Proceedings of GLOGIFT 17
December 11-13, 2017
Delhi School of Management, Delhi Technological University, Delhi
pp. 63-83

Modeling Enterprise Flexibility and Competitiveness for Indian Pharmaceutical Firms: A Qualitative Study

Asim, M[1] and Nasim, S[2]

Abstract

Given the challenges posed by today's VUCA (Volatile Uncertain Complex and Ambiguous) world, organizations are required to be highly flexible in order to survive and remain competitive. Such a need is more pronounced in the dynamic context of the pharmaceutical industry, especially in India, which has witnessed tremendous change in the last several years. This makes it imperative to explore as to how pharmaceutical firms in India are addressing the issue of flexibility and its consequent linkage with their competitiveness, by undertaking a qualitative study to structurally model their inter-relationship.

After providing a conceptual review of flexibility and competitiveness, this paper adopts the use of a qualitative approach called the Total Interpretive Structural Modeling (TISM). TISM is an innovative version of Warfield's interpretive structural modeling technique and is used to model and structure the various types of enterprise flexibility and competitiveness for greater understanding of the interplay of these factors. In the end, the implications for practitioners and researchers are highlighted.

Keywords: Enterprise Flexibility, Competitiveness, Total Interpretive Structural Modeling, Interpretive Structural Modeling, Pharmaceutical Industry.

1. Introduction

Global business environment had never been so volatile, uncertain and complex as it is today. To cope up with the challenges of such a world, business organizations are recalibrating their strategies to survive and remain competitive. This, however, calls for redefining the capability requirements of the organization and aligning them to their corporate strategies. Studies in the past have emphasized formulating dynamic and competitive strategies using flexible mechanism (Sushil, 2015), in order to remain competitive as well as to face the turbulence and vulnerabilities of environment.

Researches in the past have highlighted the significance of flexibility for the organization to grow in fast changing and even turbulent environments (Dreyer and Gronhaug, 2004). When organizations use real time information to support their business processes, incorporation of flexibility and adaptability in the system becomes necessary (Davidson, 1999). Flexible organizations dominate the business processes which are incorporated end-to-end, which in turn enable it to respond to flexibility and speed to meet customer demands, market opportunities and to face external threats (Sethi and Sethi, 1990; Shi and Daniels, 2003).

1. Research scholar, FMSR, AMU.
2. Associate Professor, FMSR, AMU.

Thus, to survive in the rapidly changing business environment of today, organizations are required to be highly flexible (Passmore, Shea and Horney, 2010). This prompted us to explore as to how the organizations are addressing the issue of flexibility and its consequent linkage with the competitiveness. This paper, thus, presents a hierarchical modeling of the constructs of enterprise flexibility and competitiveness.

An attempt is made to explore the dimensions of enterprise flexibility and competitiveness in the pharmaceutical sector. Based on the review of literature, variables/dimensions affecting competitiveness have been identified. These factors are then modeled using a qualitative tool called Total Interpretive Structural Modeling (TISM) based on the inputs from the experts of pharmaceutical industry in India. At the end of the paper, the implications for practitioners and researchers have been outlined.

2. BACKGROUND LITERATURE

The review of literature is undertaken on themes like flexibility, competitiveness and the context of pharmaceutical industry, as explained in the section below.

2.1 Flexibility

Flexibility is defined as "a ready capability to adapt to new, different or changing requirements" (Webster's Dictionary). According to Volberda (1996), "Flexibility is the degree to which an organization has a variety of managerial capabilities and the speed at which they can be activated, to increase the control capacity of management and improve the controllability of the organization." Thus, flexibility is a complex initiative which is multi-dimensional in nature, demanding, versatile, change oriented, sustainable and has the ability to develop over time (Bahrami, 1992).

Flexibility is indispensable in effectively operating in the new, dynamic competitive landscape. It is an attribute that forces the firm's capability to react rapidly according to the changing and dynamic business environment (Evans, 1982; Suarez, *et. al*., 1991; Hitt, *et. al*., 1998; Rindova and Kotha, 2001; Grewal and Tansuhaj, 2001). Therefore, the demand to enhance flexibility options can be met by developing an inventory of choices which seems to be significant for the competitiveness, particularly of high technology firms (Bahrami, 1992), as flexibility offers a competitive advantage over other enterprises.

Traditionally, flexibility intends to focus on the firm's ability to adjust their manufacturing level to meet the fluctuating market demand. However, more recently, the idea of flexibility has been extended to integrate firm's ability to widen their product range, expand market share, and enter new markets (Dreyer and Gronhaug, 2004).

Flexibility, thus, is a key capability, as it is imperative for any organization to have alternatives which help them to handle the dynamic situations (Sushil, 2001). Organizations should be flexible enough with respect to different dimensions to remain competitive, which include flexibility in functional areas like finance, marketing, strategy etc., giving importance to different types of flexibility, which is explained in the next section.

2.1.1 Types of Flexibility

This section presents types of flexibility in an organization which can be Enterprise, Strategic, Financial, Organizational, Manufacturing, Marketing and Information systems flexibility.

***Enterprise Flexibility*:** "Enterprise flexibility means creating options at different levels in the enterprise, creating ways and methods of change across the range of options, and providing freedom of choice to various actors in the enterprise to make this change happen with minimum time and efforts" (Sushil, 2014).

As discussed earlier flexibility offers competitive advantage to organizations. So the term enterprise flexibility can be defined as the capability of enterprise to bend according to the changing demands of environment and its stakeholders by taking less time and effort (Sushil, 2006). Flexibility can be easily achieved by satisfying the requirements of emerging situations. Also, the systems and the information technology infrastructure which support these processes should change easily.

The different types of enterprise flexibilities are: Strategic flexibility connected with strategic dimension; organizational flexibility connected with structure and people dimensions; and flexibility of various types of systems, such as financial, information, manufacturing, marketing, technology management, and so on (Sushil, 2001).

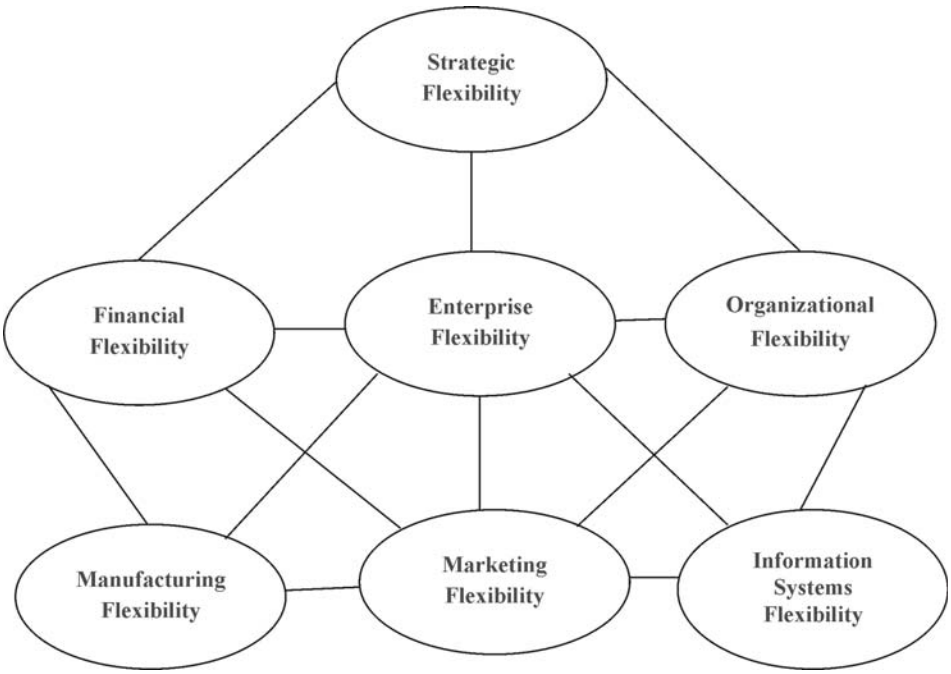


Figure 1: Components of Enterprise Flexibility (Source: Sushil, 2014)

Enterprise flexibility is favored so as to adjust to the quick pace of transformation in business environment. Flexibility in the enterprise should be created in a manner so that controllability also increases. A highly open system with lack of controls may lead to a disordered enterprise. Thus, Flexibility in various domains such as strategy, structure, systems and people should be created in a way so that it provides adaptiveness and receptiveness without losing controllability. The choices that are created within the area of the enterprise create internal flexibility, where as the options outside the enterprise in the rest of the value network create external flexibility. A right balance of external and internal flexibility is to be kept up for a high performing enterprise (Sushil, 2014).

***Strategic Flexibility*:** Strategic flexibility is a process that has an impact on the company, by virtue of the requirement instead of option, is used to denote the company's deliberate or emergent capabilities for offensive or defensive maneuver. Strategic flexibility means that the company change the way according to their needs.

Strategic flexibility offers transformational ability regarding continuous renewal of the organization and dynamic balancing of the incomprehensible key choices. This provides openness, focus, change, and flexibility in the strategy formulation and execution like a flowing stream strategy (Sushil, 2014). It is closely linked to environmental uncertainty because when the external environment becomes more volatile, enterprises require greater flexibility in order to respond to the challenging conditions.

Teece, Pisano, and Shuen (1997) emphasized that organizations should depend on dynamic potentials to build competitive advantage in times of rapid change. Researchers like Sanchez (1995) and Garud and Kotha (1994) suggested that strategic flexibility facilitates the organizations to compete successfully under such circumstances (Abbott, 2003).

***Financial Flexibility*:** It can be defined as an exercise of freedom of choice within the framework of Government monetary and fiscal policy, capital market regulations, investors' risk-return preferences, and corporate strategy to develop the financial processes with adaptability and transparency so as to have better boom with the business environment. The purpose of financial flexibility is to create more money related choices and change over these choices under turbulence to enhance budgetary execution and minimize danger.

***Organizational Flexibility*:** The organizational flexibility is the capability of the organization to initiate change along with continuity in its structure, processes, people, and culture, so as to pursue many alternatives on the same continua and at the same time and to dynamically interplay across the organizational options.

The main purpose of organizational flexibility is to offer learning, readiness for change and adaptation for organizational transformation. The need for organizational flexibility to accommodate a changing world is well understood. The high velocity and competitive markets has added immense pressure among the organizations to change rapidly along with achieving the desired performance parameters.

***Manufacturing Flexibility*:** The manufacturing flexibility is the potential of the manufacturing systems in the organization to change or adjust to both outside and inside conditions with minimum time and efforts (Sharma and Sushil, 2002). The need to have manufacturing flexibility is to ensure that the required quantity as per customers changing demands should be manufactured with agility and at a minimum cost and by this competitive advantage is achieved by reducing the cycle time.

***Marketing Flexibility*:** According to Abbot and Banerji (2003), marketing flexibility enable organizations to have a larger market share or a stronger market presence. It is, further, defined as the ability of firms to adjust its marketing efforts in response to changing environmental context.

***Information Systems Flexibility*:** The information system flexibility is the ability of the information system to change and modify according to the requirements of new conditions, demands, or circumstances both within and outside the enterprise. It is composed of both systemic flexibility (flexible for organization requirements) and usage flexibility (flexible for usage) (Palanisamy and Sushil, 2003; Palanisamy, 2012). The aim of Information systems flexibility is to ensure that the information system are more dynamic, information escalated and intelligent to enable organizational change and generate competitive advantage.

The table below presents a list of various types of enterprise flexibility, used for this study:

Table 1: Types of Enterprise Flexibility

Type of Flexibility	Author (Year)	Description
Strategic Flexibility	Sanchez (1995), Sushil (2005)	Firms ability to respond to different demands from dynamic competitive environments in an aggressive way. Strategic Flexibility is firmly connected to environmental uncertainty.
Financial Flexibility	Jain and Sushil (2000)	Financing flexibility is a practice of the opportunity of decision to progressively interchange among the different wellsprings of (i) Finance (ii) suppliers of assets and (iii) various financial instruments. • Flexibility in financial strategies, open to interplay from dilution to enhancement of EPS and profitability is likely to help in creating financing flexibility.
Organizational Flexibility	Volberda (1996), Sushil (2000)	It dynamically balances the opposing phenomenon such as centralization-decentralization/continuity change. Flexibility derives fro m the accumulation of managerial capacities (organization challenge) and the responsiveness of the organization (organization design challenge). On the premise of speculations of control, the author argues that organizational flexibility is inherently paradoxical and requires a productive contact amongst change and conservation.
Manufacturing Flexibility	Sharma and Sushil (2002)	Capacity of the manufacturing systems to change or ad just to both external and internal conditions with least time and efforts.
Marketing Flexibility	Grewal and Transtutaj (2001), Abbot and Banerji (2003)	Capacity to have a high market share/strong market presence. Market flexibility is characterized as the capacity of Transnational Corporations to recalibrate its promoting endeavors in a short period in response to changing environmental context.
Information Systems Flexibility	Palanisamy and Sushil 2003	Capacity of the information systems to change or to alter and adjust because of new conditions, demands, or circumstances both inside and outside the enterprise. It is made out of both systemic flexibility (flexible for organization requirements) and usage flexibility (flexible for usage).

Source: Adapted from Sushil, Sharma, and Jain (2010)

2.2 Competitiveness

In the present economic scenario the organizations are experiencing intense pressure which is mainly due to factors like fast changing business environment, shorter product life cycle, increasing demand from less loyal customers whose preferences evolve quickly and rising competitors (Dreyer and Gronhaug, 2004). These concerns have been brought on basically because of a changing global economy, deregulation in several ventures and fast developments in information technologies that permits the opening of new business models which increases business rivalry. As discussed in the previous sections, flexibilities of different kinds contribute towards enhancement of organizational competitiveness.

The term 'Competitiveness' has originated from the Latin world, 'competer', which means involvement in a business rivalry for markets. In business parlance, the term implies the ability to compete. It is a complex, multidimensional and relative concept which is linked to various interdependent variables, making it difficult to sense and define it. The task of defining and measuring competitiveness is itself a research challenge; though it is a familiar idea without having any immediate relationship with economic performance indicators.

Competitiveness has been framed by joining two separate but related concepts, namely, comparative advantage and competitive advantage. Competitive advantage relates to the concept of firm's assets and describes the proprietary elements that clarify what activities it should commence which will distinguish it from its competitors (Porter, 2001). The actual difference between these two terms in the literature seems to depend on their levels of assessment. While the research on comparative advantage explains that it deals with the issue of competitiveness of nations and their industries, researchers of competitive advantage are more concerned with firm level (Porter, 1985).

Competitiveness is a multidimensional concept which can be looked at from three different levels: country, industry, and firm level.

Country Competitiveness: Country Competitiveness refers to the degree to which a country' environment is helpful for business and industry. Most of the country competitiveness reports modify some variation of this definition and measure competitiveness completely regularly on more than 250 criteria of competitiveness.

Industry Competitiveness: Industry Competitiveness is the combined capability of firms in the industry to compete internationally. Performance measures such as productivity are great surrogates of competitiveness for speedy evaluation.

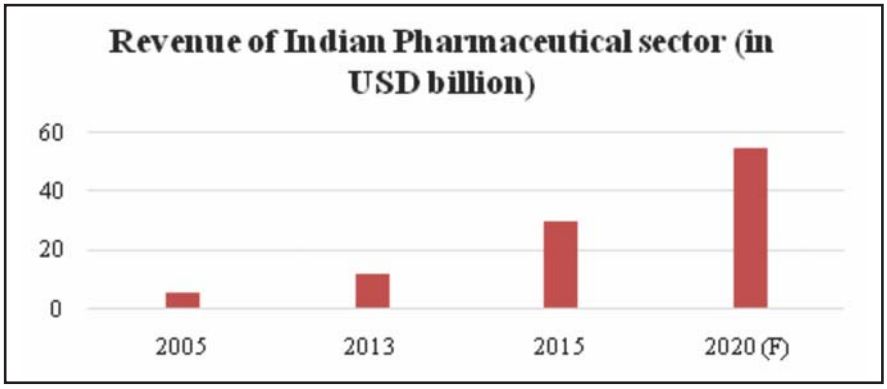
Competitiveness at Firm Level: Competitiveness of a firm is the ability to attempt any or all activities on the value system from imagining, planning, designing, engineering, manufacturing, marketing, financing to servicing of a product or service or bundle of products and services, superior to those offered by competitors considering the price or non price quality on a sustained basis.

2.3 Pharmaceutical Industry in India

India enjoys an important position in the global pharmaceuticals sector. Indian pharmaceutical sector accounts for about 1.4 per cent of the global pharmaceutical industry in value terms and 10 per cent in volume terms. This makes the Indian pharmaceuticals market is the third largest in terms of volume and thirteenth largest in terms of value. The Indian pharmaceuticals market increased at a CAGR of 9.4 per cent in 2013 from USD6 billion in 2005, and is expected to expand at a CAGR of 23.9 per cent to USD55 billion by 2020. By 2020, India is likely to be among the top three pharmaceutical markets by incremental growth and sixth largest market globally in absolute size. India has a huge market potential for Pharmaceuticals. Indian pharmaceutical industry is famous in international fraternity for making medicines at comparatively low-price. India's cost of production is significantly lower than that of the US and almost half of that of Europe. It gives a competitive edge to India over others.

India has also maintained its lead over China in pharmaceutical exports with a year-on-year growth of 7.55 per cent to US$ 12.54 billion in 2015, according to data from the Ministry of Commerce and Industry. Overall drug approvals given by the US Food and Drug Administration (USFDA) to Indian companies have nearly doubled to 201 in FY 2015-16 from 109 in FY 2014-15, an increase of 84 per cent as per analysis by USFDA.

Figure 2: Revenue of Indian Pharmaceutical Sector



Source: Department of Pharmaceuticals, PwC, McKinsey, Aranca Research, F= Forecast

The Indian pharmaceutical industry is fragmented with more than 10,000 manufacturers in the organised and unorganised segments. The products manufactured by the Indian pharmaceutical industry can be broadly classified into bulk drugs (active pharmaceutical ingredients - API) and formulations (Figure 2). Of the total number of pharmaceutical manufacturers, about 77% produce formulations, while the remaining 23% manufacture bulk drugs. Bulk drug is an active constituent with medicinal properties, which acts as basic raw material for formulations. Formulations are specific dosage forms of a bulk drug or a combination of bulk drugs. Drugs are sold as syrups, injections, tablets and capsules.

The Indian API manufacturing segment is divided into two sectors – innovative or branded and generic or unbranded. In 2009, the global generic drug market was estimated to be US$ 84 billion, of which the US accounted for 42%. India's generic drug industry is estimated to be US$ 19 billion and it ranks third globally, contributing about 10% to global pharmaceutical production.

3. MODELING ENTERPRISE FLEXIBILITY AND COMPETITIVENESS

Total Interpretive Structural Modeling (TISM) technique has been used to explore the inter-relationships among the various types of enterprise flexibility and competitiveness.

Based on literature review, the micro constituents/factors of enterprise flexibility have been identified as a part of a doctoral research conducted in Indian context. A list of these variables and their description is provided in Table 2. Though these variables form the basis of the criteria and indicators for competitiveness in the pharmaceutical firms in India, a structural analysis of how various factors of enterprise flexibility interact or affect competitiveness can bring greater clarity, given the complexity of the situation.

The stepwise method adopted for modeling the variables using the TISM technique has been illustrated in the subsequent sections. The elements, contextual relation and interpretation of enterprise flexibility and competitiveness for the pharmaceutical firms in India are summarized in Table 3.

3.1 Variables of Enterprise Flexibility

A brief explanation of the micro variables of enterprise flexibility and competitiveness, as identified from the literature, are summarized in Table 2.

Table 2: List of identified Variables of Enterprise Flexibility and Competitiveness

S. No.	Variable	Micro/ Macro Variable	Description	References
1	Enterprise Flexibility	Macro	Ability of enterprise to adapt to changing requirements of its environment and its stakeholders with minimum time and effort	Sushil (2001a), Sushil (2006), Sushil (2014)
2	Strategic Flexibility	Micro	Firms ability to respond to different demands from dynamic competitive environments in an aggressive way	Sanchez (1995), Sushil (2005)
3	Financial Flexibility	Micro	Create more money related choices and change over these choices under turbulence to enhance budgetary execution and minimize danger	Jain and Sushil (2000)
4	Organizational Flexibility	Micro	Change making capability of the organization in its structure, processes, people, and culture	Volberda (1996), Sushil (2000)
5	Manufacturing Flexibility	Micro	Ability of the manufacturing systems to change or adapt to both external and internal conditions with minimum time and efforts	Sharma and Sushil (2002)
6	Marketing Flexibility	Micro	Capability to cater to changing customer needs, handling multiple mar ket segments, and balancing global and local requirements to gain sustainable competitive advantage	Grewal and Transtutaj (2001), Abbot and Banerji (2003)
7	Information Systems Flexibility	Micro	Capacity of the information systems to change or to alter an d adjust because of new conditions, demands, or circumstances both inside and outside the enterprise	Palanisamy and Sushil (2003), Palanisamy (2012)
8	Competitiveness	Macro	Ability of the firm to offer products or services superior to those offered by the competitors considering the price or non price quality on a sustained basis	Porter (1985,1990,2001), Hamel and Prahlad (1993), Momaya (2000,2003)

Identification of structure within a system i.e. identifying relationships among the variables can be of great value in dealing effectively with the system and better decision–making. Total Interpretive Structural Modeling (TISM), a qualitative tool- which is an improved version of Interpretive Structural Modeling (ISM) (Nasim, 2011)- has been used to model and structure the various types of enterprise flexibility and competitiveness for greater understanding of the interplay of these factors. Expert's inputs about the possible relationship among the factors have been taken to develop the model. An introduction to the methodology of TISM, and the structural model and the interpretation for the study is discussed in the following sub-sections.

3.2 Introduction to TISM (Total Interpretive Structural Modeling)

Structural models may include interaction matrices and graphs (Warfield, 1973a, b, 1974b); Delta charts; signal flow graphs, etc., which lack an interpretation of the embedded object or representation system. An interpretive structural model (ISM) deals with the interpretation of the embedded object or representation system by systematic iterative application of graph theory resulting in a directed graph for the complex system for a given contextual relationship amongst a set of elements. Interpretive structural modeling, can therefore, be defined as a process that transforms unclear and poorly articulated mental models of systems into visible and well–defined models useful for many purposes.

In any Interpretive Structural Model (ISM), the interpretation of the diagraph can be done at two levels, i.e. nodes and links. An ISM interprets the nodes in terms of the definition of elements. But the interpretation of links is comparatively weak in ISM; this is limited to interpreting the contextual relationship between the elements and the direction of relationship in a paired comparison. But the interpretation of the directed link in terms of how it operates is lacking (Sushil, 2009). For example, two objectives A and B are related by the contextual relationship 'will help achieve'. If there is a directed relationship in an ISM from objective A to objective B, thereby implying that objective A is helping to achieve objective B, it does not interpret that in what way objective A is helping to achieve objective B. This weakness of ISM methodology has been addressed by Sushil (2009), whose framework and methodology of Total Interpretive Structural Modeling (TISM) interprets the links in the interpretive structural models using the tool of Interpretive Matrix (Sushil, 2005a).

Thus, TISM is essentially an innovative version of Warfield's (1973, 1974) Interpretive Structural Modeling (ISM) technique (Nasim, 2011) and is used to model/structure the various types of enterprise flexibility and competitiveness for greater understanding of the interplay of these factors.

3.3 Methodology Adopted for Modeling (TISM)

The framework and methodology of Total Interpretive Structural Modeling (TISM) is used to delineate the hierarchical relationships among the micro variables of enterprise flexibility and competitiveness for the pharmaceutical firms in India.

Opinion from a group of select domain experts has been taken to evolve the model. The central tool of ISM, i.e. reach ability matrix and its partitions is adopted as it is in the process of TISM. The basic process of TISM is discussed in a step-by-step manner and these steps along with the matrices and other tools are illustrated using the variables of 'enterprise flexibility' for which the TISM is conducted.

Step I: Identify and Define Elements

The first step in any structural modeling is to identify and define the elements whose relationships are to be modeled. This can be done by using any idea generation method as a small group exercise or may also be related with past studies if such information is available. For the study, the micro variables of enterprise flexibility, as identified from the literature, have been used to identify their inter-relationship with competitiveness.

Step II: Define Contextual Relationship

In order to develop the model of the structure relating the elements, it is crucial to state the contextual relationship between the elements. For example the contextual relationship between different elements (different types of enterprise flexibility and competitiveness) as identified for

the study is factor V1 influence/enhance factor V2 and factor V1 influence/enhance factor V7. Expert inputs are solicited to capture the contextual relationship among the elements.

Step III: Interpretation of Relationship

This is the first step forward over the traditional ISM. Though ISM, too, captures the contextual relationship, it remains silent on how that relationship really works. Thus, in order to interpret the ISM further to make it TISM, it is advisable to seek clarification from the experts the interpretation/logic behind the expressed relationship as illustrated in Table 2. That is, experts not only indicate whether strategic flexibility (V1) influence/enhance financial flexibility (V2) or not, but also explain, "In what way do they influence/ enhance?" The interpretation of the relationship would be specific for each pair of variables of enterprise flexibility and would make the deep rooted knowledge explicit by capturing the logic from the experts. The basic sets of elements considered for the study, contextual relationship and interpretation of the relationship are summarized in Table 3. The template prepared and used for seeking inputs from the expert(s) to understand the possible inter-linkages/relationships between the various types of enterprise flexibilities and competitiveness is presented in Appendix I. The list of experts used for filling up the template is also included in the Appendix I.

Table 3: Elements, Contextual Relationship and Interpretation for Enterprise Flexibility and Competitiveness

Element code	Elements	Contextual Relation	Interpretation
V1	Strategic flexibility	Factor V1 will influence/enhance Factor V2	How or in what way Factor V1 will influence/enhance Factor V2
V2	Financial flexibility		
V3	Organizational flexibility		
V4	Manufacturing flexibility		
V5	Marketing flexibility		
V6	Information Systems flexibility		
V7	Competitiveness		

Step IV: Interpretive Logic of Pair-wise Comparison

In ISM, the elements are compared to develop SSIM, as described previously. The only interpretation that is made here relate to the direction of the relationship. In order to upgrade it to TISM, it is proposed to make use of the concept of interpretive matrix so as to fully interpret each paired comparison in terms of how that directional relationship operates in the system under consideration by answering the interpretive query as mentioned in step III. For paired comparison, the *ith* element is compared individually to all the elements from *(i+1) th* to the *nth* element. If there are *n* elements, there will be in all *n(n-1)/2* paired comparisons. Since each pair of elements *(i,j)* may have two possible directional links *i-j* or *j-i,* there will be in all *n(n-1)* rows in the Knowledge Base. For each *i-j* link the entry could be 'Yes(Y)' or 'No(N)' and if it is 'Yes', then it is to be further interpreted. This will reveal the interpretive logic of the paired relationships in the form of 'Interpretive Logic - Knowledge Base'. This is illustrated in the template used to capture the response of the experts regarding relationship between the various types of enterprise flexibilities and competitiveness as attached in Appendix I.

Step V: Reachability Matrix and Transitivity Check

The paired comparisons in the interpretive logic – knowledge base are translated in the form of reach ability matrix by making entry 1 in *i-j* cell, if the corresponding entry in knowledge base

is 'Y', or else it should be entered as 0 for the corresponding entry 'N' in knowledge base. This matrix is checked for the transitivity rule and no significant transitive link was found.

Step VI: Level Partition on Reachability Matrix

The level partition is carried out similar to ISM to know the placement of elements level-wise (Warfield, 1974c; Saxena, Sushil and Vrat, 2006). Determine the reach ability and antecedent sets for all the elements. The elements in the top level of the hierarchy will not reach any elements above their own level. As a result, the reach ability set for a top level element will consist of the element itself and any other elements within the same level which the element may reach, such as components of a strongly connected sub-set. The antecedent set for a top level element will consist of the element itself, elements which reach it from lower levels, and any element of a strongly connected sub-set involving in the top level. As a result, the intersection of the reach ability set and the antecedent set will be the same as the reach ability set in case the element is in the top level. The top level elements satisfying the above condition should be removed from the element set and the exercise is to be repeated iteratively till all the levels are determined (Refer to Tables 5a – 5g).

Step VII: Developing Diagraph

The elements are arranged graphically in levels and the directed links are drawn as per the relationships shown in the reach ability matrix. A simpler version of the initial diagraph is obtained by eliminating the transitive relationships step-by-step by examining their interpretation from the knowledge base (Figure 3).

Step VIII: Interaction Matrix

The final diagraph is translated into a binary interaction matrix form depicting all the interactions by 1 entry (Exhibit 3a). The cells with 1 entry are interpreted by picking the relevant interpretation from the knowledge base in the form of interpretive matrix.

Step IX: Total Interpretive Structural Model

The connective and interpretive information contained in the interpretive direct interaction matrix and diagraph is used to derive the TISM. The nodes in the diagraph are replaced by the interpretation of elements placed in boxes. The interpretation in the cells of interpretive direct interaction matrix is depicted by the side of the respective links in the structural model. This leads to total interpretation of the structural model in terms of the interpretation of its nodes as well as links, as depicted in Figure 5.

3.4 TISM for Enterprise Flexibility and Competitiveness

As indicated earlier, the total interpretive structural model (TISM) has been developed to explore the relationships among the micro variables of enterprise flexibility and competitiveness for the pharmaceutical firms in India. In this section, the reach ability matrix (Table 4), the matrices for partitioning the variables into various levels (Table 5a – 5g), the diagraph depicting the relationship among the nodes (Figure 3), the ISM in Figure 4 and the final TISM (Figure 5) is presented, followed by a discussion on the relationships identified.

Table 5a: Partitioning the reach ability matrix into different levels (Iteration-1)

Factors	Reach ability set	Antecedent Set	Intersection Set	Level
V1	1,7	1,2,3,4,5,6	1	
V2	1,2,7	2,3,6	2	
V3	1,2,3,4,5,7	3,6	3	
V4	1,4,7	3,4,6	4	
V5	1,5,7	3,5,6	5	
V6	1,2,3,4,5,6,7	6	6	
V7	7	1,2,3,4,5,6,7	7	I

Table 5b: Partitioning the reach ability matrix into different levels (Iteration-2).

Factors	Reach ability set	Antecedent Set	Intersection Set	Level
V1	**1**	**1,2,3,4,5,6**	**1**	**II**
V2	1,2	2,3,6	2	
V3	1,2,3,4,5	3,6	3	
V4	1,4	3,4,6	4	
V5	1,5	3,5,6	5	
V6	1,2,3,4,5,6	6	6	

Table 5c: Partitioning the reach ability matrix into different levels (Iteration-3)

Factors	Reach ability set	Antecedent Set	Intersection Set	Level
V2	**2**	**2,3,6**	**2**	**III**
V3	2,3,4,5	3,6	3	
V4	**4**	**3,4,6**	**4**	**III**
V5	**5**	**3,5,6**	**5**	**III**
V6	2,3,4,5,6	6	6	

Table 5d: Partitioning the reach ability matrix into different levels (Iteration-4)

Factors	Reach ability set	Antecedent Set	Intersection Set	Level
V3	**3**	**3,6**	**3**	**IV**
V6	**3,6**	**6**	**6**	

Table 5e: Partitioning the reach ability matrix into different levels (Iteration-5)

Factors	Reach ability set	Antecedent Set	Intersection Set	Level
V6	**6**	**6**	**6**	**V**

Table 5f: Partitioning the reach ability matrix into different levels (Iteration 1-5)

Iteration	Factors	Reach ability set	Antecedent Set	Intersection Set	Level
1	V7	7	1,2,3,4,5,6,7	7	I
2	V1	1	1,2,3,4,5,6	1	II
3	V2	2	2,3,6	2	III
4	V4	4	3,4,6	4	III
4	V5	5	3,5,6	5	III
5	V3	3	3,6	3	IV
5	V6	6	6	6	V

Table 5g: List of variables and their levels in TISM

S. No.	Variable Code	Variables	Level in the TISM
1	V1	Strategic flexibility	II
2	V2	Financial flexibility	III
3	V3	Organizational flexibility	IV
4	V4	Manufacturing flexibility	III
5	V5	Marketing flexibility	III
6	V6	Information Systems flexibility	V
7	V7	Competitiveness	I

Table 4: Reach ability Matrix for Enterprise Flexibility and Competitiveness

	V1	V2	V3	V4	V5	V6	V7
V1	1	0	0	0	0	0	1
V2	1	1	0	0	0	0	1
V3	1	1	1	1	1	0	1
V4	1	0	0	1	0	0	1
V5	1	0	0	0	1	0	1
V6	1	1	1	1	1	1	1
V7	0	0	0	0	0	0	1

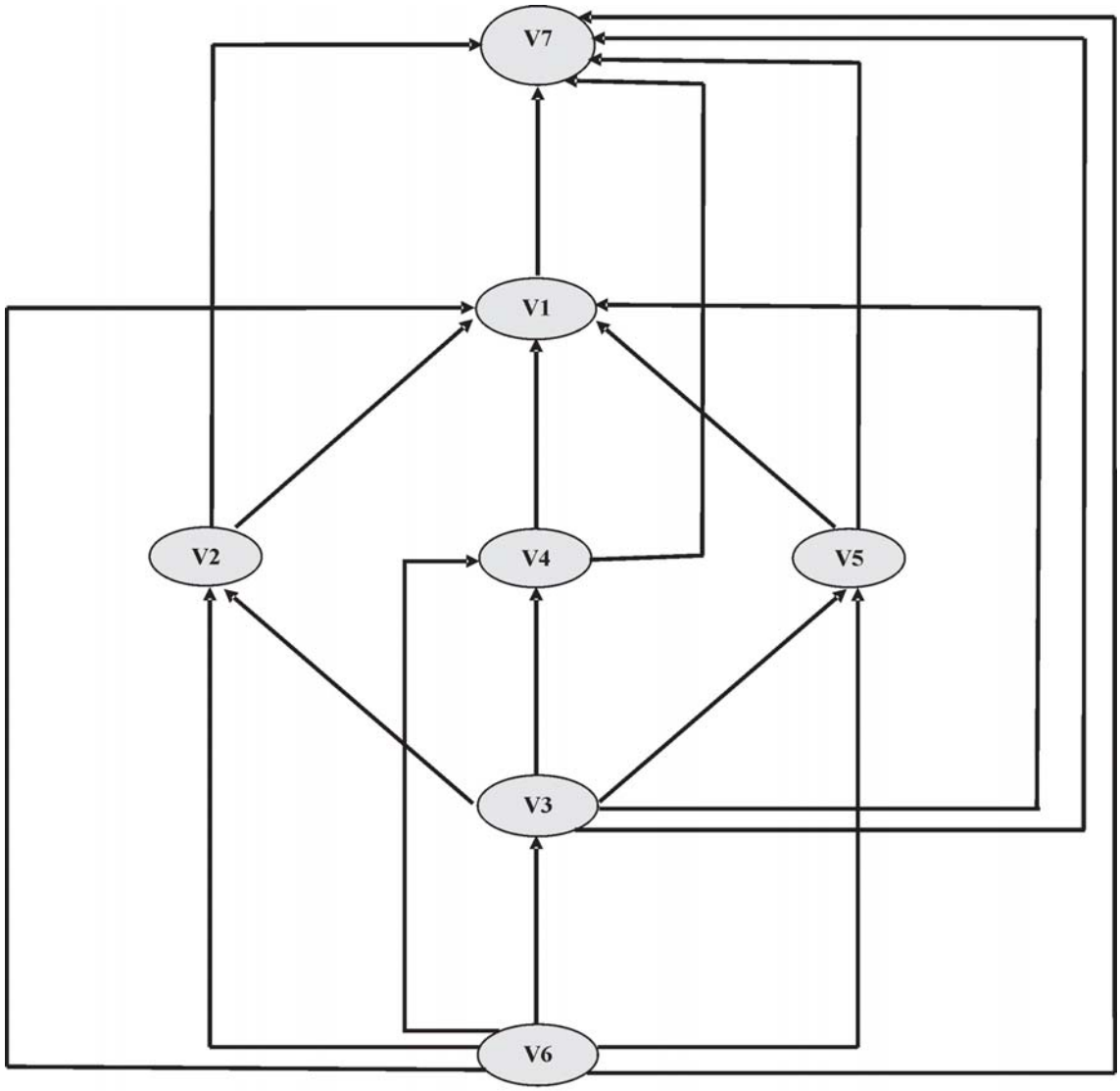


Figure 3: Diagraph

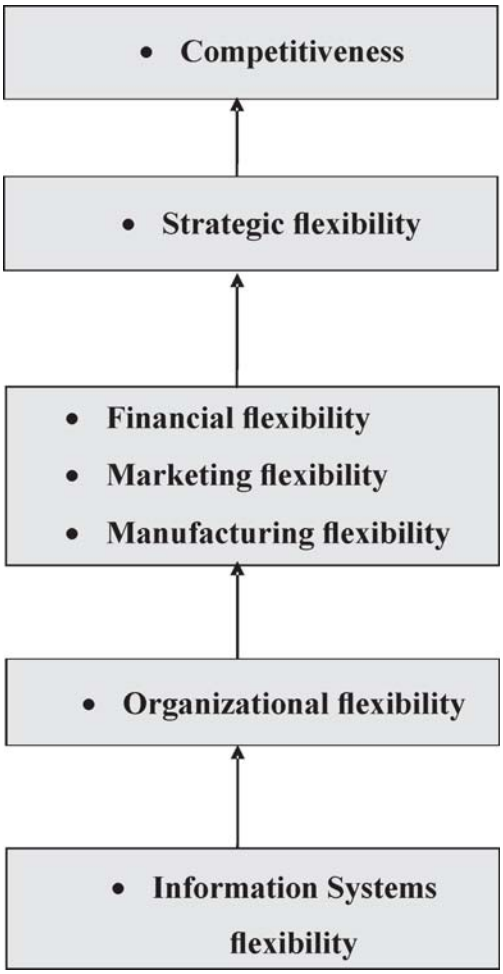


Figure 4: Interpretive Structural Model (ISM) for Enterprise Flexibility and Competitiveness

Exhibit-3a: Direct Interaction Matrix (Binary Matrix)

	V1	V2	V3	V4	V5	V6	V7
V1	-	0	0	0	0	0	1
V2	1	-	0	0	0	0	1
V3	1	1	-	1	1	0	1
V4	1	0	0	-	0	0	1
V5	1	0	0	0	-	0	1
V6	1	1	1	1	1	-	1
V7	0	0	0	0	0	0	-

Exhibit-3b: Direct Interaction Matrix (Interpretive Matrix)

	V1	V2	V3	V4	V5	V6	V7
V1	-	-	-	-	-	-	*Greater flexibility on strategic front enhances competitiveness significantly*
V2	*Being flexible in investment related matters can enhance the options on strategic front for a pharma firm*	-	-	-	-	-	*Greater flexibility on financial front enhances competitiveness significantly*
V3	*Flexible organizations can respond to evolving competitive dynamics*	*Generating greater value*	-	*Flexible in shifting/changing business model, product class etc*	*Helps to adapt their marketing efforts in line with market requirements*	-	*Flexible organizations can respond to evolving competitive dynamics in the market*
V4	*Flexible manufacturing systems and processes can definitely enhance a firm's flexibility on the strategic front in offering different solutions*	-	-	-	-	-	*Delivering differentiated products*
V5	*Flexible marketing campaigns helps in making flexible strategic choices*	-	-	-	-	-	*Flexible marketing campaigns differentiate a firm from competition and offer superior products and services*
V6	Flexible information systems respond quickly to the changing business environment	Flexible information systems can end up generating greater value	*Helps in adopting newer technologies*	*IT systems have a far reaching impact*	*Digital marketing emerges as a differentiating factor*	-	*Flexible information systems helps in responding to market needs promptly and effectively and thereby enhances competitiveness*
V7	-	-	-	-	-	-	-

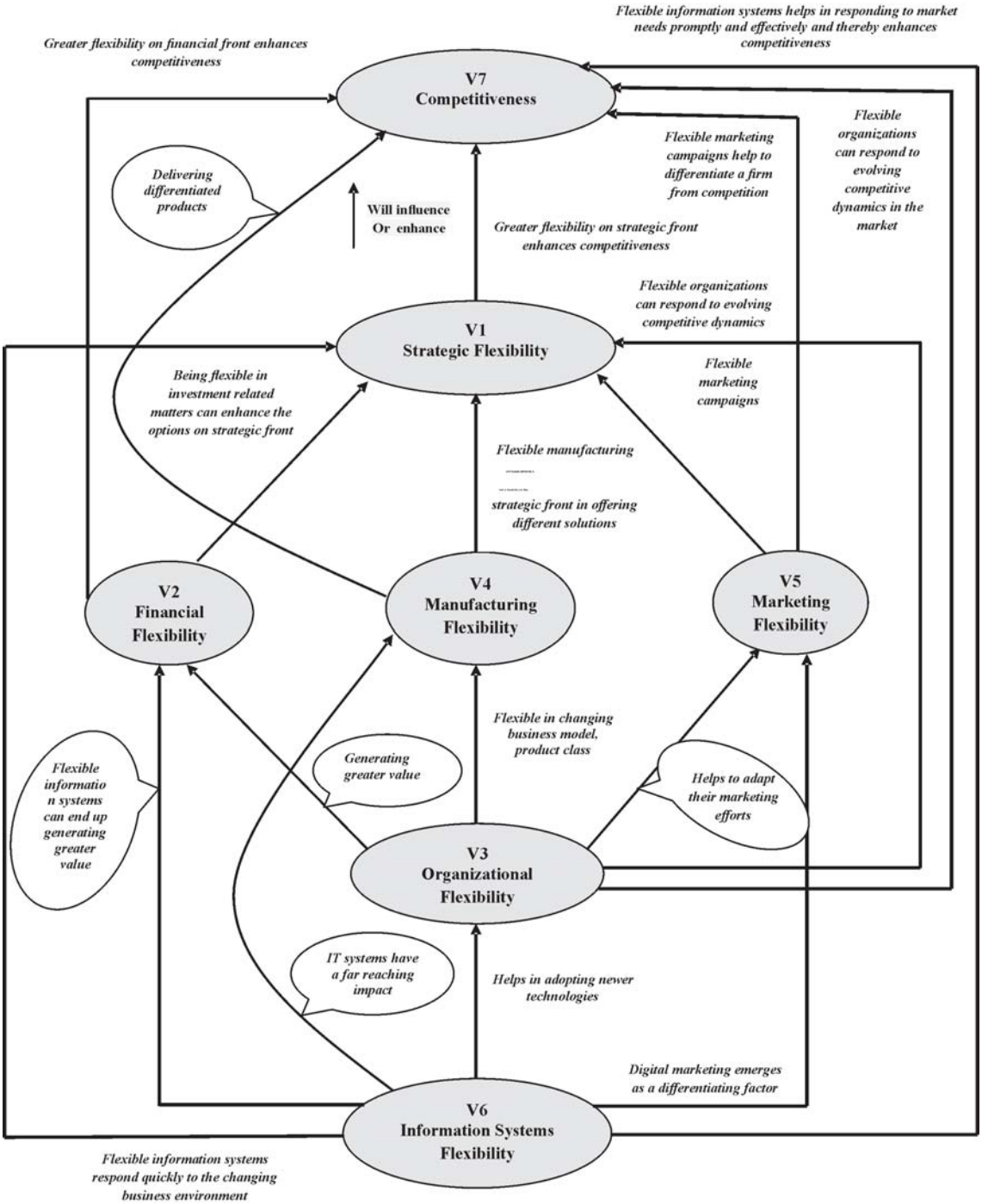


Figure 5: Total Interpretive Structural Model (TISM) for Enterprise Flexibility and Competitiveness

3.4.1 Interpreting the TISM

The contextual relationship among the various types of Enterprise flexibility and Competitiveness along with the interpretive logic was captured by conducting initial discussions with the experts, based on which the TISM model is developed. All the seven variables could be distinctly partitioned into five layers with 'competitiveness' emerging as the dependent variables and placed at the top of the model. The 'competitiveness' has direct links with almost all the other variables in the model, and hence is the key outcome variable of the study. The hierarchical structure of the model highlights the driver and dependence relationships. The variables at the top of the model have higher dependence and those at the bottom have high driving ability.

The structure of the model clearly emphasizes the criticality of 'Information systems flexibility' as the basic driving force affecting the other factors. The micro variable of 'Enterprise Flexibility' i.e. 'Information systems flexibility' is a key factor that will influence a firm competitiveness. In order to be more competitive, firms need to have flexible information systems that can respond to market needs promptly and effectively. Further, it has direct link with organizational, financial, manufacturing, marketing and strategic flexibility and thereby enhancing the competitiveness of pharmaceutical firms.

Similarly, 'organizational flexibility' is a critical factor that has direct link with financial, manufacturing, marketing and strategic flexibility and thereby enhancing competitiveness of pharmaceutical firms as only flexible organizations can respond to evolving competitive dynamics in the market and will definitely influence its ability to adopt newer technologies and enhances organization's ability to be more agile in today's virtual world. Other micro variables of Enterprise flexibility are 'financial, manufacturing and marketing flexibility', which also has a direct link with strategic flexibility and thereby enhancing competitiveness as being flexible in investment related matters can enhance the options on strategic front for a pharma firm. Further, flexible manufacturing systems can help delivering differentiated products to the marketing teams and help to differentiate a firm from competition.

The micro variable, 'strategic flexibility' is a key factor that will enhance the competitiveness of a pharmaceutical firm as greater flexibility on strategic front enhances competitiveness significantly. Flexible strategic choices will help the pharmaceutical firm in becoming more agile in responding to evolving market needs. Strategic decisions will also influence the pharmaceutical firm's flexibility in adopting newer technologies.

3.5 Implications for Researchers and Practitioners

The identification and modeling of various types of enterprise flexibility and competitiveness (in the pharmaceutical domain), as undertaken in this paper, may well serve as key inputs not just for the researchers, but also for the practitioners. The logic captured from the experts explaining the relationship amongst the variables is summarised in the interpretive matrix (as represented in Exhibit 3b-Annexures), is a valuable knowledge base which can be used by the practitioners for better understanding of the domain.

Researchers, in general, too can use the TISM technique to model key constructs for better clarity in their research area. Further, pharmaceutical researchers can also validate the relationships highlighted in the model by undertaking empirical survey and case studies.

The understanding of the interplay of these factors of enterprise flexibility and competitiveness is expected to provide direction in policymaking and strategizing for the implementation of flexibility and competitiveness projects.

4. CONCLUSIONS

In this fast changing interconnected world, it is very critical for enterprises to be flexible enough to grow and remain competitive. Past researches highlight the importance of flexibility to enhance the competitiveness of the organization. The greatest challenge for managers in today's fast changing environment is to strategize to incorporate flexibility that a firm needs in competitive environment. Indian pharmaceutical sector has witnessed rapid growth and transformation, especially, after the Patent Act of 1970. It is imperative to emphasize the role of various types of flexibility in enhancing the competitiveness, given the level of dynamism and change in the pharmaceutical industry.

This paper investigates the relationship among the various types of enterprise flexibility and competitiveness for the pharmaceutical firms in India with the help of a qualitative technique (Total Interpretive Structural Modeling). This technique is used to model the enterprise flexibility and competitiveness factors affecting Indian pharmaceutical sector, for greater understanding of the interplay of these factors.

The key takeaway of the model is that to achieve higher level of competitiveness, firms/ practitioners in the pharmaceutical domain will have to pay greater attention and focus to various aspects of enterprise flexibility, especially strategic and financial flexibility.

Flexibility being a less researched domain, any study linking flexibility with competitiveness is expected to a valuable contribution. Structuring/modeling different types of enterprise flexibility along with competitiveness can be used as a precursor for strategy formulation and implementation. While the resultant model in the pharmaceutical context provides insights for practitioners, the methodology of the modeling technique is expected to be of value to researchers.

References

- Abbot A. and Banerji. (2003). Strategic Flexibility and Firm Performance: The Case of US Based Transnational Corporations. Global Journal of Flexible Systems Management, 4(1&2), 1-12.
- Academy of Management Review, October, 19 (4), 671-693.
- Ajitabh, A., and Momaya, K. S. (2003). Competitiveness of firms: review of theory, frameworks and models, 'SAP-LAP Framework'. Global Journal of Flexible Systems Management. 2(1), 51-59.
- Bahrami H. (1992). The Emerging Flexible Organization: Perspectives from Silicon Valley. California Management Review, 34(4), 33-52.
- Boston, MA: Harvard Business School Press.
- Christensen, C. M. (1997). The innovator's dilemma: When new technologies cause great firms to fail.
- Davidson W. (1999). Beyond Re-Engineering: The Three Phases of Business Transformation. IBMSystems Journal, 38(2/3), 485-499.
- Dove R. (2001). Response Ability: The Language, Structure, and Culture of the Agile Enterprise, Hoboken, Wiley and Sons.
- Dreyer B, Gronhaug K. (2004). Uncertainty, flexibility and sustained competitive advantage. J BusRes 57, 484–494.
- Evans, J. S. (1982). Strategic Flexibility in Business. SRI International, Menlo Park, CA, USA: Research Report 678, 24 pages.
- Garud R. and Kotha S. (1994). Using the Brain as a Metaphor to Model Flexible Production Systems.
- Grewal R. and Tanshuhaj P. (2001). Building Organizational Capabilities for Managing Economic Crisis: The Role of Market Orientation and Strategic Flexibility. Journal of Marketing, 65, 67-80.
- Hamel, G., & Prahalad, C. K. (1993). Strategy as stretch and leverage. Harvard business review, 71(2), 75-84.

- Hitt M.A., Keats B.W. and DeMarrie, S.M. (1998). Navigating in the New Competitive Landscape: Building Strategic Flexibility and Competitive Advantage in the 21st Century. Academy of ManagementExecutive, 12(4), 22-42.
- Horney, N., Pasmore, B., & O'Shea, T. (2010). Leadership agility: A business imperative for a VUCA world. Human Resource Planning, 33(4), 34.
- http://www.pwc.com/gx/en/pharma-life-sciences/pdf/global-pharma-looks-to-india-final
- Jain PK, Sushil. (2000). Financial flexibility for corporate performance. In: Cornerstones of enterprise flexibility. Global Institute of Flexible Systems Management. Vikas Publishing House, New Delhi. Journal of Enterprise Transformation, 1 (2), 68-147.
- McKee K and C Sessions-Robinson. (1989). Manufacturing Productivity and Competitiveness. Journalof Manufacturing, 3, pp 35–9.
- Modeling Enterprise Flexibility and Competitiveness for Indian Pharmaceutical Firms:
- Momaya K. (2000). International Competitiveness, Hindustan Publishing Co., New Delhi.
- Momaya K. (2000). International Competitiveness, Hindustan Publishing Co., New Delhi.
- Nasim, S. (2011). Total interpretive structural modeling of continuity and change forces in e-government.
- Palanisamy R, Sushil. (2003). Achieving organizational flexibility and competitive advantage through information systems flexibility: a path analytic study. J Inf Knowl Manag, 2(3), 261–277.
- Palanisamy R. (2012). Building Information Systems Flexibility in SAP-LAP Framework: Case Study Evidence from SME Sector. Glob J Flex Syst Manag, 13(1), 57–74.
- Papadakis M. (1994). Did (or does) the US have a competitiveness Crisis? J Policy Anal Manage, 13(1), 1–20.
- Porter M. (1985). Competitive Advantage: Creating and Sustaining Superior Performance. The Free Press, New York.
- Porter M. (1998). The Competitive Advantage of Nations, Macmillan Business, pp 33.
- Porter ME. (1990). The competitive advantage of nations. Free Press, New York.
- Porter ME. (2001). Strategy and the internet. Harv Bus Rev, 79(3), 62–78.
- Rindova, V. P. and Kotha, S. (2001). Continuous ¯Morphing: Competing through Dynamic Capabilities, Form, and Function. Academy of Management Journal, Vol. 44, No. 6, pp. 1263–1280.
- Sanchez R. (1995). Strategic Flexibility in Product Competition. Strategic Management Journal, 16, 135-159.
- Saxena, J.P, Sushil &Vrat,P. (2006). Scenario building: a critical study of energy conservation in the Indian cement industry, Technological Forecasting and Social Change Research. Journal ofManagement Sciences, 2(2), 3-8.
- Sethi AK, Sethi SP. (1990). Flexibility in manufacturing: a survey. Int J Flex Manuf Syst 2(4), 289–328.
- Sharma M, Sushil, Jain PK. (2010). Revisiting flexibility in organizations: exploring its impact on performance. Glob J Flex Syst Manag 11(3), 51–68.
- Sharma OP, Sushil. (2002). Issues in managing manufacturing flexibility: a review. Glob J Flex SystManag 3(2&3), 11–29.
- Shi D, Daniels RL. (2003). A survey of manufacturing flexibility: implications for e-business flexibility. IBM Syst J, 42(3), 414–426.
- Suarez, F. F., Cusumano, M. A. and Fine, C. H. (1991). Flexibility and Performance: A Literature Critique and Strategic Framework. Sloan School of Management, MIT Working Paper 3298–91–BPS.
- Sushil. (1997). Flexible systems management an evolving paradigm. Syst Res Behav Sci 14(4), 259–275.
- Sushil. (1999). Flexibility in management. Global Institute of Flexible Systems Management, Vikas Publishing House, New Delhi.
- Sushil. (2000). Systemic flexibility. Glob J Flex Syst Manag, 1(1), 77–80.

- Sushil. (2000b). Cornerstones of enterprise flexibility: strategic, organizational, financial, information systems and manufacturing flexibilities. Global Institute of Flexible Systems Management, Vikas Publishing House, New Delhi.
- Sushil. (2001a). Enterprise flexibility. Global Journal of Flexible Systems Management, 2(4), 53–58.
- Sushil. (2005). A flexible strategy framework for managing continuity and change. Int J Glob BusCompetitiveness, 1(1), 22–32.
- Sushil. (2006). Enterprise flexibility. Glob J Flex Syst Manag, 2, 53–58.
- Sushil. (2009). Interpreting the Interpretive Structural Model. Global Journal of Flexible SystemsManagement, 13(2), 87-106.
- Sushil. (2014). Managing Competitiveness Through Flexibility in Telecom Industry of India: A Policy Perspective. The Flexible Enterprise, Springer, pp 67-97.
- Sushil. (2014). The Concept of a Flexible Enterprise. The Flexible Enterprise, Springer, pp 3-26.
- Sushil. (2015). Managing Flexibility: Developing a Framework of Flexibility Maturity Model. Managing Flexibility: People, Process, Technology and Business, Springer, pp 3-19.
- Teece DJ, Pisano G, Shuen A. (1997). Dynamic capabilities and strategic management. Strat ManagJ, 18(7), 509–533.
- Volberda HW. (1996). Towards the flexible form: how to remain vital in hypercompetitive environments, Organ Sci, 7(4), 359–387.
- Warfield J.N. (1973a). Intent Structures, IEEE Transactions: System, Man and Cybernetics. SMC-3(2), 133-140.
- Warfield J.N. (1973b). Binary Matrices in System Modeling. IEEE Transactions: System, Man andCybernetics, SMC-3, 441-449.
- Warfield J.N. (1973c). Assault on Complexities, Battelle Memorial Inst., Columbus, Ohio, Battelle Monograph, 3 April.