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Factors Causing Operational Flexibility Needs in an Uncertain Business Environment

Pervez Akhtar* and Justyna Dylak **

*University of Modern Languages, Islamabad Pakistan**

*Warsaw School of Economics, Poland ***

Abstract: Today's business environment is more universal and aggressive than it has been in the past. The modern business is characterized by shorter product life cycles, rapid new product introductions, increasingly knowledgeable well informed and sophisticated customers, highly unpredictable and indecisive environment, short product life cycles, regular and irregular changes in demand, and global logistics issues. These uncertainties have put more pressure on companies to change and react to environmental uncertainty with improvements in their performance. Thus, manufacturing firms are expected to respond to these uncertainties efficiently to survive in the market and furthermore create competitive advantage. In other words, companies must be more flexible in future to deal with uncertain business environment.

The aim of this paper is to identify the factors which cause the need of flexibility in business operations. Another aim of this paper is to identify different types of operational flexibilities to address the uncertainties of business environment.

Key Words: *Business Environment, Uncertainty, Production Operations.*

Introduction

Every situation in the manufacturing environment is unique and it needs a unique kind of flexibility to deal with. There could be many reasons for a manufacturing concern to improve its flexibility in operations. However, the literature on manufacturing flexibility has a consensus that there are two main reasons which pursue a firm to be flexible. First, intrinsic uncertainty and second, variability in output demanded. According to Correa, (1994), the variations in demand and internal uncertainties can be the attributes of changes. So, the concept of change is a reason of flexibility for any manufacturing setup. The change can be of two types, planned and unplanned. Different authors in the literature have a similar belief that only unplanned change needs flexibility while the planned change can be handled with the proper planning.

The planned change often takes place with the proper conscious decisions of the firm while the unplanned change occurs independently without the determination of the organization. So, every organization must deal with the planned and unplanned change in its operations (Correa, 1994).

Uncertainty and variability are situation specific in nature. So, it is hard to cover all the situations which a company may face in the market. The most documented general sources of change are turbulent environment and customers' demands. However, the researchers have mentioned more specific origins of different types of uncertainties and

sources of change. Qureshi, (2011) who discussed the “anatomy of changes”. Focus of his research was on the nature of change, for example, resource changes which include changes in process, labor, and supplier. A bit different point of view was presented by Palaniswami (1994) who presented five factors of change, manufacturing processes, product, human resource, planning & control and relations with the supplier. Correa (1994), also presented seven different factors of change which are called “stimuli”. There is no standardization or agreement which exist between the authors on the use of terms to communicate the situations which an organization can face in business environment. Every author has used terms of their own choice to present their point of view. There is an obvious difference between the approaches that are being focused on, First, the nature of change. Second, the origin of change.

Literature Review

Uncertainty as Main Factor

Organizations require certainty and clarity in their environment to operate rationally but, the manufacturing organizations face many ambiguities and uncertainties in their environment (Slack, 1989). In case of uncertainty, the only thing which enables a company to survive and compete is flexibility in their operations within their system and outside environment (De Toni and Tonchia, 1998). Uncertainty itself is a complex subject and has been discussed in the literature with the help of different approaches. According to Swamidass and Newell (1987), controversy still exists on the measurement of uncertainty as if it is the adequacy of perceived or objective approaches. The objective measures of uncertainty are indexes for the uncertainty which are totally based on the attributes of the environment. The uncertainty can be estimated with the help of previous knowledge and cognitive processes which are called the value of environmental attributes.

The environmental uncertainty has been the topic of discussion for many researchers in the past some of the researchers argued that uncertainty is the main reason for a company to seek flexibility (Gerwin, 1987; Slack, 1989). However, it is difficult to measure the relationship between flexibility and uncertainty because firms have the option to use buffers in the form of time and stock which makes the relationship of uncertainty and flexibility very complicated.

Variability as Main Factor

Variability is the flexibility of offering a variety of products and carrying out different manufacturing processes (De Toni and Tonchia, 1998). Just like uncertainty, variability is another reason for manufacturing companies to seek flexibility. Gustavsson (1984) defined a twofold relationship between productivity and flexibility. According to him, the products can be changed due to internal factors like technology, fashion or components rationalization. The external factors which may determine the flexibility includes competition, fluctuations of market share, and seasonal fluctuations. Upton (1994) claimed that the external factors of variability could be cyclic aggregate demand for products, opportunities to gain more market share, a frequent demand for customization and broadening the product line. Viswanadham and Raghavan (1997) argued that these are the internal resources of a company which creates variability like human resources, machine resources, absenteeism, machine failure, rush orders, transport breakdowns, and other routine issues.

Cui et al. (2005) divide the causes of variations in demand into two categories, company led changes and consumer-led changes. According to them, the company led changes include, the marketing strategy, delivery methods, and supply chain structure. While the consumer-led changes can be of short-term nature or long-term nature. The short-term changes include weather, environment, and buying habits of the consumers. The long-term changes include seasonality, changes in economy and changes in the market make up.

Flexibility in Operations

The flexibility of a system is its capacity to adopt a wide range of variables in changing environments. A flexible system must be adept of varying to deal with a changing environment. An early definition of operational flexibility goes back to Ropohl (1967) “it is an ability of the system and its elements that are linked and coordinated to each other to perform various production tasks in an uncertain environment”. According to Kickert (1985), flexibility is a combination of meta-control forces which can be controlled and used to increase the speed, variety and amount of response in an uncertain environment.

JaiKumar (1986) emphasized that flexibility in manufacturing is always guarded within a domain. Every domain should be defined in terms of process, procedures, and products. The production managers, manufacturing engineers, and software programmers should understand this domain clearly and fully. The domain should be planned and managed properly, and it should be extended with the learning in the future.

According to Garrett (1986), there are very important limitations on the concept of flexibility that should be defined. These are the costs of response, speed, required investment and interruptions in the existing system in an uncertain environment.

In the presence of environmental uncertainties, the firms should have flexible manufacturing setups to cope up with the internal changes and external forces that may cause a change (Garret 1986). The equipment breakdowns, queuing delays, rework, rejects and variable task times are different types of internal disturbances. The external forces which may cause or demand a change in operations of an organization are changes in the level of demand, product mix, product price, availability of resources. It may also arise from the actions of competitors, new regulations, technological innovations, and changing consumer preferences. These internal or external forces may be current or potential and their effects may not be forecasted.

Manufacturing flexibility is important for any firm to compete well with its competitors. The manufacturing flexibility should be a part of the company’s strategies. The word strategies here mean the plans and policies which a company may use to gain a competitive advantage. The later writers like Preacher and Hayes (2008) consider flexibility as a vital dimension for a competitive strategy along with cost, quality, dependability, and price. Moreover, the priorities set by the managers to these dimensions decide the position of their business relative to their competitors. According to Lim (1987) manufacturing flexibility as part of the strategy requires a great attention of the managerial staff and it can no longer be relaxed, as in the past. Preacher Hayes (2008) goes even further by saying that the flexibility in manufacturing as a weapon of competitive advantage and strategic asset has been overlooked in the past by management. The concept of manufacturing strategy in the words of Hayes (2008) is a sequence of decisions that enable an organization to achieve the desired manufacturing

setup. That could be desired manufacturing system (capacity, technology, vertical integration, and facilities), infrastructure (production, planning, material control, organization, workforce, and quality) and capabilities (that enables an organization to pursue its chosen strategy to gain the competitive advantage)

Operational flexibility must be a permanent preoccupation and not just an improvisation (Maier 1996) it is much more than buying a simply flexible manufacturing system. According to Ranta and Alabian (1989), the flexibility cannot be purchased but it should be planned, implemented and managed properly.

The management of manufacturing flexibility can be questioned at any level by the managers “what is the optimal level of various types of flexibilities”? The answer to this question is simple the management should identify and be able to measure the different types of flexibilities that a manufacturing system must have to gain the competitive advantage over its competitors (Ranta and Alabian 1989).

The Manufacturing View of Flexibility

The manufacturing flexibility is a newer concept and not much of the work has been done so far. However, the researchers have presented a few very good ideas in the past regarding this concept. Leaver and Brown (1946) presented and proposed a few small but functions-oriented machines that can be plugged together to take the best outcome. Seeing their design unjustifiable economically Diebold (1952) proposed his own design of machines that can perform several functions that are related to each other. Moreover, it is noteworthy to mention that he also forecasted the concept of manufacturing flexibility which we see today. As he wrote, “ if we could couple a group of manufacturing machines or similar machines designed around the bundle of functions by some form of inexpensive and flexible material handling equipment and add a control mechanism to do the work normally done by the operator, we will have a factory completely automatic in terms of direct operations, although there would still be need for considerable indirect labor”.

According to Wheelwright (1981), these designs which we see today might not be possible without the advent of microprocessor chip technology. According to him flexibility in the past was just viewed as the trade-off between efficiency in production and dependability in the market.

How to increase the flexibility at a larger scale in the production without sacrificing efficiency was not a clear concept until the late 1980s. Simon (1971) recognized that machines are not that much flexible as humans could be. He raised two questions:

1. What are the prospects for matching human flexibility with automatic devices?
2. What are the prospects for matching human skills activities by reducing the need for flexibility?

Simon Said “the first question is more unique, and novel as compare to the second one because the second question has familiarity with the history of mechanization. He relates the second question with the concept and principle of homeostatic control of the environment that is “environment control as a substitute for flexibility”. He concluded that mechanization proceeds most of the time by excluding the need for human flexibility.

With flexible manufacturing systems, the concept of mass production came into existence to bring efficiency in production by replacing the concept of batch production. The concept economy of scale was replaced by the concept economies of scope. According to

which through the reduction in setup cost and time required for switching from the production of one product to the production of another product the efficiency of mid variety and mid volume can easily be accomplished.

Manufacturing Flexibility Frameworks

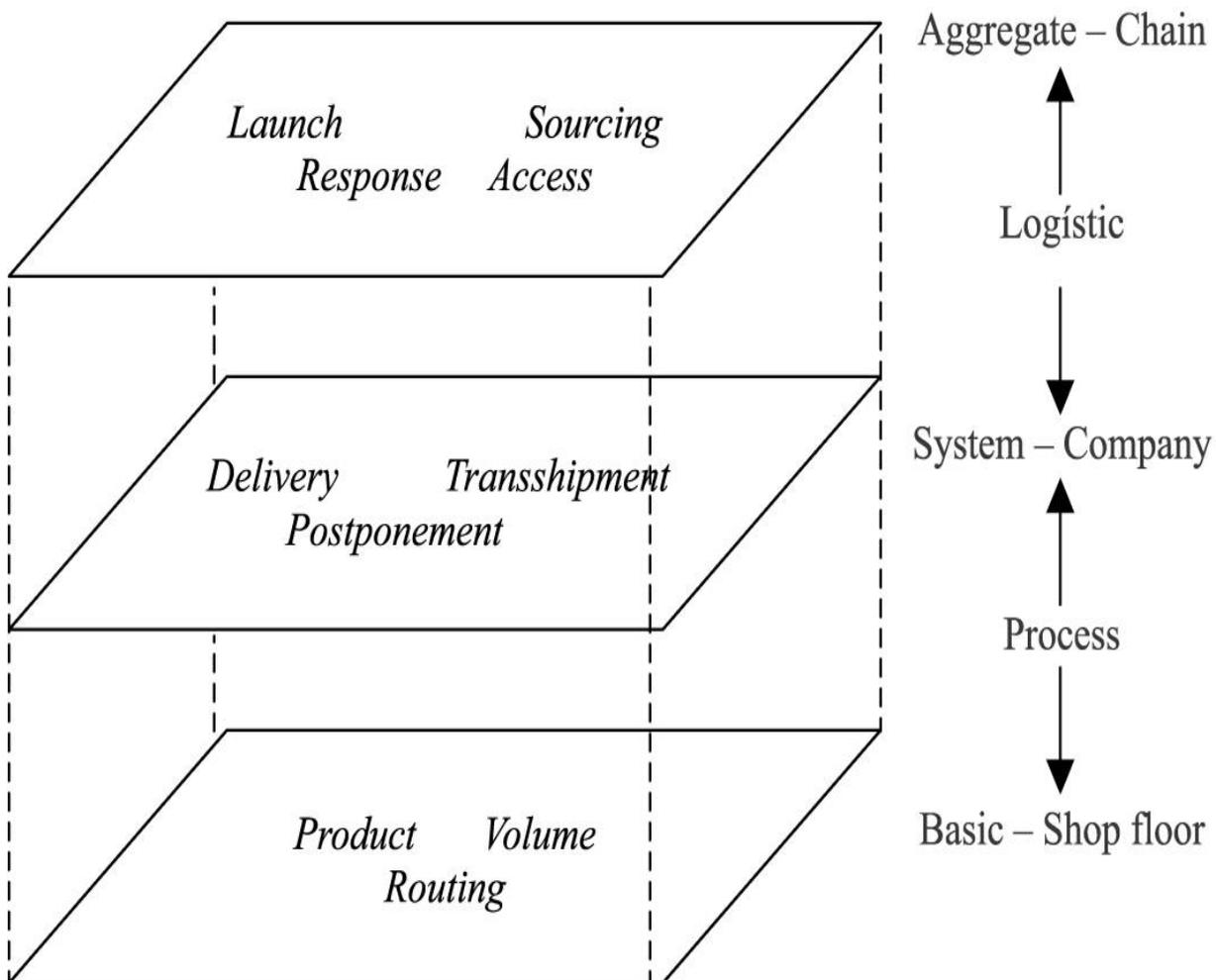
There are many frameworks through which different flexibility types can be reviewed and discussed. The most famous and classical approach to flexibility frameworks has a bottom-up structure which has three hierarchical flexibility levels.

Basic: It is a flexibility of the system components: machines, the material handling units, and the transporting network.

System: It is the basic flexibility type at the manufacturing system level; an important type of system flexibility with implications for the supply chain system is routing flexibility.

Aggregate: The aggregated attributes of the manufacturing system technology enabling it to cope with the variety of changes and needs at the strategic level.

Figure 1: Manufacturing Flexibility dimensions

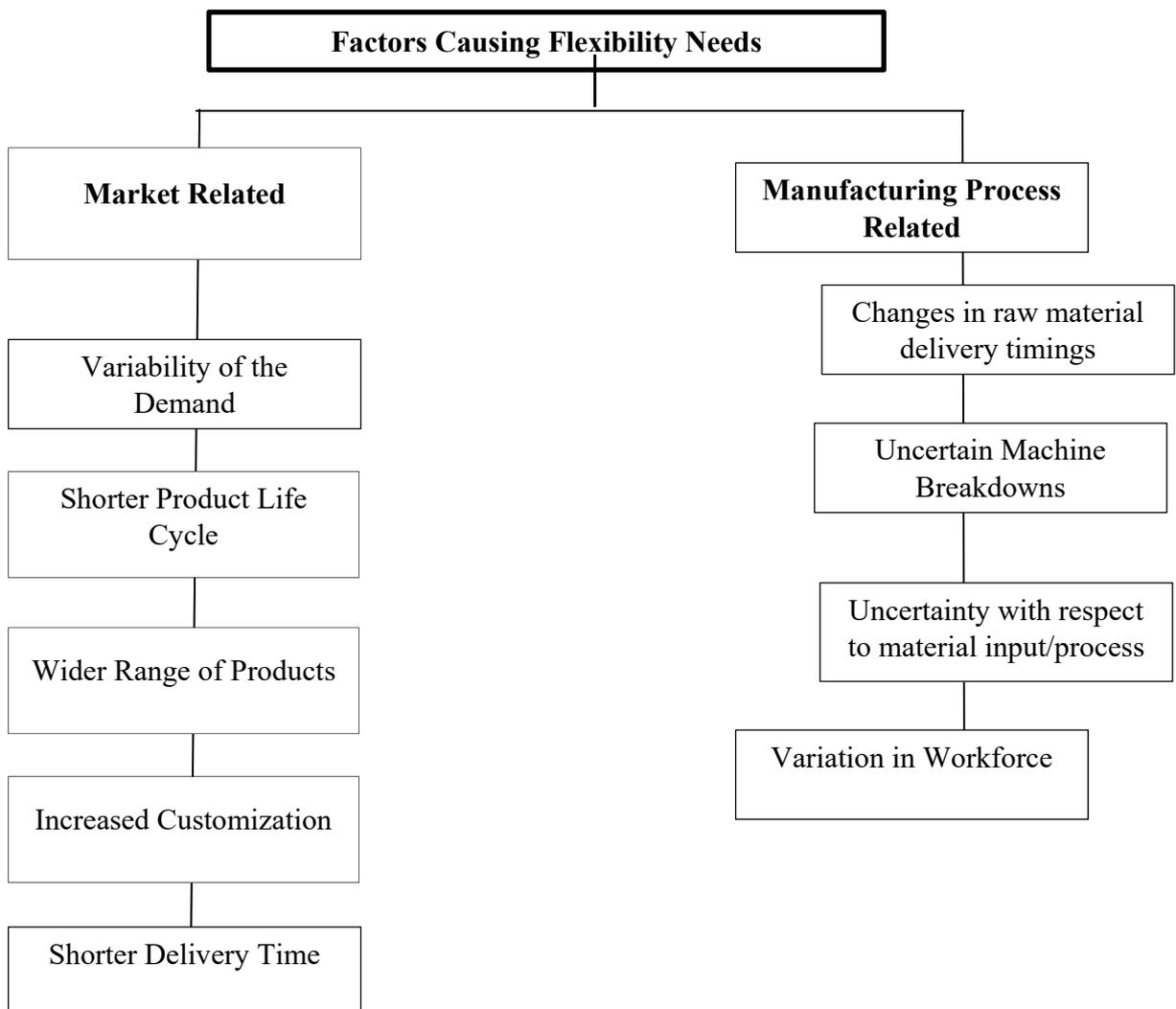


(Source: Sánchez & Pérez 2005, p. 685)

Other Factors Causing Flexibility Needs

The requirement of change can be linked with variations or uncertainty. It can either be generated inside or outside of a system. Chen and Adam (1991), divide the causes for flexibility needs into two groups: environmental uncertainties about company's marketing or uncertainties regarding manufacturing process.

Figure 2: Factors causing flexibility needs



(Source: Toni and Tonchia, 1998; Gerwin, 1993)

Market Related Factors

Chen and Adam (1991) presented three different sources of flexibility needs from a marketing perspective. Diversification of products, Shorter product life cycle and Demands variations from the buyer's perspective. De Toni and Tonchia (1998) presented an extended list of factors which include demand marketing flexibility, Demand variations, Shorter product life cycles, Shorter technologies life cycles, Wider product range, Increased customization and Shorter delivery times.

Manufacturing Process Related Factors

From a manufacturing point of view, Chen and Adam (1991) also presented three sources which need flexibility in the organization, Focused manufacturing, Innovation in manufacturing technologies and Unexpected competition. Correa (1994) and Gerwin (1993) have indicated several internal factors requiring flexibility capabilities, Uncertain machine downtime, Material uncertainty with respect to the standard of process, Uncertain delivery time changes with respect to material, Workforce variations.

Conclusion

The concept of flexibility should be broadened, and it should be studied from the perspective of a production systems. Globalization and liberalization are the important factor for the growing competition and changing demand patterns by the consumers in the marketplace. The firms cannot compete in the market without proper collaboration and trust among the partners in the value chain. Effective management of relationships in value chain management is a necessity to withstand competitive pressures and economic downturns.

The current changes in environment, socio-political, changing demand, logistics, processes, and technology have compelled companies to focus more on flexibility. The old view of focusing more on cost and speed is not enough for the companies to earn profit and survive in the market. The cost and speed solely cannot guarantee the survival of any company in the market because of the availability of alternates available in the market.

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