ALIGNING MANUFACTURING FLEXIBILITY WITH COMPETITIVE STRATEGY OF THE ORGANIZATION

Kumari Ruchi,[1]. Ashok K Pundir.[2] & L. Ganapathy[3]

***Abstract**: In recent years, manufacturing flexibility has started being adopted by managers as a source of competitive advantage for their organisations. These organisations work in very uncertain and turbulent environment and manufacturing flexibility helps these organisations gain competitive advantage in such an environment. Demand uncertainty and the pressure of cut-throat competition have led to many firms in several industries opting for manufacturing flexibility as an indispensible option. Several researchers have found that increased flexibility is a path to competitive advantage. Researchers and managers contend that flexibility is a strategic imperative that enables firms to cope with uncertainty in the environment. The purpose of this paper is to provide a comprehensive literature survey in the area of manufacturing flexibility and show how manufacturing flexibility can be treated as a source of competitive strategy for an organisation. Conceptual in nature, the paper explores the different perspective of manufacturing flexibility and how it provides competitive advantage to the organization.*

Keywords: Flexibility, Competitive strategy, Flexible manufacturing systems, Organizational performance.

[1] Fellow (Doctoral program),National Institute of Industrial Engineering (NITIE) ,Vihar Lake, Mumbai-400087 ruchi461@gmail.com

[2] Professor (Operations Management) & Dean (Students Affairs & Placement) National Institute of Industrial Engineering (NITIE)Vihar Lake, Mumbai-400087 ashokpundir@nitie.edu , pundir.ashok@gmail.com,

[3] Professor (Operations Management) &Dean (Academic) National Institute of Industrial Engineering (NITIE) Vihar Lake, Mumbai-400087 ,ganapathyl@gmail.com

1. Introduction

Increasing pressure of global competition and the need for higher customization has shifted the strategic focus from reactive approach in manufacturing to proactive approach for meeting the rapidly changing customer need. Manufacturing flexibility provides a source of competitive advantage to organisations in uncertain and turbulent environment. Further, manufacturing flexibility has been considered as both as a reactive and proactive tool to deal with environmental uncertainty.

A survey of existing literature suggests that manufacturing flexibility helps to develop new products and modify existing products in response to the changing market and competitive threat. Several researchers have cited that increased flexibility is an important source of competitive advantage. Current literature suggests that many of the new competitive frontiers advocated by authors appear to depend on manufacturing flexibility. Further, Operation flexibility has different dimensions including product flexibility, volume flexibility, new product flexibility, and delayed differentiation. Initial studies on manufacturing flexibility related to development of the concept of manufacturing flexibility, including definition of the types of flexibility and the relative importance of various types of flexibility. Later, during the nineties, the focus shifted to the measurement aspect of manufacturing flexibility, where the researchers attempted to define the construct, antecedent and contingent of manufacturing flexibility. They also focussed on the method to achieve any particular types of manufacturing flexibility. Recent studies tend to focus mostly on the application aspect, in manufacturing and other different functions. Although several studies have been done to find the contexts in which investment in flexibility may make economic sense (Das, 2007; Menor et al.2007), there is a clear need of understanding the direct and indirect linkages of flexibility with firm performance.

The purpose of this paper is to provide a literature survey in the area of manufacturing flexibility and show how manufacturing flexibility works as a source of competitive advantage for the organisation. Conceptual in nature, the paper explores the different perspectives of manufacturing flexibility and how it provides competitive advantage to the organization.

2. Need for manufacturing flexibility

Organisations have to face very unpredictable environment these days. Dynamic environments consist of two distinct characteristics, 'rate of change' (velocity or volatility) and 'unpredictability of change' (Miller and Friesen, 1983). Highly unpredictable environment requires organic and flexible structure whereas highly volatile environment needs centralised and mechanistic structure (Burns and Stalker, 1961; Lawrence and Lorsch, 1967, Anand, and Ward, 2004). The main sources of change in the environment are the market, competitors, technology and regulatory agencies (Duncan, 1972).

In highly unpredictable environment, role of flexibility becomes critical. Demand uncertainty and the pressure to cope with the existing cutthroat competition have led to many firms seeing flexibility as an indispensible option. Thus flexibility has been highlighted by both researcher and managers as a critical component of the manufacturing strategy that works as a competitive priority for the organizations (Dangayach and Deshmukh, 2001; Davies and Kochhar, 2002; Ketokivi, 2006).

3. Different perspectives on manufacturing flexibility

Flexibility has been defined in different ways by different authors. Adopting an operational view, Nagarur (1992) defines flexibility as "the ability of the system to quickly adjust to any change in relevant factors like product, process, loads and machine failure". At macro level, Flexibility can be defined as an absorber of environmental uncertainty and variability (Gerwin, 1993; De Toni and Tonchia, 1998; Beach et al, 2000). Research in the area of operational management cites flexibility as a strategic imperative that will enable firms cope up with uncertainty (Gerwin, 1987) and (Sethi and Sethi, 1990).

De Toni and Tonchia (1998) provide two general perspectives on flexibility: flexibility as a filter, and flexibility as a dampener. As a filter, flexibility is an uncertainty absorber, which shields a firm from external disturbances and provides them internal stability in the face of exogenous changes through homeostatic mechanism. Thus, flexibility provides a notion of adoptability with the ability to preserve a degree of integrity and coherence in external volatile environment to the organisations. Further Sanchez (1995) suggested that flexibility is constrained not only by resources but also by the method of the use of the resource as also suggested by the Resource based view (RBV) of the firm. Thus strategic flexibility view

suggests that a firm can achieve competitive advantage by creating strategic flexibility in the form of alternative course of action available to the them (Sanchez, 1993).

Strategy is about aligning a company with its environment. Porter (1980) in his article "five forces that shape strategy" argued that to sustain long-term profitability firms must respond strategically to the competition. Hence, a firm's success depends on the attractiveness of the industry as well as the firm's relative position in that particular industry. Porter (1979) proposes that four additional competitive forces can hurt firms' prospective profits. *Savvy customers* can force down prices by playing firm and its rivals against one another. *Powerful suppliers* may constrain firms' profits if they charge higher prices. *Aspiring entrants* with new capacity can ratchet up the investment required for the firm to stay in the competitive industry. *Substitute offerings* can lure customers a way. In such a situation, after deciding an industry, a firm must decide the way it should enter into industry to gain competitive advantage. Early manufacturing literature also support this by asserting that alignment between the external environment and firms' manufacturing strategy is crucial to overall success (Skinner, 1969; Hayes and Wheelwright, 1984). In operation management, this translated into a set of structural (e.g. physical characteristics) and infrastructural (e.g. operating policies and management practices) decisions that best supported the firm's competitive strategy (Hayes and Pisano, 1996).

The positioning view of flexibility comes from the widely accepted positioning theory of strategic management whereby a firm chooses a competitive strategy that is most appropriate to the market condition and surrounding industry (Porter, 1980). In this way, manufacturing flexibility allows firms operating in an industry to respond in a particular way to a dynamic environment. This view has been cited by many researchers e.g., Shewchuk and Moodie, 1998; Ramasesh and Jayakumar, 1991; Chen and Chung, 1996; Koste and Malhorta, 1999; D'Souza and Williams, 2000 and Anand and Ward, 2004.

Using the competence and capability theory as a basis, internal core competencies along with external flexible capabilities enable managers to develop a comprehensive view of manufacturing flexibility. This view emphasises the need of co-alignment between the firm's internal competencies and the expectations of the customers. Competencies are the antecedents of the capabilities (Ling-yee and Ogunmokun, 2008). Competencies, thus refer to internally focused types of flexibility, and provide the processes and infrastructure that

enable a firm to achieve the desired level of flexible capability. On the other hand, capabilities relate to externally focused types of flexibility that provide the link between corporate, marketing, and manufacturing strategies (Watt, Nahn, and Sohn 1993; Kathuria and Partovi, 1999; Watt et al., 1993). As an example range flexibility as a firm's capability can be enhanced by manufacturing competencies (Seith and Seith, 1990; Gupta and Somers, 1992; Dixon, 1992; Suarez et al., 1996; Ling-yee and Ogunmokun, 2008).

4. Reactive and Proactive views of Manufacturing Flexibility

Manufacturing flexibility helps to cope with environmental uncertainty (Swamidass and Newell, 1989). There are two different approaches to flexibility: defensive and pro-active. Defensive approaches aim to cope with flexibility requirements of the environment while proactive approach attempts to turn flexibility into competitive advantage (Gerwin, 1993).

Gerwin (1993) identifies four generic flexibility strategies: adaptation, redefinition, banking and reduction. The aim of proactive reduction strategy is literally to reduce the need of flexibility for example long-term contracts with customers and suppliers (Gerwin, 1993**).**

Similar to this Hallgren and Olhager, 2009 study also classified the approach into proactive and reactive to mitigate uncertainty. In proactive approach flexibility, source factors are total preventive maintenance, statistical process control, modular product design and design for manufacturing. In reactive approach flexibility, source factors are setup time reduction, advanced manufacturing technology, slack capacity volume and multi-trained employees.

Some scholars have argued that reactive perspective of manufacturing flexibility is too narrow approach and in this way, it fails to capture the bigger and better view of flexibility approach. Recent researcher criticised that competitive positioning approach should not be narrowly focused. For instance, Chang et al. (2003) and Sawhney (2006) argued that many success and failure such as success of southwest airlines as well as observed difference in performance of several firm such as Honda, IBM, Xerox and GE could not be analysed with competitive positioning view with its main emphasis on external industry characteristics. These firms have employed the flexibility in their production systems to create and maintain a competitive advantage in "tough" industries. As an example, Honda's line of smaller, fuel-efficient vehicles is critical to its success. However, its superior ability to switch production

among different plants and to produce different models efficiently in the same plant that enables it to compete successfully in the markets (Linebaugh, 2008).

5. Manufacturing Flexibility and concept of Fit

Environmental change can be managed using flexibility and constant adaptation to environment, which will ultimately lead to fit between the firm and its environment (Drazin and van de Ven, 1985; Venkatraman, 1989). The strategic effectiveness of an organization depends on fit, where fit implies the compatibility of structures and processes of an organisation within the firm and outside the firm i.e. the environment in which the firm operates (Miller, 1992). Degree to which an organization is able to matches resources and capability with the opportunities in an external environment can be expressed in term of fit. In 1989, Venkatraman defined fit as an internal consistency between a set of variable that are theoretically related. On the other hand Wright and Snell, 1998 defined fit as a degree to which one component's needs, demands, objectives and structure are consistent with the needs, demands, goals, objectives and structure of another. The matching process takes place through the effective use of strategy. Firm strategy should able to scan the environment for achieving competitive advantage.

Flexibility is one of the ways to achieve the fit of the organization with its external environment. However, flexibility alone does not ensure fit of the organisation with external environment. Flexibility along with speed is crucial for achieving competitiveness (Swink and Song, 2007). A company that makes good decisions quickly has a higher metabolism, which allows it to act on opportunities and overcome obstacles. The best decision makers create an environment where people can come together quickly and efficiently to make the most important decisions (Rogers and Blenko, 2006).

Taking the resource based view (RBV) of the firm, manufacturing flexibility as a capability that provides the theoretical foundation that has been lacking in the operations management literature (Lucas and Kirillova, 2010). These capabilities are further classified into four general categories and the dimensions are process based, system (coordination) based, organization based and network based. Manufacturing flexibility can be seen as a capability that links to the development of organizational competencies. Development of competencies

provides strategic option to the firm that enables it to handle the demand of the environment proactively or reactively (Llore´ns, Molin and Verdu´, 2005).

6. Development of Manufacturing Flexibility Literature

6.1. 1980-1990- Development of the concept

The focus of initial series of studies was on the definition of the concept of flexibility (Diebold, 1952; Slack, 1983; Hayes and Wheelwright, 1984; Nemetz and Fry, 1988), their types, need and importance in dynamic environment.

6.2. 1990-2000- Measurement of flexibility

In this phase major focus of research was the measurement of flexibility types (Sethi and Sethi, 1990; Dixon, 1992; Suarez, 1992; Berry and Cooper, 1999), method to achieve manufacturing flexibility for an organization (Gerwin, 1993) and exploration of the antecedents and contingents of manufacturing flexibility (Lau, 1999; O'Leary-Kelly, 2000; Narasimhan et al., 2004).

6.3. 2000 onward – Application into other manufacturing and functional Areas

6.3.1 Review of Literature

During this period, researchers have done review of conceptual and empirical side of flexibility. As per their findings, more research opportunities were found to be in the area measurement and achievement side of flexibility (Beach et al., 2000; Das, 2001; Koste et al., 2004; Oke, 2005; Schmenner and Tatikonda, 2005; Grosler, 2005; Voss, 2005; Gong and Hu, 2008; Larso and Doolen, 2008; Lucas and Kirillova, 2010).

6.3.2 Application into other Manufacturing areas

Studies have tried to explore the relationship among the constructs of manufacturing flexibility with manufacturing functions such as new product development (Yi et. al., 2008), production responsiveness and firm performance (Llore'ns et al., 2005; Baykasog˘lu and Ozbakır, 2005; Hutchison and Das, 2007; Ling et al., 2007; Camiso´n and Lo´pez, 2009; Verdu´ et al., 2009).

6.3.3 Application into other functional areas

Literature also focused on specific type of flexibility and applied flexibility concept into other functional areas such as the application of flexibility in mitigating supplies chain risk (Tang and Tomlin, 2008), concept of flexibility with respect to e-business and customer satisfaction (Avittathur and Swamidass, 2007; Hallgren and Olhager, 2009; Zhan et al., 2009; Zhou and Wu, 2010; Buganza et al., 2010).

However, the quantification of flexibility becomes very imperative as very large flexibility or very little flexibility can have unintended consequence or may not have any effect. Thus, researchers argue that there should be optimal level of flexibility for the achievement of optimal firm performance. Desired level of flexibility can be achieved by reducing the gap between the desired level of flexibility and actual level of flexibility that company have within the organization close to zero(Verdu and Go´mez-Gras, 2009). In the case of volatile market, the fast-reaction type flexibility is most appropriate. It include ability to quickly make rapid, low-cost changeovers; the ability to adjust capacity incrementally; and the ability to quickly launch products with incremental changes within certain parameters in response to market needs. This type of flexibility can be called as range flexibility on the other hand when change in environment is unpredictable in nature mobility flexibility is desired that allows companies to alter the use of their facilities and change their product offering (Anand et al. 2004).

7. Conclusion

The need of flexibility is felt by the organization for the modification of current practices in order to adopt themselves with the environmental changes rapidly. The nature of the environment change is non-transient. Managing change both within and outside the environment becomes the main challenge for an organisation. Organisation must have pool of novel responses to accommodate these non-transient changes. Although these days, it is essential for an organisation to maintain an ability to change itself but the achievement of total flexibility level is very difficult. Thus, an organisation should try to have an optimal level of flexibility for gaining competitive advantage.In this paper, different perspective of manufacturing flexibility has been discussed that works as a competitive strategy for the organisation. The paper also stresses on the significance of achieving fit between desired level of flexibility and actual level of flexibility.

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