intensity' and the management of knowledge has become the central task of the firms wanting to survive in a world of rapidly evolving technological possibilities. [8] advocate that flexible manufacturing organizations will have the capability to be flexible in their response to unique customer demands. [9] stresses that pioneering companies are experimenting with novel organizational structures and management processes. The impetus is towards flexible organizational forms which can accommodate novelty, innovation, and change. Other developments include delayering, team-based network, alliances and partnerships and a new employer-employee covenant [10] proposes a framework for management of flexibility which asks a manager to identify dimensions, time horizon, and elements of flexibility for effectively managing flexibility. Has discussed an evolving paradigm of flexible systems management, which revolves around the concepts of continuum, dynamic interplay, and freedom of choice. It contemplates the dynamic interplay on the continuum by exercising freedom of choice exhibiting systemic flexibility'. The flexible systems management paradigm has three components - situation, actor, and process. An industrial enterprise, which is the actor under consideration, exercises the freedom of choice to flexibly and systemically develop a management process for managing a situation. The literature review reflects the infancy of the subject of management of flexibility. Some conceptual and theoretical work has been evidenced. Practical aspects have not been dealt with

in detail. The proposed work aims at collecting relevant information on the status, needs, and effects of flexible manufacturing and to work out an implementation plan considering the economic viability and competitiveness aspects.

Conclusion

1t is concluded from the research that a change in various types of f1exibilities has an impact on various factor productivities and total productivity. A change in a particular type of flexibility may also affect other Flexibilities. Various types of productivities are also correlated with one another. While managing flexibility, an industrial fin should take into account the correlations between various types of flexibilities and productivities to achieve higher levels of productivity. The trends of various types of productivities in the surveyed industrial firms depict that the percentage change in the level of equipment productivity has been maximum. The minimum change is in case of material productivity. The status and trends of various types of f1exibilities in the surveyed industrial firms show that the average values of machine flexibility and product flexibility are less as compared to other flexibilities. The percentage change has been maximum in communication flexibility and volume flexibility from the year 1991-92 to 1995-96, while routing flexibility and planning flexibility have improved marginally. Irrespective of the status and trends of flexibilities, the decision, as to which type of flexibility should be improved in the future, is governed by a number of factors, such as, the present levels of flexibility, the required levels of flexibility, the type of industrial fin, and the investment required to achieve a particular level of flexibility

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