

Flexible Systems Management

Sushil  
Gerhard Chroust *Editors*

# Systemic Flexibility and Business Agility

# Flexible Systems Management

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Sushil • Gerhard Chroust  
Editors

# Systemic Flexibility and Business Agility

 Springer

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# Preface

Flexibility and agility in business are emerging as key dimensions of business excellence that encompass the requirements of both choice and speed. Both flexibility and agility have been used, in literature as well as practice, in multiple ways and often interchangeably. The growing need of flexibility/agility in business can be seen from reactive as well as proactive perspectives. A business enterprise is supposed to have reactive flexibility/agility (as adaptiveness and responsiveness) to cope with the changing and uncertain business environment. It may also endeavor to intentionally create flexibility/agility as a strategic change by the way of leadership change, reengineering, innovation in products and processes, use of information and communication technology, learning orientation, and so on.

The proposed book is intended to provide a conceptual framework of “Systemic Flexibility and Business Agility” supported by researches/case applications in various types of flexibilities and agility in business.

This book presents selected, reviewed, and updated papers of GLOGIFT 12 conference on the theme of systemic flexibility and business agility that was held at University of Vienna, Austria during July 30—August 1, 2012. These are organized in the form of an edited volume that can serve as a good reference material in the area of creating and managing systemic flexibility and business agility.

The selected papers from a variety of issues concerning the theme of systemic flexibility and business agility are organized into following five parts:

1. Systemic and strategic flexibility
2. Information and business agility
3. Flexibility, innovation and business excellence
4. Flexibility in value and supply chains
5. Financial flexibility and mergers and acquisitions

The first part of the book deals with six chapters on the sub-theme of systemic and strategic flexibility. The first chapter gives an overview of systemic flexibility and agility in business leading to the evolution of a flexibility maturity model. A related concept of managing diversity is treated in Chap. 2 in the context of international information and communication technologies (ICT) project teams. One aspect of strategic flexibility of managing confluence of continuity and change is elaborated in

the context of telecom service providers by delineating elements of flowing stream strategy crystal. Another chapter deals with the interaction of continuity and change with e-government performance. Next two chapters exhibit the implementation of flexible strategy game-card as a performance management framework; one through a case study of a telecom service company and the other one illustrating the effective strategy execution.

Part II, on information and business agility, comprises five chapters. The first chapter in this part takes a case study of Japanese electronics industry to illustrate exploiting economies of scope on 70–30 principle that treats products and services for separate segmented submarkets to be designed 70% in common with remaining 30% for customization. The next chapter links the agile management practice with developing personal flexibility; according to which, flexible and agile management methods require one to react to change at any time of a project's lifecycle. E-learning and knowledge management are important contributors of flexibility that are dealt through a case study of national level repository of knowledge content. The subject matter of the next chapter, in this part, is related to e-governance performance that aims to empirically relate flexibility of processes with performance of e-governance systems. Finally, the stakeholder engagement methodology is applied for the design and development of a workflow automation process for an accounting system in reinsurance domain.

Part III covers the issues interlinking flexibility, innovation, and business excellence. It consists of six chapters; the first one deals with issues of localization, cultural preferences, and global commerce. It discusses cultural differences between nations as per Hofstede's framework and relates it to seven hierarchical layers of localization. The issue of organization vitality is focused in the next chapter; it elaborates the pillars of vitalization as learning, innovation, flexibility, and entrepreneurship illustrated by a caselet-based study. The next chapter deals with designing flexible performance targets and presents a fast innovation model supported by the case study of Toyota as a leader in product development and as a forceful strategic innovator. Building flexibility into product development teams is talked by a new factor named time-bound formulation in the next chapter through a study of 108 teams in public and private sector organizations. Flexibility constructs have not been well represented in business excellence models, which is the subject matter of the next chapter. It captures flexibility dimensions for all the nine criteria of EFQM business excellence framework through semistructured expert interviews. The last chapter in this part takes flexibility as a strategy for reducing cost of renovation in building construction projects.

Flexibility in value and supply chains is the subject matter of Part IV, consisting of four chapters. The first chapter, in this part, takes the case of a beverage giant that implemented flexible systems for establishing visibility across the value chain. Next three chapters cover various aspects of supply chain flexibility. One of the chapters applies total interpretive structural modeling and fuzzy interpretive structural modeling for structural flexibility in supply chains. Another chapter also uses total interpretive structural modeling for evaluating flexibility index of a supply chain. The last chapter in this part considers interaction of flexibility and green

perspectives of supply chain. It uses analytic hierarchy process and interpretive ranking process in this context.

Part V, which is the last one, comprises three chapters in the area of financial flexibility and mergers and acquisitions. The first paper in this part seeks to explore the influence of innovative mode of financing like combination of cash and stock or earn-out offer used in the acquisitions. The next chapter gives multiple perspectives of mergers and acquisitions performance. The last chapter provides a system dynamics model of post merger integration and analyses the post merger integration of Kelvinator and Whirlpool with its real life validation.

We thank all the authors and reviewers whose efforts have made it possible to create this volume. Special thanks are due to Rejani Raghu who helped at various stages in communicating with authors and reviewers, and also provided support in word processing and formatting the manuscript.

We hope that this volume on “Systemic Flexibility and Business Agility” will generate enough interest in the readers to take up research in this up coming area to further evolve and enrich the paradigm of flexible systems management.

Sushil  
Gerhard Chroust



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**Part I**  
**Systemic and Strategic Flexibility**



# Chapter 1

## Diverse Shades of Flexibility and Agility in Business

Sushil

### 1.1 Introduction

Flexibility and agility in business are emerging as key dimensions of business excellence that encompass the requirements of both choice and speed. Both flexibility and agility have been used, in the literature as well as practice, in multiple ways and often interchangeability. The growing need of flexibility/agility in business can be seen from reactive as well as proactive perspectives. A business enterprise is supposed to have reactive flexibility/agility (as adaptiveness and responsiveness) to cope with the changing and uncertain business environment. It may also endeavor to intentionally create flexibility/agility as a strategic change by way of leadership change, reengineering, innovation in products and processes, use of information and communication technology, learning orientation, and so on.

The chapter explores and intends to clarify diverse shades of flexibility/agility in business. A review of the literature indicates multiple perspectives of flexibility/agility such as adaptiveness to changes in the environment; agility in action; balance in competing opposites; customizing solutions; liberalization from controls; localness in functioning; and responsiveness to customer requirements (Sushil 2012a; 2013). In order to synthesize these diverse shades in the form of a spectrum, the baseline is discussed in the form of systemic flexibility (Sushil 1997, 2000) as a mechanism of managing paradoxes.

Further, interviews were conducted over a period of time with experts, both from industry and academia, to grasp the broad dimensions of flexibility/agility being espoused or practiced in business organizations. These dimensions have been related to each other in a pairwise manner to generate a hierarchical structure using total interpretive structural modeling (TISM) methodology (Sushil 2012b). Finally, a discussion of the hierarchical interpretive structure is provided with case examples

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to pave the directions for further research and practice of this upcoming business excellence dimension.

## 1.2 Connotations of Flexibility and Agility

The need for flexibility in management, both at the theoretical and practical levels, has been emphasized both by researchers and practitioners. There are multiple connotations attached with the concept. It implies openness in thinking, adaptiveness to environment, responsiveness to change, versatility of action, contingency, nonrigidity, variability of parameters and specifications, multiplicity of process setting, freedom, liberalization, informal attitude, adjustment, compromise, autonomy of function, agility in action, resilience in systems, elasticity, looseness, customized or tailor made solutions, and broadening of mind. This is only a representative list and many more connotations of flexibility can be identified (Sushil 2008).

Peters and Waterman (1982) have found in their study that excellent organizations have simple fluid structures with flexible and permeable organizational sub-units and discourage rigid job descriptions. A measure of work group flexibility has been presented by Kozan (1982) where he defined morphogenetic flexibility as flexibility based on structural adjustments such as program change in public agencies and introduction of new technological processes, and steady-state flexibility based on adjustments involving temporary changes in group activities such as using discretion for a temporary deviation from rules. In the operational definition of steady-state flexibility, he includes work load variances, input properties variances, and thru-put variances.

The flexiform model of professional service organizations consists of concentric power circles of operational units, unit heads, and governing body, respectively. In this model, there is a decreasing power toward an increasing authority core. The operational units are loosely structured and have client cooperation (Mills et al. 1983).

A flexible managerial approach has been referred by Baker (1985) with long-term financial planning having a full understanding of the dynamic nature of the business environment. A flexible managerial approach has been in vogue in finance function since long. For instance, revenues expected from projects are estimated at more than one level (pessimistic, most likely, optimistic) and so the costs. Instead of referring to single budgeted profit figure, a range is referred to. Likewise, flexible budgets are planned estimating costs at several levels of activity. The merit of a flexible budget is that it contains several estimates in different assumed circumstances. Since business activities cannot be accurately predicted, it is a useful tool in real business situations reflecting unpredictable environment.

Goold and Campbell (1987) refer to flexible strategies in their presentation on strategies and styles. Hamel and Prahalad (1989) in their study of global organization in America, Europe, and Japan found that successful ones had clear strategic intent with flexible means of achieving the outcome.

The concept has been most extensively applied in the context of manufacturing as “flexible manufacturing systems (FMSs)” and “agile manufacturing systems (AMSs).” Adler(1988) reviewed the flexibility in automation and brought out that economic definition is the most generic one. He identified two key dimensions of flexibility, i.e., process and product and observed conceptual difficulty in linking them. From engineer’s point of view, the process dimension seems more exciting, whereas from the societal and managerial point of view the product dimension offers bigger challenges and opportunities.

The influence of process and product flexibility on marketing strategy is discussed by Easton and Rothschild (1988) where they have examined the tradeoff between flexibility and financial efficiency. According to them, flexibility is the ability of a system to take on a variety of forms. Carlsson (1989) used the concepts of operational, tactical, and strategic flexibility in the context of the theory of the firm. While discussing the strategic success hypothesis, Ansoff (1990) refers to flexible capacity responsiveness seeking to create the environment and seeking novel change. According to him, in case of surprise environments creative action and flexible capability are desired.

Bahrami (1992) described some of the features of emerging flexible organization based on field studies of 37 high-technology firms in California Silicon Valley including ABB, Apple, ROLM, etc. This study articulated the building blocks of flexible organizational designs as multipolar organizations, dualistic systems, front-line organizations, multitalented employees, and semipermeable boundaries. This refers the flexibility to be a polymorphous concept whose meaning varies according to the situational context implying:

Flexibility is a multidimensional concept-demanding agility and versatility: associated with change, innovation, and novelty: coupled with robustness and resilience, implying stability, sustainable advantage, and capabilities that may evolve over time.

The concept of “flexibility management” has been outlined by Armstrong (1993) as a flexible approach to organization management to ensure that the organization will be able to adapt to change, respond quickly to new threats and opportunities, and manage diverse and decentralized operations. He overviews techniques of achieving flexibility as contract-based flexibility, time-based flexibility, job-based (functional) flexibility, skill-based flexibility (multiskilling), and organization-based flexibility. He further emphasizes the flexibility as a human resources management activity as developing and implementing flexibility strategies to make the best use of human resources and enable people to learn and apply a wider range of skills.

Storey and Sisson (1993) refer to the “flexible firm” model developed by Atkinson (1985). This model deals with two groups of employees in the firm, viz., core group and peripheral group. The core group has the functional flexibility and the peripheral group has the numerical flexibility. The numerical flexibility is the ability to adjust the number of workers, or the hours worked, in line with changes in the level of demand, wherein, functional flexibility is the ability to deploy workers over a broader range of tasks in line with changes in the nature of demand (Atkinson and Meager 1986).

Stacey (1993) refers to installation of flexibility in a real integrative sense. In the flexible organization concept, the managers make a choice between short-term control and flexibility through self-managing teams. According to him:

The flexible organization seeks to resolve the paradox of flexibility and control by choosing a balance that favors flexibility, but flexibility by design so as to reduce the tension. It is this very tension, however, that provides the creative drive of the informal organization.

Upton (1994) has outlined multiple types of flexibility as product flexibility, process flexibility, operation flexibility, volume flexibility, machine flexibility, routing flexibility, action flexibility, state flexibility, expansion flexibility, design-change flexibility, labor flexibility, and so on. Product flexibility is considered as the ability to change the product being made, while the volume flexibility is the ability to alter production volumes. He discusses the multidimensional nature of flexibility and draws a useful parallel between the management of flexibility and management of quality. He has defined flexibility as:

Flexibility is the ability to change or react with little penalty in time, effort, cost, or performance.

He has also dealt with the concept of internal and external flexibility, and potential or demonstrated flexibility and has proposed a framework for analysis of manufacturing flexibility in terms of dimensions, time horizon, and elements.

Flexibility became a critical issue as markets became congested and unpredictable. Production had to incorporate product differentiation without sacrificing the economies of scale. The productive flexibility depended on an intrinsic ability to adapt to change. Morales (1994) discussed the notion of “flexible specialization” that was introduced by Piore and Sable in 1980s as a strategy of permanent innovation: accommodation to ceaseless change, rather than an effort to control it.

Pasmore (1994) while dealing with the issue of strategic change has treated flexibility as the ability to change everything, all at the same time. According to him:

Improving organizational flexibility starts with the recognition that organizational change and human change are one and the same.

He deals with flexibility at various levels such as flexible people, flexible technology, flexible work, flexible thinking, flexible managers, and flexible organization. While discussing the benefits of flexibility he expressed:

Flexibility becomes the source of competitive advantage, as the company's products, services, and ways of doing business evolve more quickly than the competitions. The organization becomes an industry leader and remains in a leadership position by virtue of its ability to adapt. Examples? Merck, 3M, Procter and Gamble.

Champy (1994) takes this further in his work on reengineering management, that “... is not only to hold two good, contradictory ideas, but to act on them.” He reports the contradiction between constancy, and “discontent” by quoting Roberts C. Goizueta, Chairman, and CEO of Coca Cola Company. “At the end of every day of year, two things remain unshakable—Our constancy of purpose and our continuous discontent with the immediate present.” Mintzberg (1994) has suggested that man-

agers need not always program their strategies formally; sometime the strategies must be left flexible, as broad visions, to adapt to a changing environment.

While discussing the emergence of a molecular and flexible organization Ross and Key (1995) expressed:

Just as Henry Ford transferred the logic of mass production to standardized management, we are finding a transfer of logic from mass customization to flexible management today.

A new era of strategic management of business enterprises is being ushered in. The shift required in strategic management in this era of “real-time fast response” (Miles 1996) and how the degree of environmental turbulence affects strategy and responsiveness attract many management researchers’ attention. Innovation is linked to flexible categorization and resource allocation driven by a market sensitive, adaptive culture (Bruce and Langdon 1997).

Pascale et al. (1997) emphasized that not top down change prescription but only by combining it with values and belief transformation can change be sustained. Great success strategies fail when times change because companies fail to put strategy on change list (Christensen 1997).

Volberda (1998) gave a taxonomy of flexibility considering both variety and speed and classified organizations according to flexibility and controllability. A flexible organization is one that has high degree of flexibility as well as controllability. Sharma et al. (2010) revisited the flexibility literature and linked it with organizational performance.

Bahrami and Evans (2011) proposed the concept of superflexibility as real-time adaptation. The action principles of superflexibility, proposed by them, are strategizing by maneuvering; executing by experimenting, iterating, and recalibrating; organizing by federating; leading by aligning; and innovating by recycling.

There has been a growing attention on organizational dynamic capabilities and agility. This is supported by developments in information technology (IT). A study by Lee (2012) has taken a mix of IT exploitation and IT exploration for organizational transformation. Huang et al. (2012) have reported a case study of Haier, a Chinese home appliances major, bringing out the role of IT leveraging competence in enhancing organizational agility. The enhancement in the ability to process information, Haier gained capability to sense and respond to market changes more readily. The principles of flexibility and agility in the context of policy implementation have been deliberated by Gong and Janssen (2012). An empirical investigation of US manufacturing firms depicting impact of strategic sourcing on supply chain agility is dealt by Chiang et al. (2012). Oliveira et al. (2012) have analyzed the influence of leadership style and factors associated with organization agility on project performance.

The concept of a flexible enterprise is delineated by Sushil (2014) in terms of its cornerstones as strategic flexibility, organizational flexibility, financial flexibility, information systems flexibility, manufacturing flexibility, and marketing flexibility.

A brief review reported in this section indicates that a growing concern is voiced on many fronts towards flexibility and agility in business. Since the connotations of flexibility in the literature are so varied, it projects a multidimensional view of the nature of flexibility at a generic level.

### 1.3 Systemic Concept of Flexibility and Agility

The systemic concept of flexibility and agility is evolved based on the concept of continuum. The concept of continuum itself in builds two ends or extremes, which usually form a pair of opposites. The concept of pair of opposites is dealt with at considerable length in ancient philosophy. These are considered to be the creation of intellect because of its discrimination, which can exist only in relation to one another. Thinking of one creates the other, which shows their relativity. There are enormous examples of pairs of opposites in life, e.g., good and bad, pleasure and pain, life and death, firm and yielding, above and below, etc., that are both sides of the same reality; extreme parts of a single whole.

In Chinese philosophy, these are named as *Yang* and *Yin*, which connote male or bright and female or dark, respectively. There is a cyclic interplay of the two; as one of the two reaches its extreme, it contains in itself already the seed of the opposite. There is a dynamic unity of the polar opposites. In a single dimension, there is a continuum of *Yin* to *Yang* on which oscillation takes place which in two dimensions is united into a circular motion (Capra 1976).

In Indian philosophy, enlightenment means transcending the realm of these pairs of opposites and looking beyond. The essence of Indian philosophy looks for “unity in diversity,” which is also the spirit of flexibility.

In modern management, the synthesis or dynamic interplay of the thesis and antithesis is being strongly advocated and is considered to be the viable trend emerging out of the creation of antithesis in management. Ackoff (1981) has expressed:

The Systems Age, as I see it, is a synthesis of the Machine Age and its antithesis, which is still being formulated.

Toffler (1980) has also discussed such opposing concepts, e.g., small-within-big is beautiful, and a concept of “prosumer.” Moreover, if we decide to attach the modern management with the antithesis we are again becoming rigid leaving the whole range of options available from the thesis to the antithesis. A similar concern regarding synthesis on decision making at strategic level is expressed by Jauch and Glueck (1988).

The human being is a mix of the rational and the emotional. We also know that the environment is a mixture of the analyzable and of chaotic change and pressures. Strategic management decisions therefore are made in a typically human way: using the rational conscious analysis and intuitive, unconscious “gut,” in light of political realities.

It has been clearly shown by the study of Pascale (1990) that successful organizations are characterized by paradox showing integration or fit on one hand and differentiation or split on the other. Bahrami (1992) refers the emergence of a bimodal organization that could accommodate opposing tendencies and yet function as a coherent and cohesive concern. This refers to three types of tensions, viz., centralization versus decentralization, stability versus dynamism, and uniformity versus diversity.

Handy (1994) has given an elaborate treatment of paradox in the world of organizations and calls for finding a balance between many alternatives. According to him, “Paradox does not have to be resolved, only managed.” The paradoxes to be managed in evolving a flexible organization design have also been discussed by Pasmore (1994), such as ownership and partnership, control and delegation, short- and long-term goals, intrinsic and extrinsic values, commonality and diversity, efficiency and effectiveness, focused and opportunistic, and flexible and inflexible.

More and more researchers are now pointing out the inherent duality in the strategy concept and neither the dooms day nor the panacea views are correct. Possibly this characteristic was always there but in the era of continuous turbulence it is easier to visualize the need for duality of succeeding in today’s core business to survive while fiercely innovating for tomorrow. The “either/or” concepts need to be replaced by “both/and” conjoint (Koshnik 1996) “Sterile dichotomies” and “old frames” of apparent conflicts need to be synthesized and expanded into new paradigms that explore white space opportunities.

Mckenzie (1996) developed 15 dialectical frames. According to Fletcher and Olwyler (1997) contrary thoughts need to be encouraged for exploratory learning and strategic opportunism. In diagnosing the paradoxes in organizational strategies, Volberda (1997) considered flexibility as the most valuable strategic option in turbulent environment and proposed a construct of internal and external flexibilities at the operational, structural, and strategic levels.

The flexibility in the systemic sense cannot be generated by attaching ourselves to a point on the continuum. The flexibility is generated in the system by virtue of the existence of the continuum. The success lies in making a dynamic balance between the polar extremes. Thus, the systemic flexibility can be defined as (Sushil 1997):

Flexibility is the exercise of free will or freedom of choice on the continuum to synthesize the dynamic interplay of thesis and antithesis in an interactive and innovative manner, capturing the ambiguity in systems and expanding the continuum with minimum time and efforts.

The concept of choice has been used by Merkhofer (1977) to define decision flexibility. According to him, “larger the choice set, that is, the more alternatives available for a decision the greater the decision flexibility.” Maira and Scott-Morgan (1997) inspired by the approach derived from new insights into the complexity theory presented the concept of growth flexibility and change flexibility. The view on flexibility in this research is that of versatility to handle conventional opposites like between differentiation and integration.

The proposed concept of flexibility dwells on three central issues of “continuum,” or “options,” “dynamic interplay,” or “change,” and “freedom-of-choice,” which are highly interrelated. The attributes of flexibility are closely linked to these issues creating cohesiveness and harmony in the domain of flexibility. In order to create flexibility, first of all we must have a range of “options”; secondly, we should be prepared to “change” across these options; and thirdly, the change should not be random but governed by the “freedom-of-choice” (Sushil 2000, 2014).

## **1.4 Dimensions of Flexibility and Agility**

A review of the literature and interviews with experts generated various ideas about what flexibility and agility in business might mean to researchers as well as practitioners. The views expressed by experts have been qualitatively clustered into dimensions by way of content analysis. The dimensions of flexibility/agility that emerged through this process are as follows:

1. Managing paradoxes
2. Ambidexterity
3. IT and business agility
4. Confluence of continuity and change
5. Flexibility in operations
6. Flexibility in business excellence
7. Flexibility maturity.

### ***1.4.1 Managing Paradoxes***

This is the fundamental understanding that has been reflected in the works of Volberda (1998), Sushil (1997, 2000, 2014), and others. Flexibility/agility can be visualized as dynamic interplay and change across paradoxical options in any system such as: centralization–decentralization; globalization–localization; continuity–change, and so on. Rather than the traditional “either-or” approach, the paradox is to be managed upfront as “both-and” synthesis of the opposing forces.

### ***1.4.2 Ambidexterity***

A similar development has taken place in the literature regarding ambidexterity that defines a characteristic of an organization capturing opposite things at the same time. Birkinshaw and Gibson (2004) have linked ambidexterity to high performance of organizations via an empirical study. They have successfully demonstrated it in companies like Nokia, Ericsson, Oracle, and Renault. According to them, an organization dealing with only one extreme, i.e., exploitation or exploration may not be as successful as the ones dealing with a confluence of the two.

### ***1.4.3 IT and Business Agility***

Off-late, another dimension that is gaining momentum is business agility supported by developments in information and communication technologies. These developments have provided IT agility that ultimately contributes to business agility. Cloud



computing, social networking, knowledge-based systems, search technologies, mobile transactions, and many other developments have facilitated to carry out business in an agile manner to fulfill the requirements of dynamically evolving and turbulent business environment.

#### ***1.4.4 Confluence of Continuity and Change***

Several researches have pointed to the simultaneous presence of both change and continuity in organizations (Nasim and Sushil 2011). The notion of continuity and change was popularized in the business press after the work of Collins and Porras (1994), which highlighted that the “ability to manage continuity and change is the secret to an enduring great company.” Mintzberg et al. (1998), in their expositions on change, highlighted the need for balancing change with continuity, i.e., the need to achieve change when and where necessary while maintaining order. Pettigrew (2000) reiterated the view that any adequate theory of change is expected to also explain continuity. Bianco and Schermerhorn (2006) also emphasized about co-existent states of both continuity and change that should be allowed by organizational leadership. Many practitioners have also testified and extended support to this idea. A framework for managing confluence of continuity and change is provided by Sushil (2012a, 2013) as flowing stream strategy.

#### ***1.4.5 Flexibility in Operations***

FMSs, AMSs, and flexible supply chains have been a subject matter of interest for quite some time. Flexible work practices at operational level such as flexi time and flexi place are *in vogue* in global corporations. Flexibility/agility in other business operations such as financial flexibility, marketing flexibility, and services flexibility are gaining considerable interest in modern day organizations.

#### ***1.4.6 Flexibility in Business Excellence***

Business excellence models have traditionally been focused around the issue of quality in business processes. Well-established business excellence models such as Malcolm Baldrige and European Quality awards still lack in integrating flexibility constructs in their design and implementation. A review of business excellence models by Gupta and Nagpal (2011) has indicated a growing concern for including flexibility constructs in business excellence models. How can this be addressed, both at the levels of enablers and outcomes of business excellence, is a moot question to be answered.

### 1.4.7 Flexibility Maturity

Keeping both flexibility and agility together under the larger framework of flexibility, any business enterprise is supposed to evolve through various maturity levels. There is a need to define new maturity models for business organizations for assessing their flexibility and risk-taking capabilities. An organization may climb the maturity of flexibility from operational to strategic on one hand, and organization centric to value network orientation on the other (Sushil 2014).

## 1.5 Hierarchical Structure of Flexibility and Agility Dimensions

TISM (Sushil 2012b) is used to develop a hierarchical structure of flexibility/agility dimensions, which interprets both nodes and links in the structure. This has been applied by Nasim (2011) in the context of e-government, by Prasad and Suri (2011) in higher education context and by Srivastava and Sushil (2013) in the context of strategy execution. The following steps have been followed for developing TISM:

- Define contextual relation and interpretation of flexibility/agility elements.
- Carry out pairwise comparison of these elements by a group of relevant experts to obtain interpretive logic knowledge base of each paired relation.
- Convert the pairwise comparison data into a reachability matrix and test its transitivity.
- Carry out level partition of reachability matrix to know the hierarchical levels of various elements.
- Graphically represent the interpretive relationships in the form of a TISM and interpret the relationships.

The hierarchical interpretive structure of flexibility/agility dimensions is depicted in Fig. 1.1; the reachability matrix and its partitioning are provided in Appendix I.

## 1.6 Discussion

The interpretation of relationships of diverse shades of flexibility/agility in business (as shown in Fig. 1.1) provides clues for many action points and research directions. First, we would like to illustrate these diverse shades and relationships by the way of case examples in practical enterprises.

The management of paradox is effectively carried out by Gillette as a cosmopolitan corporation balancing the paradox of globalization and localization. Gillette managers acknowledge country differences but still preferred to treat the world as one. In internal functions, of personnel and finance, Gillette's systems have followed

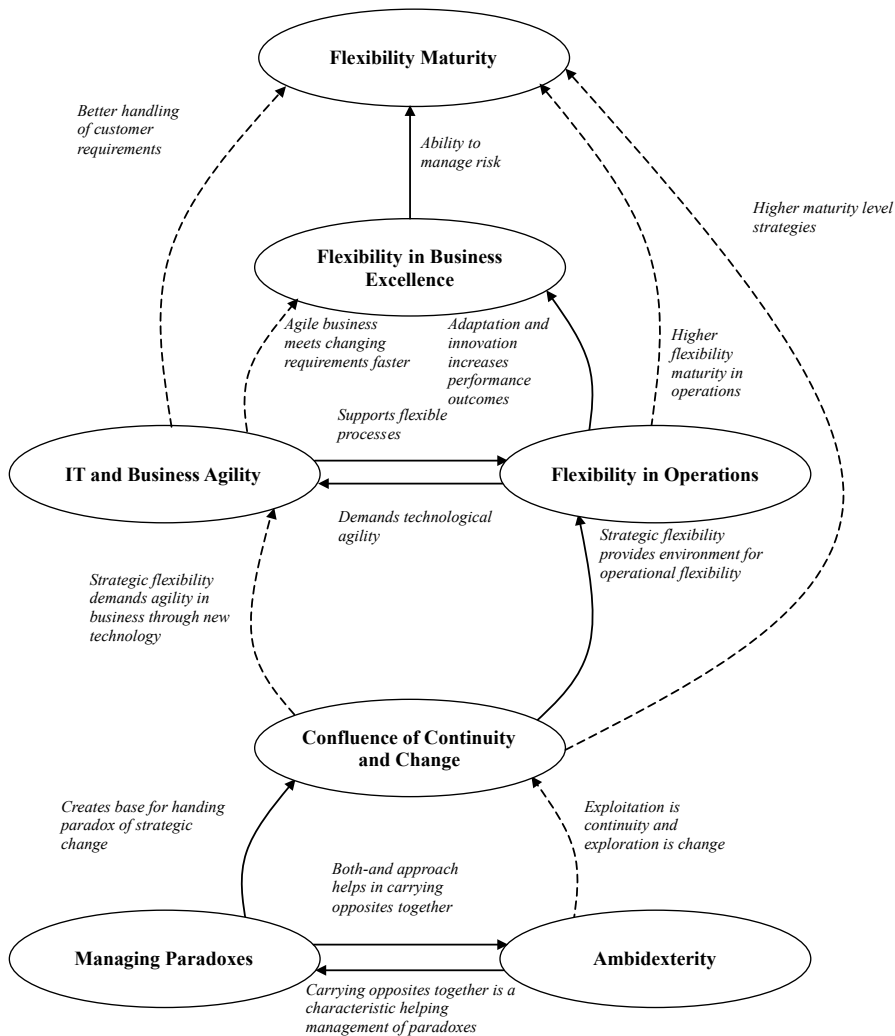


Fig. 1.1 TISM of flexibility and agility in business

a consistent framework across the world. Human resource policies were standardized globally to facilitate personnel transfers, with local adaptation.

The case of Apple is a representative example of ambidexterity. Apple has used a combination of exploitation and exploration strategies successfully. It has exploited its Mac platform and explored a mixture of products and services via i-Phone and i-Pad. This led to an integration of continuity and change.

Management of continuity and change can be seen in various ways as depicted by Sushil (2013). Some of the golden strategies followed by leading corporations are as follows: cannibalization (Microsoft from DoS to Windows); extending core

competence (Honda in engines and power trains); extending/repositioning the brand (FMCG giant Nestle's brand portfolio); outsourcing (Airtel outsourcing management of network); developing wider technological competencies (ICT companies); creating innovation culture (3M's 15% rule); institutionalizing organizational learning (GE); and offering solutions (IBM from a computer company to computing solutions provider), among others.

Information and communication technologies have created business agility. A typical example is of creation of ecosystems of products, services, and applications by technology-based organizations like Apple, Google, and Nokia. This is based on "integrate" strategy of continuity and change. Even the auto companies like Ford are working to evolve ecosystems for business agility with new possible applications. A closely related development is in the area of operations flexibility in manufacturing, supply chains, marketing, and finance, which is dependent on the use of technology in these processes.

Integration of flexibility constructs in business excellence models is of recent interest. In the latest version of European Quality Award, provision of flexibility is explicitly stated in the leadership module. It is stated that leadership should encourage creation of flexibility in organization. However, constructs of flexibility are not well defined and included in the assessment. The next stage would be assessing the flexibility maturity of organizations. It may be noted that most of the past work relates with flexibility at the base level, i.e., flexibility in individual operational processes. Some concerns are visible in flexible supply chains, and strategic flexibility that represent higher maturity levels. Definition of flexibility constructs in business excellence models will help in assessing maturity levels as well.

## 1.7 Conclusion

An evolving framework of flexibility and agility in business has been presented here, which revolves around the concepts of "continuum," "dynamic interplay," and "freedom of choice." It contemplates the dynamic interplay on the continuum by exercising the freedom of choice rather than attaching ourselves to the ends. The ends of the continuum always act as strong "attractors" and force the system to stretch in one direction leading to failure. It considers the reality to be dynamic, ambiguous, and all embracing. This in a way provides recipe for managing dilemmas, paradoxes, and conflicts.

Such a systemic concept of flexibility is pragmatic as well as ideal, and overcomes the negative connotations attached with the traditional concept of flexibility, i.e., lack of commitment, soft work culture ("*chalta hai*"), and lack of conviction. Instead, it is more challenging and spiritually oriented, and its practice demands higher individual and organizational development.

It requires initiating flexibility and agility in business on the whole spectrum to generate higher business excellence. The process of flexibility and agility assessment on multiple fronts will facilitate climbing up the ladder of organizational maturity.

## Appendix I

### Exhibit 1: Reachability Matrix for Dimensions of Flexibility/Agility

	1	2	3	4	5	6	7
1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1
3	0	0	1	0	1	1	1
4	0	0	1	1	1	1	1
5	0	0	1	0	1	1	1
6	0	0	0	0	0	1	1
7	0	0	0	0	0	0	1

Dimensions of flexibility/agility:

1. Managing paradox
2. Ambidexterity
3. IT and business agility
4. Confluence of continuity and change
5. Flexibility in operations
6. Flexibility in business excellence
7. Flexibility maturity

### Exhibit 2: Level Partitioning

#### a) Iteration 1

Dimension	Reachability set	Antecedent set	Intersection set	Level
1	1, 2, 3, 4, 5, 6, 7	1, 2	1, 2	
2	1, 2, 3, 4, 5, 6, 7	1, 2	1, 2	
3	3, 5, 6, 7	1, 2, 3, 4, 5	3, 5	
4	3, 4, 5, 6, 7	1, 2, 4	4	
5	3, 5, 6, 7	1, 2, 3, 4, 5	3, 5	
6	6, 7	1, 2, 3, 4, 5, 6	6	
7	7	1, 2, 3, 4, 5, 6, 7	7	I

**a. Iteration 2**

Dimension	Reachability set	Antecedent set	Intersection set	Level
1	1, 2, 3, 4, 5, 6	1, 2	1, 2	
2	1, 2, 3, 4, 5, 6	1, 2	1, 2	
3	3, 5, 6	1, 2, 3, 4, 5	3, 5	
4	3, 4, 5, 6	1, 2, 4	4	
5	3, 5, 6	1, 2, 3, 4, 5	3, 5	
6	6	1, 2, 3, 4, 5, 6	6	II

**b. Iteration 3**

Dimension	Reachability set	Antecedent set	Intersection set	Level
1	1, 2, 3, 4, 5	1, 2	1, 2	
2	1, 2, 3, 4, 5	1, 2	1, 2	
3	3, 5	1, 2, 3, 4, 5	3, 5	III
4	3, 4, 5	1, 2, 4	4	
5	3, 5	1, 2, 3, 4, 5	3, 5	III

**c. Iteration 4**

Dimension	Reachability set	Antecedent set	Intersection set	Level
1	1, 2, 4	1, 2	1, 2	
2	1, 2, 4	1, 2	1, 2	
4	4	1, 2, 4	4	IV

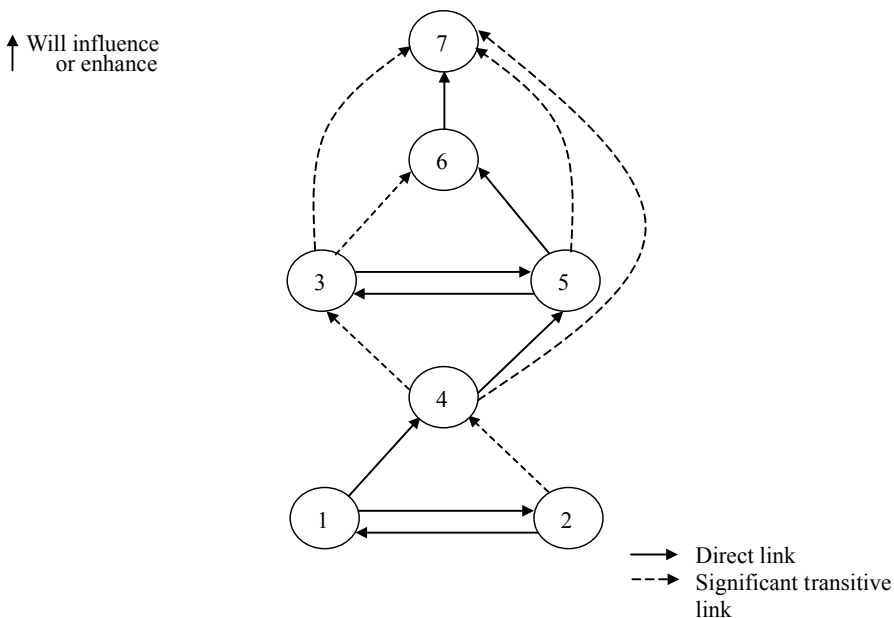
**d. Iteration 5**

Dimension	Reachability set	Antecedent set	Intersection set	Level
1	1, 2	1, 2	1, 2	V
2	1, 2	1, 2	1, 2	V

### Exhibit 3: Summary of Level Partitioning

Dimension	Reachability set	Antecedent set	Intersection set	Level
7	7	1, 2, 3, 4, 5, 6, 7	7	I
6	6	1, 2, 3, 4, 5, 6	6	II
3	3, 5	1, 2, 3, 4, 5	3, 5	III
5	3, 5	1, 2, 3, 4, 5	3, 5	III
4	4	1, 2, 4	4	IV
1	1, 2	1, 2	1, 2	V
2	1, 2	1, 2	1, 2	V

### Exhibit 4: Digraph of Hierarchical Relationships



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# Chapter 2

## New Research Perspectives on Managing Diversity in International ICT Project Teams

Christina Böhm and Renate Motschnig-Pitrik

### 2.1 Introduction

Nowadays, ICT projects are often characterized by high internationalization. Consequently, project managers of international ICT projects face certain challenges: geographic distances, different time zones, specific regulations or laws, and intercultural teams. While project management methodologies provide clear guidelines for dealing with the first three aspects, intercultural project teams are given little attention in existing international standards.

Although technical and methodical skills are vital for managing international ICT projects successfully, competencies in managing diversity aspects in intercultural project teams should be of an equally high interest. This is because the impact of culture on the success of management is acknowledged in theoretic management literature. However, international project management standards do not provide a comprehensive, methodical approach in the field.

### 2.2 Team Diversity

Discussions about “diversity” often lead to the insight that the term creates various images for different people. Several researchers tried to define the concept of diversity. Wagner and Sepehri (1999), for instance, describe diversity as visible and subjective differences between people. Visible aspects in international teams refer

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to ethnicity or related symbols. Subjective differences, on the other hand, are different values, attitudes, or experiences.

Several definition attempts share their focus on the individual. According to Aretz and Hansen (2003, p. 9) diversity aspects are “dissimilarity, variety, and individuality that emerge from various differences between people.” A vital component in this aspect is that individuals need to be in interaction or connection with other people to establish diversity. In social systems, such as project teams, the individuals’ identities and characteristics create a variety of perspectives aiming to solve a problem or task in team collaboration (Fleury 1999; Egan 2005).

Various authors elaborated several possible perspectives of the factor “diversity.” Aretz and Hansen (2003) defined levels of diversity based on previous research: a primary dimension and a secondary dimension. While the primary dimension includes aspects such as age, gender, ethnicity, race, and physical abilities, the secondary dimension also takes educational backgrounds, income, marital status, religious beliefs, and work experience into account (Loden et al. 1991). Other approaches cluster diversity aspects into individual factors such as personality, group-relevant factors such as cultural differences, and relevant organizational aspects such as structural and informal integration (Cox 1993). Furthermore, diversity can be observed from demographic, psychological, and organizational perspectives. The demographic perspective focuses on aspects such as gender, age, or ethnicity, while the psychological level examines values, beliefs, and knowledge. Occupation, status, or hierarchical structures within organizations are summarized in the organizational perspective (Jackson and Ruderman 1996).

Clustering diversity into visible and invisible aspects is a recurring differentiation in existing definitions. Correspondingly, this distinction can also be interpreted more comprehensively as implicit and explicit levels. Implicit aspects can be defined as knowledge and information that is not explicitly expressed and/or unconscious (Horvath 1999; Busch 2008). In consequence, team diversity can refer to “explicit and implicit differences between individuals with the social system team.” Regarding international projects, many differences are not as obvious as gender or ethnicity. Implicit values such as ideologies or previous work experience only come to surface in open communication environments (Aretz and Hansen 2003). As the basic terms were defined in this section, in the following the impact of diversity aspects on project success will be examined.

### 2.3 Diversity as Success Factor in Projects

Several researchers agree on the important influence that diversity has on successful and effective ICT projects or IT system implementations (Ives and Jarvenpaa 1991; Shore and Venkatchalam 1995; Harris and Davison 2002; Markus and Soh 2003; Narayanaswamy and Henry 2005). From an organizational management perspective, “individual abilities, experiences, competencies, and qualifications of human resources build a success factor in organizations, which enable entrepreneurial strat-

egies of increasing flexibility and continuous learning” (Aretz and Hansen 2003). Creating a deeper understanding and interest for cross-cultural issues may further improve the effectiveness of project management practices (Narayanaswamy and Henry 2005).

Ignoring differences in teams and organizations may inhibit information systems’ implementations in global settings and increase the risk of project failure (Harris and Davison 2002). For example, transferring a software product from one geographic location to another cannot be achieved by simply translating content into the local language. The software product needs to be adapted to local needs, culture, and regional expectations. This implies a transformation on various levels. Neglecting local and cultural impact can decrease effectiveness and productivity. This can be caused by misunderstandings in communication, such as misinterpreting messages or statements, triggered by incomprehensive understanding of others’ motives and expectations. Such misunderstandings can be a “source of *ridicule*, *embarrassment*, or *offence* and in the worst case result in broken personal and economic opportunities” (Chroust 2008, p. 825).

Egan’s research (2005) examined the importance of diversity in leading creative teams. The study, performed with high-performing leaders, revealed that heterogeneous teams are more likely to develop creative ideas compared to homogenous teams. Different perspectives and knowledge can enrich the effectiveness and creativity of teams. This is best supported by providing opportunities for direct interaction and for building relationships between team members, as well as explicitly addressing diversity aspects within the team. “By developing a deeper appreciation of the interactions between individuals motivated towards creative team processes and creative outcomes, we can better understand teaming, the role of diversity in teamwork, and creativity in general” (Egan 2005, p. 208). If emerging conflicts caused by different expectations and perceptions are managed effectively, new and innovative ideas can emerge.

## 2.4 Culture in International Management

Regarding research on diversity in projects, the main approaches focus on one specific aspect of diversity: culture. In this section, theories that combine cultural aspects with management are presented. As Kroeblner and Kluckhohn (1952) stated:

Culture consists of patterns, explicit and implicit, of and for behavior acquired and transmitted by symbols, constituting the distinctive achievement of human groups, including their embodiment in artifacts; the essential core of culture consists of traditional (...) ideas and especially their attached values.

When different people from different cultural backgrounds work together in projects, team members’ diverse values and habits may cause conflicts in international projects. This requires that cultural diversity is included in business practices in order to avoid or reduce misunderstandings and disputes that are caused by interfering

culture-based expectations. Actively increasing understanding and acceptance between diverse cultures might be an attempt to approach such issues. Identifying differences, for example values and behavioral norms, can enhance acceptance and respect towards other cultures in international business practices.

Several concepts that explain the roots of cultural diversity and its measurements have been published. From all existing approaches, Geert Hofstede's study is most referred to in related research. In his view, one of the reasons why many implementations fail is that different thinking and behavioral patterns are ignored (Hofstede et al. 2010). He describes culture as “mental programs” that are influenced by experiences from early childhood and education as well as other experiences in individuals' personal lives within a specific community environment. These mental programs highly influence our practices as they are based on cultural values, which manifest not only in ritual and symbols but also national laws, country-specific organizational structures, language, or religious views (Hofstede et al. 2010). In his research, he elaborated the five main dimensions of national culture:

- The power distance index (PDI) measuring the inequality within a society
- Individualism (IDV) measuring the degree of individualism in society
- Masculinity (MAS) measuring the distinction of gender roles in society
- Uncertainty avoidance index (UAI) measuring the extent of threat by an unknown situation
- Long-term orientation (LTO)

A second approach dealing with cultural aspects in projects was established by the Dutch consultant Trompenaars. He described culture as “the way in which a group of people solves problems and reconciles dilemmas” (Trompenaars and Hampden-Turner 2010, p. 1). Similar to Hofstede's approach, he based his research on the “onion theory.” This theory shows various layers of cultures: an outer (visible, explicit) and an inner (invisible, implicit) layer. While Hofstede associates rituals, heroes, and symbols in the outer layer, Trompenaars assigns characteristics such as language, food, architecture, or religion to this layer. Underneath those visible aspects lies the implicit part of culture: norms and values.

Trompenaars and Hampden-Turner (2010) survey—conducted in 30 different international companies—was mainly focused on participants at managerial levels. He concluded not only that the effects of cultural diversity may be hard to measure by traditional criteria but also that they have a significant impact on international companies' success. Therefore, his approach emphasizes finding adequate solutions particularly in business situations. In this respect, he formulated the three categories and subdimensions (Table 2.1).

### ***2.4.1 The Concept of “National Culture”***

Comparing the two approaches, Hofstede has a stronger focus on structural aspects in his dimensions while Trompenaars highlights relationships and actions influenc-

**Table 2.1** Trompenaars' categories and dimensions of cultural diversity in business. (Summarized from Trompenaars and Hampden-Turner (2010), pp. 8–10)

Categories	Subdimensions	Description
Relationships with people	Universalism versus particularism	Universalism describes how work life is influenced by societal codes. Particularistic cultures, on the other hand, put greater attention on relationships rather than strict appliance of societal codes
	Individualism versus communitarianism	This dimension equals Hofstede's individualism (IDV) index and measures the degree to which people focus on their individual achievements or—in contrast—on the community
	Neutral versus emotional	This dimension describes if emotions in business are expressed, tolerated, or even encouraged (emotional) or if objectiveness and few emotions in a work context are preferred (neutral)
	Specific versus diffuse	This dimension measures how important personal contact and relationships are in business settings. Diffuse cultures tend to build upon a personal, informal level before dealing with business facts
	Achievement versus ascription	Achievement describes the focus on past achievements within a society. In contrast, ascription measures a person's status by attributes such as gender, age, or educational background
Attitudes towards time		This category describes if people focus on achievements in the past or on planned development in the future. This category is not equivalent with Hofstede's dimension "long-term orientation" (LTO) as it primarily measures if planning is done in a short term or a long term
Attitudes towards environment		This category describes the relation between people and their environment. It examines individuals' tendencies to gain motivation within themselves or by outer incentives

ing international business situations. Both approaches emphasize the importance of understanding cultural differences and present significant findings regarding the relation between culture and management. Still, the concept of national cultures in a modern world seems too simplistic (Markus and Soh 2003). Besides the fact that cultures are not necessarily linked to national boundaries (Harris and Davison 2002), several researchers revealed bias in Hofstede's research (e.g., Huo and Randall 1991; Markus and Soh 2003). The strong focus on IBM-related organizations and demographic concentration regarding occupation and gender of the respondents are criticized. Although Hofstede's dimensions cover the main cultural components, some are not considered. Religious views, for instance, are not included in the cultural management approaches, even though they may have a high influence on values and behavior of a society. Further, religious aspects may be relevant in the planning phase of ICT projects.

The focus on "national cultures" in the survey results is another critical point. Clustering people based on country origin may lead to stereotypes as ethnic and

**Table 2.2** Traits of the normative personality of an organization. (Fink et al. 2011, p. 13)

Domain	Trait
Organizational culture	Dependency on others versus autonomy
Strategy	Opportunity and change seeking versus reliance on organizational resources
Structure	Strong hierarchy versus loose hierarchy
Operations	Rule obedience versus pragmatism
Relationship to external environment	Extroversion versus introversion

religious groups are not considered within the borders of one country. If we take a closer look at Hofstede's country categories, one may recognize an inadequate clustering. For instance, while the European country Belgium is split into French and Dutch parts, African countries are mainly clustered into West, East, and South African countries. In the latter example, even national boundaries are not considered while in the former ethnic groups are. Here, the survey shows high levels of inconsistency. Further, reducing individuals to their citizenship does not seem adequate in a globalizing world. A passport or birth certificate might not fully describe the cultural background of a person. For example, a team member was born in Japan but grew up in Switzerland before studying several years at an US university. Which Hofstede cluster would apply to this person?

Even though Trompenaars describes organizational difference or diverse functional responsibilities within a company as influencing factors in international business, his dimensions also focus on countries. Given these critical points, it seems necessary to adapt existing concepts on culture to international management. Evaluating differences and similarities on a team level or organizational level rather than on a country level seems more appropriate. Fink et al. (2011) combined various concepts from organizational and corporate culture studies and formulated a generic model on an organizational level. This holistic, dynamic model of organizational culture presents five traits of normative personalities based on five domains (Table 2.2).

These traits could provide an adequate basis for further research on culture in social systems such as teams. The traits are collected from various models and approaches and combined in a generic model focusing on business systems. Based on this generic model, other dimensions could be specified, combined with practical situations, best practices, and particular measures.

## 2.5 Diversity Management Approaches in Organizations

Creating and applying effective diversity management concepts is one of the main challenges in modern organizations (Harrison et al. 2002). Comprehensive diversity management is a strategic approach and attitude towards understanding differences in organizations and teams. Diversity strategies use diversity as a strategic

resource for complex problem solving (Aretz and Hansen 2003). By planning and implementing corporate organizational practices in leadership and team work, potential advantages of diversity can be maximized and disadvantages, such as conflict potential, are minimized (Cox 1993). Implementing strategy-oriented diversity measures will not only raise the acceptance towards diversity but also increase the acceptance and appreciation of new perspectives (Aretz and Hansen 2003).

Strategic diversity measures act on various levels and are connected management measures based on four systems: a social system aimed at building trust and strengthening equality; an organizational system providing measure for managing different age and ability levels; a cultural system that is reflected in the corporate vision, mission, and values within an organization; and a psychological system that is characterized not only by education and personality but also by work style and mindsets of people (Aretz and Hansen 2003).

Successful implementation of adequate diversity management concepts can lead to higher creativity, better problem solving, and higher system flexibility (Aretz and Hansen 2003). Heterogeneous teams may generate more creative and innovative solutions and higher employee satisfaction due to intense and effective collaboration. Still, inefficient diversity management could trigger negative impacts and lead to manifestation of stereotypes, communication issues, and consequently lower efficiency and effectiveness.

As organizations and teams are both systems that depend on individuals working towards a common vision or goal, diversity management should not only focus on a management level but also on a project management level.

## 2.6 Inclusion of Diversity in Project Management Methodologies

The previous sections extensively examined how diversity and cultural differences impact business practice at the management level. Although the importance of diversity seems obvious in several research projects, international project management standards do not currently offer methods or tools for project practices. Comparably, the literature on project management recognizes the importance of culture in international projects but provides incomprehensive actions for project managers. Shore and Venkatachalam (1995, p. 5) stated the core reason for lacking methodical approaches in ICT projects as follows: “Culture’s influence may be indirect, difficult to isolate, and difficult to measure.” Instead of trying to explicate implicit cultural factors, project management builds upon measurable characteristics.

For example, the Austrian researcher Roland Gareis (2006) elaborated that temporary organizations such as projects also generate their own specific norms, rules, values, and a unique, project-specific culture. This “project culture,” in his view, can be fostered by building upon project identity and activity-oriented tasks or orders during the project initiation and controlling phase. Here, the measures are primarily addressing explicit aspects, although the definition of “project culture” reveals its



implicit nature. Other researchers (Litke 2007; Patzak and Rattay 2009) also value the impact of values, mindsets, and norms on a project member's behavior and on their identification with the project goals but do not provide implementation strategies. Similarly, diversity studies on teams and conflict potential or communication (O'Reilly et al. 1989; Williams and O'Reilly 1998; Pelled et al. 1999) primarily examine demographic or explicit diversity factors. But as described previously, individuals do not only differ in gender, age, or ethnicity but equally in professional background or affiliation to departments within an organization (Aretz and Hansen 2003; Cummings 2004).

Few publications provide practical solutions for managing diversity on a project team level. Grimheden et al. (2006) researched on establishing cohesion and trust—especially within distributed teams in an international context—through a culture coach. This role is part of the team and intervenes if difficulties arise. A cultural coach needs to understand cultural influences or organizational impacts in order to be able to facilitate the team in face-to-face meetings. This approach represents one method of dealing with cultural diversity in ICT projects but for generating a comprehensive diversity management concept similar methods need to be added. Such methods do not necessarily address technological support but rather methodical measures. Technology can—if appropriate—support ICT projects but technology alone cannot improve collaboration and teamwork (Grimheden et al. 2006).

### ***2.6.1 Approaching Diversity in ICT Teams Individually and Flexibly***

In summary, implicit aspects of diversity are currently not a central research focus in standardizing ICT project management. Hofstede's and Trompenaars' surveys are an appropriate foundation but their approaches need to be extended and developed in two aspects. First, diversity dimensions should also cover previous work experiences of project members and understandings of software development approaches as well as different work styles. Second, individuals should not only be reduced to tendencies in their behavior due to their citizenship as Hofstede's studies suggest. Preferably, individual experiences and attitudes toward work practices of team members should be included in ICT projects. In practice, any highly diverse environment needs to take cultural values, as well as distinct business practices and work styles into account (Tractinsky and Jarvenpaa 1995). Project managers are responsible for facilitating interactions between team members and foster an environment for open sharing (Cummings 2004).

Consequently, it needs to be questioned how implicit diversity aspects can be explicated, methodically integrated, and technologically supported throughout the project management process. Specific methods need to focus not only on explicating diversity aspects in teams but also on allowing a reciprocal sharing of team members' differences, similarities, expectations, and experiences. Every project

team is a unique, social system—methodologies should consider this fact and support approaches that enable managing project teams flexibly and individually. Further, if project managers refrain from the concept of “national cultures,” generalizations and potential for creating stereotypes may be prevented.

Research on intercultural ICT project management needs to include individual experience of team members as part of diversity. This could, for instance, be personal work experience in previous projects that may influence the current teamwork. A practical example demonstrates the relevance of including person-based experience: Person A works in a traditionally organized, hierarchical organization, and is used to approach projects with waterfall-based methodologies. In contrast, Person B is a developer in a small enterprise, which primarily uses agile methodologies in software development. If Persons A and B are cooperating in a project, their different approaches towards software development and their understanding of standard procedures and processes need to be considered as relevant diversity aspects.

## 2.7 Conclusion

International ICT projects and their success are linked to explicit and implicit diversity aspects. Every team member in an ICT project has different behavior, attitudes, values, and work styles—these are mainly unconscious. If individuals with different experiences work together on projects, discrepancies may lead to conflicts within the team. In these conflicts, different expectations and thinking patterns often are revealed. To prevent and reduce such conflicts—and consequently additional costs—explicating diversity factors in an early phase of the project may be beneficial. From an economical perspective, preventively reducing conflict would lower costs as employees’ energy is focused on completing tasks rather than on solving conflicts.

Current research on diversity in business has primarily focused on demographic or other explicit impacts and considerably less on implicit differences (Avery 2011). It is suggested that more effort should be invested in researching implicit diversity aspects and on methods that support explicating project-related differences between team members. Such methods need to be flexibly usable and embedded in existing standards and process in ICT project management. Further, new research attempts should focus more on individuals and on teams than countries. Diversity management theories at organizational levels provide an appropriate basis but specific measures, methods, and implementation strategies need to be elaborated. Enabling practical implementation of diversity measures at a project team level could help to control effects of diversity in teams (Jackson et al. 2003). Future research should aim at improving project success through increasing flexibility and effectiveness of team work in international ICT projects by reducing conflict potential throughout the project management process.

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# Chapter 3

## Elements of Flowing Stream Strategy Crystal for Telecom Service Providers

S. B. Khare

### 3.1 Introduction

Strategy makers are facing most uncertain times these days. This has, in turn, made the job of business planning for future quite challenging. Strategy making, scenario planning, and successful execution of strategies have become much more challenging due to uncertainties prevalent in the market. All this is making many business managers to throw up their hands in this era of radical uncertainty (Sawhney and Parikh 2001). However, all this uncertainty and turbulence of new economy is making strategy not less important as some may argue it to be more essential than ever (Porter 2001).

This chapter is about determining strategic factors for telecom service provision business in Indian context. Knowledge of company's strategic factors is important for strategy development. Having determined the strategic factors, their periodic performance measurement is crucial for effectiveness of strategy deployment. The organization's performance evaluation periodically is necessary to see whether the intended strategy is working or not. Management has one perspective while assessing organizational performance, which consists of parameters related to organizational efficiency and outcomes. These parameters are called *enterprise factors*. Then there are measures from the customer's perspective, which can be categorized as *customer factors*. These factors are what customers really look for from the company, e.g., price, trade terms, product quality, range of products, customer service, delivery, etc. In this chapter, these two factors namely *enterprise factors* and *customer factors* have been termed as strategic factors (Kenny 2001).

From the operational point of view, an organization must maintain certain current characteristics, which can be called as *continuity* forces of the company. These *continuity* forces in an organization are those forces, which on one hand provide

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stability for current production, but on the other they add to inertia in an organization as well. These forces relate to existing infrastructure, expertise in existing/legacy technologies, current organizational structure, processes, and people. Telecom service provision is a highly capital intensive business. Extensive investments are required in cable, land, buildings, exchange equipments, services, and so on. These investments create its own set of continuity forces and inertial flywheel. At the same time, telecom service provision business is subject to high level of *change* forces that are largely external to the organization. These *change* forces mainly relate to rapid technological and regulatory changes. The businesses are required to respond quickly to these changes if they have to survive in the market place. It is important to determine various elements of the forces. Towards the end, we will also determine in this chapter, various elements of *continuity* and *change* forces that are critical for strategy formulation and deployment in Indian context. Strategy development and its deployment have to take into account the relevant *continuity* and *change* forces of the organization concurrently.

A flexible strategic framework will be needed to study the effect of *continuity* and *change* forces on strategic factors. This framework, known as *flowing stream strategy* framework (Sushil 2012a, 2013), uses elements of *continuity* and *change* forces along with strategic factors in strategic analysis of the firm. The framework is about strategy formulation with confluence of *continuity* and *change* and it will be dealt in the beginning of the chapter. In the subsequent sections, the elements of strategic factors namely *customer* factors and *enterprise* factors are gathered from telecom management literature. Similar study is done for *continuity* and *change* forces for telecom service sector. In the subsequent sections, a questionnaire-based survey is reported eliciting response from telecom service sector professionals and managers of Indian telecom operating companies. The results of this survey are analyzed and the *customer* and *enterprise* factors as well as *continuity* and *change* force elements are verified.

## 3.2 Background Literature

Strategy should be the means by which an organization is able to achieve and sustain success. Yet most of the organizations fail to create an effective strategy (Mitreanu 2006). This is because technologies evolve, regulations shift, customers make surprising choices, macroeconomic variables fluctuate, and competitors thwart the best-laid plans (Sull 2007). In the past, the business environment used to be relatively stable and not so turbulent. This led strategy researchers to mostly come up with frameworks in strategic management, which implicitly assumed a benign environment that is simple and not very dynamic (Chakravarthy 1997). During stable times strategies could be framed using a planned approach around *continuity*. However, the effect of uncertainty or rapid changes in the environment has been that it is no longer possible to preplan prior to execution. Depending on the uncertainty in the situation, the organization will need flexible strategies, that is, be prepared for the change in the business environment on account of strategic surprise (volberda 1997).

Strategy is like a roadmap or the game plan to go and reach from current state to a desired state and it cannot be made in vacuum. It needs to take into account the current reality or the continuity aspect of the company. It, therefore, needs to first understand the “as-is situation” before getting into “how” of “to-be” decision-making. Organizations cannot abruptly change from the current state to a desired state. Even in a highly turbulent environment, a discontinuous change may not always be desirable (Sushil 2005). Growth strategies should take into account continuity aspect of the organization such as organizational processes, structures, and employees existing skill set (Dewhurst et al 2011). Thus, there are important bearings of both continuity and change in strategy making and deployment. Mintzberg (1987), in his chapter “Crafting strategy,” has recommended reconciling of change and continuity in strategy making. The concept of managing continuity along with change for better organizational performance has been around for a while for strategy-making and deployment in view of a number of seminal works in the area, namely, Mintzberg (1987) “Crafting strategy,” Volberda (1998) “Paradox of flexibility,” and Sushil (2005) “Flexible strategy framework for managing continuity and change.” In recent years, the concept of managing continuity and change concurrently has been well researched and applied across various domains (Nasim 2010; Nasim and Sushil 2011, 2014; Bhat et al. 2011).

### 3.2.1 Flexible Strategy Framework

By considering flexibility as a valuable strategic option in turbulent environments, the strategist reconciles the conflicting forces of change and continuity (Volberda 1997). It has also been argued by Sushil (2012a) that strategic management of change could be effected well with clear understanding of continuity aspect of the organization. There are certain vital and desirable areas along the continuity dimension of an organization, which can be effectively utilized for ushering change. Unlike the *Blue Ocean Strategy* (Kim and Mauborgne 2005), which aims to create new market spaces deploying a radical change strategy having discontinuities, flowing stream strategy dynamically employs the interplay of both change and continuity concurrently. A radical change strategy having underpinning of discontinuities can be applied rarely in the life time of an enterprise. *Flowing stream* has been symbolically used to represent the management of continuity and change concurrently. Just as flowing water stream exhibits characteristics of continuity and the continuous flow represents change, similarly organizations are acted upon by both, continuity and change, simultaneously. These need to be balanced side by side for bringing in effective change.

It has further been proposed that the combinations of continuity and change forces can be mapped on a continuity-change (C-C) matrix as given in Fig. 3.1 (Sushil 2005, 2013). Four extreme combinations of continuity and change forces are possible to provide an industry classification. Using these four continuity–change combinations a flexible strategy framework has been generated. The continuity as well as the change forces could be “low” or “high” and accordingly four combinations emerge that are: high continuity–low change (*tree-fertilizers, steel*), low continu-

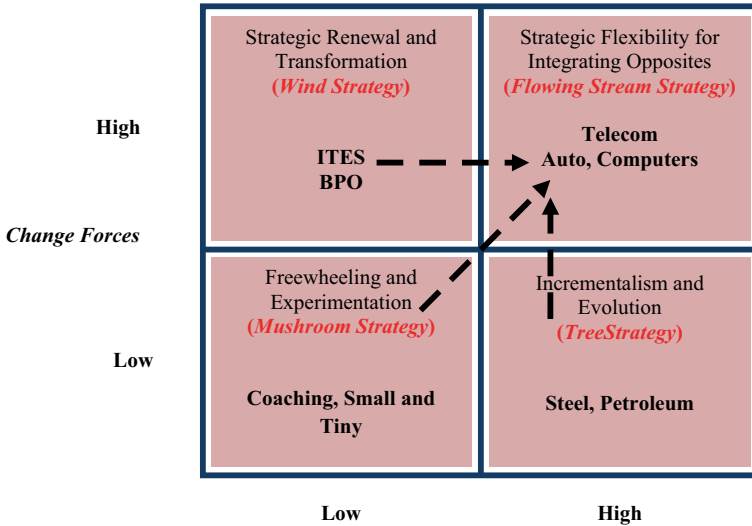


Fig. 3.1 Continuity–change matrix

ity–low change (*mushroom-coaching*), low continuity–high change (*wind-BPO*), and high continuity–high change (*flowing stream-auto, telecom, pharma, and computers*). The situation of high continuity and high change has been metamorphically represented as flowing stream.

The life trajectory of individuals and enterprises alike are living systems and their life journey can safely be treated as a flowing stream. Just like a flowing stream, which finds its path naturally, successful organizations follow strategies for natural growth and opening up new vistas. Long lasting organizations also, despite gradual as well as radical changes during their course, maintain a strong sense of identity and continuity, which is the hallmark of a flowing stream as well (Sushil 2012a).

Implementation of flowing stream strategy framework in telecom service sector domain will require managing continuity and change simultaneously. Application of the framework will therefore require identification of continuity and change forces pertinent to telecom sector on one hand and the identification of desirable strategic outcomes on the other. Strategic recommendations will be possible only when firstly these variables are known for the telecom service sector and then the relationships among them. The relationship aspect is brought out in the concept of flowing stream strategy crystal in the next section.

### 3.2.2 *Flowing Stream Strategy Crystal*

The continuity and change forces represent the current reality of the organization, whereas the strategic factors consisting of customer and enterprise factors depict the composition of the strategy. These four components and their relationships lead to



crystallization of the flowing stream of the enterprise and are portrayed as flowing stream strategy crystal (Sushil 2012b, 2013). The “flowing stream strategy” deals with strategic flexibility to synthesize the paradoxically opposite forces of continuity and change. Analyzing this relationship, crystal reveals not only the strategic change actions of “reduce/raise” some factors, but also specifies which factors need to be “maintained/nurtured” to take advantage of continuity. This chapter is about first determining micro variables of these four macro variables namely continuity and change forces, and the strategic factors, namely, enterprise and customer factors. These are then used to draw the strategic crystal, which is the starting point of flowing stream strategy formulation for the domain under study. Identification of these strategic factors along with continuity and change forces for telecom service provision business is the purpose of this chapter. This is dealt in the subsequent sections.

### 3.3 Identification of Strategic Factors

There are two key stakeholders for any company. These are the customers and the management of the enterprise. Strategy making is the job of top management in the company and they are constantly grappling with the question as to what are those things that could lead a business in having a competitive advantage. *Strategic customer factors* are those factors that an organization needs to get right in order to succeed with *customers* and which lead to factors/measures that reveal the performance of the enterprise. Thus, the strategic factors have two parts namely the customer factors and the enterprise factors. The critical customer and enterprise factors for telecom service providers have been culled out from telecom management literature as a first step.

#### 3.3.1 Identification of Customer Factors

Following customer factors have been identified from telecom service provision related literature.

*Product Price* Price is one of the most important parameters in a customer’s decision in choosing a service provider. There are many such references in literature such as that growing price pressures are increasingly being felt by incumbents. One of the biggest contributors to customer defection is pricing or fee structure of new market entrants (Teleservice News 2009). Customers are tempted by lower price, which acts as a trigger in switching loyalty from one operator to another (Roos and Friman 2008). On one hand, high price is one of the reasons of slow adoption of mobile TV among mobile users apart from quality and reliability issues; high price was however the main reason for giving up of mobile TV service among former users on the other (Wieland 2007d). Today it is possible for consumers to seek low price for their telecom needs (Jelinski 1998). It is observed in the developed world

that as mobile phone service market is maturing, mobile-phone users are becoming more price sensitive (Dahlstorm et al. 2004). There is plenty of evidence in the literature that price is an important customer factor.

*Quality of Telecom Service* Numerous instances have been cited in management literature where quality of service (QoS) has been determined as an important determinant by consumers in choosing or changing their service provider. It has been found that when customers perceive a decline in the quality of the service, e.g., in the audibility or audible range and so on, they experience a reaction trigger to change their service provider (Teleservice News 2009). Improving QoS is important for high satisfaction level in case of mobile services. Satisfied customers are price tolerant. They stay loyal to their current mobile service provider in the face of price increase and they are more profitable (Balaji 2009). QoS leads to customer satisfaction, which in turn leads to customer loyalty. Customer retention is primarily dependent on QoS (Guslaffson et al. 2005). In Puerto Rico's highly competitive mobile market, customer service is the one factor that ultimately decides which company takes the business (Hernandes 2009).

Consumer research indicates that QoS is the second most important driver of switching after price. Business as well as residential consumers are interested in QoS comparisons (Ofcom 2006). Spreng and Mackoy (1996) showed that service quality leads to customer satisfaction. QoS parameters like call performance and reliability form the number one factor consumers have in assessing their carrier and is nearly twice as important to consumers as the number two factor, brand image and is more than double the third factor, i.e., cost (Smith 2007). The price of telecom service is at rock bottom in India. In such a market, quality is an important factor in determining the overall competitiveness of service providers (Sridhar and Jain 2004).

*Product Rate Plan Innovation* This attribute is another big differentiator in the choice of a service provider. If you make new product or offer, which is really simple, e.g., let the customer sign up with one click and make sure that the offer is sensible simple and useful, your customer will wait for the next such product from you (Leslie 2008). Wireless rate plans are often perceived as confusing and difficult to compare. Rate plans offered by the operator have a considerable bearing on customer's choice of operator. Customers with optimal rate plans are found to stay significantly longer with the wireless carriers than those with the nonoptimal ones (Wong 2009). Ability of the operator to offer content rich engagements and innovative next-generation applications such as Triple Play; bundled IPTV, VoIP (voice-over-IP) and a high speed broadband network supporting You Tube videos, on-demand hi-def movies and long-distance calls will only fuel their growth in future (Ferguson and Brohaugh 2008).

It has been seen that service providers grow by innovating around new products, services, and applications that expand the market and excite customers (Seidenberg 2009). Further, to remain competitive and increase their revenues, 3G telecommunications operators have developed value-added services, such as multimedia messaging, video calls, and Internet access. In fact, new forms of mobile services such as streaming TV, banking, trading, and shopping, have also been available (Teng et al. 2009).

*Brand Image of the Operator* Brand image reflects the customer's perspective about what he/she receives from brand (Kamakura et al. 2003). Customer's expectations and resulting satisfaction thereof with a product or service are often influenced by its brand image (Dobni and Zinkhan 1990). Brand image pertains to the perception or mental picture a customer holds of a brand and is formed through his/her response, whether reasoned or emotional. Intangible assets make up most of the value, as high as 70%, of merger and acquisition deals. In most cases, brands account for a considerable portion of these assets (Knudsen et al 1997). Among the hierarchy of criteria for choosing a mobile operator, price is the most important factor followed by service quality, and brand image (Rahman et al. 2011). Smith (2007) states that brand image is the second most important factor for consumer in choice of an operator after QoS.

### 3.3.2 Identification of Enterprise Factors

Following enterprise factors have been identified from telecom service provision related literature.

*Market Share* Market share of a telecom operator determines its relative position in the market place. It also determines whether it is dominating the market or is a laggard and is in an also-ran category. Market share performance is the organic growth a company records by gaining or losing a share of the market. Market share is an important metric that the management uses in order to judge the effectiveness of marketing campaigns including branding initiatives, advertising campaigns, CRM programs, and any other revenue generation effort. Market share metric is more important than return on investment (RoI) measurements, the reason being that it is a relative measurement against external benchmarks. Market share tells us how companies are doing relative to their competitors.

*Customer Satisfaction* Customer satisfaction is defined as "the number of customers or percentage of total customers, whose reported experience with a firm, its products, or its services (ratings) exceeds specified satisfaction goals." It is a measure of how products and services supplied by a company meet or surpass customer expectation (Farris et al. 2010). Unlike the monopoly era when telecom operators were required to satisfy their customer needs, today they should be ensuring customer delight to remain successful in the highly competitive marketplace. Service providers must keep improving their QoS to retain their loyal customers and to increase their market share and profitability. This is what makes it a key performance indicator of the business and a key element of business strategy. How does a company find out whether its customers are satisfied? The best way is to ask them by conducting an independent customer satisfaction survey.

*Average Revenue per Unit (ARPU)* ARPU can be understood as total revenue divided by the total subscribers for a particular time period. Generally, ARPU is the amount of money that an operator generates per subscriber per month. Industry

associations and country regulators bring out this information operator wise. It helps not only in understanding how the industry as a whole is faring but also assists in benchmarking a particular player against others or industry average (Avasthy 2003). This is what makes ARPU an important performance indicator for the operator.

*Earnings before Interest, Tax, Depreciation, and Amortization (EBITDA)* EBITDA is an indicator of a company's financial performance. It is generally calculated simply as *revenues* minus *expenses*. The expenses do not include interest, taxes, depreciation, and amortization. EBITDA is used to analyze and compare profitability between industries and companies (Fan 2006). EBITDA allows one to analyze the performance of the company's operations while eliminating all nonoperating and nonrecurring items such as depreciation and amortization, interest expense, taxes and one time charges such as professional fees, or other nonrecurring costs. EBITDA as an earnings measure is of particular interest in cases of telecom operating companies as they have large amounts of fixed assets that are subject to heavy depreciation charges. As EBITDA is essentially the income that the company has free for interest payments, it also indicates its ability to borrow money for expansion or merger/acquisition deals. Thus, in general, EBITDA is a good performance indicator for telecom operating companies as they have significant assets as well as are saddled with a significant amount of debt financing.

*Compounded Annual Growth Rate (CAGR)* CAGR is defined as the year-over-year growth rate of an investment over a specified period of time. It gives the growth rate of a company on an annualized basis. This parameter remains widely used, particularly in growth industries or to compare the growth rates of two investments because CAGR dampens the effect of volatility of periodic returns. Telecom service provision being a growth industry, it is quite a useful parameter to compare the company growth rate with industry growth rate or to compare growth rates among companies of this industry.

*Network Rollout and Product/Services Innovation Speed* It is endeavor of every operator to roll out its network as fast as possible and ahead of its competitors. The operators are also under pressure to catch up with its major rivals. Not only this, the operator needs to have an aggressive network rollout lest more competition rushes in. Faster network rollout also results into a faster way of generating network revenues. Thus, this parameter spells out one critical company performance parameter.

*Productivity (per Employee)* This is an important ratio that looks at a company's revenues in relation to the number of employees they have. This ratio is most useful when compared against other companies in the same industry. Ideally, a company wants the highest revenue per employee possible, as it denotes higher productivity. If a company is able to increase its revenue per employee, then it can share this productivity gains with their employees through higher wages. There is increasing realization that financial performance (seen through balance sheets, cash flow reports, and income statements), though, no doubt is and will remain the principal metric for evaluating a company and its management, but it is high time to recognize that financial performance increasingly comes from returns on talent, and not on capital (Bryan 2007).

### 3.3.3 Identification of Continuity Forces

Following continuity forces have been identified from telecom service provision related literature.

*Existing Infrastructure* It makes more business sense to utilize existing infrastructure such as cable ducts to expand into new products and services such as high speed broadband through fiber to the home (FTTH). For example FTTH rollout can be cut down to half if existing cable ducts can be used compared to laying out a new cable duct (McClelland 2007). Another example of exploiting existing infrastructure was seen in NTT's strategy of implementing "Multimedia that can start today" business plan. NTT utilized its existing buried copper cable and the available existing network technologies namely the digital ISDN communication system as a platform to provide various application services to customers. It was result of this strategy of utilizing existing copper asset base and digital network that Japan quickly surpassed Germany (Deutsche Telecom) in ISDN dissemination (Kodama 2001).

*Current Customer Base* Retention of customer, though, is a challenge for a telecom operator, but it also presents new revenue earning opportunities. If you have in-depth customer knowledge, then they can be segmented; and targeted customer campaigns can be launched around consistent, personalized customer service and innovative products for them. Having a large customer base helps in all this and is a desirable continuity force. A telecom service provider has many points of customer tact, say, when customers call in with their enquiries, pay their bills online, or for any other reasons. This way they get many opportunities to up sell (the process of upgrading purchases to higher priced, higher value goods) and cross sell (selling complementary goods) to customers (Chou 2011). In fact, 85% of incremental revenues for international telecom companies is derived from customer interactions—when customers call in with questions, pay their bills online, or for any number of reasons. Thus, as the market starts to saturate, having a large customer base helps the operator on shifting its focus from acquiring new customers to maximizing the lifetime value of current customers.

*Core Competencies* Cable & Wireless (C&W) ignoring the importance of its historical key capabilities of operating in diverse international markets sold off its profitable but seemingly less attractive businesses. These businesses though were less glamorous, had historically developed core capability which went missing in C&W when these core businesses were sold off but were sorely needed in managing newly acquired IP-based businesses (Turner 2003). This went contrary to Collins and Porras (1994) approach of conservatism where growth is generated through the continuities provided by the enterprise's traditional core business (Turner 2003). The process of change from geographically diverse business to focused one on IP-based core business was needed to be more pragmatic with the new core business built on continuities provided by its key assets and capabilities (Turner 2003).

*Organization's Structure, System, Processes and People* Any organizational transformation exercise has to take into account its existing structure, system, processes, and people. Many successful organizations continue with their structure, systems, and processes because they feel comfortable with the same because of its simplicity despite pressures of changing them for reasons of seeming cost benefits (Marmol et al. 1995). It is important to take into account the existing organizational structure, systems, processes, and people before embarking on a growth strategy. It is worthwhile for the management to examine whether the changes desired are in line with the existing practices, or whether the process can take care of increased work load and people are skilled enough for new jobs (Dewhurst et al. 2011). These organizational realities form a critical continuity force to be kept in mind while drawing up organization strategy and implementation thereof.

*Expertise in Existing Technology* Organizations have expertise on the existing domain technology in the present. It is well known that all technologies are getting outdated and the rate of obsolescence is becoming faster and faster. If an organization wants to retain its competitive advantage, it has to keep on transforming itself with induction of new technology, be it in its production processes, marketing, or business processes. However, since the organization has already invested heavily in a particular technology, got its people trained on that technology it would want to fully exploit the existing technology before moving on to a new technology. Even though it may be desirable to undertake a quick sequence of focused incremental shifts in the long-term strategic direction, which may give superior returns, yet implementation of these steps are very difficult. Technology poses even bigger problem in this than operational shortcomings and organizational inertia. It is partly because technology is deeply embedded in operations and organization and partly because information systems based on current technology are rigid (Brown and Hagel III 2003).

*Organization Culture* Organization culture reflects the employees' views about "the way things are done around here." Organization culture also determines as to how employees feel and act and what type of employees are hired and retained by the company. Evidence suggests that organization members are more inclined to embrace change when the organization's culture is aligned with the mission and goals of the company (Mallinger et al. 2009). One of management's toughest tasks is changing company culture because changing organization culture is about winning the hearts and minds of the people you work with. This takes a lot of persuasion.

*Company's Ownership Aspect* Company ownership is of many types. Some companies are privately owned and not publicly traded. Some are widely held private companies that are publicly traded and have to abide by regulations. Some are wholly owned government companies. Some are family owned private companies. It has been seen that the family owners take keen and very personal interest in managing the company. Whereas in a public company, board members, though many in number, come and go. There may be a few replacements every year with the result that there are always some who are less informed. In private-equity-owned firms, the board members are highly informed and follow the business very closely. This is because they often have a substantial stake in it.

### 3.3.4 Identification of Change Forces

Following change forces have been identified from telecom service provision related literature.

*Competition* The kind of competition a service provider faces in the marketplace determines its strategy towards adoption of a technology. Instances are numerous where the competition is acting as a great change force on the company. This can be seen in the case of British Telecom and France Telecom in their choice of broadband access strategies. France Telecom moved much faster in adoption of fiber to the home (FTTH) technologies compared to British Telecom for the simple reason that it is facing stiff FTTH competition from Illiad group in the marketplace whereas British Telecom has no such competition (Wieland 2007c).

Incumbent operators are facing serious brand image transformation threats from their competitors that are positioning themselves as providing fantastic user experience, innovative products and services, and a great company to work for, and so on (Wieland 2007a). One objective of deregulation in the USA was to make the old communications companies face more competitive pressure and, in turn, to become more innovative and efficient as a result (Koselka 2001). Incumbents have been losing market share in Europe and the USA, revenue and profits due to competition (Beardsley 1998; Beardsley et al. 2004).

NTT DoCoMo has been facing fierce competition from its rivals KDDI and Softbank Mobile in Japanese market. Due to fierce price competition NTT DoCoMo's ARPU has been falling compared to its rivals (Wieland 2007b). Competition in telecommunication service sector is a serious change force being experienced by telecom operators around the world.

*Emerging New Technologies* Emerging new technologies coupled with deregulation of telecom service sector had very high impact on the telecom service business. The existing telecom networks of incumbent telephone companies, in developed nations that were designed solely to carry the voice traffic, were not ready to handle the boom in digital data. Internet protocol (IP) and packet switching technologies brought in convergence of voice, video, and data. The telecom service providers were not ready for the transition from traditional *circuit-switched networks* to networks based on Internet technology and business challenge thereof (Eugster et al. 1998). In mobile telecom space, 3G is driving a strong migration from cell phones to smartphones. VoIP Internet Protocol (IP)-based technology changes and consequential data traffic over take of traditional voice telephony forced Cable & Wireless (C&W) to redefine their strategic focus towards high growth IP data traffic services and corporate customers. C&W, in order to implement its changed strategic thought, acquired many IP-based small businesses in the USA and Continental Europe (Turner 2003).

The emerging information and communication technologies had created a new and high growth multimedia business market. NTT faced a significant transition period of technology change from analog to digital changing the voice only "analog telephone" business to a new future of "new business using multimedia." NTT was required to change from a telephone company to a multimedia company (Kodama 2001).

Owing to the significant development in the field of information and communications technologies (ICTs) over the past decades, mobile telecommunications technologies have evolved rapidly. Several different new standards, such as the global system for mobile telecommunications (GSM), wireless application protocol (WAP), general packet radio service (GPRS), code division multiple access (CDMA), and high speed downlink packet access (HSDPA), have been implemented. Moreover, even while third-generation (3G) mobile communications system have not entirely replaced earlier ones, further fourth-generation (4G) mobile communications systems are already under consideration by international standardization bodies (Teng et al. 2009). Radio, television, PCs, laptops, smartphones, and the Internet have all become part of people's everyday lives. Sensing growing demand of consumers multimedia services anytime-anywhere, wireless service providers have invested heavily in upgrading their networks to the next generation standard (3G) (Malhotra and Kubowicz 2009). Emergence of smartphones and emerging new technologies of 3G/4G/LTE are going to have tremendous impact on the way the service providers will conduct business and generate revenue. Emerging new technologies are impacting telecom service provision business in many ways.

*Governmental and Regulatory Telecom Policies* Regulatory changes have a significant impact on strategic choices of an organization. There are many such examples the world over. While posing significant competitive threats in its core market as a result of deregulation, an organization may be lured into seemingly lucrative unknown market as has been seen in case of Kingston Communications of the UK city of Kingston upon Hull (Turner 2002).

Regulation has revolutionized the Nigerian Telecom market from a single monopoly market to a duopoly and then a wholly unregulated market. Such a revolution has already taken place within the UK and the USA markets and is now being positively implemented in Nigeria (Ojiako and Stuart 2006).

In the early 1990s, European governments introduced new laws on telecommunications that regulated the opening of the telecom market and ended the monopoly of public telecom operators (van Marrewijk 1997). In 1997, the European governments committed themselves in the general agreement on trade in services to restructure their national telecom markets according to a specified time schedule to create a global telecom market that is accessible to all participants (Steinfeld 1994). As a consequence, each government faced, at national level, the difficult task of dismantling the power of the national operator and opening up the home market for new and foreign competitors (Noam and Kramer 1994). Deregulation and subsequent policy changes by governments in their telecom markets have affected the telecom businesses in these countries.

*Globalization* Globalization has been an important change force in telecom sector evolution. The emergence of European Virtual Users Association (EVUA) in Europe presents a case to point the impact of globalization in developing and developed world. An important development underlying the fundamental changes in the telecom sector has been the growing number of multinationals and rise of organizational networks. Telecommunication is responsible for bridging time and place



and is therefore seen as an important force behind the globalization of economy and technology and the networking of organizations (Castells 2000). Therefore, multinationals have put much emphasis and finance into the development of high quality corporate networks. Public telecom operators have not managed to meet the needs of multinationals for a long time. In Europe, the 50 largest multinationals that united to form the European Virtual Users Association (EVUA) successfully claimed in the European political centres in Brussels the need for cheap and easy-to-reach international services and reliable service. The EVUA members wanted just one provider to deal with, a service called “one-stop-shopping” (van Marrewijk 2004).

Deregulation in Australia not only affected the operating company but affected the equipment manufacturers as well. Telecom Australia (Telstra) increasingly sought to expand its technology source, and with the deregulation of the telecommunications industry in 1992, Ericsson found itself operating in a radically altered environment. There was, thus, the need to create a more responsive, customer-oriented, competitive organization and the new managing director effected significant changes to the organization structure (Graetz 2000).

*Changing Customer Needs* In current times, customer needs are becoming more diverse and are often changing from day to day. This is putting tremendous strain on the resources and capabilities of the companies and particularly sales organizations (Davie et al. 2010). The consumers have become increasingly sophisticated, demanding about what they want, and hence microsegmented. This is resulting into premium-priced brands losing their shine as consumers are increasingly trusting only their own ability to seek value. Multiplying user needs and the market segment even for the most homogeneous of product categories is making the job of companies and their marketers ever more challenging (George et al. 1994).

*Mergers and Acquisitions* Mergers and Acquisitions (M&A) are strategic tools in the hands of management to achieve greater efficiency by exploiting synergies and growth opportunities. Mergers are motivated by desire to grow inorganically at a fast pace, quickly grab market share and achieve economies of scale (Banka 2006). Implementation of M&A strategies, in turn, act as a change force on the resulting entity. It is in the integration phase of an acquisition, where the change management effectiveness lies, that is when often deals go wrong; some studies blame poor integration for up to 70% of all failed transactions (Palter and Srinivasan 2006).

*E-Business Processes* Telecommunications today is increasingly a commodity business. For traditional telecom companies, maintaining customer loyalty and delivering growth in the face of fierce price competition and new market entrants requires them to go through an e-business transformation. They need to develop online capabilities across their entire business operations, from back-room processes and logistics to customer service and sales. This is an essential step for capturing and retaining today’s savvy customers, who expect the same kinds of benefits from all technologically oriented service providers. An e-business transformation will not only reduce costs in the long run, but also is a prerequisite for effectively delivering digital goods and services in today’s world that bring new revenue growth (Severino et al. 2011)

Verizon's CEO states that by shifting the bulk of IT expenditures from maintenance of the existing system to the development and support of new business capabilities, the company has changed an internally oriented IT organization into one focused firmly on markets and customers. Verizon's IT organization is innovating more and more aggressively now (Appel and Yeboah-Amankwah 2005). E-business process is one change that no telecom operating company can avoid. It has to embrace it as fast as possible if it wants to remain competitive.

### 3.4 Verifying Strategic Crystal Elements

The continuity and change forces along with strategic factors namely customer factors and enterprise factors, that were identified from the literature, need to be further verified, for their Indian context relevancy. This was done by conducting a survey eliciting response from senior telecom executives and experts closely associated with Indian telecom service sector.

#### 3.4.1 Expert Survey—Purpose and Methodology

Identifying the strategic factors comprising of customer factors and enterprise factors from the literature of telecom domain is important first step but they need to be further verified, for their relevancy to Indian context. The importance and sensitivity to context has been emphasized by researchers in country specific studies (Islam 2010; Bryman et al. 1996). Keeping this in view, the strategic factors pertinent to India have been determined by conducting a survey eliciting response from telecom professionals and experts closely associated with Indian telecom service sector.

An idea engineering exercise, done earlier for e-government domain in Indian context (Nasim and Sushil 2010), has been adapted in this chapter for verification of strategic crystal element variables in the context of telecom service provision business. A survey was conducted eliciting response to a structured questionnaire (Appendix) from telecom service sector professionals of both private and public sector companies in India. A judgmental sample of 54 experts in the area of telecom service, with substantial experience and understanding of the field, responded to the structured questionnaire, which was administered and responses received either electronically or personally collected in hard copy. The experts' responses based on a five point scale were received and were analyzed to finally select and validate the continuity and change forces as well as strategic factors comprising of customer factors and enterprise factors that are relevant for India. Based on the literature review, seven continuity forces, seven change forces, four customer factors, and seven enterprise factors were identified for validation from experts. The descriptive statistics have been presented for all the four set of variables in Table 3.1, 3.2, 3.3 and 3.4. These statistics uniformly present higher mean (more than three) median

**Table 3.1** Analysis of customer factors

S.No.	Proposed strategic customer factors in telecom service sector	Mean	Median	Mode	SD	Cumulative percentage of experts who agreed/strongly agreed	t-value (test value=3)	Significance value (two tailed; 95 % confidence interval)	Accept the change force as valid if significance value <0.05
1	Product price offering by the operator	3.94	4.00	4.00	1.16	77.6	6.220	0.000	Accept
2	Operator's quality of service (QoS)	4.65	5.00	5.00	0.68	94.8	18.220	0.000	Accept
3	Operator innovativeness in introducing product and services in the marketplace	4.39	4.50	5.00	0.69	91.4	15.208	0.000	Accept
4	Operator's brand image	3.89	4.00	4.00	0.78	77.6	8.667	0.000	Accept

**Table 3.2** Analysis of strategic enterprise factors

S.No.	Proposed strategic enterprise factors in telecom service sector	Mean	Median	Mode	SD	Cumulative percentage of experts who agreed/strongly agreed	t-value (test value = 3)	Significance value (two tailed) (95% confidence interval)	Accept the change force as valid if significance value < 0.05
1	Market share of the operator	3.60	4.00	4.00	1.05	70.7	4.341	0.000	Accept
2	Customer satisfaction levels	3.50	4.00	4.00	1.11	65.5	3.424	0.000	Accept
3	Average revenue per unit (ARPU)	3.77	4.00	4.00	0.85	77.6	6.876	0.000	Accept
4	Earnings before interest, tax, depreciation and amortization (EBITDA)	4.12	4.00	4.00	0.53	94.9	16.032	0.000	Accept
5	Company's net-work rollout speed	4.08	4.00	4.00	0.43	98.3	14.962	0.000	Accept
6	Compounded annual growth rate (CAGR) of the company	4.36	4.00	4.00	0.69	94.8	19.211	0.000	Accept
7	Productivity (per employee) of the company	4.25	4.00	4.00	0.68	93.1	13.896	0.000	Accept

**Table 3.3** Analysis of continuity forces

S.No.	Proposed continuity force in telecom service sector	Mean	Median	Mode	SD	Cumulative percentage of experts who agreed/strongly agreed	t-value (test value = 3)	Significance value (two tailed) (95% confidence interval)	Accept the change force as valid if significance value <0.05
1	Existing telecom infrastructure	4.12	5.00	5.00	1.39	79.3	6.140	0.000	Accept
2	Current customer base of the company	4.55	5.00	5.00	0.50	100.00	23.557	0.000	Accept
3	Company core competence	4.34	4.00	4.00	0.57	94.9	17.691	0.000	Accept
4	Existing organizational structure system and processes	4.43	5.00	5.00	0.67	93.1	16.068	0.000	Accept
5	Existing technology expertise	4.13	4.00	4.00	0.78	87.9	11.076	0.000	Accept
6	Organizational culture in the company	4.13	4.00	4.00	0.66	91.4	13.113	0.000	Accept
7	Company ownership aspects	3.53	4.00	4.00	1.06	65.5	3.829	0.000	Accept

**Table 3.4** Analysis of change forces

S. No.	Proposed change force in telecom service sector	Mean	Median	Mode	SD	Cumulative percentage of experts who agreed/strongly agreed	t-value (test value = 3)	Significance value (two tailed)(95% confidence interval)	Accept the change force as valid if significance value <0.05
1	Intensity of competition	4.39	4.00	4.00	0.49	100.00	21.554	0.000	Accept
2	Emerging new telecom technologies	4.46	5.00	5.00	0.62	93.1	17.792	0.000	Accept
3	Governmental and regulatory telecom policies	3.98	4.00	4.00	0.73	87.9	10.152	0.000	Accept
4	Globalization	4.00	4.00	4.00	0.74	89.7	10.164	0.000	Accept
5	Changing customer needs	4.51	5.00	5.00	0.50	100.0	22.923	0.000	Accept
6	Mergers and acquisitions in telecom service sector	3.63	4.00	4.00	0.85	69.0	5.701	0.000	Accept
7	E-Business processes	3.60	4.00	4.00	0.95	75.9	4.817	0.000	Accept

(four and above), and mode (four and above) of the distribution and a high cumulative percentage of experts (65% and above). These statistics, therefore, provide a fair basis of accepting these variables.

However, to authenticate the survey results, one sample *t*-test of significance has been used to compare the mean value of each of the strategic factors with a specified constant called test value, which is taken to be mean value greater than 3 seem to be a reasonable test value for hypothesis testing. The basic hypothesis for validating the continuity and change variables may be enumerated as follows:

*Null hypothesis (H<sub>0</sub>)*—There is no significant difference between the observed mean and specified mean value for the variable (customer factor or enterprise factor).

*Alternate hypothesis (H<sub>1</sub>)*—There is significant difference between the observed mean and specified mean value for the variable (customer factor or enterprise factor).

Thus, a variable would be accepted as valid if the significance value of the *t*-statistic is less than 0.05 (95% confidence interval) indicating a higher level of acceptance of a strategic crystal element variable.

## 3.5 Results and Discussion

The expert responses received have been analyzed in the following subsections. This analysis reveals a strong agreement on all the four set of variables namely; strategic customer factors, enterprise factors, continuity forces, and change forces.

### 3.5.1 Customer Factors

An analysis of the experts' responses reveal a strong agreement on all the strategic customer factors identified (Table 3.1).

Out of the four customer factors, all were accepted as the significance value was much less than 0.05. Majority of the experts (76%) believed that all the factors identified namely price, QoS, speed of innovative product offering, and brand image of the service provider are important determinants in selection of service provider by the Indian consumer. QoS has been rated as the most important parameter for the customers followed by operator innovativeness with mean scores of 4.65 and 4.39 respectively. An overwhelming majority of experts 94.8 and 91.4% respectively also agreed with this order of importance for the consumer. Price has been rated as third most important factor with mean score of 3.94 and 77.6% of experts either agreeing strongly or very strongly with it. What is coming out is that Indian consumers are not so price sensitive as they are made out to be. They would want their operator to provide excellent QoS over and above other factors. Operator brand image has come out as very near to price as criteria for operator selection with

mean score of and 77.6% percent experts agreeing/strongly agreeing. The possible explanation could be telecom services are still mostly consumed by relatively well off people who want QoS over and above everything else and for whom brand image of the operator is almost as important as price.

### **3.5.2 Enterprise Factors**

Management of the enterprise would want to measure its performance on these factors. An analysis of the experts responses reveal a strong agreement on all the seven strategic enterprise factors identified for which the  $t$ -value has been found to be significant in order to accept (Table 3.2).

From Table 3.2 it is seen that experts have verified all the seven identified factors as the significance value is much less than 0.05. More than 70% professionals have either agreed or strongly agreed with all the seven to be relevant enterprise performance related strategic factors. Network roll out speed has been rated as the most important of all these factors with 4.36 mean and 98.3% of experts saying so. This makes sense as network rollout speed determines the enterprise ability to expand fast and hence associated first mover advantage increasing its monetization capability.

Next important parameters are financial parameters, namely, EBITDA and CAGR. Both have been rated almost equally important with mean value for EBITDA being 4.12 and CAGR being 4.08. In case of EBITDA, 94.9% and in case of CAGR, 94.8% of surveyed experts have either strongly or very strongly agreed with these parameters indicating importance of these parameters for the enterprise. This is not surprising as EBITDA tells about financial soundness of the company and CAGR tells as to where the company growth stands in comparison of industry growth and that of its competitors. Productivity (per employee) is also given quite high importance by the experts. Mean value for this parameter is 4.25 and 93.1% experts have either strongly or very strongly indicated their preference for it.

ARPU has also been considered a fairly important parameter as experts are giving this parameter a mean score of 3.77 and 77.6% of them are either strongly or very strongly indicating their preference for it. Surprisingly, market share has been rated in the least important category of all the parameters among all, though, it has not been rejected either. Mean score given for market share is 3.60 with 70.6% of experts either agree or strongly agree with it being a strong indicator of company performance.

### **3.5.3 Continuity Forces**

An analysis of the experts' responses reveal a strong agreement on all the seven continuity forces identified for which the  $t$ -value has been found to be significant in order to accept (Table 3.3).



Among these seven continuity forces accepted, the existing customer base has emerged to be the most significant continuity force with maximum mean score of 4.55 and 100% of experts either strongly or very strongly agree with it to be so. In importance, continuity force of customer base is closely followed by company “core competence” and “current organizational structure, systems and processes” with respective mean scores of 4.34, 4.43, and 94.9, and 93.1% of experts respectively either strongly or very strongly agree with these to be so.

Next important continuity force is “organization culture” with mean score of 4.13 and 91.4% of experts either strongly or very strongly agree with this. This is followed by the continuity force namely “existing technology expertise” with mean score of 4.13 and 87.9% of experts either strongly or very strongly agreeing with this. Both these continuity forces have been rated high on importance because both are closely related to human resources of the organization and their existing skills. Though management may want to monetize the existing telecom infrastructure as much as possible this has not been rated as high as other continuity forces. However, this continuity force has not been rejected either with mean score of 4.12 and 79.3% of experts either strongly or very strongly agree with this. The last identified continuity force namely “company ownership aspect” has the least mean score of 3.53 and 65.5% experts have either strongly or very strongly agreed with this to be an important continuity force. This continuity force as per experts has the least bearing on strategy but important enough not to have been rejected.

### **3.5.4 Change Forces**

An analysis of the experts’ responses reveal a strong agreement on all the seven change forces identified for which the *t*-value has been found to be significant in order to accept (Table 3.4).

Among these seven change forces accepted, “changing customer needs” and “competition” have emerged to be the most significant change forces with respective means scores of 4.55 and 4.39. All experts have either strongly or very strongly agreed with these to be so. These two important change forces are closely followed by “emerging new technologies” with mean score of 4.46 and 93.1% of experts either strongly or very strongly agree with it to be so.

Next important change force is “globalization” with mean score of 4.00 and 89.7% of experts either strongly or very strongly agree with this. This is followed by the change force namely “government policy and regulation” with mean score of 3.98 and 87.9% of experts either strongly or very strongly agree with this. After this, the change force namely “e-business” follows with mean score of 3.60 and 75.9% of experts either strongly or very strongly agree with this. The last identified change force namely “mergers and acquisitions” has the least mean score of 3.63 and 69.0% experts have either strongly or very strongly agreed with this to be an important change force. This change force as per experts has the least bearing on strategy but important enough not to have been rejected.

### 3.6 Synthesis of the Expert Survey

The results of the expert survey reveal that the mode value is 4 or more in case of all the four customer factors and hence experts have endorsed all the four customer factors culled out from the literature. However, among these four, quality of telecom service and operator's innovativeness in introducing products and services in the market place have been much more strongly endorsed by the experts compared to the other two customer factors, namely, product price and brand image.

Similarly, the mode value for all the strategic enterprise factors has been found to be 4 or more. Among the seven enterprise factors identified from the literature, the experts have strongly endorsed network rollout speed, earning before interest, tax, depreciation, and amortization (EBITDA); CAGR; and productivity (per employee). The other three enterprise factors, though accepted by the experts as significant, have not been so strongly endorsed. These are market share, customer satisfaction, and ARPU.

The results of the expert survey have also clearly strengthened the basic conjecture that both forces of change and forces of continuity are high in telecom service sector (mode  $\geq 4$ ). This is reflected in the fact that all the change and continuity forces identified from the literature were strongly endorsed by the experts. All the forces driving change in the sector as identified from the telecom management literature were found to be statistically valid in Indian context. Some of the basic drivers of change include forces of changing customer needs, emerging new telecom technologies, government and regulatory telecom policies, and competition. As per the experts, the remaining change forces like, the e-business processes, globalization, and mergers and acquisition though statistically accepted as valid change forces, do not seem to be strongly driving change in the context of Indian telecom.

Similarly, so far as microvariables relating to continuity forces are concerned, seven forces of continuity were identified from the literature and all of them were endorsed by the experts as significant in Indian context. One of the most significant continuity force, as unanimously endorsed by the experts, is the customer base of the company, the other being core competence, organization structure, systems and processes; and organization culture. Continuity forces, namely, existing telecom infrastructure, existing technology expertise, and company ownership aspects though accepted as valid continuity forces, have not been so strongly endorsed by the experts.

The chapter has, thus, determined the four set of micro variables related to telecom service provision business. These four components and the relationships among them are depicted as flowing stream strategy crystal. Following the methodology of drawing strategic crystal diagram (Sushil 2012b, 2013), the strategic crystal for telecom service provision business for India can be drawn as follows (Fig. 3.2).

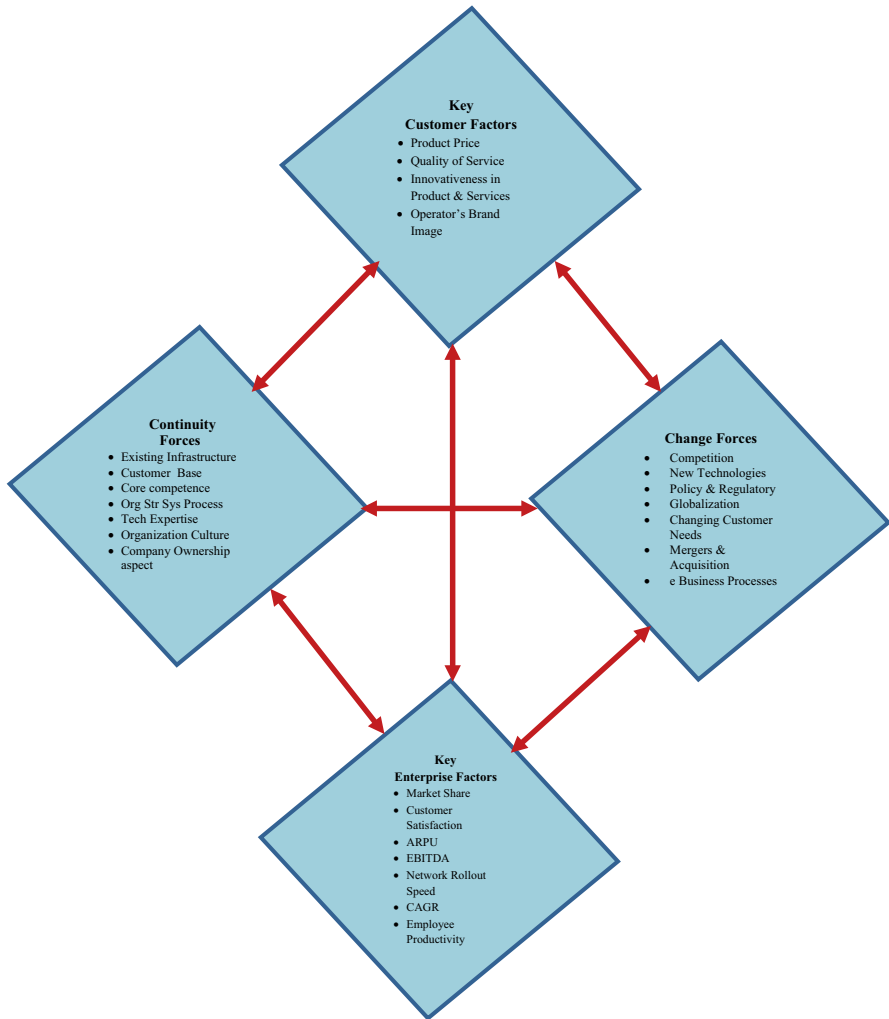


Fig. 3.2 Flowing stream strategy crystal for telecom service provision sector

### 3.7 Conclusion

Determination of elements of strategic crystal, namely, continuity, and change forces; enterprise and customer factors in the context of telecom service provision business; and finalization of strategic crystal diagram are important starting steps of flowing stream strategy formulation in the context of Indian telecom service sector.

The next steps of flowing stream strategy formulation that can be built up further are summarized below.

- Mapping of continuity and change forces on continuity change matrix and determine whether it lies in the high change—continuity quadrant.
- Categorize the continuity forces using the VDB (vital, desirable and burdensome) and change forces using impact analysis (high, medium and low).
- Determine “how” these forces (continuity and change) are interrelated and they relate in that manner. This can be done using total interpretive structural modeling (TISM) (Sushil 2012c).
- Determine how the strategic factors are linked with the reality of continuity and change forces in the strategic crystal. Determine how these interactions can be interpreted.
- Having known the relationships in the strategic crystal, both the strategic factors, i.e., customer factors and enterprise factors can be landscaped in terms of “as-is” and “to-be” strategies for a specific case organization/sector.
- Key strategies can be selected and their trajectories guided depending on categorization of continuity and change forces. These strategic trajectories can then be aligned with strategic direction or the strategic intent.

This chapter, thus, has given the important first step of determining the macro and micro variables pertinent to telecom service provision domain and development of flowing stream strategy crystal thereof. Strategy formulation based on flowing stream strategy can be undertaken from here on for the domain or the case organization.

## Appendix: Structured Questionnaire for Expert Survey

S.No.		Response scale
	<i>Statements describing the customer factors</i>	Strongly agree (5) Agree (4) Neither agree nor disagree (3) Disagree (2) Strongly disagree (1) Response scale
1	Price is an important consideration in customer's buying decision of a telecom product or services	
2	Quality of telecom service (QoS) (speech quality, extent of network coverage, fault repair service, credibility in billing service etc.) is one of the main criteria in customer remaining loyal to an operator	
3	A customer is attracted into buying a telecom product or service from an operator who offers a variety of packages, inducts innovative products/rate plans on a regular basis without any delay	
4	Brand image of a service provider is an important criterion for the consumer in its buying decision of a telecom product or a service	
	<i>Statements describing the enterprise factors</i>	
5	Market share is an important indicator of a telecom operator's performance	
6	Customer satisfaction measured by an independent agency is a strong indicator of service provider's performance	
7	Average revenue per unit (ARPU) is a good indicator of service provider's performance in terms of its acceptability among consumers	
8	A high value of earnings before interest, taxes, depreciation and amortization (EBITDA) is very good indicator of company operations	
9	A high compounded annual growth rate (CAGR) is desirable as it implies that the company is growing from year to year. Comparing company CAGR with industry CAGR will tell on management's performance among operators	
10	The ability of an operator to roll out network fast or bring new product or services to the market fast is a good indicator of performance of company's business processes	
11	Productivity per employee of a telecom company is a good indicator of quality of its human resource, its motivation level, and competency	
	<i>Statements describing the continuity forces</i>	
12	Existing telecom infrastructure such as cables, cable ducts, optical fiber cable and systems, GSM/CDMA tower and equipments, voice and data exchange, and transmission equipments of a company are critical for the future growth of the company business	
13	A large customer base of the service provider can be effectively used to enhance company business and develop new revenue streams for future	
14	Core competence of the company should not be lost sight of while making new business plan or while implementing it	

S.No.		Response scale
15	Existing organizational elements such as structure, systems, process, and people are important for effective implementation of business plans	
16	Expertise in existing technology (GSM, TDMA\switching and transmission, DSL-based broadband technologies etc.) will continue to have important bearing on future growth of company business	
17	Existing organization culture should not be ignored while formulating and implementing company strategy	
18	Company ownership aspects (predominantly known domestic business house or leading multinational or Government) are important determinants of company success in the marketplace	
	<i>Statements describing the change forces</i>	
19	Open competition in telecom is forcing operators/service providers to change the ways of their doing business	
20	Fast emerging technologies in telecom (Internet protocol (IP)-based voice and data, 3G, 4G and long term evolution (LTE), WIMAX technologies etc.) are forcing operators to invest in these new technologies, learn and rollout services based on these technologies fast	
21	Changes in Government policy or regulation whether to protect Government interest, meet the universal service obligations, ensure level playing field among the operators or formulating and enforcing rules pertaining to new technologies etc. force service providers to adapt to such changes and modify their business model accordingly	
22	The effect of globalization in telecom where international telecom players are a big player in domestic telecom business influences the telecom operations of service providers	
23	The customers are demanding newer and newer services (anytime anywhere broadband services, streaming video, gaming, mobile TV and Internet, and mobile banking/e-commerce) based on new and emerging technologies which is forcing companies to respond quickly to these ever-changing consumer needs	
24	Mergers and acquisitions among telecom companies to consolidate operations have been unleashing forces of change in merged or acquired companies	
25	Introduction of e-business practices (enterprise resource planning (ERP) packages, computerized billing, and customer service business processes) affects the company operations such as retraining the employees, rendering legacy systems/procedures useless and so on	

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# Chapter 4

## Interaction of Continuity and Change Forces and E-Government Performance

Saboohi Nasim

### 4.1 Introduction

Organizations, in general and government in particular, focus overwhelmingly on “change and transformation,” given the immense pressure of keeping pace with the environment. However, despite the unprecedented focus on change, the record of change success is startlingly low, both in business organizations (Kotter 1995; Beer and Nohria 2000) and in the context of e-government projects (Heeks 2003; Ruth and Doh 2007). This has led the researchers to explore alternatives beneath and beyond change (Sturdy and Grey 2003).

Researchers reviewing the literature on organizational change have highlighted the fact that “managing change is invariably managing paradoxes” (Nasim and Sushil 2011). Various researchers have suggested ways to manage such dualities and paradoxes for enhancing change outcomes. One such approach that has gained considerable acceptance indicates the need for “managing continuity and change concurrently” for effective change (Brown and Eisenhardt 1997; Huy 2002; Leana and Barry 2000; Sturdy and Grey 2003; Sushil 2005; Graetz and Smith 2009). Further, despite the emphasis by researchers on managing such paradoxes/dualities, there hardly exists any empirical validation of the suggested notions (By 2005).

The context of e-government, too, seems highly paradoxical. On the one hand, in order to keep pace with the changing environment, the domain of e-government calls for radical changes embracing new technologies and processes, while “government” as an entity, on the other hand, is largely driven by rules, norms, and laws which strengthens the forces of continuity. This led researchers to explore the e-government domain from the dual perspective of continuity and change. In fact,

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based on experts' opinion survey, researchers have concluded that this domain is highly affected by both continuity and change forces and have even identified these forces (Nasim and Sushil 2010). Further, a study has also highlighted the structural relationships among these forces, and has even suggested their linkages with the performance factors (Nasim 2011; Nasim and Sushil 2014).

This chapter is an attempt to empirically demonstrate that managing continuity and change forces simultaneously (i.e., their interaction) will result in better delivery of strategic deliverables of e-government projects, than when managed separately. At the outset, a brief review of the background literature introducing the strategic new approach is presented, followed by the details of the methodology undertaken for the empirical analysis. The results of the empirical survey are then discussed, followed by the concluding section highlighting the implications for both the academia and the practitioners.

## 4.2 Background Literature

Discourses on strategy have traditionally hailed “continuity and change” as mutually exclusive, i.e., as an either–or situation. However, in the past two decades, the waves of change have compelled businesses to evolve a more “flexible approach” (Volberda 1998; Sushil 2000, 2014) for managing change and transformation. Evidence from the literature further prove that if everything about an organization would change it would lead to chaos. Hence, it is imperative to know what needs to be retained and what should be changed. This has led to a greater acceptance of the notion of managing both change and continuity together.

The concept of managing “continuity and change” was popularized in 1994 when Collins and Porras (1994) stated in their famous book *Built to Last* that the “ability to manage continuity and change is the secret to an enduring great company.” Other researchers, too, agreed that continuity and change coexist in the organization and that it should be managed not as alternative states but as coexistent ones (Leana and Barry 2000; Sturdy and Grey 2003). Thus, it was posited that while managing change is inevitable, it is also imperative for managers today to embrace stability and learn to manage continuity if they want to survive.

Although the hosts of management writers emphasized the need for managing “change and continuity,” very few of them actually attempted to present a framework for doing so. One of the earliest thinking on “reconciling change and continuity” in strategy making is provided by Mintzberg (1988). In his excerpts on *Crafting Strategy*, he proposed that the reconciliation between change and continuity forces should be done alternatively, a departure from the current thinking, calling for concurrent management of the forces.

Volberda (1997) highlighted the need of an organization to manage change and continuity simultaneously by emphasizing the need for flexibility. An inductive model to resolve the tension between continuity and change at the micro-/individual level has been proposed by Huy (2002). The “flowing stream strategy framework” for managing continuity and change, propounded by Sushil (2005, 2012a, 2012b, 2013), provides a detailed approach to “consciously manage the vital and desirable

areas of continuity along with change.” Burchell and Kolb’s (2006) model based on “systems thinking,” too, emphasized the need for change and stability to create sustainable organizations for future. Of late, Graetz and Smith (2009) have proposed a “dualities-aware perspective” as a potential way forward in balancing the contradictory forces of continuity and change.

### 4.2.1 *Managing Continuity and Change in E-Government*

“E-government” or “electronic government” refers to the delivery of information and services by the government online leading to better and effective governance (Ebrahim and Irani 2005; Beynon-Davies 2007). ICT, in general, and the Internet in particular, has subjected the domain of e-government to continual change (Stojanovic et al. 2006). However, despite the focus on change, e-government projects have not delivered, especially in the context of developing countries which are grappling with a dismal percentage (15–17%) of success (Heeks 2003). The intragovernmental changes have been slow, ad hoc, and plagued by poor planning, inadequate application of strategic management principles, and weak leadership (Moon 2002).

Researchers worldwide have consistently highlighted that the e-government is more of an organizational change issue than a technological one (Li 2003; Kumar et al. 2003). India, despite being recognized as a leading power in information technology, has a poor e-government index (UN E-Government Survey 2008, 2012). With massive investments made by the government in these projects and with a dismal success rate (15–17%; World Bank 2004; Suri 2009), it is imperative to explore the approaches that may enhance the outcomes of such projects.

Of late, researches in e-government in Indian context not only suggest the significance of managing change in the domain (Kumar 2005; Suri and Sushil 2008) but also highlight the need for managing continuity forces like culture, etc. Further, a comprehensive review of the e-government literature undertaken by researchers, with the objective of identifying change and continuity forces, resulted in seven forces of change (*globalization, new opportunities, pressures of good governance, stakeholders’ needs and expectations, new technology, the e-platform, government policies and legislation, and public–private partnership*) and five forces of continuity (*large number and heterogeneity of citizen base, established traditional infrastructure, existing process of service delivery, legacy databases, and existing culture*; (Nasim and Sushil 2010).

These change and continuity forces are further used as predictor variables for assessing the impact of their interaction on e-government performance, as reported in this chapter. A detailed explanation of these forces is provided in Appendix 4.1.

## 4.3 Methodology

This chapter adopts the empirical methodology to validate the research proposition that managing “continuity and change” simultaneously yields better results. A questionnaire-based opinion survey has been undertaken in the context of select

**Table 4.1** Research framework for opinion survey method adopted for the study

Perspective of the opinion survey	Research context/ domain	Research variables investigated	Survey instrument used	Unit of analysis	Sample size
<i>Opinion survey</i> Service provider (planners and implementers) perspective	Government-to-citizen (G2C) projects operational in India	All macro- and micro-research variables Impact of managing change and continuity on project- and citizen-related performance factors	Questionnaire based	Planners and implementers involved in the select G2C projects in India	131

e-government projects to investigate the relationship between the constructs of managing continuity and change and the strategic deliverables of e-government projects. The questionnaire draws from the literature the predetermined continuity and change forces affecting the e-government domain in India and is administered to the planners and implementers of a variety of government-to-citizen (G2C) projects in operation in India. The questionnaire consists of statements on managing continuity and change forces and strategic factors consisting of performance variables from project and citizen's perspectives. A five-point Likert scale is used to elicit response from the respondents and the questionnaire has been duly tested for its reliability and validity (Nasim 2010). A summary of the questionnaire used for the study, reported in this chapter, is provided in Appendix 4.2. The basic methodological approach adopted for the empirical survey method undertaken for the study is briefly presented in Table 4.1.

The results of the survey are then analyzed to determine the impact of managing change and continuity forces, separately as well as simultaneously, on the strategic factors or performance factors of e-government projects. To test the simultaneous impact of managing change and continuity forces, the interaction or the product of the significant continuity and change forces is tested. A detailed insight into the research constructs, research propositions, and the sample e-government projects is provided in this section for better clarity about the methodology of the study.

### 4.3.1 Research Constructs

As drawn from strategy, change management, and e-government literature, three broad sets of research constructs, namely forces of change, forces of continuity, and strategic factors of e-government projects have been identified. A brief explanation of these macro-constructs is presented as follows:

*Forces of Change* “Forces of change” typically refer to the drivers or imperatives of change arising from either the external or internal environment of an organization.

Broadly, these refer to the contextual factors as depicted in various change models (Pettigrew 1985; Greenwood and Hinings 1988; Dawson 1996). In the context of the situation, actor, and process (SAP) framework, these forces emanate largely from situations (Sushil 2001) and may include forces like globalization, stakeholder's needs and expectations, emergence of new technology, government policies and legislations, etc. Haberberg and Rieple (2008), however, refer to them as factors that enhance the likelihood of organizational change requiring an analysis of the organization's environment, resources, and stakeholders to delineate those forces.

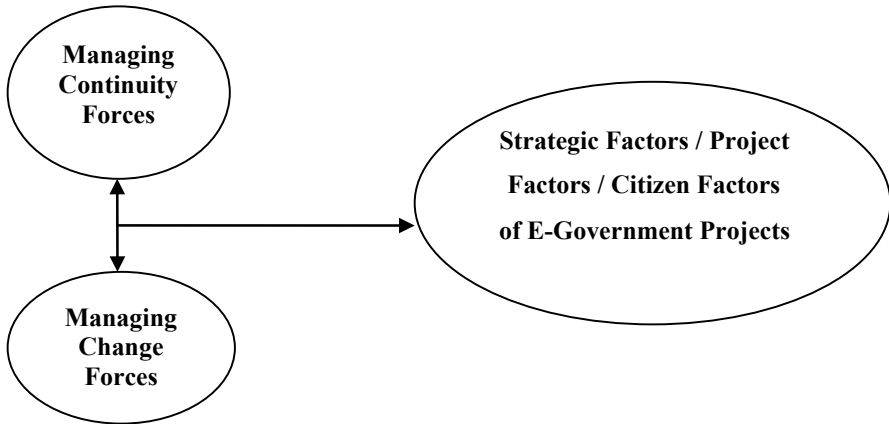
In the context of the e-government domain, the key forces of change as identified from the literature include globalization, new opportunities, pressures of good governance, stakeholders needs and expectations, new technology, e-platform/e-business, government policies and legislations, and public-private partnership.

*Forces of Continuity* The term "continuity" is widely used across disciplines and has various connotations. In the context of organizations, it has been defined as "the connectedness over time among organizational efforts and a sense or experience of ongoingness that links the past to the present and the present to future hopes and ideals" (Srivastava and Fry 1992). In the context of organizational change, however, the construct "forces of continuity" refers to those factors that contribute to the inertia in an organization (Haberberg and Rieple 2008) and thus need to be managed for effective change. Continuity forces in an organization, e.g., core ideology, core competence, culture, existing high performance, etc., add to the inertia of the organization (Trompenaars and Woolliams 2003; Sushil 2005, 2013). These continuity forces are continued by default and if not consciously managed may come in the way of constructive change; not all continuity forces however obstruct change. Some of them, for example, core ideology, strong culture, etc., may even be vital or desirable to be continued further in order to leverage change.

In the context of e-government, the key forces of continuity as identified from the literature include a large number and heterogeneity of the citizen base, established traditional infrastructure, traditional process of service delivery, manual records or legacy databases, and existing culture.

*Strategic Factors of E-Government Projects* The "strategic factors" in the e-government domain consist of all those deliverables which are strategic in nature from the perspectives of both, the project and the beneficiaries. The "project factors," thus, would include the set of factors required to evaluate e-government projects. Further, the need for a citizen-centered evaluation framework has been proposed by several researchers (Jones et al. 2007; Lee et al. 2008). Thus, the strategic factors of e-government would broadly consist of two set of factors: citizen factors and project factors, the sub-factors of which may be further drawn from strategy and e-government literature, and should be validated for the context used.

*Project Factors* Project factors refer to those performance parameters that are related to e-government projects. Though the literature review indicates a wide array of evaluation methods, the study adopts a comprehensive approach including financial, nonfinancial, technical, process-, and actor- related parameters for assessing the e-government projects. The "strategy game-card" (Sushil 2010)



**Fig. 4.1** Management of continuity and change forces concurrently and performance factors of e-government

approach has been adapted for the e-government domain to include ten micro-variables spanning both financial and nonfinancial parameters as replicability and sustainability, top management commitment, employee training and involvement, strategy and policy adopted, technological process, relationship with the private vendors, internal business efficiency, interaction with other external stakeholders, and the e-government readiness/maturity of the context situation.

*Citizen Factors* Though the governments worldwide strive for citizen-centric e-government services, the actual e-services provided are far from being citizen centric (Soufi and Maguire 2007; Velsen et al. 2009). The citizen-centric or user-centric approach has been identified as an important evaluation perspective for e-government projects by various researchers (Jones et al. 2007, Macintosh and Whyte 2008; Lee et al. 2008; Verdegem and Verleye 2009). For the research under consideration, citizen-related performance parameters are grouped separately as a macro-construct to emphasize its importance and include five factors, namely service efficiency, service quality parameters like availability, ease of use, information quality, and citizen participation and empowerment.

### 4.3.2 Research Hypotheses

Various researchers recommend balancing continuity and change forces simultaneously rather than alternately for successful change and sustainability (Leana and Barry 2000; Huy 2002; Sturdy and Grey 2003; Sushil 2005; Burchell and Kolb 2006; Sushil 2012a, b, 2013). Consequently, it may be proposed that managing continuity and change concurrently, i.e., interaction of continuity and change forces, would lead to better delivery of strategic factors (project and citizen factors taken together) in the e-government domain as depicted in Fig. 4.1. Thus, based on

the theoretical premise that managing continuity and change concurrently leads to better performance, the relationships between the constructs may be hypothesized for the three categories of performance factors as follows:

- Hypothesis 1: Managing the forces of continuity and change simultaneously (i.e., interaction of both forces) leads to better delivery of strategic factors in e-government projects.
- Hypothesis 2: Managing the forces of continuity and change simultaneously (i.e., interaction of both forces) leads to better delivery of project factors in e-government projects.
- Hypothesis 3: Managing the forces of continuity and change simultaneously (i.e., interaction of both forces) leads to better delivery of citizen factors in e-government projects.

### ***4.3.3 Methodology for Hypotheses Testing***

A three-step methodology is undertaken for testing the interaction of managing continuity and change forces on the three categories of e-government performance factors envisaged for the study, namely citizen factors, project factors, and the sum of these, i.e., strategic factors.

Step 1: All the micro-variables of change forces are regressed on each of the performance factors: citizen factors, project factors, and strategic factors.

Step 2: All the micro-variables of continuity forces are regressed on each of the performance factors: citizen factors, project factors, and strategic factors.

Step 3: The product of the significant micro-variables of continuity and change forces as identified in the above two steps is then regressed on each of the performance factors for testing the impact of interactions.

Finally, the variance explained ( $R^2$ ) by the predictor variables in each of the steps is compared. If the value of  $R^2$  as determined in step 3 is greater than those in steps 1 and 2, then the hypotheses of the study is accepted.

### ***4.3.4 Sample Description***

The unit of analysis for the study are the planners and implementers involved in G2C projects operational in India for at least 2 years. “Planners” refer to the higher-level officials, from both the government and implementing agencies, and generally include the project director, deputy director, technical director, project manager, etc. They are largely involved in planning, supervision, and monitoring of the project. “Implementers” refer to the middle-level front-end executives involved in the execution of the projects and include team leader, team member, system analysts, and similar executives. For the purpose of this survey, both planners and implementers are assumed as one homogeneous group of G2C service providers.



**Table 4.2** Project-wise breakup of the sample respondents for opinion survey

Sl. No.	Name of the project	No. of respondents		
		Planners	Implementers	Total
1	Agriculture-related projects (AGMARKNET, Plant Quarantine, etc.)	5	4	9
2	Backend (NSDG, Standards)	4	3	7
3	Online counseling	1	1	2
4	Common service center	3	2	5
5	E-district	2	1	3
6	E-post	2	2	4
7	Online EPFO	2	3	5
8	IRCTC (e-ticketing)	1	1	2
9	E-filing of taxes	7	7	14
10	E-payment of tax refunds	4	5	9
11	PAN (Permanent Account Number) project	3	5	8
12	Land records	2	3	5
13	MEDLAR (Medical Literature Analysis and Retrieval) MOH (Ministry of Health)	1	1	2
14	Monitoring vehicle movement	2	2	4
15	National do not call (NDNC)	2	1	3
16	National portal of India (NPI)	2	2	4
17	Online monitoring of NREGA	9	6	15
18	Online passport	6	9	15
19	Publishing exam results	1	2	3
20	RTI-related project (CIC online, Jaankari)	5	4	9
21	Transport vehicle registration	2	1	3
	<i>Total no. of respondents</i>	<i>66</i>	<i>65</i>	<i>131</i>

*AGMARKNET* Agricultural Marketing Information Network, *NSDG* National e-Governance Services Delivery Gateway, *EPFO* Employees' Provident Fund Organisation, *NREGA* National Rural Employment Guarantee Act, *RTI* Right to Information, *CIC* Central Information Commission

Response from a sample of 131 planners and implementers involved with the G2C projects (more than 20) has been elicited. A wide array of mission mode, state, and integrated G2C projects spanning various ministries and departments has been selected for the study. The method adopted for the sample selection has been largely purposive and judgmental, given the focus of the survey. For almost two third of the sample of this survey, the questionnaire has been personally administered by taking prior appointments as the eligible respondents were senior officials either in the government ministries or the implementing agencies like National Informatics Centre (NIC), International Business Machines (IBM), Tata Consultancy Services (TCS), etc. For the respondents stationed outside Delhi and National Capital Region (NCR), telephonic requests were made before forwarding the e-mail with the link to the questionnaire uploaded online. Several follow-up calls and emails were also sent to finally receive the response (Table 4.2).

## 4.4 Analysis

The key proposition of this chapter to be tested is that “interaction (product) of change and continuity forces leads to better delivery of the performance factors, i.e. impact of the product of significant continuity and change forces will explain greater variance in performance factors as compared to the impact of continuity and change forces taken separately.” For this, three sets of regression analyses have been undertaken: first, the three performance factors were regressed one by one on all change forces (8 micro-variables), then on all continuity forces (5 micro-variables), and finally on the interaction (products of three continuity and four change variables, i.e., 12 micro-variables) of significant change and continuity forces. The results of the regression analysis are summarized in Table 4.3 and the sample regression output explaining the steps are provided in Appendix 4.3.

## 4.5 Discussion

As is clear from Table 4.3, the interaction of continuity and change variables explains greater variation in the performance factors than when addressed or managed separately. In the case of overall strategic performance factors, four change forces (PGG, pressures for good governance; GPL, government policy and legislation; NTG, new technology; PPP, public–private partnership) and two continuity forces (CUL, existing culture; LCB: large citizen base) were found to be significant predictors explaining variance up to 28 and 23%. However, the interaction of these forces (product of four change and two continuity forces) resulted in four significant interactions explaining more than 40% variation in performance factors. The simultaneous impact/interaction of the change force of “pressures of good governance” and the “cultural continuity force” exhibits the maximum effect on all the categories of performance factors. Similarly, the concurrent management of change forces like “government policy and legislation” and the continuity force of “large citizen base” leads to a greater impact on performance factors. In all, seven interactions have been found to be significant predictors of performance factors.

The interaction of continuity and change variables explains greater variation in project factors as compared to citizen factors. This is because the project performance factors are directly controlled/maneuvered by stakeholders as compared to citizen factors, which are the ultimate deliverables. The summary of hypotheses tested is presented in Table 4.4.

## 4.6 Conclusion

The empirical study as reported in this chapter ably demonstrates that managing continuity and change simultaneously affects performance parameters, than when managed separately. The analysis of the results of the survey indicates the significant

**Table 4.3** Regression analysis summary for testing interaction of continuity and change forces on performance factors

Dependent variable	Independent variables	Significant predictor variables with beta coefficients	R	R <sup>2</sup>	Significant value
Strategic factors	All change forces	PGG(0.295), NTG(0.324), GPL(-0.228), PPP(0.174)	0.531	0.282	0.000
	All continuity forces	CUL(0.467), LCB(-0.225)	0.484	0.235	0.000
	Interaction of continuity and change forces	IPGGCUL(0.446), IGPLLCB(-0.525), IPPPCUL(0.249), INTGLCB(0.250)	0.637	0.406	0.000
Project factors	All change forces	PGG(0.270), NTG(0.300), GPL(-0.250), PPP(0.213)	0.511	0.261	0.000
	All continuity forces	CUL(.), LCB(-), ETIN()	0.515	0.265	0.000
	Interaction of continuity and change forces	IPGGCUL(0.418), IGPLLCB(-0.467), INTGETIN(0.270) IPPPCUL(0.195)	0.656	0.430	0.000
Citizen factors	All change forces	PGG(0.262), NTG(0.252)	0.441	0.195	0.000
	All continuity forces	CUL(0.433), ETIN(0.163)	0.443	0.196	0.000
	Interaction of continuity and change forces	IPGGCUL(0.354), IGPLLCB(-0.206), INTGCUL(0.266)	0.548	0.300	0.000

*PGG* pressures for good governance, *GPL* government policy and legislation, *NTG* new technology, *PPP* public–private partnership, *CUL* existing culture, *LCB* large citizen base, *ETIN* established traditional infrastructure, *IPGGCUL* interaction/product of PGG and CUL

**Table 4.4** Hypotheses relating to association of macro-variables

	Dependent variable	Associated with variable	Status of hypotheses
Testing the impact of interactions	Strategic factors	Comparing the impact of forces of change, continuity, and interactions	Accepted
	Project factors	Comparing the impact of forces of change, continuity, and interactions	Accepted
	Citizen factors	Comparing the impact of forces of change, continuity, and interactions	Accepted

change and continuity forces as predictors of e-government performance when managed separately. Two continuity forces and four change forces have emerged as significant predictors of e-government performance. In the case of concurrent management of both continuity and change forces, seven interactions have been found significant. The simultaneous impact of “good governance pressures” on the “existing cultural aspects” explains the maximum variation. The results of the survey also indicate a greater impact of the interaction on project factors than citizen factors, project factors being the immediate variable and the citizen factors being the final deliverables of the e-government projects.

This chapter is, thus, a modest attempt to validate the theoretical notion that managing continuity and change concurrently yields better results. Besides the theoretical contribution, the significant predictors as highlighted in the survey may provide valuable practical insights for the practitioners, i.e., the planners and implementers of the e-government project.

## Appendix

### *Appendix 4.1 List of Identified Forces of Change and Continuity in E-Government*

Sl. No.	Forces of change	Explanation
1	Globalization (GLB)	Globalization has placed strong pressures on states to compete for trade flows, investments, and resources and is a strong force outside the control of government. It affects the stakeholder's perception of service delivery and seems to be the basic imperative to change the way governments relate to the citizens
2	New opportunities(NOP)	“E-government is not just about forms and services online,” it brings about new and unique opportunities like enhanced efficiency, transparency, accountability, participation, effectiveness, etc. for all stakeholders
3	Pressures of good governance (PGG)	Governments are under continual pressure from the society to increase their effectiveness and efficiency, competing with their peers to provide electronic services to the citizens
4	Stakeholders' needs and expectations(SNE)	Citizens' expectations for better government services change with changing times. They expect a similar level of service from government as customers expect from e-business and hence e-alignment of e-government with the needs of the primary stakeholders is called for

Sl. No.	Forces of change	Explanation
5	New technology (NTG)	Adoption of information and communication technologies (ICT) to deliver government services has become a global trend in public administration. Proliferation of such new technologies has thus become the underpinning driver and enabler of e-government
6	The e-platform (EPF)	With citizens' increasing comfort level with the e-platform, the pressure to adopt e-government increases. E-government offers the potential to reform the public sector, just as e-commerce is driving change in the business sector
7	Government policies and legislation (GPL)	Changes in government policies and legislation are expected to pave the path for e-government implementation. Institutional infrastructure and apt legal framework has been identified by the researchers as a critical success factor for national e-strategy
8	Public-private partnership (PPP)	Public-private partnership has emerged as a viable alternative towards faster and sustainable growth of e-government initiatives, and hence can be considered as a significant driver for change in the domain
Sl. No.	Forces of continuity	Explanation
1	Large number and heterogeneity of citizen base (LCB)	The challenge of addressing a large and heterogeneous citizen base affects the implementation of e-government projects. Governments, however, have to focus on training the existing citizen base to use the new delivery mechanism rather than strategize to retain them, as is the case with business organizations where the inertia creeps in due to the fear of losing large customer base
2	Established traditional infrastructure (ETIN)	E-government projects inheriting huge traditional infrastructure, which may become redundant with the implementation of e-government technology, are expected to experience greater continuity
3	Existing process of service delivery (EPSD)	A preexisting network of supply chain/delivery process leads to a greater continuity in the current offering and could pose a major challenge for e-government implementation, if not adequately managed
4	Manual records or legacy databases (LDB)	From manual records to computerized databases and now networked databases, changes in governance have largely been technology driven, which if not leveraged can pose serious problems in e-government implementation
5	Existing culture (CUL)	E-government requires change in the processes, attitude, and mind-set of the government, which is a big challenge. In fact, the problem of change management in e-government implementation largely revolves around managing the existing culture

Source: Adapted from Nasim and Sushil 2010

**Appendix 4.2 Summary of the Attributes of the Questionnaires Used in the Opinion Survey**

Number of questionnaires for the study	Explanation of the terms and instructions	Sections and items in the questionnaire		
		PART-A	PART-B	Total no. of items in Part B
Questionnaire	Yes	Respondents' profile	Items related to change forces	110
(Used for opinion survey of the planners and implementers of e-government services)		Project profile	Items related to continuity forces	
		Other project details for cross verification	Items related to project actors Items related to citizen factors	

**Appendix 4.3 Sample Regression Output for Testing Interaction of “Continuity and Change Forces” on “Strategic Factors”**

(Similar steps have been performed to test interactions on project and citizen factors)

Step 1: Change forces as independent variable  
Variables entered/removed

Model	Variables entered	Variables removed	Method
1	AVCHPGG (pressures for good governance)		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤0.050, probability-of- <i>F</i> -to-remove ≥0.100)
2	AVCHNTG (new technology)		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤0.050, probability-of- <i>F</i> -to-remove ≥0.100)
3	AVCHGPL (Govt. policy and legislation)		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤0.050, probability-of- <i>F</i> -to-remove ≥0.100)
4	AVCHPPP (public-private partnership)		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤0.050, probability-of- <i>F</i> -to-remove ≥0.100)

<sup>a</sup> Dependent variable: STRGFACT (strategic factors)

Model Summary

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Std. error of the estimate
1	0.415	0.172	0.166	0.396
2	0.477	0.228	0.216	0.384
3	0.505	0.255	0.238	0.378
4	0.531	0.282	0.259	0.373

<sup>a</sup> Predictors: (constant), AVCHPGG

<sup>b</sup> Predictors: (constant), AVCHPGG, AVCHNTG

<sup>c</sup> Predictors: (constant), AVCHPGG, AVCHNTG, AVCHGPL

<sup>d</sup> Predictors: (constant), AVCHPGG, AVCHNTG, AVCHGPL, AVCHPPP

ANOVA

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	4.207	1	4.207	26.845	0.000
	Residual	20.217	129	0.157		
	Total	24.424	130			
2	Regression	5.559	2	2.779	18.859	0.000
	Residual	18.865	128	0.147		
	Total	24.424	130			
3	Regression	6.239	3	2.080	14.523	0.000
	Residual	18.185	127	0.143		
	Total	24.424	130			
4	Regression	6.885	4	1.721	12.366	0.000
	Residual	17.539	126	0.139		
	Total	24.424	130			

<sup>a</sup> Predictors: (constant), AVCHPGG

<sup>b</sup> Predictors: (constant), AVCHPGG, AVCHNTG

<sup>c</sup> Predictors: (constant), AVCHPGG, AVCHNTG, AVCHGPL

<sup>d</sup> Predictors: (constant), AVCHPGG, AVCHNTG, AVCHGPL, AVCHPPP

<sup>e</sup> Dependent variable: STRGFACT

Coefficients

Model		Unstandardized coefficients	Std. error	Standardized coefficients	t	Sig.
		B		Beta		
1	(Constant)	2.862	0.220		12.997	0.000
	AVCHPGG	0.275	0.053	0.415	5.181	0.000
2	(Constant)	2.318	0.279		8.304	0.000
	AVCHPGG	0.191	0.059	0.288	3.257	0.001
	AVCHNTG	0.211	0.070	0.268	3.028	0.003
3	(Constant)	2.640	0.312		8.452	0.000
	AVCHPGG	0.217	0.059	0.328	3.685	0.000
	AVCHNTG	0.254	0.071	0.323	3.558	0.001

		Unstandardized coefficients		Standardized coefficients	<i>t</i>	Sig.
Model		<i>B</i>	Std. error	Beta		
4	AVCHGPL	-0.140	0.064	-0.186	-2.179	0.031
	(Constant)	2.431	0.323		7.529	0.000
	AVCHPGG	0.196	0.059	0.295	3.310	0.001
	AVCHNTG	0.255	0.070	0.324	3.620	0.000
	AVCHGPL	-0.172	0.065	-0.228	-2.638	0.009
	AVCHPPP	0.116	0.054	0.174	2.155	0.033

<sup>a</sup> Dependent variable: STRGFACT

Step 2: Continuity forces as independent variables

Variables entered/removed

Model	Variables entered	Variables removed	Method
1	AVCTCUL (culture)		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤ 0.050, probability-of- <i>F</i> -to-remove ≥ 0.100).
2	AVCTLCB (large and heterogeneous citizen base)		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤ 0.050, probability-of- <i>F</i> -to-remove ≥ 0.100).

<sup>a</sup> Dependent variable: STRGFACT

Model Summary

Model	<i>R</i>	<i>R</i> <sup>2</sup>	Adjusted <i>R</i> <sup>2</sup>	Std. error of the estimate
1	0.430	0.185	0.179	0.393
2	0.484	0.235	0.223	0.382

<sup>a</sup> Predictors: (constant), AVCTCUL

<sup>b</sup> Predictors: (constant), AVCTCUL, AVCTLCB

ANOVA

Model		Sum of squares	<i>df</i>	Mean square	<i>F</i>	Sig.
1	Regression	4.526	1	4.526	29.342	0.000
	Residual	19.898	129	0.154		
	Total	24.424	130			
2	Regression	5.730	2	2.865	19.617	0.000
	Residual	18.694	128	0.146		
	Total	24.424	130			

<sup>a</sup> Predictors: (constant), AVCTCUL

<sup>b</sup> Predictors: (constant), AVCTCUL, AVCTLCB

<sup>c</sup> Dependent variable: STRGFACT

Coefficients



		Unstandardized coefficients		Standardized coefficients	<i>t</i>	Sig.
Model		<i>B</i>	Std. error	Beta		
1	(Constant)	2.266	0.320		7.086	0.000
	AVCTCUL	0.415	0.077	0.430	5.417	0.000
2	(Constant)	2.650	0.339		7.824	0.000
	AVCTCUL	0.450	0.076	0.467	5.955	0.000
	AVCTLCB	-0.140	0.049	-0.225	-2.871	0.005

<sup>a</sup> Dependent variable: STRGFACT

**Step 3: Interaction of change and continuity forces as independent variable**  
**Variables entered/removed**

Model	Variables entered	Variables removed	Method
1	IPGGCUL		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤ 0.050, probability-of- <i>F</i> -to-remove ≥ 0.100).
2	IGPLLCB		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤ 0.050, probability-of- <i>F</i> -to-remove ≥ 0.100).
3	IPPPCUL		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤ 0.050, probability-of- <i>F</i> -to-remove ≥ 0.100).
4	INTGLCB		Stepwise (criteria: probability-of- <i>F</i> -to-enter ≤ 0.050, probability-of- <i>F</i> -to-remove ≥ 0.100).

<sup>a</sup> Dependent Variable: STRGFACT

**Model Summary**

Model	<i>R</i>	<i>R</i> <sup>2</sup>	Adjusted <i>R</i> <sup>2</sup>	Std. error of the estimate
1	0.527	0.278	0.272	0.370
2	0.591	0.349	0.339	0.352
3	0.621	0.385	0.371	0.344
4	0.637	0.406	0.387	0.339

<sup>a</sup> Predictors: (constant), IPGGCUL

<sup>b</sup> Predictors: (constant), IPGGCUL, IGPLLCB

<sup>c</sup> Predictors: (constant), IPGGCUL, IGPLLCB, IPPPCUL

<sup>d</sup> Predictors: (constant), IPGGCUL, IGPLLCB, IPPPCUL, INTGLCB

**ANOVA**

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	6.792	1	6.792	49.689	0.000
	Residual	17.632	129	0.137		
	Total	24.424	130			
2	Regression	8.531	2	4.265	34.352	0.000
	Residual	15.893	128	0.124		
	Total	24.424	130			
3	Regression	9.415	3	3.138	26.555	0.000
	Residual	15.009	127	0.118		
	Total	24.424	130			
4	Regression	9.906	4	2.476	21.493	0.000
	Residual	14.518	126	0.115		
	Total	24.424	130			

<sup>a</sup> Predictors: (constant), IPGGCUL

<sup>b</sup> Predictors: (constant), IPGGCUL, IGPLLCB

<sup>c</sup> Predictors: (constant), IPGGCUL, IGPLLCB, IPPPCUL

<sup>d</sup> Predictors: (constant), IPGGCUL, IGPLLCB, IPPPCUL, INTGLCB

<sup>e</sup> Dependent variable: STRGFACT

### Coefficients

Model		Unstandardized coefficients	Std. error	Standardized coefficients	t	Sig.
		B		Beta		
1	(Constant)	2.932	0.153		19.116	0.000
	IPGGCUL	6.201E-02	0.009	0.527	7.049	0.000
2	(Constant)	3.241	0.168		19.298	0.000
	IPGGCUL	7.296E-02	0.009	0.621	8.216	0.000
	IGPLLCB	-2.993E-02	0.008	-0.283	-3.742	0.000
3	(Constant)	3.132	0.169		18.571	0.000
	IPGGCUL	5.795E-02	0.010	0.493	5.651	0.000
	IGPLLCB	-3.579E-02	0.008	-0.338	-4.423	0.000
	IPPPCUL	2.960E-02	0.011	0.245	2.735	0.007
4	(Constant)	3.087	0.168		18.381	0.000
	IPGGCUL	5.248E-02	0.010	0.446	5.013	0.000
	IGPLLCB	-5.562E-02	0.012	-0.525	-4.451	0.000
	IPPPCUL	3.007E-02	0.011	0.249	2.813	0.006
	INTGLCB	2.889E-02	0.014	0.250	2.064	0.041

<sup>a</sup> Dependent variable: STRGFACT

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# Chapter 5

## Development of Flexible Strategy

### Game-card: A Case Study

Neetu Yadav and Sushil

#### 5.1 Introduction

Measurement is a mess; these were the words from a manager during a discussion, “we measure everything that walks and moves, but nothing that matters” (Neely 1999, p. 206). In the past two decades, performance measurement and management have received a lot of interest among researchers. The issues related to development of strategic performance management framework had been discussed in the literature in the early 1990s. Balanced scorecard (BSC) has been proven to be a dominant performance measurement framework in the literature, which has been widely used all over the globe. In the past decade, the criticism of BSC (Kaplan and Norton 1992, 1996, 2004) has come on the horizon, and this gives a motivation to many researchers to develop the performance management frameworks that can be effectively used by the enterprises.

There is a plethora of research work done about performance management frameworks/models or systems in the past decade. Some researchers discussed the updates in BSC approach as Kanji’s business scorecard (Kanji and SA 2002), holistic scorecard (Sureshchandar and Leisten 2004), total performance scorecard (Rampersad 2005), system dynamics-based BSC (Barnabe 2011), etc. Other developments are performance prism (Neely et al. 2001), dynamic multidimensional performance framework (Maltz et al. 2003), performance planning value chain (Neely and Jarrar 2004), the performance management system framework (Ferreira and Otley 2009), and so on.

In the late 2000s, an attempt was made in this area by Sushil (2010) to propose a new performance management framework named as flexible strategy game-card, which intends to look beyond the scorecard concept and emphasizes on game-card.

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This evolving performance management framework intends to support the whole cycle of strategy formulation and execution and emphasizes to develop an integrated and dynamic view of enterprise performance management.

This chapter makes an attempt to develop a flexible strategy game-card by using this evolving performance management framework in a case context. Here, the case study has been developed in the context of one of the Indian telecom service-providing firms. The main objectives of this chapter are:

- To describe the mechanism for development of flexible strategy game-card for an enterprise
- To develop flexible strategy game-card in a case context

The structure of the remainder of the chapter is as follows. The second section of this chapter describes the structural overview of this evolving performance management framework, the third section discusses the mechanism for the development of flexible strategy game-card, in general for an enterprise, and the fourth section demonstrates the mechanism for the development of game-card in the case context. The last section of this chapter culls out the discussion related to the study and concludes with highlighting the limitations and future scope related to the study.

## 5.2 Flexible Strategy Game-card: A Description

Before giving the description of flexible strategy game-card, it is imperative to analyze the shortcomings of existing performance management frameworks, as this framework has intended to overcome some of the major shortcomings of existing performance management frameworks. Some aspects of BSC need to be balanced, such as balance of enterprise and customer factors, balance of continuity and change forces, balance of reactive and proactive drivers, balance of internal and external actors, and balance of internal and external processes (Sushil 2009).

The structural overview of the flexible strategy game-card has been exhibited in Fig. 5.1. It tells that this framework dominantly deals with two perspectives of performance, i.e. enterprise perspective, and customer perspective. Integrative perspective of performance has been taken from BSC, where all the major stakeholders are considered under the enterprise perspective and as the customers are in the center for enterprise's strategic decisions and actions, they are taken apart as another independent perspective. The theoretical roots of this framework lie in some classical approaches, such as integrative approach (BSC), stakeholder perspective (stakeholder theory), duality perspective (flowing stream strategy crystal), and operational aspects (SAP-LAP framework; Yadav et al. 2011; Yadav and Sushil 2014).

Enterprise perspective deals with situation-actor-process-performance (S-A-P-P) framework where situation factors are dealing with proactive and reactive measures of strategic actions and consists of external and internal situations. Actors are crucial factors for strategy formulation as well as strategy execution. Actor-related measures deal with internal as well as external actors. Process factors are

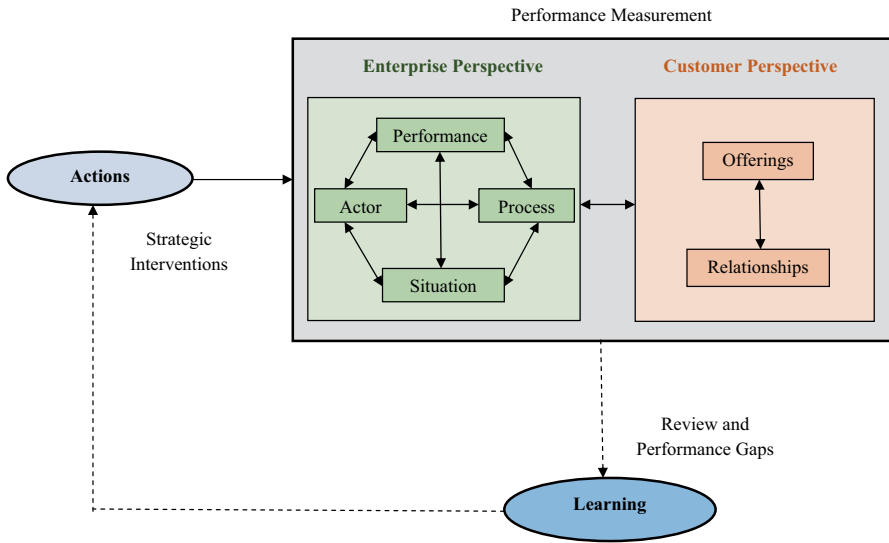


Fig 5.1 Flexible strategy game-card. (Adapted from Sushil 2010)

related to strategy execution and deal with internal and external business processes. Performance factors are treated as the lag factors that represent outcomes of strategy. These can be considered as financial as well as non-financial measures. Customer factors related to game-card consider the performance of the enterprise from the customer’s perspective, which is linked to the value in offerings and relationships to the customers.

This framework intends to support the whole cycle of strategy formulation, execution, learning, and corrective actions with the game-card and, thus, gives a dynamic view of the performance. The learning–action–performance (LAP) framework gives it an edge over existing performance management frameworks. It helps to take strategic actions as required learning from the performance measurements and reviews.

### 5.2.1 Critical Comparison with BSC

The authors attempt to present a critical comparison of flexible strategy game-card with BSC, which is presented in Table 5.1. It is clearly evident from the comparison that strategy game-card emphasizes the concept of dynamism in performance management system, and thus intends to overcome some of the major weaknesses of BSC.

The conceptual and theoretical bases of this framework have been clearly defined, but the application on the practical ground and steps for developing a game-card for any enterprise has not yet been discussed, where an attempt has been made to describe this in the next section.

**Table 5.1** Comparison with balanced scorecard

Parameter	Balanced scorecard	Flexible strategy game-card
Perspective	Four perspectives ( <i>financial, customer, internal business process, and learning and growth perspectives</i> )	Two perspectives ( <i>enterprise and customer perspectives</i> )
Situation	Not incorporated	External and internal situational aspects are incorporated
Actor	Some stakeholders are incorporated, external actors are neglected	External and internal actors are incorporated (major stakeholders in enterprise perspective, customer separately in customer perspective)
Process	Only internal business processes are incorporated	External and internal business processes are incorporated
Nature	Static	Dynamic (incorporation of learning–action–performance loop gives feedback to existing measures and corrective actions can be taken, if required)

### 5.3 Development of Flexible Strategy Game-card: Mechanism

For the application of a new framework, it is imperative to describe the steps or processes related to the development of that framework. In this light, it is imperative to discuss about the mechanism for the development of a flexible strategy game-card.

The important steps rooted into the flowing stream strategy process (Sushil 2013) for developing a flexible strategy game-card for any enterprise are as follows (Sushil 2011):

Step I: Identify the strategic factors and categorize the enterprise factors as S–A–P factors as per the structure of game-card.

Step II: Identify the customer-related strategic factors and categorize as value in offerings and relationships.

Step III: Develop the hierarchical structures of these factors exclusively for enterprise factors and customer factors or integrated enterprise and customer factors.

Step IV: Define measures and targets of various strategic factors.

Step V: Measure the existing performance, derive feedback, and define strategic direction.

Step VI: Identify the strategic actions and align them with strategic direction.

Step VII: Review, adaptation of strategies, and corrective actions.

The steps described above are developed for any enterprise in general, but it is important to discuss them in a case context. Here, an attempt is made to develop a flexible strategy game-card in case context, which is described in the next section.



## 5.4 The Case Study

For developing flexible strategy game-card, a case study has been developed here. The case company chosen for the study is one of the Indian telecom service providers (the data in the case study are realistic, whereas the name of the case company has been changed due to confidentiality issues).

### 5.4.1 Description of Case Company

Company C1 (fictitious name) is one of the largest and leading units providing comprehensive range of telecom services in India. C1 has a vision of being a leading telecom service provider in India with global presence and creating customer-focused organization with excellence in customer care, sales, and marketing. The company's mission is to generate a value for all stakeholders including employees, shareholders, vendors, and business associates, to offer differentiated products/services tailored to different service segments, and providing reliable telecom services that are value for money.

C1 operates in a hyper-competitive environment. The government policies related to tariff rates and spectrum allocation have a major impact on the strategic decisions and overall performance. For surviving in the competitive environment, the company has launched many new services such as third-generation (3G) services, value-added services (VAS), and broadband services. It has created partnership to provide VAS including content-based services and video calls to customers. C1 has world-class training centers and also established call centers in many parts of the country. For developing flexible strategy game-card, following steps have been implemented.

### 5.4.2 Step I: Identification of Strategic Factors Related to Enterprise Perspective

The strategic factors in enterprise perspective are related to S–A–P–P. For identifying strategic factors, semi-structured interviews have been conducted with the experts from the telecom service-providing firm. The interviewers are the personnel with the designation at senior level or top management. The strategic factors are identified using thematic content analysis and summarized as follows:

*Situation:*

- Fierce competition
- Government policies

*Actor:*

- Customer satisfaction
- Employee productivity

*Process:*

- Call completion rate
- New service offerings

*Performance:*

- Compounded annual growth rate (CAGR)
- Average revenue per user (ARPU)
- Number of subscribers

### ***5.4.3 Step II: Identification of Strategic Factors Related to Customer Perspective***

Likewise, the strategic factors related to customer perspective have been identified. These factors have been identified after interacting with the customers of the case company. The discussions carried out with the customers have been analyzed and with the help of thematic content analysis, the following factors related to customer perspective are identified:

*Value in offerings:*

- Quality of telecom services
- Product/service price

*Value in relationships:*

- Brand image of the operator

### ***5.4.4 Step III: Development of Hierarchical Structure***

The strategic factors related to enterprise and customer perspectives discussed in the above steps have been arranged in the hierarchical structure with the help of total interpretive structural modeling (TISM). TISM is an extension of interpretive structural modeling (ISM), which seeks the opinion of experts to develop the hierarchical relationships of the factors and demonstrates the interpretations and causes of the linkages (Sushil 2012).

One group of experts consisting of five members from the case company participated to respond to the interpretive knowledge base. The process for the development of TISM has been followed and the hierarchical structure integrating both enterprise and customer factors has been developed, and it is portrayed in Fig. 5.2. It helps to identify the driver and outcome factors of the performance for C1. The reachability matrix (with transitivity) and level matrix are shown in Appendix I.

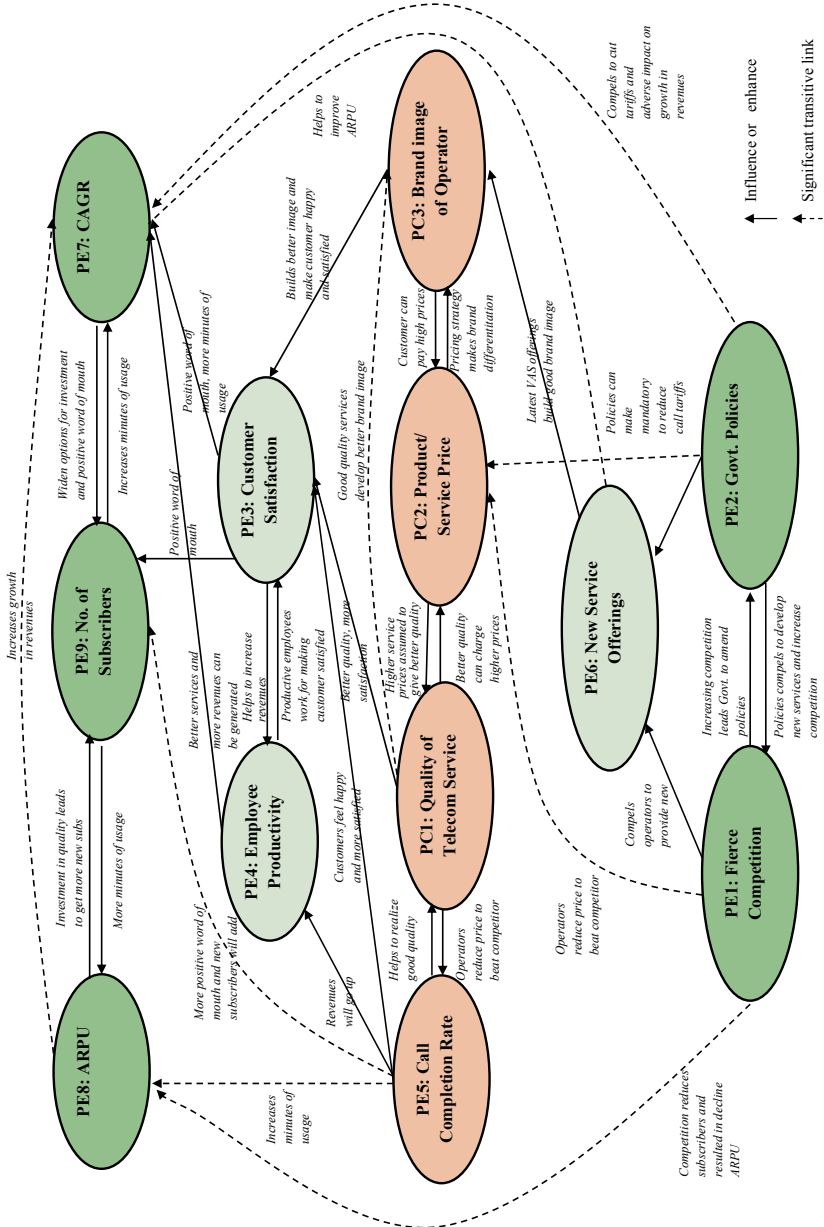


Fig. 5.2 Total interpretive structural model for strategic factors for case company

### 5.4.5 Step IV: Define Measures and Targets

The measures and their targets of the strategic factors that were identified in step II are defined with the help of company annual reports and secondary information available. The measures and targets are shown in Table 5.2.

The strategic factors that have been discussed qualitatively are now assessed in terms of identifying surrogate measures or direct measures. There are some factors that have direct quantitative measures, as ARPU, number of subscribers, customer satisfaction, etc. For other factors, such as quality of service, brand image of operator, competition, etc., their surrogate measures are identified. The existing targets are identified from the group performance management system and corporate scorecards developed by the case company—the existing targets are denoted as (As-Is).

### 5.4.6 Step V: Measurement, Feedback, and Strategic Direction

The existing performance results are measured against the targets set by the company. This helps the company to learn about the future and gives the direction for future targets. As there is no surrogate measures identified for “government policies,”

**Table 5.2** Measures and targets related to strategic factors

Code	Strategic factor	Measures	Targets (As-Is)
PE1	Fierce competition	Competition index	–
PE2	Government policies	–	–
PE3	Customer satisfaction	Customer satisfaction index (CSI)	5 (1–5 scale)
PE4	Employee productivity	Percentage of call center complaints resolved within 24 h	70%
PE5	Call completion rate	Percentage of call completed	50%
PE6	New service offerings	Percentage of new services offered	30%
PE7	CAGR	Growth in revenues Y-o-Y	20%
PE8	ARPU	Average revenue per user	₹ 200
PE9	No. of subscribers	No. of subscribers	170 million
PC1	Quality of telecom service	Percentage of connection with good voice quality	70%
PC2	Product/service price	Competitor's price	Same or below competitor's price
PC3	Brand image of mobile operator	Brand image index	7 (1–10 scale)

*CAGR* compound annual growth rate, *ARPU* average revenue per user

it has been removed from further analysis. The aspirations of the company management where they want to go in the future related to strategic factors are denoted as targets (To-Be). The existing performance results and aspiring targets are summarized in Table 5.3.

Strategy landscape (Sushil 2013) is a tool, which can be helpful to portray the existing targets and aspiring targets on one plane and gives an insight to decide the strategic direction for factors. The strategy landscape has been developed for the case company, which is shown in Fig. 5.3. It gives the direction to strategic interventions in terms of what to raise/improve, reduce, or maintain. This is exhibited in strategic direction diagram, which is shown in Fig. 5.4. The company's management has the aspiration to increase the call completion rate, number of subscribers, ARPU, CAGR, and new service offerings. The company has an adequate level of customer satisfaction, which it wants to maintain besides maintaining product price,

**Table 5.3** Performance results and aspiring targets

Code	Strategic factor	Measures	Targets (As-Is)	Performance	Targets (To-Be)
PE1	Fierce competition	Competition index	–	–	Reduce competition
PE3	Customer satisfaction	Customer satisfaction index (CSI)	5 (1–5 scale)	2.5	5
PE4	Employee productivity	Percentage of call center complaints resolved within 24 h	70 %	35 %	70 %
PE5	Call completion rate	Percentage of call completed	50 %	40 %	75 %
PE6	New service offerings	Percentage of new services offered	30 %	20 %	50 %
PE7	CAGR	Growth in Revenues Y-o-Y	20 %	15 %	25 %
PE8	ARPU	Average Revenue per user	200	100	200
PE9	No. of Subscribers	No. of subscribers	170 million	100 million	170 million
PC1	Quality of telecom service	Percentage of connection with good voice quality	70 %	55 %	70 %
PC2	Product/service price	Competitor's price	Same or below competitor	Same or below competitor	Same or below competitor
PC3	Brand image of mobile operator	Brand image index (ten-point scale)	7	4	7

*CAGR* compound annual growth rate, *ARPU* average revenue per user

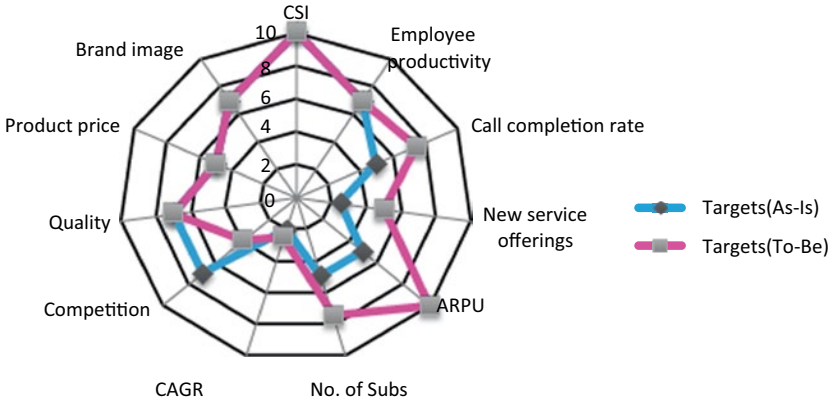


Fig. 5.3 Strategy landscape

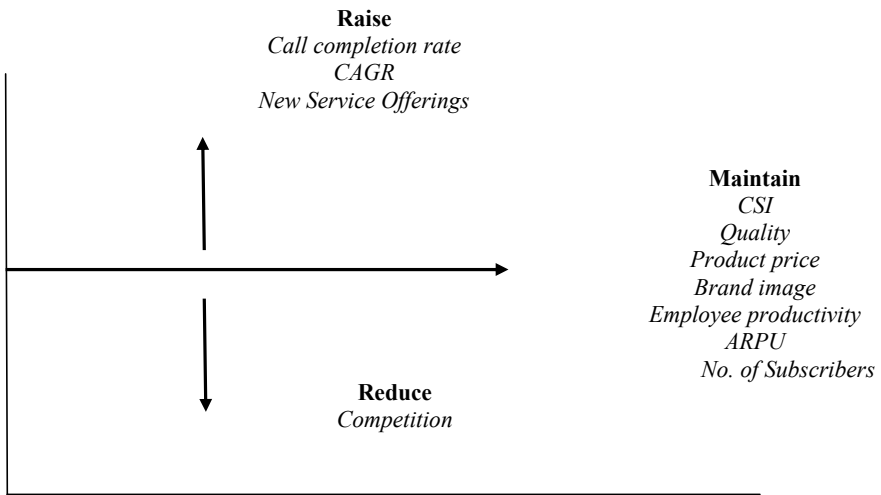


Fig. 5.4 Strategic direction diagram

quality, brand image, and employee productivity. The factor which the company expects to reduce is competition.

**5.4.7 Step VI: Align Strategic Actions with Strategic Direction**

Strategy alignment matrix is a tool, which is used here to align strategic actions with strategic direction. The feedback emerged from the performance results and the To-Be targets, the strategic interventions or actions need alignment with strategic direction. Table 5.4 exhibits the strategic direction for selected strategic actions in the form of strategy alignment matrix.

**Table 5.4** Strategy alignment matrix

Strategic action	Strategic direction		
	<i>Raise</i>	<i>Maintain</i>	<i>Reduce</i>
1. VAS offerings	ARPU, CAGR		
2. Roll out of services	No. of subscribers		
3. Mergers and acquisitions			Competition
4. Investment in network towers and infrastructure	Call completion rate, CSI	Quality of service	

*CAGR* compound annual growth rate, *ARPU* average revenue per user, *VAS* value-added services

This matrix helps the top management to review the performance by revising the strategic actions as well as executing new actions required. Here, the company looks to go for more mergers and acquisitions to reduce stiff competition. The company needs to provide more VAS, which helps to raise the CAGR and ARPU. The other strategic actions as investment in towers and infrastructure will help to maintain the quality of the service, which in turn, would increase the call completion rate and increase customer satisfaction.

#### 5.4.8 Step VII: Review, Adaptation, and Corrective Actions

The last step is about iterative learning and feedback to make corrective actions, adapting the changes required for the better performance results, as well as executing the new strategic actions required as per changing business environment and circumstances.

The company needs to develop a plan for the strategic actions to be executed, and, it will help to complete the whole cycle of strategic performance management which game-card is intended to develop. For company C1, the company can go to develop new strategies as per changes in the government regulations related to spectrum allocation. The revenues from voice-based services are reducing, so there is a need to develop the existing strategies for moving from voice-based services to data-based services and value-added apps and services.

## 5.5 Conclusion

This chapter makes an attempt to develop a flexible strategy game-card in a case context, which helps to understand the practical application of an evolving performance management framework. It presents the illustration for the development of game-card.

The strategic interventions that have a crucial role in effective performance results have been lacking in the existing performance management frameworks,

which are included in this framework exclusively, and give an edge to develop a dynamic and holistic performance management framework. The illustration presented here gives the practical application of flexible strategy game-card to the body of knowledge and can be used by researchers as well as practitioners. During this case development, it is realized that game-card can be considered as a development one step further to scorecard, as it has evolved from those four perspectives defined by BSC, but goes beyond objectives, targets, and measures to strategic direction, strategic interventions, and thus, it emphasizes double-loop learning.

There is a very limited application of this framework available in the literature, so this needs an extensive research. The interplay of strategic actions and strategic direction can lead to develop causal loop diagrams and feedback structure. This can further lead to develop system-dynamics models that can help to predict the likely behavior of the system for better performance results. This can be seen as a future direction of research related to game-card. There is a need to apply the proposed methodology in the context of services as well as manufacturing enterprises, which will help to get better insights in the application of this strategic performance management framework.

## Appendix I

### *Development of TISM*

**Table A1** Reachability matrix (with transitivity)

	PE1	PE2	PE3	PE4	PE5	PE6	PE7	PE8	PE9	PC1	PC2	PC3
PE1	1	1	1 <sup>a</sup>	1 <sup>a</sup>	0	1	1 <sup>a</sup>	1	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	0
PE2	1	1	1 <sup>a</sup>	1 <sup>a</sup>	0	1	1	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1	0
PE3	0	0	1	1 <sup>a</sup>	0	0	1	1	1	0	0	0
PE4	0	0	1	1	0	0	1	1 <sup>a</sup>	1 <sup>a</sup>	0	1 <sup>a</sup>	0
PE5	0	0	1	1 <sup>a</sup>	1	0	1	1	1	0	1 <sup>a</sup>	0
PE6	0	0	1	1	1 <sup>a</sup>	1	1	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>
PE7	0	0	0	0	1 <sup>a</sup>	0	1	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>
PE8	0	0	0	1 <sup>a</sup>	1 <sup>a</sup>	0	1	1	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>
PE9	0	0	0	0	1 <sup>a</sup>	0	1	1	1	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>
PC1	1 <sup>a</sup>	0	1	1	1 <sup>a</sup>	0	1	1	1	1	1	1
PC2	1	0	1	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1	1	1	1	1	1 <sup>a</sup>
PC3	1 <sup>a</sup>	0	1	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1	1	1	1 <sup>a</sup>	1	1

<sup>a</sup> Transitivity



**Table A2** Level matrix

Factor code	Strategic factor	Level
PE1	Fierce competition	V
PE2	Govt. policies	V
PE3	Customer satisfaction	II
PE4	Employee productivity	II
PE5	Call completion rate	III
PE6	New service offerings	IV
PE7	CAGR	I
PE8	ARPU	I
PE9	Number of subscribers	I
PC1	Quality of telecom service	III
PC2	Product/service price	III
PC3	Brand image of operator	III

*CAGR* compound annual growth rate, *ARPU* average revenue per user

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# Chapter 6

## Flexible Strategy Game-card Framework for Effective Strategy Execution

Amit Srivastava and Sushil

### 6.1 Introduction

The criticality of strategy execution is well recognized by the scholars of all times (Hrebiniak and Joyce 1984; Kaplan and Norton 1996; Bossidy and Charan 2002; Martin 2010; Srivastava and Sushil, 2013, 2014). However, there are comparatively much more researches on strategy formulation than execution (Noble 1999; Hrebiniak 2006). The failure of many leading organizations indicated the challenges and problems of execution. Responding to the challenges of execution, many scholars, especially since the past 15 years, started paying heed to addressing strategy execution issues. The performance measurement and management have been found to be a missing link and the need for a framework of link strategy execution with the performance management is realized.

Evaluating the organization performance is always needed but the complexity of how to effectively measure the performance often perplexes organizations. There are both external and internal demands for organization evaluation. An organization should proactively measure the performance and effectiveness in order to learn and grow. Scholars have argued that at individual level, hierarchically based performance appraisal has not been successful in improving the overall organizational performance (Mohrman et al. 1991). Therefore, a comprehensive and integrated performance management system is required for the organizational development (Training 1988). The traditional performance management systems have been limited to individual-level evaluation that has been used to quantify and justify salary increase (Schneier et al. 1991).

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The fundamental task of strategic management is defining what the organization aspires to achieve and what exactly needs to be done to achieve those goals. This exercise leads to the collection of information within a data system that effectively tells the organization how it is performing. Although each step of the organization evaluation comes with challenges of their own, they also provide an organization with a toolbox of knowledge to continue to improve and grow the organization in a changing environment. Both the practitioners and scholars have realized that organizations need an integrated framework, which can be used not only to monitor different perspectives of performance but also for smooth strategy execution (Hrebineak and Joyce 1984; Rodgers 1990; Ulrich and Lake 1990; Schneier et al. 1991; Srivastava and Sushil, 2013). Such an integrated framework can give an organization a competitive strength to achieve and sustain the winning edge.

## 6.2 Background Literature

The balanced scorecard (BSC) was a major step for the development of a strategic management system to translate the strategy into action (Kaplan and Norton 1992, 1996, 2008). The BSC focuses on four perspectives for performance measurement and monitoring for smooth strategy execution—financial, customer, internal business, and learning and growth. It has been much debated and received a wide range of appreciation and criticism. Many organizations today use second and third generation of BSC, which is contextual to organization needs and challenges (Egalson and Waldersee 2000; Kennerley and Neely 2000).

The BSC has, for the first time, come forward to balance multiple aspects for the development and execution of the strategy such as short- and long-term objectives, financial and nonfinancial measures, lagging and leading indicators, and external and internal performance perspectives. However, there are a number of aspects, which are yet to be balanced, such as balancing enterprise and customer factors, continuity and change forces, reactive and proactive drivers, internal and external actors, and internal and external processes (Sushil 2008). The theoretical roots of stakeholders' management and management of paradoxes could help in understating this.

The seminal work of Freeman and Reed (1983) articulated the “stakeholder model” to replace the “managerial model” of the firm. He defines stakeholders as “any group who can affect or is affected by the achievement of the firm’s objectives.” With the changing business dynamics, organizations are broadening their understanding about the actors who can influence the firm’s performance. They now need to develop the understanding of groups previously perceived to be external to the firm. These have also been called “influencers,” “claimants,” “constituents,” or “interest groups.” The understanding of the stakeholders also reflects our understanding of the nature of the business itself, which forms the basis of any description we may make (Kaler 2003). This may be explained by saying that when we are referring to stakeholders, we are constructing a narrative about the company (Freeman 1999). This is equally true in the case of developing a model of strategy formulation and execution. We cannot refer to stakeholders without setting out the

values, criteria, and conceptions that allow them to be reorganized and classified as such with interests, the purpose of relationship, and value given to it by each actor must be considered (Lozano 2005).

Demonstrating the paradoxical principles, Miller (1990) explained the downfall of excellent organizations, which focused on one extreme of strategies, policies, attitudes, and events. This extreme approach may give initial success but in due course, the extreme attractors bring organizations to failure. The successful organizations are characterized by paradoxes showing integration or fit, on one hand, and differentiation or split on the other (Pascale 1990; Tushman and Anderson 1997). Therefore, the organizations need to manage the paradoxes and balance between many alternatives (Bahrami 1992; Handy 1994). With the increasing turbulence in the environment, it is important to visualize the need for managing duality to not only survive current success but also innovating for tomorrow. The “either/or” concepts need to be replaced by “both–and” conjoint (Volberda 1997; Sushil 2009; Nasim and Sushil 2010, 2014). For example, hybrid centralized/decentralized operations could be the most effective way of reengineering business processes (Hammer and Champy 1994; Sushil 2000; Sushil 2008).

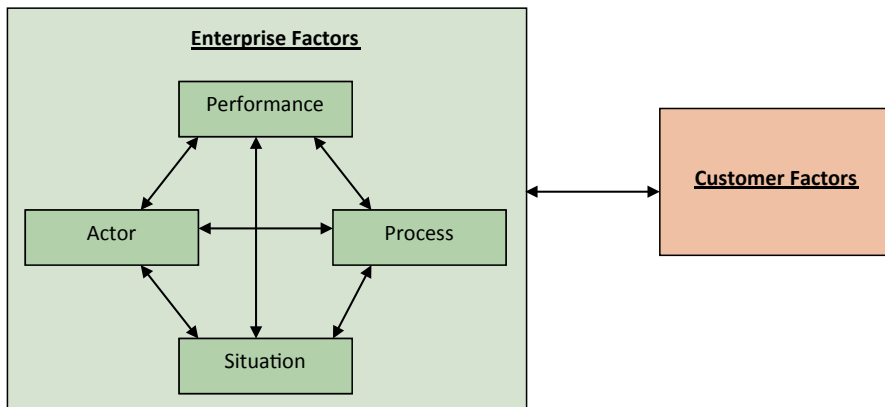
### 6.3 Flexible Strategy Game-card

The BSC framework could be viewed as no more than a measurement system. On the other hand, there is little direction on how the framework should be used. The points of major criticism of BSC pointed out by Sushil (2008) are:

- *Filtering*: Limiting the number of measures in a perspective reduces the value of lead indicators (Egalson and Waldersee 2000; Kennerley and Neely 2000).
- *Clustering*: It is difficult to modify the four perspectives as per the needs of the organization (Kaplan and Norton 1996; Kennerley and Neely 2000).
- *Causality*: There is a lack of empirical support for the causality proposed in the BSC (Ittner and Larker 1998; Norreklit 2000).

At the same time, it has also been highlighted that BSC needs to be more balanced consisting of different perspectives while measuring and managing the strategic factors. This scenario led to the need for developing a more comprehensive framework covering the whole strategy cycle in an integrative manner. Sushil (2012, 2013) proposed the flowing stream strategy crystal, which is the seed for developing such a transformative framework. He argues that the continuity and change forces define the current reality of the organization. The strategy is to be formulated in terms of strategic factors, which can broadly be classified into two types, i.e., customer factors and enterprise factors (Fig. 6.1).

The game-card could be a tool to develop and execute the strategy, while score-card is simply a measurement tool. This may be where new strategy models, such as flowing stream strategy, come into play. The limitations of BSC need to be overcome and moved to the background of strategic thinking as no more than a measurement tool and less of a strategy development and execution tool. The continuity and



**Fig. 6.1** Flexible strategy game-card. (Adapted from Sushil 2010)

change forces represent the current reality of the organization, which acts as a basis for the strategy to be formulated in terms of key strategic factors, i.e., enterprise factors and customer factors. These four components lead to crystallization of the flowing stream of the enterprise and are portrayed as the flowing stream strategy crystal (Sushil 2013; Yadav and Sushil 2014). The strategic factors related to the enterprise perspective are: situation (SF1), actor (SF2), process (SF3), and performance (SF4). The strategic factors related to customer perspectives are: offerings (SF5) and relationships (SF6; Fig. 6.2).

The strategy formulation and execution can be based on these strategic factors. These factors can be mapped for both the strategy under process and new strategy. The enterprise as well as customer factors contribute to define the strategy in an actionable form. These factors can be measured as well as monitored during strategy execution so as to meet the strategic objectives effectively. The “flexible strategy game-card” can be used for playing the strategy game in terms of strategy formulation as well as execution. Some important steps in implementing the game-card include: developing total interpretive strategy map, playing the strategy game in terms of factors and their targets, scoring the performance of the game, and changing the strategy game during review. It takes the strategic performance management a step ahead in terms of taking both the strategy formulation and execution side by side so as to integrate all the aspects of strategic performance management rather than simply acting as a tool for performance monitoring and review.

#### **6.4 Linkages Among the Strategic Factors of Flexible Strategy Game-card**

The review of the literature and initial discussions with the experts and practitioners led to the research objective of developing linkages among the strategic factors suggested in flexible strategy game-card. The holistic and integrated picture of strategic

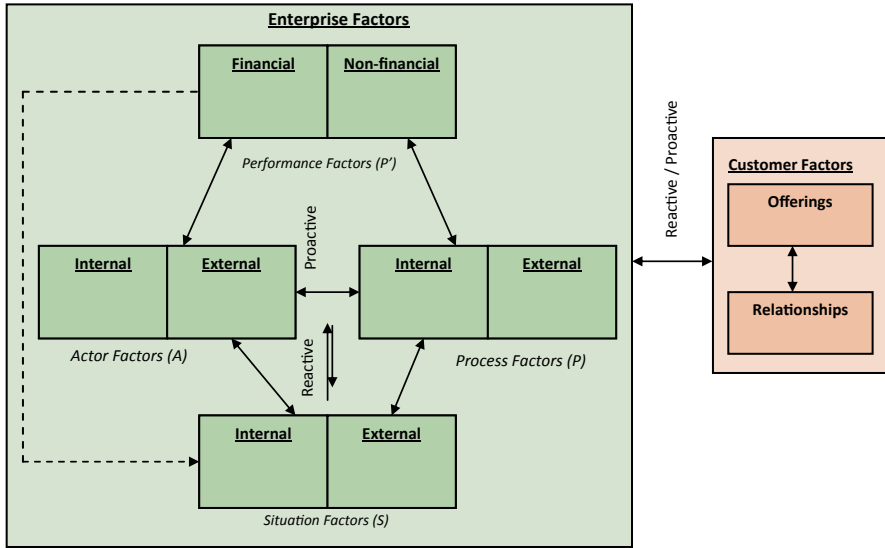


Fig. 6.2 Strategic factors in flexible strategy game-card

factors would result in better understanding of not only measuring strategy execution performance but also adding value to make strategy formulation and execution more effective.

### 6.4.1 Methodology

The first logical step followed is the literature review, which is conducted using electronic databases: Elton B Stephens company (EBSCO), ScienceDirect, ProQuest, and Google Scholar. Following the literature review, we had a 4-h discussion with 48 corporate practitioners in India to further explore strategic factors. The average years of experience of the participants was 9.3, and they represent 12 industries (Table 6.1). The depth of experience of participants and breath of industry covered helped in making the exploratory exercise more comprehensive. Considering the literature and opinion of practitioners and experts, we confirmed the six strategic performance factors suggested in “Flexible Strategy Game-card”: situation (SF1), actor (SF2), process (SF3), performance (SF4), offerings (SF5), and relationships (SF6).

“Interpretive structural modeling” (ISM) is applied to develop the structural hierarchical relationships among the strategic performance factors. An ISM survey was conducted to take experts’ and practitioners’ views. The participants also gave feedback on the interpretation of the causal linkages (Appendix 6.1). The interpretation helps to answer how the linkages make sense in a given context (Corley and Gioia, 2011). Finally, the “total interpretive structural model” (TISM) was developed demonstrating linkages among strategic performance factors as indicated in

**Table 6.1** Profile of participants of brainstorming discussion ( $N=48$ )

Criteria	Respondents' profile
Sectors	ICT (27.1%), power (12.5%), consulting (10.4%), banking (8.3%), construction (8.3%), and others
Functional areas	Operation (33.3%), IT (14.6%), planning (10.4%), marketing (10.4%), HR (4.2%), consulting (4.2%), and others
Hierarchical level	Lower management (35.4%), middle management (35.4%), and top management (29.2%)
Total work experience (years)	Minimum (3), maximum (28), mean (13.5), and SD (8)
Experience in the current organization (years)	Minimum (1), maximum (27), mean (8.5), and SD (7)
Planning/coordination/execution	Planning (29.2%), coordination (20.8%), and execution (50%)
Leadership role	Leadership role (70.8%), non-leadership role (29.2)

*SD* standard deviation; *ICT* information and communication technology

flexible strategy game-card (Nasim 2011; Sushil 2012; Srivastava and Sushil 2013; Nasim and Sushil 2014; Srivastava and Sushil, 2014a). To reduce the risk of invalidity and intransitivity, this study conducts face-to-face interviews with the respondents and takes majority view. The development of TISM is also an effort towards methodological value addition. The steps in developing TISM are:

1. Identify and define elements
2. Define contextual relation
3. Interpretation of relation
4. Interpretive logic of pair-wise comparison
5. Reachability matrix and transitivity check
6. Level partition on reachability matrix
7. Developing digraph
8. Interaction matrix
9. Total interpretive structural model

### 6.4.2 Results and Discussion

Most companies realize the importance of financial and nonfinancial performance measures; however, they have failed to represent them in a balanced framework. Some companies and researchers have concentrated on financial performance measures; others have concentrated on operational measures (Kaplan and Norton 1992). The BSC remains a means of effectively measuring strategy rather than a means of deciding strategy (McAdam and O'Neill 1999). Increasing competition has forced the companies to measure the performance differently, with much more emphasis



**Table 6.2** Reachability matrix of strategic factors

	SF1	SF2	SF3	SF4	SF5	SF6
SF1	1	1	1	1	1	1
SF2	1 <sup>a</sup>	1	1	1	1 <sup>a</sup>	1 <sup>a</sup>
SF3	1	1	1	1	1	1
SF4	0	0	0	1	0	0
SF5	0	0	0	1	1	1
SF6	0	0	0	1	0	1

*SF1* Situation, *SF2* Actor, *SF3* Process, *SF4* Performance, *SF5* Offerings

<sup>a</sup> Significant transitive links

**Table 6.3** Summary of level partitioning

Sr. No.	Strategic factor	Reachability	Antecedent	Intersection	Level
1	Situation	1,2,3	1,2,3	1,2,3	IV
2	Actor	1,2,3	1,2,3	1,2,3	IV
3	Process	1,2,3	1,2,3	1,2,3	IV
4	Performance	4	1,2,3,4,5,6	4	I
5	Offerings	5	1,2,3,5	5	III
6	Relationships	6	1,2,3,5,6	6	II

now on measures directly related to operations and to the areas of strategic importance (Bromwich and Bhimani 1994; Dent 1996). Better balance in performance measurement, with measures that monitor both external relations and the efficiency of internal processes, is required for sustaining the organizational success (Euske et al. 1993). The outcome of the TISM exercise produces the direct and transitive links between the strategic factors (Table 6.2). On the basis of the direct and transitive link, the reachability matrix is developed, and consequently, the level partitioning is done to show the logical hierarchical relationship among the strategic factors identified in flexible strategic game-card (Table 6.3).

The final TISM of strategic factors demonstrate that situation (SF1), actor (SF2), and process (SF3) are the most important driving forces for other strategic factors (Fig. 6.3).

The TISM framework bolsters the proposition that strategic game-card needs to reflect on the organization, the actors in the organization, and the nature of relationship (Lozano 2005). These three elements cannot be addressed by an isolated company model, management model, a description model, a comprehension model, and legitimacy model. Further, addressing stakeholders requires contextualization and evolution of the relationships among the actors.

*Situation (SF1)* The situation factors are critical in a turbulent environment. These factors are basically the reactive drivers and diagnose the environment for strategy formulation. These factors consist of both internal and external factors. The internal

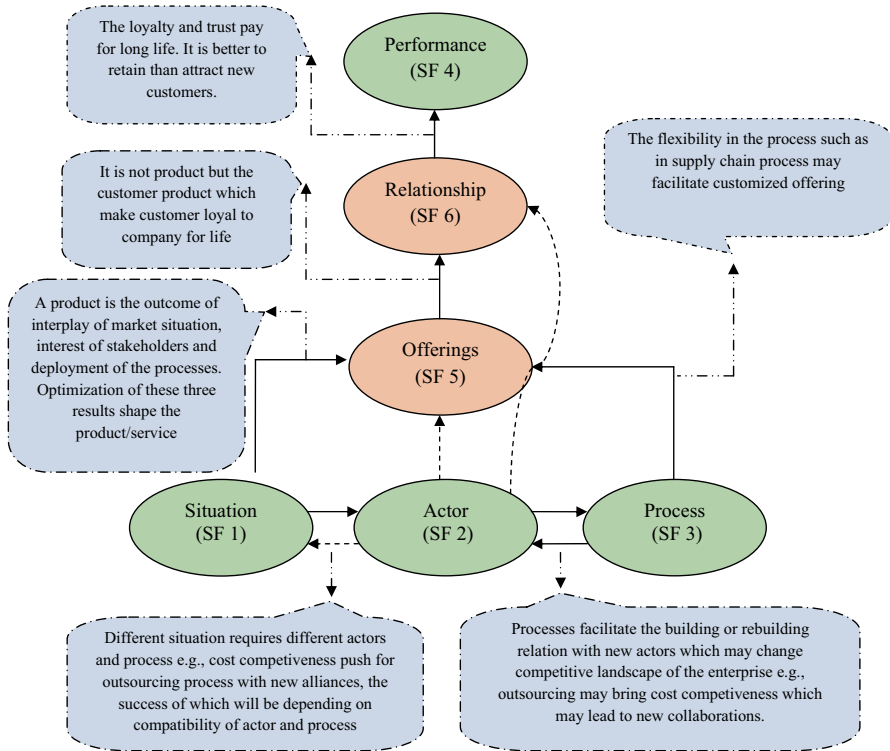


Fig. 6.3 The TISM framework of strategic factors. TISM total interpretive structural modeling

situation factors are the feedback on performance of strategy under operation and reflect on strengths and weaknesses of the enterprise. Some of the examples of the internal situation factors are: poor financial health, strong technology base, and declining market share. On the other hand, the external situation factors reflect on the opportunities and threats in the business environment. Some important external situation factors are: competition, growing demand, globalization of market, volatile financial market, etc.

The traditional BSC fails to discuss the strategic situation factors and, therefore, it was limited to performance monitoring. The flexible strategy game-card exemplified the mingling of strengths, weaknesses, opportunities, and threats (SWOT) matrix with the BSC. This approach provides a roadmap to understand both the internal and external situations (Lee and SaiOnKo 2000). The companies which have most accurate and up-to-date information will have the competitive edge to their rivals (Lee and SaiOnKo 2000). Information helps in the analysis process and decision making and consequently has better chances to guarantee strategy execution success. The SWOT analysis serves as a great “stepping stone” to build the key performance indicators (KPI) of the BSC. The financial measurements tend to measure the past; therefore, an organization knows what has happened without explanations

of “why it has happened” (Sanger 1998). The flexible strategy game-card not only paves the way to learn about what is happening but also keeps on updating why it is happening, which helps in the betterment of the strategic weak areas, and finally leads to better financial as well as nonfinancial performance.

*Actor (SF2)* The actors are also key drivers of strategic performance factors. They are of two types—internal (leadership, employees’ capabilities, learning, etc.) and external (vendor capability, inter-alliance capability, corporate social responsibility, etc.). The strategic internal actors are partially presented in “learning and growth perspective” of BSC. Traditional accounting-based performance measurement systems are unsuited to current organizations in which the relationships with employees, customers, suppliers, and other stakeholders have changed. Established measures lack the focus to evaluate intangibles such as service, innovation, employee relations, and flexibility. For example, only few companies have systems for monitoring employee satisfaction and development (Sveiby 1997).

The BSC was a unique step forward to develop holistic performance management system to define performance measures and communicating objectives and vision to the organization (Roest 1997). A stakeholder approach to performance measurement captures strategic planning issues, while the choices a company makes in strategic planning direct the design of the performance measurement system (Atkinson et al. 1997). The two sets of actors identified in flexible strategy game-card bring more clarity in measuring and managing actors and setting strategic direction and actions accordingly. The TISM exercise rightly reveals that actors are also among the most important drivers for strategic factors (Srivastava, 2014). The actors not only affect other important strategic drivers, such as situation and process, but also affect offerings and relationships with the customers who ultimately positively influence the performance of the enterprise.

*Process (SF3)* The process factors are also crucial for effective strategy execution. The process factors are also related to the internal and external business processes. Innovation, knowledge management, quality improvement, etc., exemplify strategic internal process factors. On the other hand, supply chain, branding, strategic alliances, etc., exemplify strategic external process factors. The process development is difficult to be monitored with formalized methods of measurement (Lothian 1987). Many scholars have pointed out a need of covering the process issues in performance measurement. For example, there is a need for supply chain performance measurement (Gunasekaran et al. 2004). The reduction in order cycle time leads to reduction in supply chain response time, and as such is an important performance measure and source of competitive advantage (Christopher 1992). For example, by analyzing the customer order path, non-value-adding activities can be identified so that suitable steps can be taken to eliminate them.

As depicted in TISM framework, the strategic process factors drive other strategic performance factors. For example, supplier partnership formation is vital in supply chain operations and as such for efficient and effective sourcing. Performance evaluation of buyers or suppliers is simply not enough; relationships must be evaluated (Macbeth and Ferguson 1994; Graham et al. 1994). The link in a supply chain

that directly impacts customers is delivery. It is a primary determinant of customer satisfaction; hence, measuring and improving delivery is always desirable to increase competitiveness (Christopher 1992; Stewart 1995; Gunasekaran et al. 2004). Flexibility in meeting a particular customer delivery requirement at an agreed place, packaging, and mode of delivery, etc. influences the decision of customers to place orders, and therefore, flexibility in process is important in enhancing and retaining customers and finally affecting organization performance (Novich 1990).

*Performance (SF4)* The final outcome of a strategy is reflected in the performance factors that are also termed as key result areas (KRAs) or “lag factors” in the BSC. The performance factors are both financial and nonfinancial in character. The primary stakeholders have direct impact on the strategy and function of an organization and secondary stakeholders are intermediaries in the process. The literature on stakeholder management highlights that if important “internal” or “external” stakeholders becomes dissatisfied from the corporate system, the corporation will be seriously damaged. Jones (1995) argues that firms that develop relationships with primary stakeholders based on mutual trust and cooperation are in a better position to gain an advantage over firms that do not. Such exchanges are beneficial to primary stakeholders as they receive more value as well as to the firm as they gain advantages that improve the performance (Jones 1995; Prahalad 1997). A high level of responsibility towards primary stakeholders is an indicator of superior management skill, which leads to lower explicit costs (Alexander and Buchholz 1982).

The time is also an important strategic issue that companies should strive to measure and improve in order to be able to compete in the world market. Measuring, controlling, and compressing time will increase quality, reduce costs, improve responsiveness to customer orders, enhance delivery, increase productivity, reduce risks since reliance on forecasts is reduced, increase market share, and increase profits (Stalk 1988; Bockerstette and Shell 1993; Ghalayini and Noble 1996). The reducing cycle time reduces costs and improves customer satisfaction, which in turn, increases revenue. While financial performance measurements are important for strategic decisions and external reporting, day-to-day control of manufacturing and distribution operations is often handled better with nonfinancial measures (Maskell 1991). A measurement system should also facilitate the assignment of metrics to where they would be most appropriate (Gunasekaran et al. 2004).

*Offerings (SF5)* A happy customer is the key characteristic of a world-class company. Some of the strategic offering factors are choice, delivery, connectivity, packaging, etc. (Kald and Nilsson 2000). These factors vary across the industries and acquire the criticality depending upon the strategic direction of a firm. The consequences of combining performance measurement with a customer approach will depend very much on which concept of the consumer is being invoked (Pollitt 1988). The relationship between market orientation and business performance can be situation specific, where there can be other moderating variables (Jaworski and Kohli 1993). Still the impact of marketing with focus on customer’s needs and satisfaction influence organizational performance (Diamantopoulou and Hartb 1993; Lee and SaiOnKo 2000). The BSC does a great job in strengthening the link

between customer improvement initiatives and the organization's strategy. However, the BSC does not indicate how new customers and markets can be identified (McAdam and O'Neill 1999). The "flexible strategic framework" measures multiple perspectives of performance. This also results in tracking changing customer need and brings insights on how to incorporate that in the strategy. For example, in the modern supply chain, customers can reside next door or across the globe, and in either case they must be well served. Therefore, to assess supply chain performance, supply chain metrics must center on customer satisfaction (Lee and Billington 1992; Van Hoek 2001).

*Relationships (SF6)* The current performance measures pay limited attention to the areas that directly affect the customer relationship (Ittner and Larcker 1998). Scholars have argued that nonfinancial measures including customer relationships may better predict financial performance and, therefore, such measures should be integrated with financial measures (Wallman 1995; Kaplan and Norton 1996). Healthy relationships with customers improve financial performance by increasing loyalty of existing customers, lowering marketing cost, enhancing firm reputation, etc. (Fornell 1992; Anderson et al. 1994; King and Burgess 2008). Though achieving strong customer relationship may require additional investments that may have negative impact on performance (Bowbrick 1992), usually scholars and practitioners agree on positive association between customer relationship and financial performance of organization (Aaker and Jacobson 1994).

## 6.5 Conclusion

This study develops linkages among the strategic performance measurements for effective strategy execution. The TISM framework bolsters the proposition that strategy execution excellence needs to reflect on the organization, the actors in the organization, the nature of relationships, the changing situations, etc. The TISM model demonstrates that the structural understating of strategic performance factors (SPFs) is more useful in managing strategy execution. For example, firms that are doing well on actor-related measures, i.e., developing strong relationships with strategic actors, based on mutual trust and cooperation, have better chances of achieving process improvements and higher financial performance. The actors not only affect other important strategic drivers such as situation and process but also affect offerings and relationships that ultimately influence financial performance. Situation factors has been the central focus of strategy research. However, unfortunately, rarely any framework integrates strategic situation factors in performance measurement systems. The TISM exercise highlights that situation, actor, and process factors are the key drivers that help in identifying key financial and nonfinancial performance measures for effective strategy execution. The proposed TISM framework may also help in bridging the gap between strategy formulation and strategy execution. The framework integrated strategy formulation with execution planning.

The situation, actor, and process factors are to be based on strategic direction and accordingly they suggest performance measures to be monitored for effective execution of a given strategy.

## Appendix 6.1 TISM Questionnaire<sup>a</sup>

S. No.	Element	Paired comparison of variables of 'Adapt'	Yes/No	In what way a variable will influence/enhance other variable? Give reason in brief
1	A1–A2	Adapt the targets—modify the strategies		
2	A1–A3	Adapt the targets—reformulate strategic plan		
3	A1–A4	Adapt the targets—redefine operational plan		
4	A1–A5	Adapt the targets—reassess capabilities		
5	A1–A6	Adapt the targets—adaptive culture		
6	A1–A7	Adapt the targets—incorporating reflections		
7	A2–A1	Modify the strategies—adapt the targets		
8	A2–A3	Modify the strategies—reformulate strategic plan		
9	A2–A4	Modify the strategies—redefine operational plan		
10	A2–A5	Modify the strategies—reassess capabilities		
11	A2–A6	Modify the strategies—adaptive culture		
12	A2–A7	Modify the strategies—incorporating reflections		

<sup>a</sup> Considering the large size of the questionnaire, only a part of it is given here

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**Part II**  
**Information and Business Agility**

# Chapter 7

## Strategic Flexibility in Exploiting Economies of Scope on 70–30 Principle: A Case Study of Japanese Electronics Industry

Ushio Sumita and Jun Yoshii

### 7.1 Introduction

In the midst of the global mega-competition, the most competitive battlefield is often referred to as the tripod consisting of the USA, EU, and Japan. The common characteristics of the three markets can be found, in that they have advanced to the matured market economy from the growing market economy.

In the growing market economy, consumers share the sense of lacking goods and services for consumption and are eager to possess what others have. In this situation, a typical R&D strategy from the manufacturers' side would be the market-out strategy, where the economies of scale prevail and products of good quality with reasonable price are introduced into the market in large volumes. In contrast, in the matured market economy, consumers tend to pursue individual tastes in consumption so as to maximize their own utility functions. In other words, consumers are interested in acquiring goods and services that others may not have but fit their particular needs. Naturally, this trend results in a variety of products and services in small quantities and the market segmentation becomes extremely important. A typical successful R&D strategy in this stage would be the market-in strategy, where a variety of products are introduced into the market in small quantities in response to particular needs in particular market segments.

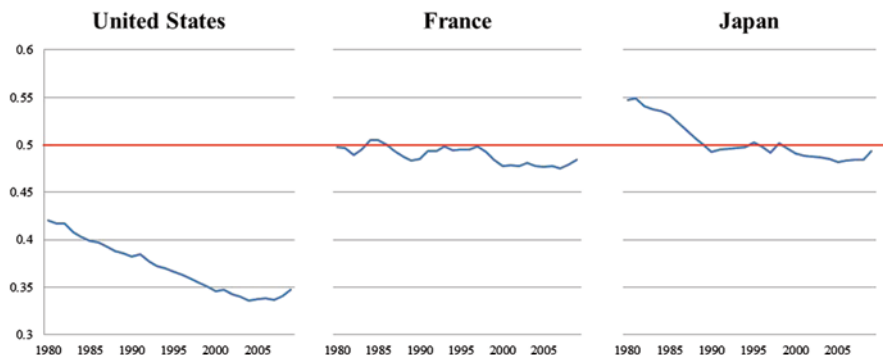
In order to identify the advancement of the market economy from the growing stage into the matured stage in a quantifiable manner, one may consider the necessary consumption against the selective consumption. The necessary consumption is to maintain the current level of life, whereas the selective consumption is purely

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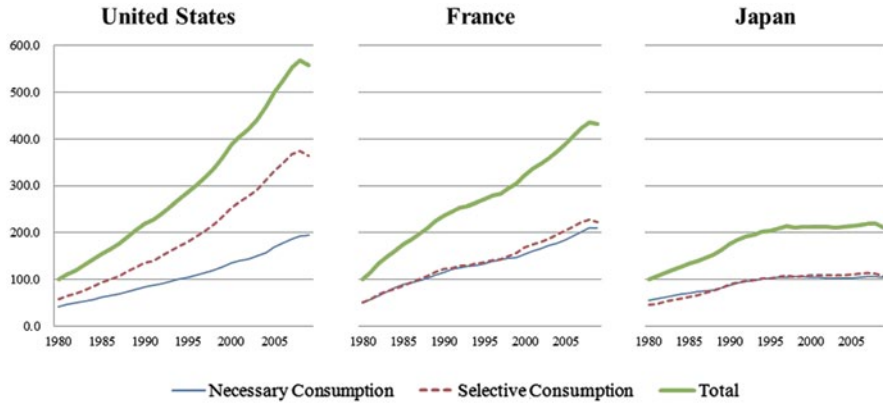


**Fig. 7.1** Portion of necessary consumption in total consumption. (Data source: OECD.Stat Extracts)

to enhance individuals' utility functions, including the cost for children to inherit the desirable life standard. The former is represented by consumptions for food and nonalcoholic beverages, clothing and footwear, housing, water, electricity, gas, and other fuels. The latter includes consumptions for alcoholic beverages, tobacco and narcotics, furnishings, household equipment, communications, recreation and culture, education, restaurants and hotels, and the like. We define that a market has advanced to the matured market economy if the selective consumption supersedes the necessary consumption. Otherwise, the market is still in the stage of the growing economy.

In Fig. 7.1, the portion of the necessary consumption in the total consumption is plotted for the period 1980–2009 for the USA, France, and Japan. One sees that both the USA and France have reached the stage of the matured market economy by 1980, whereas Japan has reached it in 1989. While consumers in the USA continue to shift to the selective consumption more or less steadily, consumers in France and Japan are more modest, in that this shift is quite slow. Similarly, in Fig. 7.2, the total consumption, the necessary consumption, and the selective consumption are depicted with the 1980 data as a base of 100. Table 7.1 provides actual numbers for 1980 and 2009. During this period, the total consumption has increased by 5.6 times in the USA, where this increase for the selective consumption is 6.3 times and that for the necessary consumption is 4.6 times. These figures are 4.3, 4.4, and 4.2 for France and 2.1, 2.4, and 1.9 in Japan, respectively. Again, the modesty of consumers in France and Japan can be observed against consumers in the USA.

As long as the real economy is concerned, the economies of scale are always present. Since the matured market economy requires more detailed marketing strategies for individual segmented submarkets, the efficiency resulting from the economies of scale tends to diminish. In other words, if corporations have to deal with separate segmented submarkets in a one-on-one manner, the profit margins would inevitably decrease. In order to overcome this difficulty, the authors claim that the 70–30 principle becomes extremely important, where products and services for separate segmented submarkets are designed 70% in common with



**Fig. 7.2** Necessary consumption versus selective consumption (1980 Data = 100). (Data source: OECD.Stat Extracts)

**Table 7.1** Necessary consumption versus selective consumption (1980 Data=100). (Data source: OECD.Stat Extracts)

Country	USA		France		Japan	
Year	1980	2009	1980	2009	1980	2009
Necessary consumption	42.0	193.8	49.7	209.5	54.8	103.5
Selective consumption	58.0	364.2	50.3	223.2	45.2	106.4
Total	100.0	557.9	100.0	432.7	100.0	209.9

the remaining 30% for customization so as to cater for peculiarities of individual submarkets. In R&D, for example, the market-in approach is no longer effective, where one core technology produces one product in response to a particular need of one submarket. Instead, if a core technology is newly developed, it should be combined with different peripheral technologies, yielding multiple products to be sold in totally separate submarkets based on the 70–30 principle.

The purpose of this chapter is to identify the emerging trend of the 70–30 principle in Japan and to examine its effectiveness for strategic flexibility and business agility in the following areas.

1. Hollowing out production bases outside Japan: skeleton import (SI) approach
2. Business model expansion: smart card from integrated circuit (IC) ticket to e-Money and credit card
3. R&D: Emaki for producing static connected photos from digital movies
4. Preventive maintenance in semi-conductor manufacturing: Profile vectors and cockpit system
5. e-Marketing: dynamic customer segmentation for enhancing customer relationship management (CRM)

## 7.2 70–30 Principle in Hollowing Out Production Bases Outside Japan: SI Approach

In the matured market economy, manufacturers have to deal with segmented submarkets separately by incorporating a variety of products in small quantities. Naturally, this new competitive environment demands more sophisticated inventory and other operations management, potentially increasing the associated costs. In order to respond to this challenge, by taking advantage of the Internet, the manufacturing industry in Japan has been shifting rapidly from “production based on demand estimates” to “production based on confirmed orders,” thereby enabling one to reduce the inventory costs and other operational costs significantly. The order-based production is now one of the key factors to be competitive in manufacturing.

In printer business in Japan, for example, the confirmed orders of a day would be sent to a domestic manufacturing plant from the sales offices across Japan through the company’s intranet. During the night, the production plan of the next day would be established based on these confirmed orders. A typical production lead time for printers is 1 day, and the ordered products would be produced by the end of the next day, and packaged and shipped out on the following day. Accordingly, the market lead time from the generation of an order to the delivery of the products would be within 3 days. In organizing the value chain in this scheme, it is not necessary to estimate daily demands, and the inventory of the final products are completely eliminated. Only the inventories of parts and materials, typically worth of a few days, would be reserved.

Another pressure facing the manufacturing industry in Japan is to reduce the production costs further. In this regard, many Japanese manufacturing companies have moved their production facilities partially or completely to China and other Asian countries. In the literature, many different factors are discussed for motivating outward foreign direct investment (FDI), including heterogeneity in productivity among domestic firms (Helpman et al. 2003, 2004), networks to sell products to buyers from the same country (Greaney 2003), rapid demand growth in the FDI host country (Rob and Nikolaos 2003), and cheaper costs for labor and others (Horstmann and Markusen 1992; Yomogida 2004). For the case of Japan, the last two factors seem to be most important. Other references concerning FDI and the hollowing out effects include (Cowling and Tomlinson 2000; Matsubara 2004; Gaston and Nelson 2004).

While moving the production facilities abroad may reduce the production costs significantly, it also inevitably incurs additional logistics costs at the same time. Furthermore, the market lead time would be prolonged and the order-based production becomes impossible because of the transportation time over several days. This means that it is necessary to estimate daily demands of the final products and to keep the safety stocks at domestic distribution centers in order to sustain the same level of the customer satisfaction achieved by the order-based domestic production.

In order to compensate these negative effects, certain Japanese companies have been implementing the SI strategy, where a variety of products of one type in small quantities would be designed in such a way that a common frame (called Skeleton) can be used for all the products, and various product specifications can be mounted onto the common frame. While skeletons are produced abroad and imported to Japan, manufacturing operations to meet a variety of product specifications are done at logistics centers in Japan.

The major advantage of the SI strategy can be found in the following manner. If the production facility is moved abroad for  $K$  different products of one type without the skeleton design, it is necessary to estimate daily demands of the  $K$  products separately. In contrast, if the skeleton design is present, it is only necessary to estimate the total demand of the  $K$  different products, since only skeletons common for all the  $K$  products are produced abroad. In order to observe this major advantage of the SI strategy more explicitly, let  $D_i(t)$  be the demand of the  $i$ -th product for day  $t$ . The total demand  $D(t)$  of the  $K$  products for day  $t$  is then given by

$$D(t) = \sum_{i=1}^K D_i(t) \quad (7.1)$$

It can be seen that

$$Var[D(t)] = \sum_{i=1}^K Var[D_i(t)] + 2 \sum_{i < j} Cov[D_i(t), D_j(t)] \quad (7.2)$$

Since the  $K$  different products are variations of one product type, they are substitutable, in that the demand increase of product  $i$  would be likely to result in the demand decrease of any other product. Accordingly, one has  $Cov[D_i(t), D_j(t)] < 0$  so that  $Var[D(t)] < \sum_{i=1}^K Var[D_i(t)]$ . This means that the estimate of the total demand can be more accurate than the sum of the individually estimated demands. Because of this, the safety stock of the skeletons at a distribution center may be reduced in comparison with the sum of the safety stocks of the  $K$  final products, resulting in significant reduction of the inventory costs.

In summary, the SI approach would produce only skeletons abroad, which are common for all  $K$  products. The skeletons would then be shipped to distribution centers in Japan where the final processing for meeting the specifications of the individual products would take place. The confirmed orders of day  $t-1$  would be sent to distribution centers from the sales offices across Japan through the company's intranet. During day  $t$ , the ordered products would be processed by incorporating necessary specifications onto skeletons. By the end of day  $t+1$ , they would be packaged and shipped out, resulting in the market lead time of 3 days, provided that the inventory stock of skeletons is large enough. Such a combination of production of skeletons abroad and value-added logistics within Japan enables one to take advantage of the cost reduction by producing abroad and to maintain the almost-order-based production with the minimum market lead time at the same time. The reader is referred to Sumita and Isogai (2007) for further details.

### **7.3 70–30 Principle in Business Model Expansion: Smart Card from IC Ticket to e-Money and Credit Card**

In Japan, an automated ticket gate system was first installed in 1969 at a station of Kinki Japan Railway on an experimental basis, where a passenger placed a magnetized ticket into the system, and its validity would be confirmed by the system after reading the ticket. The gate was then opened and the passenger walked through the gate, picking up the ticket which would emerge at the end of the gate system. Since then, the system spread rapidly in Kansai area, and almost all of the private railway companies in Kinki and Kansai areas installed the system at all stations by the middle of the 1980s. Japan Railway (JR), then owned by the Japanese government, and other private railway companies in Kanto area were rather reluctant to introduce the system, and one had to wait until the late 1990s to enjoy the system in Kanto area. The technological difficulty of the automated ticket gate system is centered on how to synchronize the speed of reading and processing a ticket and the average walking speed of passengers. This technological achievement was recognized by the Institute of Electrical and Electronics Engineering (IEEE) as “IEEE Milestone” in November 2007. As of March 2012, only six prefectures of Japan (Ishikawa, Fukui, Tottori, Shimane, Tokushima, and Miyazaki) have not introduced the system yet.

Commuters of railways often use a monthly pass, a 3-month pass, or even an annual pass. When a ticket gate was attended by a station clerk, a commuter would pull out a transparent pass holder and show it to the clerk to go through the gate. As the automated ticket-gate system became widely spread, such passes were also magnetized. A commuter had to pull out a pass holder, take the pass out of the pass holder, run it through the automated ticket-gate system, re-collect it after passing through the gate, put it back to the pass holder, and then put the pass holder into a pocket or a bag. While the automated ticket-gate system would provide both the cost reduction and the better convenience to ordinary ticket passengers, it actually degraded the service to pass users who were apparently important for railway companies. In order to overcome this problem, a group of researchers at Railway Technical Research Institute, led by Dr. Shigeo Miki, started to hatch an idea of using an IC card to replace a magnetized ticket as early as the middle of the 1970s. However, at that time, many railway companies were overwhelmed by the huge investment needed to install the automated ticket-gate system, and could not afford to pursue an alternative technological development simultaneously. However, the research group of Railway Technical Research Institute, with help from Sony researchers, never gave up the idea, despite the fact that they failed to gain support from the top management.

The persistence of the research group resulted in the successful development of a rechargeable contactless smart card named Suica standing for Super Urban Intelligent Card. Launched in November 2001 by JR East, which had been privatized in 1987, the card was originally used as a fare card for transportation services. The



card is used in the following manner. A passenger passes over a card reader, where the technology allows the card to be read at some distance from the reader and the direct contact is not required. Typically, people keep the card in their wallet and just pass the wallet over the reader as they go through the ticket gate. The balance on the card is displayed at the ticket gate and a travel record is stored. The minimum fare is required to enter the train system. Upon exit, the card is again passed over the card reader and the fare is deducted from the balance with the resulting new balance displayed at the ticket gate. Should the remaining balance be not enough to cover the necessary fare, the card is recharged automatically by transferring a prespecified amount from the bank account of the passenger.

As of March 2011, more than 35 million Suica cards have been issued. Many other railway companies followed this new development by issuing their own smart cards, including Setao by Tokyu in 2002, IC Operating Card (ICOCA) by JR West in 2003, Postpay it Touch and Pay (PiTaPa), where “Touch” is abbreviated as “Ta” following the Japanese way of pronouncing “Touch,” by railway companies in Kansai area other than JR in 2004, Tokai IC Card (TOICA) by JR Tokai in 2006, and PASMO (Here, “PASMO” is a newly created word where “PAS” taken from “PASnet” and “MO” from “More.”) by railway companies other than JR in Kan-to area in 2007. Such systems were introduced separately and independently, and were incompatible against each other. For the sake of the convenience of customers, however, many of them have been integrated by now. For example, the two most popular smart cards, Suica and PASMO, are now completely interchangeable.

Originally, these smart cards were developed as a fare card for transportation services, providing cost reduction for railway companies, and enhanced convenience for passengers. In order to recover the huge investment needed, however, the business model has been expanded rapidly. This expansion began with using the smart card for e-Money within railway stations. Most vending machines, kiosks, and coin-operated lockers within railway stations can now be paid by the card. In addition to payment, the card also functions as an electronic key to open the locker occupied by the cardholder. The e-Money function of the card was soon expanded to stores outside railway stations. Many retail chain stores, including 7-Eleven, FamilyMart, Circle K Sunkus, Yodobashi Camera, and Bic Camera, now support transactions with some of such smart cards.

In order to expand the potential of the smart card further, it can now also function as an ordinary credit card through collaboration with Visa or MasterCard. Many transportation services other than railway, such as bus and taxi, can be paid by the card. Some corporations use the smart card as the company ID card as well. Recently, the smart card functions described above have been transferred to smart phones, providing a mobile smart card. In place of the smart card, the smartphone with these functions can now be used. As we discussed above, the original business model of automating the ticket processing at railway stations has been expanded into many different directions, where the core model is common and built upon the contactless radio frequency identification technology. Subsequent developments have been made by providing limited software–hardware alterations specific to individual

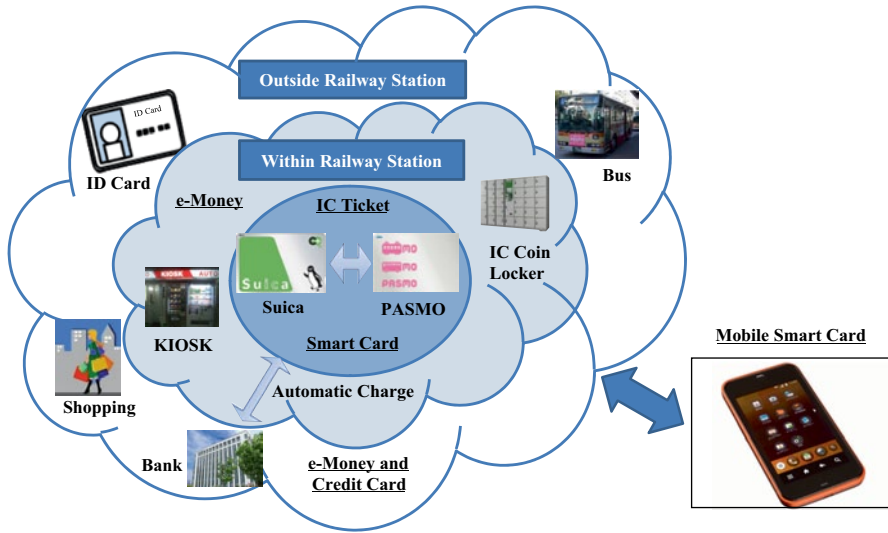


Fig. 7.3 Business model expansion of railway smart cards

developments, demonstrating the effectiveness of the 70–30 principle in business model expansion as depicted in Fig. 7.3.

#### 7.4 70–30 Principle in R&D: Emaki for Producing Static Connected Photos from Digital Movies

In R&D, it is quite difficult to overcome the inefficiency resulting from the efforts to respond to various market needs spread across different segmented submarkets. Typically, R&D involves huge investments. If corporations deal with such small submarkets by providing a variety of products in small quantities in a one-on-one manner, the advantage of the economies of scale is doomed to disappear, and it becomes extremely difficult to recover the huge investments promptly. This observation suggests that the 70–30 principle is most important and effective in R&D.

The basic scheme for implementing the 70–30 principle in R&D management is depicted in Fig. 7.4. Here, upon finding a new scientific phenomenon, a core technology is first established. By combining the core technology with different peripheral technologies, the value-creation engine should be designed which could function as solution tools for providing multiple products in totally separate markets. Naturally, the core technology is the key for the competitive edge of the company and may be developed internally. For developing the peripheral technologies, however, the company may work with other companies which have the necessary fundamental technologies. So as to provide different products in different markets, the company may also collaborate with other companies having the marketing expertise in

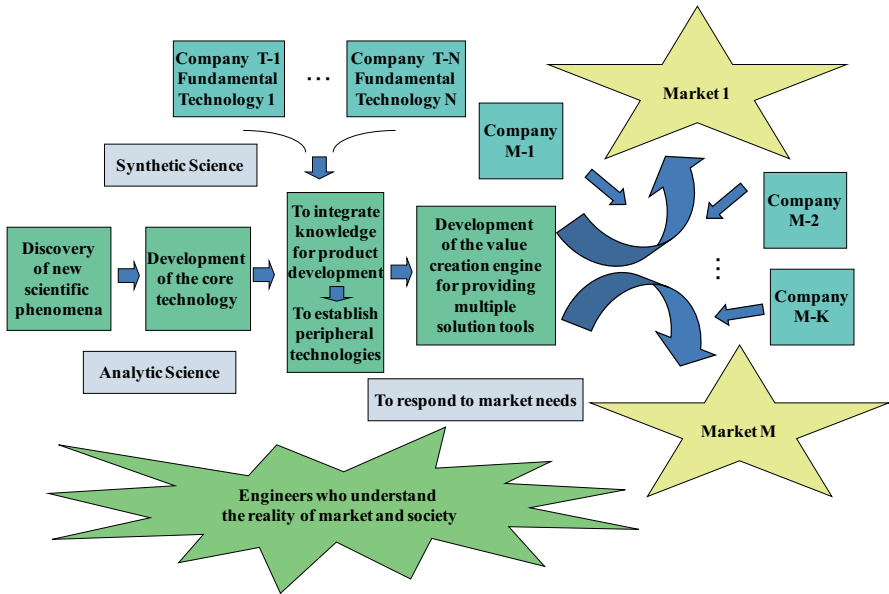


Fig. 7.4 R&D management based on the 70–30 principle

those markets. The development costs for the peripheral technologies are typically much less than the development cost of the core technology. By providing multiple products developed through the common core technology combined with different peripheral technologies, it becomes possible to gain profits from separate markets simultaneously, thereby enabling one to recover the development costs efficiently.

As an example of exercising the 70–30 principle in R&D management, we discuss a case of a company named Emaki. Emaki, meaning a picture scroll in Japanese, was established in 2000 in the city of Aizu in Fukushima prefecture as a subsidiary of Aizu Construction Company (ACC). At that time, ACC was involved in the project to rebuild the areas along the Abukuma River after the flood which had occurred in 1998. To the astonishment of ACC, the company could not find the data necessary to recover from the damages, and understood the need to capture the state of the damages along the river over a quite long distance. The president of ACC, Mr. Tadahiro Kanke, came up with an idea to shoot a digital movie of the river by flying a helicopter above it and then to construct a picture scroll of the river from the digital movie. This is possible because the digital movie is actually composed of a sequence of static digital photos, typically around 30 frames per second, which change little by little in an almost lattice continuous manner if the camera is moved slowly. Such digital photos can be patched together to produce a static long picture scroll. Wisely, he assumed that the necessary technology was already available and explored the market, finding that the fundamental technology existed in relation with the military technologies led by NASA, Massachusetts Institute of Technology (MIT), and Hebrew University. He immediately flew to Israel

and signed the exclusive license agreement for the fundamental technology with Hebrew University.

He hired several PhD students from Aizu University and established Emaki. The fundamental technology in this case, representing the 70–30 principle, is to construct a static picture scroll from the digital movie by patching a sequence of static digital photos obtained from the movie. By combining peripheral software interfaces with the fundamental technology, the company successfully developed many application packages, including the road state assessment system, the dam and river assessment system, and the avalanche state assessment system. Emaki also applied the basic idea of constructing a picture scroll of a subject over quite a long distance by patching the static digital photos extracted from the digital movie to the tunnel maintenance. In order to prevent the tunnel surface from detaching and falling, JR companies used to slowly run an open-deck car in the tunnel after midnight where several maintenance engineers on the deck would closely observe the tunnel surface within the assigned angular sectors, and find cracks if any. Emaki developed a system with three digital cameras fixed to a high-speed open-deck car so that digital movies of one side of the tunnel surface, the other side of the tunnel surface, and the upper side of the tunnel surface could be shot simultaneously. By patching the digital photos generated from the three digital movies not only along the time axis but also along the three angular sectors, a flat picture scroll of the tunnel surface over quite a long distance can be constructed, thereby enabling one to detect even subtle cracks which may be missed in the previous approach. Furthermore, in collaboration with the medical school of Chiba University, a similar idea was applied to develop a system for detecting polyps and cancers in the large intestine. This example demonstrates the effectiveness of the 70–30 principle in R&D.

## **7.5 70–30 Principle in Semiconductor Manufacturing: Preventive Maintenance via Profile Vectors and Cockpit System**

In semiconductor manufacturing, a sequence of sophisticated manufacturing processes is involved, often exceeding several hundred production steps. These production processes are quite unique in that they possess both aspects of continuous and discrete operations. On the one hand, many production steps are related to chemical diffusion for etching layers of circuits and such steps ought to be controlled continuously. On the other hand, the final products are semiconductor chips that are clearly discrete in nature. Combined with necessary ultraprecision technologies, these factors make semiconductor manufacturing extremely difficult to control and force one to rely upon quite expensive automated production machines. Accordingly, the cost of machine downtimes in semiconductor manufacturing is quite huge. When a major failure of a production machine occurs, vendor engineers have to be called in often, and the repair may sometimes take more than a few days.

Apart from such major failures, the machine downtimes due to minor stoppages would also amount to the huge loss. A minor stoppage is defined to be a machine failure which requires the direct involvement of an operator for repair, but the repair time is quite short once the problem is addressed by the operator. Typically, an operator is responsible for multiple production machines. Since frequency of minor stoppages is quite high and it is not rare to have multiple minor stoppages occurring simultaneously, a machine with a minor stoppage may have to wait until it is attended by the operator. Because of such waiting times, the machine downtimes due to minor stoppages often exceed 40% of the working hours of a day. Accordingly, it is extremely important to develop effective ways for controlling such minor stoppages.

In the literature, the issue of enhancing the yield and reducing the machine downtime in manufacturing has been addressed largely from the point of view of detecting root causes of the product defects based on some data mining techniques (Gardner and Bieker 2000); for example, employ a combination of self-organizing map, neural networks, and rule induction to identify the critical poor yield factors in the wafer manufacturing process. In Chen et al. (2005), correlations between combinations of machines and the defective products are first analyzed. The technique of association rule mining is then used to establish the root-cause machine identifier efficiently. Chien et al. (2007) focus on the wafer fabrication process and challenge the problem of detecting root causes based on a Kruscal–Wallis test, K means clustering and the variance reduction approach.

Here, the main idea behind the K means clustering is to classify a set of N vectors into K clusters by defining K centroids in an arbitrary manner at the beginning. Then, each vector is assigned to the nearest centroid. When all vectors have been assigned, the centroids are recalculated within their respective clusters. This procedure is repeated until the K centroids no longer move, resulting in K clusters of the N vectors.

While these contributions may enable one to identify the correlation structure between combinations of machines and the defective products, and detect root causes of the defections, they do not provide preventive maintenance policies automatically. In particular, in semiconductor manufacturing, effective methodological tools for preventing the minor stoppages are hard to come by. Part of the reason for this difficulty may be found in that there are many different potential sources of minor stoppages. Certain minor stoppages may be attributed to factors related to products, including shape, size, weight, pins, and the like. In addition, deterioration of machine conditions may cause minor stoppages. Human Resource (HR)-related factors such as work shifts, skills of workers, and training programs would also affect minor stoppages.

In order to control both major failures and minor stoppages in semiconductor manufacturing, it is important to monitor the state of the manufacturing processes continuously and prepare preventive maintenance strategies in a proactive manner. With this objective in mind, the authors have been working with a semiconductor manufacturing company to develop an information infrastructure named cockpit system, as depicted in Fig. 7.5. Here, all production machines are connected to a local area network (LAN) and monitored continuously through the LAN. Massive

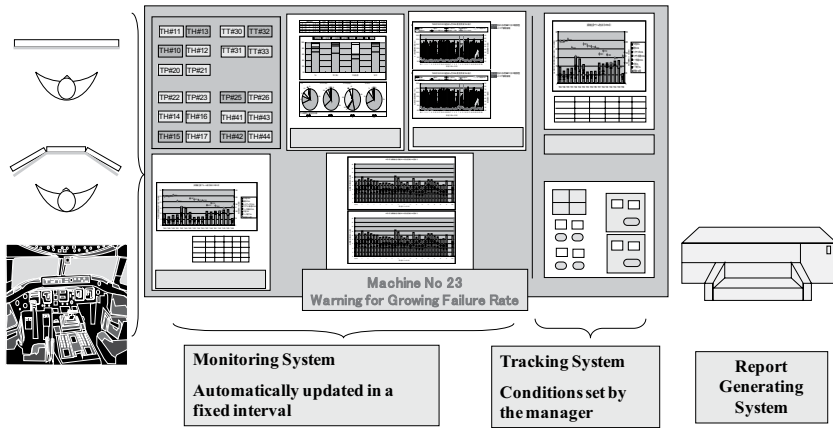


Fig. 7.5 Conceptual scheme of the cockpit system

data are collected at a server and fed into a database (DB), enabling one to trace status changes of production machines with time stamps and causes. Two analytical engines are developed to extract the management information from the DB in a timely manner. One engine is called monitoring system, which automatically evaluates a variety of performance measures once in each fixed time interval, whereas the second engine named tracking system allows one to explore potential causes of a problem detected through the monitoring system by tracing back the historical data. Like the cockpit in an airplane, a large display provides the user interface by exhibiting and extracting multiple graphs and tables in a user-friendly manner.

In order to sustain cockpit system, the huge amount of data has to be analyzed repeatedly for evaluating necessary performance measures. If each computation is conducted by extracting the necessary information directly from the DB, the processing burden becomes too much to make the system efficient. In order to overcome this processing difficulty, a variety of profile vectors are constructed and updated automatically for key entities, including machine profile vector, product profile vector, team profile vector, and the like. For monitoring system and tracking system, the majority of the necessary information can be extracted from such profile vectors without going back to the DB, achieving the necessary speed. This example demonstrates the effectiveness of the 70–30 principle in the area of massive information processing.

## 7.6 70–30 Principle in e-Marketing: Dynamic Customer Segmentation for Enhancing CRM

Since the beginning of this century, the Internet has been penetrating into many aspects of business practices, changing the basic business model in almost every industry. In the retail chain business, for example, it is now possible to collect and accumulate massive data from the market via a point of sales (POS) system and

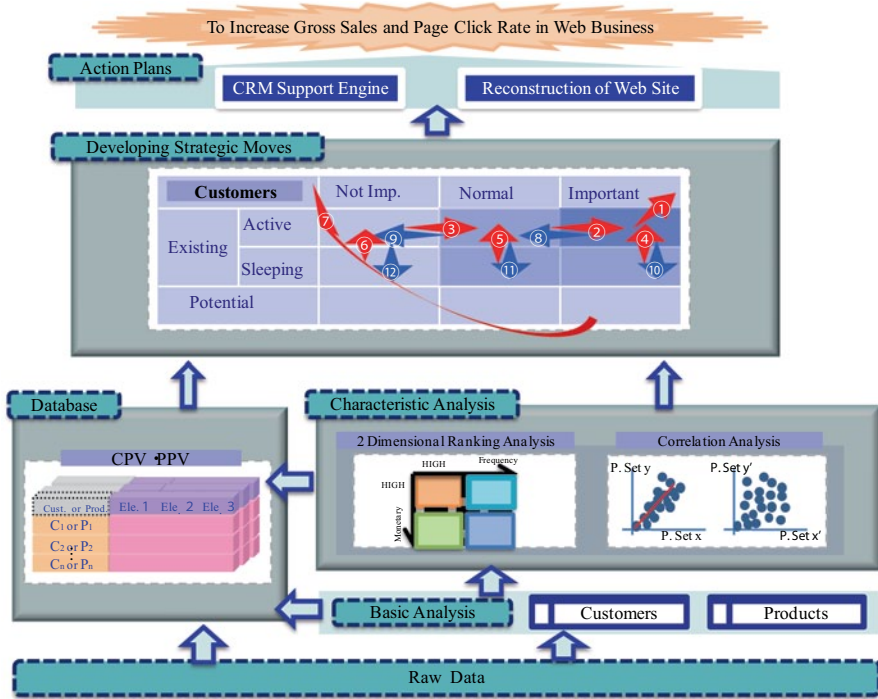


Fig. 7.6 Dynamic customer segmentation for enhancing CRM

utilize them so as to develop effective marketing strategies for enhancing sales of products. An extensive literature exists for analyzing consumer purchasing behaviors based on POS data, represented by (Fader and Lattin 1993; Eugene 1997; Yada et al. 2006 Taguchi 2010; Ishigaki et al. 2011) to name only a few.

As for the case of development of cockpit system for implementing preventive maintenance policies in semiconductor manufacturing discussed in Sect. 7.5, we face here the same problem of the excessive computational burden, where the tremendous amount of POS data collected from the market has to be analyzed repeatedly in a timely manner. Accordingly, the concept of profile vectors as an intermediary information base between various analytical engines and the DB of POS data would be again valid. Fig. 7.6 depicts the basic framework for implementing dynamic customer segmentation for enhancing CRM based on the profile vector approach.

Here, a variety of profile vectors, such as customer profile vector (CPV), product profile vector (PPV), and store profile vector (SPV), are automatically constructed and updated periodically from the DB. These profile vectors are then used by different analytical engines, producing the standard reports from the basic analysis, as well as some ad hoc reports derived from characteristic analyses specified by the user through the graphic interface. Furthermore, these results are used to update customer segments dynamically so as to yield different marketing strategies applied to different customer segments.

CRM typically means that the lifetime value of a customer is to be maximized by maintaining two-way communications between the customer and the company through the Internet. This concept is limited in that the potential customers are not addressed explicitly. By combining POS data with transaction data on the Internet, not necessarily linked to purchasing, it is now possible to capture the entire market as depicted in Fig. 7.6, where the market is decomposed into nine segments: (Existing–Active, Existing–Sleeping, Potential)  $\times$  (Not Important, Normal, Important). The arrows ① through ⑦ indicate the desirable changes of the market for the company, whereas the arrows ⑧ through ⑫ represent the changes of the market to be avoided. The new marketing approach for enhancing CRM would then be to devise strategic moves so as to promote the moves along favorable arrows and prevent the moves along unfavorable arrows. Since such customer segments have to be updated dynamically, the profile vector approach becomes again crucial for containing the underlying computational burden. This example demonstrates the importance of the 70–30 principle in e-Marketing.

## 7.7 Conclusion

In this chapter, we consider the necessary consumption against the selective consumption to identify the advancement of the market economy from the growing stage into the matured stage in a quantifiable manner. The necessary consumption is to maintain the current level of life, whereas the selective consumption is purely to enhance individuals' utility functions, including the cost for children to inherit the desirable life standard. A market is defined to be in the matured market economy if the selective consumption supersedes the necessary consumption. Otherwise, the market is still in the stage of the growing economy. According to this definition, both the USA and France have reached the stage of the matured market economy by 1980, whereas Japan has reached it in 1989.

In the growing market economy, consumers share the sense of lacking goods and services for consumption and are eager to possess what others have. In contrast, in the matured market economy, consumers tend to pursue individual tastes in consumption so as to maximize their own utility functions. Naturally, this trend results in a variety of products and services in small quantities to be distributed into segmented submarkets, requiring more detailed marketing strategies for the segmented submarkets. In this context, the efficiency resulting from the economies of scale tends to diminish.

In order to overcome this difficulty, the concept of the 70–30 principle is introduced, where products and services for separate segmented submarkets are designed 70% in common with the remaining 30% for customization so as to cater for peculiarities of individual submarkets. The chapter examined the emerging trend of the 70–30 principle in Japan in the following areas.



1. Hollowing out production bases outside Japan: SI approach.
2. Business model expansion: smart card from IC ticket to e-Money and credit card.
3. R&D: Emaki for producing static connected photos from digital movies.
4. Preventive maintenance in semiconductor manufacturing: profile vectors and cockpit system.
5. e-Marketing: dynamic customer segmentation for enhancing CRM

It is expected that the 70–30 principle provides a general guidance to enhance the strategic flexibility and the business agility in other areas to be competitive in the midst of the global mega-competition in the twenty-first century.

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# Chapter 8

## Developing Personal Flexibility as a Key to Agile Management Practice

Renate Motschnig-Pitrik

### 8.1 Introduction

Much has been written about innovative, agile methods for management and software development. Such methods, in particular, take into account the need for change, even if it arises late in development (Beck et al. 2001). This is but one instance of a more general characteristic of our time. According to Verna Allee (1997, p. 5): “Change is All there is” in modern thinking—as opposed to traditional thinking where change is described as “Something to worry about.” In fact, new communication media make fast communication available anytime and almost anywhere and modern, more democratic management styles favor team and customer participation—as it is easier to achieve than ever before (Highsmith 2004; Senge 2006). These are just two factors that promote interaction and fast feedback cycles to increase the probability of the “final” product meeting the customer’s needs. Naturally, adapting continuously to the changing environment is an advantage in business as it has been in the evolution of species and cultural and legal systems (Damasio 2012).

As evident as the advantages of flexibly reacting to the changed and changing environment are, and as timely agile management methods respond to the zeitgeist, so hard it is to understand that little is actually being done in Western educational systems to help human beings become more flexible inwardly, in their psychological and whole organismic substance. Little, for instance, has changed at universities, to take up an example from an area the author is familiar with, to support students in acquiring interpersonal competences to become psychologically fit for increased

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and ubiquitous change. Rather, ever more intellectual information, sophisticated modeling, documentation, and precise planning for research is required, emphasizing intellectual processes while disengaging experiential ones. While, of course, leading to new data and insight in special areas, this intellectual overemphasis bears the danger of extinguishing creativity and diminishing openness to new ideas and relationships (Rogers 1961).

To propose an alternative, in this chapter we first revisit the values called for by agile methods and then briefly introduce a humanistic, person-centered approach that holds the promise of supporting the development of inner flexibility and creativity (Ryback 1998; Motschnig-Pitrik and Holzinger 2002; Motschnig-Pitrik 2005; Cornelius-White and Harbaugh 2010; McCombs 2011). In the author's view this provides some counterbalance to the cognitive dominance of (not only) most of academic education. The main part of the chapter, however, is devoted to illustrating how the proposed approach works in practice. For this reason the author will present the case of an international, academic course in "Person-Centered Communication" that she conducted in the current term (2012) at the Masaryk University in Brno, Czech Republic.

## 8.2 Agile Values and Principles

In the past decade, agile methods have come to be appreciated in a variety of fields (Highsmith 2004). One prominent example is software development. In that field, the authors of the "Manifesto for Agile Software Development" (Beck et al. 2001) could improve the ways of developing software by adopting the following value preferences, although not completely discarding the "traditional" values. They value:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

Interestingly, these value preferences show a clear shift towards the human being in collaborative relationship with fellow human beings—be it a team mate or a customer—and away from "design constructs" such as contracts, plans, tools, documentations. This may be the response to traditional methods' overemphasis on the artificial constructs and a perceived missing satisfaction of the human "players." Some preferences of the agile "philosophy" are expressed still more distinctly in agile principles. Let us quote 6 out of the 12 items from the principles behind the agile manifesto (Beck et al. 2001) that most clearly indicate the human qualities they call for (italicized by this author for emphasis):

- Welcome changing requirements, even late in development. Agile processes harness *change* for the customer's competitive advantage.

- Business people and developers must *work together daily* throughout the project.
- Build projects around *motivated individuals*. *Give them the environment and support they need, and trust them to get the job done.*
- The most efficient and effective method of conveying information to and within a development team is *face-to-face conversation*.
- The best architectures, requirements, and designs emerge from *self-organizing teams*.
- At regular intervals, the team *reflects* on how to become more effective, then *tunes and adjusts* its behavior accordingly.

The next section is aimed at giving an idea of how the required personal and interpersonal qualities can be understood in a psychological context and how their unfolding might be supported. Already at this point the reader can sense that the qualities cannot be learned by purely intellectual learning but will need to be experienced, developed, and shaped gradually.

### 8.3 The Person-Centered Approach, Significant Learning, and Encounter Groups

The person-centered approach was developed by the American psychologist Carl Rogers (1902–1987). While having its roots in psychology, psychotherapy, and counselling, it has spread to several areas as close or distant as education, management, social work, cross-cultural communication, conflict resolution, peace work, etc. (Cornelius-White et al. 2013a; Motschnig and Nykl 2014). Interestingly, Rogers envisaged the primary value of education in *dealing with and adapting to change*. Almost half a century ago he wrote (1983, p. 196–197):

We are, in my view, faced with an entirely new situation in education where the goal of education [...] is the facilitation of change and learning. The only man who is educated is the man who has learned how to learn [...] how to adapt and change [...]. Changingness, a reliance on process rather than upon static knowledge, is the only thing that makes any sense as a goal for education in the modern world. [...] Out of such a context arise true students, real learners, creative scientists and scholars, and practitioners, the kind of individuals who can live in a delicate but ever-changing balance between what is presently known and the flowing, moving, altering problems and facts of the future.

But how can the facilitation of change and learning be achieved in practice? The basic motive upon which Rogers relies for *significant learning* to happen is that in each person there is a directional, forward-moving tendency, referred to as an *actualizing tendency* (Kriz 2007; Rogers 1951, 1980). Students “who are in real contact with life problems wish to learn, want to grow, seek to find out, hope to master, desire to create” (Rogers 1961, p. 289). Rogers characterized significant learning as a kind of whole-person learning that integrates various aspects of human capacities. In Rogers’ words (1983, p. 20): “Significant learning combines the logical and the intuitive, the intellect and the feelings, the concept and the experience, the idea and

the meaning. When we learn in that way, we are whole.” Since various processes are involved in this kind of learning the formation of rigid, preconceived mental models is kept to a minimum.

According to research and practice conducted by Rogers and his colleagues, for significant learning to happen it is essential that learners are provided an atmosphere in which the facilitator (manager, instructor, teacher, etc.) holds three core attitudes such that the students actually perceive them, at least to some degree (Rogers 1961). These attitudes are:

- Congruence, with synonyms such as, realness, transparency, genuineness, authenticity; it also includes a lived, moment to moment openness to experience.
- Acceptance, else referred to as respect, unconditional positive regard, caring attitude, concern for the individual; it implies a non-judgmental attitude.
- Empathic understanding, a deep form of understanding of the meanings as well as feelings of the other person from his or her point of view.

In the context of significant learning, person-centered encounter groups, i.e., unstructured meetings allowing people to freely express their thoughts, feelings, meanings have proved to be potent vehicles for developing (inter)personal qualities such as constructive communication, collaborative decision making, and creative problem solving in a rather self-organized way (Rogers 1970). The author has experienced that such group meetings can provide sources of motivation, collaboration, reflection, deep learning, rich communication, and personal growth unmet in other educational settings (Rogers 1970; Lago and McMillan 1999; Nykl and Motschnig-Pitrik 2005; Motschnig-Pitrik 2008). The basic *encounter group*—a setting for self-experience and problem solving—if well facilitated, has been regarded as one of the most potent social inventions of the twentieth century. The group as a whole and its participants as members move through a group process that is characterized by smalltalk, superficial conversation, and a resistance against expressing own feelings at the beginning and moving towards trust, open and respectful interaction, deep understanding, and helpful relationships inside and outside the group setting as the group process continues.

From the perspective of theorizing in the person-centered approach, perceiving a person-centered climate, for example in an encounter group, favors certain features of personal development. The following five (out of ten) features have been listed that characterize the developmental direction in a person-centered climate (Rogers 1959) and are related to inner flexibility:

- Openness to one’s experience.
- The self-structure will be a fluid gestalt, changing flexibly in the process of assimilation of new experience.
- Full absence of conditions of worth (such as prejudices, valuing conditions, rigid constructs)
- Each situation will be met with behavior that is a unique and creative adaptation to the newness of that moment.

- Persons will live with others in the maximum possible harmony because of the rewarding character of reciprocal positive regard.

In order to illustrate how person-centered learning, including encounter groups can contribute to flexibility and personal agility the reader is invited to join the author in her journey through the most recent course on person-centered communication that she facilitated in the spring term 2012.

## 8.4 Case of an Academic Course on Person-Centered Communication

The course on *person-centered communication* is an elective course for Masters and PhD students offered at the Faculty of Informatics at the Masaryk University in Brno, Czech Republic. Although attracting primarily advanced students of informatics, the course is open to students of other faculties and to international students. It is conducted in English and consists of three 1,5 day face-to-face blocks that are interconnected by a web-space providing the course description, course goals, online learning resources, a virtual space for sharing reactions between the course units and a space for uploading the students' self-evaluation at the end of the course.

**Course Description** The primary goal of this course is to allow students to communicate more sensitively and effectively. The course is highly student-centered in so far as the instructor acts as a facilitator to the group by providing resources and, most importantly, a facilitative atmosphere. Students are expected to contribute actively by attentively listening to one another as well as sharing their feelings, meanings, and thoughts, while sitting in a circle to ease mutual perception. It is the way participants communicate with each that is pivotal. Students are invited to contribute themes according to their personal and/or professional concerns. Examples of concerns are conflicts, decisions, challenges, problems, opportunities, or just anything the participants (students and facilitators) consider important from their personal and subjective point of view.

Besides participating in the group sessions, students work in teams of two to three persons to elaborate theory topics in a self-directed way. The course assessment takes into account the students' active participation in face-to-face sessions, online reflections, a brief seminar thesis, and includes an element of self-evaluation.

**Course Goals** Participants acquire personal experience, skills, and background knowledge in situations of professional and everyday communication (such as listening, articulating, speaking in a group, conflict resolution, decision making, etc.). Participants build a learning community for better communication and understanding.

- At the *level of knowledge and intellect*, students acquire knowledge about the basics of the person-centered approach and person-centered encounter groups.

- *At the level of skills and capabilities*, the course aims at allowing students to gain active listening skills and to improve their abilities in spontaneous communication and decision making in a group setting as well as in reflecting their experiences.
- Finally, the *level of attitudes and awareness* is addressed by letting students gain self-experience while expressing their own feelings, meanings, and intentions and perceiving those of others. They experience active listening and develop their own attitude towards it. Students become more sensitive and open to their own experience and loosen preconceived, rigidly held constructs. Students move towards acceptance and better understanding of themselves and others. Students move from stereotyped behavior and facades to personal expressiveness.

In the following section students speak for themselves. This is accomplished by presenting excerpts for students' online postings of their reactions after each of the three blocks and by arguing how the reflected experiences may be seen as contributing to developing inner flexibility. Note that the course in 2012 was exceptionally rich in international attendance: Besides Czech and Slovak participants we had students from South Africa, Southeast Asia, and Russia. In sum, ten students participated in the course, which is about an ideal number for this intensive and loosely structured event.

#### ***8.4.1 Excerpts from Students' Reactions after the First Block***

Talking and sharing with new people gives me new perspectives on communication and I am thankful for everybody's contribution, whether I already knew them or not. I am constantly learning, an example: I got it quite right with empathy when I felt that some of us were afraid to move the chairs to the middle ...

Though I have never attended any kind of subject like Person-Centered Communication, it's enriching and I'm really glad I can participate here. In the first block we spoke about problems of communication, [...] tried to solve some problems and so on. I think this is really useful for social life. I've met here many new people and listened to their interesting opinions that gave me new stimulations for other ways of thinking.

An international student shared an important question the course had raised: "During the end of first block, I said that I had a pretty difficult question to think about. I told about active listening, and how it's hard to find a balance between listening to a person and being congruent with myself at the same time. This is indeed a tricky question, because when you are really actively listening to someone, you have to hide your ego, and in some extreme case—you do not perceive yourself, but put all your attention into perceiving the other person. [...] So, how to be a truly active listener, but at the same time be authentic?"

Another international student wrote: "During one of the discussions the following words were uttered: 'Experience is always broader than theory because theory is always shortened or cut down to the version of the one who had experienced it.' [...] This is because experience comes with emotion and feelings as opposed to



reading which can be limited to just theory. For me this was the most interesting topic that really stood out and I have since read articles about it:-). I also enjoyed the atmosphere in the seminar:-)”

An interesting part of lesson for me was the discussion about the article on active listening. I was surprised in how many ways the same text can be understood.

I really liked the way the course is given, especially on Friday when we were sitting in the circle not hiding ourselves behind the desk. Our teacher and all the students are open to new ideas and trying to understand the others and this is what I really miss at other courses and generally in normal life. Maybe this could be a reason why the learning progress of this group is very unique.

Summarizing, the reactions illustrate, first of all, the positive atmosphere in the class. Based on that, students' are motivated, opened up to the unusual new experience and made curious to learn from both theory and multiple participants' viewpoints. Note that the initial phases in a group process often tend to be more difficult and exhibiting more conflict. One reason why this was not the case in the particular course may be the fact that the majority of students had attended another person-centered course they liked and thus trusted this course would be equally exciting and enriching.

#### ***8.4.2 Excerpts from Students' Reactions after the Second Block***

Sharing is simply a great way of thinking, speaking out gives the idea somewhat new perspective.

I can see the concept of significant learning—I like the attitude of PCA, I try to implement it into my life, I am experiencing it, reading the theory of it and also practicing it in a kind of a learning mode in our group, which is also as a whole keen on PCA—and I see that it works. [...] This road is hard and slow, the goal is never to be fully achieved even after decades, but it is still exciting and fun. I was actually a bit sad for a moment last time when I thought about the fact that the next session will be the last one. Thank you everyone, I am looking forward to the next class.

A Czech participant notes: “Every opinion can change us in some way. Anyway, about this topic we have also talked at the beginning of the block. [...] I also like that we are not only Czechs, so we have to speak English all the time—also at lunch. Our soft skills are simply improving the whole day. I also consider it great that we can listen to the different ideas and experiences from people from other countries—this way we can also learn something new about our own nationality.”

An international student reflects: “We somehow started helping each other in our ideas. Theory, suggested by M., found some support, we tried to develop it, add some personal ideas and explanation. Another remarkable point was our dialog exercise. I was surprised, that sometimes it's so hard to paraphrase what your partner said, and it's so extremely hard to explain your mind in simple understandable words. Concerning our group dynamics, sometimes I felt some disappointment, that

some participants were more active and spoke a lot, and others were more silent. I always want more balance in interpersonal interactions, and it seemed to me that some participants were too shy to say something. So I really wanted to help them somehow, but I didn't know how. [...] We are growing and accepting more interesting and challenging tasks. And I believe that next session will be even better."

First I must say that I like our international mix. I think that this group is good for discovering ideas, or may be making myself (and the others) think about my (their) patterns of behavior or responses. This is a condition for possible improvements.

I was surprised, how many things in person-centered communication can be drawn by a line similar to the discussion—dialogue line, with no sharp divisions but as a continuum. The game with the ball (listening, repeating what the previous person said in my own words and only then articulating your message) seems like a very simple game, but it was not! I recognized how complicated and exhausting listening can be when we tried to do it really well.

Summarizing, the continued positive atmosphere in class encourages participants to accept challenges, such as questioning one's patterns of behavior and accepting that something such as accurate listening that they thought would be simple if not trivial, in fact is not! Students acknowledge (rather than distort or deny) their current limits and welcome the opportunities for development offered by and to each other in the course.

### ***8.4.3 Excerpts from Students' Reactions after the Third Block***

I really liked especially how Thursday began. Sharing from the first minute, running even long time after we should have had a break and nobody complained. That means real interest was among us in the group. [...] It was great when we went to lunch together. Even during the search for the right restaurant we learned something about H.'s religion and habits related to it, talked, had fun... This is the great thing about these person-centered courses—the relationships that are created and strengthened through it. Amazing. We also continued after the course ended and played outside for two hours. [...] When I mentioned H., I must say that she enriched our group in many ways, but really significantly in the multicultural aspect and we got to think about many more perspectives. My learning is that everything is not black and white but fuzzy is strengthening. [...] Actually, I feel this approach strongly supports creativity. New ideas are not judged, fear is not necessary, people cooperatively develop and learn. [...] I now remember one more thing—how we developed an acceptance of silence. At least I personally had a feeling that I enjoy some time for digestion of so many inputs after intensive sharing and was not feeling awkward in any way. [...] Well, there is one wish I had, it was that this course does not end so fast. It could be partially fulfilled by the ideas we had at the end and the agreement on continuity of our person centered efforts...

I can say that the atmosphere in our group has changed during the whole course in the right way. We have known each other better and I think all of us feel very good and comfortable there.

For me, the last block was the most 'relaxing'. But not because I did nothing, but because I was much more calm inside and had very few worries about everything. I didn't worry if something was right or wrong in the group, if someone speaks more or less, if I have

to add something, or not. I was just enjoying the process, and I think that it was a great achievement.

This workshop was the last and in my opinion the one I enjoyed the most. I do not know how to really put this in words but when I left this session I felt that the people who shared in depth on their experiences felt lighter and in turn I felt lighter. I believe that the level of respect keeps growing as we continue to learn so much about each other on a personal level. I really appreciated H.'s openness about her culture/country and her courage to share what was not entirely positive in her eyes, thus she said before sharing 'I do not want to say anything bad about my country/culture'. I believe I have learned a lot from her character. During the sessions there were times when there would be some awkward silences and in my personal view I appreciated the silences as it gave me time to ponder on the previous speakers' shared thoughts. The combination of the theory that we have learned during the course has facilitated our growth through our own experiences.

The atmosphere got really open and more than friendly. I realized that I have a lot in common with many others—personal problems, communication problems with others and even with myself. I appreciate our intercultural experience where we were openly discussing topics [...]. It is hard to name all the benefits by words, but I feel this is one of the strongest impulses to improve myself I have ever faced.

In general, the third and final block is characterized by participants' coming to realize that often things are not in black or white and are best understood in context and with some sort of "empathy to the whole situation." For example, the fact that some persons spoke more than others initially has been perceived as disturbing while finally it became o.k. This also illustrates the increased acceptance for individual differences. Intriguingly, some participants changed their attitudes to basic phenomena such as silence. While it had been perceived as "awkward" in the beginning, it was later experienced as meaningful for "digesting" the rich sharing and/or preparing for a new theme. These changes are directed towards inner "lightness," calmness and relaxation, using the participants' words. This could indicate a higher degree of flexibility and less rigidity that tends to cause tension (Rogers 1959; Senge 2006). Another fascinating effect is the participants' wish to continue the experience. Some of them intend to actively act on that wish in a self-organized way (Motschnig-Pitrik 2008; Motschnig-Pitrik and Barrett-Lennard 2010).

## 8.5 Conclusion

This article voiced the need for developing inner flexibility if we want to implement flexibility in organizations and apply agile methods wholeheartedly and in coherence with human resources. To illustrate how personal flexibility can be developed, Rogers' setting of an encounter group has been adopted and complemented by the Web to meet the demands on academic education in the twenty-first century (Motschnig-Pitrik 2013). Based on an innovative course design and on students' on-line reflections it was argued that such settings have the potential to loosen mental models and to promote significant learning that makes a difference in the learners'

thought as well as behavior. Amazingly, students themselves confirmed an important fact: to retain and increase the effect on personal growth, significant learning needs to be followed up. Indeed, students started searching for opportunities to accomplish this as no follow-up course was being offered at the university. Since participants (including facilitators) of successful encounter groups often wish some kind of continuation, the author proposed the setting up of a significant learning community (SILC) (Motschnig-Pitrik 2008). In a nutshell, a SILC is a largely self-organized socio-technical system that is based on the person-centered approach and combines knowledge construction with personal growth. The Web is used to connect participants between encounter-like meetings that provide the nurturing ground for significant learning to unfold, pervade the system, and radiate its constructive influence to the environment.

Given we trust person-centered theorizing and the students' and author's experience, activities and events sharing essential features with the course described above would hold the promise of promoting learning from multiple perspectives and authentic experiences. This kind of experiential, collaborative learning is known to be deep and influential on building a self-structure that is a fluent gestalt acceptant of new situations arising in the richness of each moment rather than a rigid, made-up structure of prefabricated facts and beliefs (Rogers 1951, 1961, 1983). In any case, more research is needed to confirm the hypothesis that settings involving person-centered encounter groups (such as SILCs), sustainably build the kind of inner flexibility needed for agile (or any service-oriented) management. These benefits, as evident from our case, would apply regardless of the cultural background of participants (Cornelius-White et al. 2013b).

Currently, the sample manifestation of a significant learning community is "on the way" in a joint EU project on "constructive international Communication in the context of ICT" (iCom) between the Universities of Vienna in Austria and Masaryk in Brno in the Czech Republic. In iCom, the two universities collaborate with regional small and medium enterprises on a PhD course offering for (ICT) professionals who aim to improve their practice through scientific work. More generally, the project aims to facilitate higher qualification and constructive communication as a key factor in (ICT) projects.

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# Chapter 9

## Flexibility in E-learning through Knowledge Management Practices: A Case Study

Kalyan Kumar Bhattacharjee, Ravi Shankar and M. P. Gupta

### 9.1 Introduction

Knowledge management (KM) is a systematic process through which knowledge needed for an academic institute's success is created, captured, shared, and leveraged (Laal 2011). KM can be used effectively in e-learning (Lau and Tsui 2009). National Programme on Technology Enhanced Learning (NPTEL), a web portal of the Government of India, was initiated to develop web-based technology courses catering to the need of students, faculty members, and working professionals. The NPTEL framework has been successfully implemented for the best use of all its stakeholders, i.e., students, faculty members, working professionals, and industry learners. The main objective of the initiative is to develop and make free the availability of web-based multimedia-enriched technology courses that have the potential to enhance both the on-campus and off-campus learning experience for students and others in a distance-learning mode.

NPTEL is a one-stop engineering educational portal in India and abroad. It maintains knowledge contents for science and engineering education (both video and text) in all major disciplines as well as specialized and newly developing interdisciplinary subjects. The Indian premier institutes of higher learning in technologies (IHLTs) and other leading universities in India have created this knowledge pool with academic content. The primary target groups of the NPTEL are students, working professionals, and faculty offering undergraduate engineering courses. NPTEL video courses have been converted into streaming video lectures and are available

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for free access via the Internet. It is now integrated with many Indian universities' curricula for enhanced learning. The portal offers the facility for interaction with its viewers and a course-specific Wiki has been developed to offer a complete package on virtual online courses on engineering.

## 9.2 Methodology Adopted

The questionnaire-based survey and its data analysis are categorized under quantitative data analysis. The significance of the technical-, managerial-, and perception-based factors that affect knowledge transfer at an e-learning portal was analyzed under strengths, weaknesses, opportunities, and threats (SWOT) and situation, actor, and process (SAP) learning, action, and performance (LAP) frameworks.

Nowadays, the SWOT analysis is widely used as a managerial tool in strategic management. One of its basic advantages is that it is easily understandable by users (Sherman et al. 2006). The idea of management of important knowledge is consistent with Zack's (1999) description of a knowledge-based SWOT analysis, in which firms can map their knowledge against their strategic opportunities and threats in the higher education industry to better understand their issues of advantage and weakness and identify knowledge gaps that need to be closed.

The SAP-LAP analysis (Sushil 2000a, b, 2001, 2009) is another methodology, which has been used extensively by researchers for the case studies of different sectors. It provides one of the most useful methodologies of analysis and synthesis for the organizations, which are in the process of adaptation of a new and complex technology (Majumdar and Gupta 2001).

The value proposition model is described as the definition of how items of value, such as products and services as well as complementary value-added services, are packaged and offered to fulfill customer needs (Kambil et al. 1997). The value proposition element gives an aggregated view of the value an institution offers to its students. This method has been used to evaluate the knowledge transfer model of the NPTEL.

## 9.3 Data Collection

This case study is based on the study and evaluation of the NPTEL portal in terms of its creation and delivery of knowledge with particular reference to the qualitative analysis through the SWOT and SAP-LAP framework. The data are a set of discrete facts about events. When certain context is added to data, they become information, which is finally transformed into knowledge by adding value to the information. In this study, two instruments have been used for data collection: (a) through personal interviews with the academic administrators; and (b) survey through a structured

**Table 9.1** Respondents profile of NPTEL courses ( $N=2323$ )

Profile of the respondents who have accessed the NPTEL portal	Total numbers	Percentage (%)
Students	1537	66.2
Faculty members	219	9.4
Working professionals	538	23.2
Others	29	1.2

NPTEL National Programme on Technology Enhanced Learning

questionnaire. A questionnaire was designed and it was circulated through e-mail to various engineering colleges registered under the NPTEL. A web link was also given on the website of NPTEL to attract visitors to fill the questionnaire. A total of 2323 users have given complete responses.

The breakdown of the respondents is illustrated in Table 9.1.

## 9.4 The Value Proposition Model of NPTEL

As per Ross and Grace (2012), the value disciplines strategy (VDS; developed by Treacy and Wiersema (1995)) is encircled around the creation of value for the customers and organizations and this is a more appropriate framework to understand the strategies of educational institutions. The three entities mentioned above have been perceived to form a value chain, known as the “knowledge value chain” (Shankar et al. 2003). The operating model of the KM implementation of the NPTEL value propositions is furnished in Fig. 9.1. The operating models can be reengineered to leverage the knowledge aspects in each of the value propositions. The NPTEL knowledge portal has been analyzed into six value propositions that are explained as follows.

### 9.4.1 Academic Leadership

Leadership is essential in all organizations and educational institutions are no exception (Rowley 1997). An academic institution requires leadership for efficient and effective management in order to achieve excellence (Boulter and Bendell 2002) and it delivers quality knowledge content and support. Top-level commitment is essential for efficient management of academic processes to enable smooth knowledge transfer. Leadership is identified as a driver for all components, including measurement, analysis, KM, strategic planning, faculty and staff focus, and process management (Badri et al. 2006). To provide education in an open forum, higher education institutions need to consider how to do the “McDonaldization of education” (Ritzer 1993), i.e., to enable education to reach its customers first. Thus,



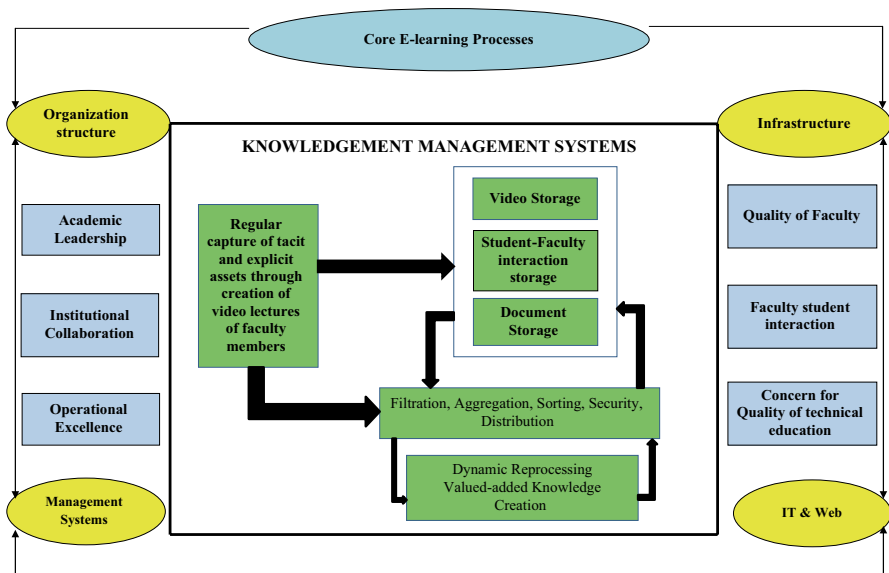


Fig. 9.1 NPTEL operating model and KM system from value addition to value proposition. NPTEL National Programme on Technology Enhanced Learning, KM knowledge management

academic leadership is the most important component for the implementation of the value proposition framework.

### 9.4.2 Operational Excellence

Operational excellence leads to delivering the best services at the best price and with the least inconvenience (Shankar et al. 2003). For an academic portal, it is the smooth delivery of knowledge to its students. The operational excellence of the NPTEL portal is due to its effective interface to access the knowledge base. Once a faculty member of an institute leaves or retires, the IHLT suffers from knowledge loss. With the growing power of *information and communication technology* (ICT), such academic knowledge can be preserved for future use.

### 9.4.3 Institutional Collaboration

Institutional collaboration can generate completely new approaches that are able to deal with new challenges in education (Dorner et al. 2011). Collaboration among the institutes brings the internalization of scarce skills and tacit knowledge (of the academicians) and it also increases competitiveness. This is the primary benefit of academic alliances. The creation of knowledge is carried out through technological

cooperation (Inkpen 1996). Academic institutes collaborate with others for the purpose of a synergic effect. *ICTs have already transformed course delivery and research collaboration that help in the development of content.*

#### **9.4.4 Faculty–Student Interaction**

ICT has transformed the world into a small global village and it acts as a connector between students and teachers. A virtual class is where students and teachers participate in academic activity from any geographical location (Fetterman 1998). In addition to viewing videos, a visitor is allowed to raise questions on a specific topic, which is answered by the faculty members. Cohen (1999) classifies virtual courses into two categories, namely synchronous learning (teacher and learner engage in a certain topic simultaneously) and asynchronous learning (learning not at the same time). In this chapter, asynchronous types of learning have been studied. In today's highly competitive age, the aim is to maximize student satisfaction.

#### **9.4.5 Quality of Faculty**

As per Mood (1995) and Parr (2005), a teacher plays the roles of a facilitator, an assessor, a participant, and also a motivator to encourage student participation and transfer of knowledge. With students increasingly being viewed as clients to whom education services are provided (McCuddy et al. 2008), the students' satisfaction can be seen as an indicator of the success of quality implementation. Students' satisfaction is positively influenced by the commitment of faculty and management and the quality of course content (Ardi et al. 2012). Hence, the quality of faculty is an important component of the value proposition model.

#### **9.4.6 Concern for Quality in Technical Education**

The Government of India encouraged the expansion of engineering education for the overall development of the country. In the past decade, there has been a sharp increase in the number of private colleges as well as universities in India with the status of either deemed-to-be universities or state universities. But somehow, the expansion of higher technical education has been compromised with quality. As per Umashankar and Dutta (2007), higher education is continuing to expand, mostly in an unplanned manner, without even minimum levels of checks and balances. Higher education should be guided through total quality management (TQM) principles by the top management in order to achieve excellence (Kanji and Tambi 1999). Hence, the underperformance of private institutes in India is creating a knowledge divide, which an ICT-enabled NPTEL model can bridge.

PRICE	High End					⊗								Innovation	VALUE
	Market Price				⊗		⊗		⊗		⊗			Excellence	
	Economy	⊗							⊗		⊗			Innovative Imitation	
	FREE		⊗	⊗									⊗	Me-Too	
		DVD price	Viewing Price	Downloading Price	Quality of Faculty	Flexibility in learning	Knowledge retention	Knowledge Sharing	User Friendly Interface	Interactviness	ICT infrastructure	E-learning Environment			

**Fig. 9.2** Strategy canvas of NPTEL knowledge portal based on value proposition model. NPTEL National Programme on Technology Enhanced Learning

Figure 9.2 shows a simplified strategy canvas of the NPTEL portal based on the value proposition model initially proposed by Kim and Mauborgne (2002) and later on implemented by Osterwalder and Pigneur (2003). The feedback of the academicians has been suitably mapped into the strategy canvas. The canvas portrays two aspects of a knowledge portal, i.e., price and value. The price attribute scale has four elements measured in terms of free, economy, market price, and finally high-end. On the other side, the utility is measured by estimating the value level of the knowledge portal.

To do this, a qualitative value scale has been followed (similar to Osterwalder and Pigneur (2003)) that is different from a normal quantitative scale that ranges from low to high. In this case, the measure goes from a me-too value to innovative imitation and from excellence to innovation. A me-too value level implies that the value of the services the portal offers to its viewers do not differentiate itself from its competitors. Innovative imitation conveys that it imitates an existing value proposition, but improves value by adding innovative elements. Excellence refers that the value is pushed to its extremes. Innovation implies that a portal introduces either completely new courses or videos or a revolutionary combination of products and services. The survey results show that the NPTEL knowledge portal offers quality knowledge to its viewers free of cost (for both viewing and downloading). Only its media is priced on a minimum cost basis. The NPTEL survey results also show that quality of faculty, knowledge retention, user-friendly interface, and its ICT infrastructure are ranked as excellent. The flexibility of learning through NPTEL ranks at the innovation level, followed by knowledge sharing and interactivity at the innovative imitation stage. The e-learning environment stands at the me-too stage. The diagrammatic presentation of the value proposition framework

of NPTEL (Fig. 9.2) defines the portals' salient features, which converts the mental model of the academic administrators into a common form. Further, to understand the usefulness of the NPTEL portal and to evaluate its effectiveness, a survey was undertaken. A questionnaire was designed and circulated through e-mail to various engineering colleges registered under the NPTEL. In response to the survey, 2323 responses were received and they were analyzed. The results of the analysis have been used to portray the implementation status of six value propositions of the NPTEL knowledge portal (Table 9.2).

## 9.5 The Operating Model

The operating model of NPTEL encompasses the contributions of major Indian IHLTs, namely Indian Institutes of Technology (IITs), Indian Institutes of Management (IIMs), and Indian Institute of Science (IISc) towards value addition. This operating model may be perceived to exist across almost all value propositions of the working scopes of an academic institution. To leverage the knowledge imbibed in these value propositions, the operating model requires some intelligent reengineering through which this may be transformed into knowledge-centric processes. The knowledge on which operating models would be centered is determined by the value proposition in which they operate. These KM activities are powered by knowledge-sharing mind-sets and the cooperative nature of the contributing institutes under NPTEL. Table 9.2 presents the implementation model of six value propositions of the NPTEL knowledge portal.

Table 9.2 provides us better understanding of the value of the NPTEL knowledge portal based on the responses received from the NPTEL respondents. The performance of the NPTEL portal can be estimated through its tremendous growth identified under nine parameters, namely growth in number of uploaded courses, viewers, website hits, NPTEL viewers on YouTube, Indian visitors vis-a-vis US and UK visitors, etc. (Table 9.3). The model also shows the level of value and efforts needed to leverage knowledge in each of these value propositions. The strategic tool of NPTEL, which has been derived from this conceptualization, is similar to the strategy canvas of Kim and Mauborgne (2002).

## 9.6 KM Framework

The tactical KM framework of NPTEL is summarized below:

1. The knowledge management system (KMS) has a platform for the sustained capture and leverage of knowledge. Any KMS should incorporate cyclic KM processes to capture and leverage knowledge leading to sustained value addition to the institutional value proposition. The way operating models would interact with the KMS should be outlined in the form of a KM framework.

**Table 9.2** Implementation status of six value propositions of NPTEL knowledge portal

Academic leadership	Operational excellence	Institutional collaboration	Faculty–student interaction	Quality of faculty	Concern for quality of technical education
Core business processes: E-learning process has been adopted for delivery of knowledge	The NPTEL portal is available in a 27 × 7 pattern. It meets the need of student and working professionals for the search of knowledge base	NPTEL is focused on sharing of knowledge. The portal uses tacit knowledge of faculty members from all major institutes in India	Focus on developing solutions and student-oriented e-learning processes. Manage student–faculty relationships, and support	NPTEL is focused on people development and sharing of knowledge	10% of the total users of NPTEL e-learning are faculty members from different private colleges that transmit quality knowledge to its students
Organization and structure: NPTEL has set up knowledge teams to leverage academic knowledge. The team consists of members from all IITs, IIMs, IISc, and the ministry	The portal has been designed in the most user-friendly way. 95% users of NPTEL have expressed their satisfaction over the quality of knowledge transfer	There has been an equal distribution of faculty members from each IIT, IIM, and IISc. 82% of the students certified that depth of knowledge delivered is high	NPTEL has developed explicit knowledge interface for closer contact. It manages real-time academic knowledge base	Providing institution-wide knowledge feedback by enabling easy access to central knowledge repository. Incentives for using NPTEL portal	89% of the NPTEL users have stated that it helps in quick learning
Management systems: Recognition of individual's talent and creation of new knowledge from it is the reason behind the success of NPTEL	Acquire knowledge and encourage nonhierarchical managerial structure. Manage total quality. Manage knowledge documentation	Develop effective working environment and integrate the knowledge of supply chain partners. Manage capture and dissemination of skills and learnings	Retain and use knowledge is the main objective of a web portal. 92% users of NPTEL portal agree on the importance of quality faculty for smooth knowledge transfer	Enable individual and group interactions. Manage learning and capture of tacit assets. Manage the conversion of tacit knowledge into explicit knowledge	NPTEL arranges awareness programs to publicize the portal. 93% of its users are satisfied with the pace of delivery of lecture

**Table 9.2** (continued)

Academic leadership	Operational excellence	Institutional collaboration	Faculty-student interaction	Quality of faculty	Concern for quality of technical education
<p>Infrastructure: ICT-based infrastructure has helped in creating a virtual academic environment under the dynamic leadership of academicians and admin staff</p>	<p>NPTEL has emphasized on bringing efficiency in knowledge delivery. 95% of its users have agreed that it has created a life-long learning opportunity</p>	<p>NPTEL infrastructure has helped in creating a platform for faculty collaboration. 77% of its users have agreed for its user-friendly interface</p>	<p>87% of NPTEL users have agreed that it has created a knowledge-sharing platform. It is the infrastructure and the faculty quality makes the difference</p>	<p>91% of its users agreed that use of graphics and animation has helped in learning through NPTEL. 83% agreed for student focus of education</p>	<p>Though the portal has been put in the high-speed server of IITM and YouTube, the local colleges require limited infrastructure to view</p>
<p>IT and the web: Use IT and the web for knowledge reuse. Induct expert systems</p>	<p>Focus on information integration. Set up a repository of web courses. 77% of its students have agreed that NPTEL is helping in retention of knowledge</p>	<p>IT has been used for creating online collaboration among the best teaching institutes in India. 77% of its users have stated that NPTEL makes education enjoyable</p>	<p>83% of its students agree that NPTEL provides a professionally managed learning environment. 82% agree that it offers flexibility in learning</p>	<p>NPTEL provides contextual and personalized knowledge access to its students</p>	<p>NPTEL has taken the maximum use of ICT to reach the masses. 70% of its users have found it highly interactive</p>

*NPTEL* National Programme on Technology Enhanced Learning, *IITs* Indian Institutes of Technology, *IIMs* Indian Institutes of Management, *IISc* Indian Institute of Science, *ICT* information and communications technology, *IT* information technology, *IITM* Indian Institute of Technology Madras

**Table 9.3** Growth of NPTEL portal

Growth parameters	Years					Growth
	2008	2009	2010	2011	2012	
Uploaded courses	216	244	260	283	517	2.3 times
Video courses	90	118	135	150	278	3 times
Web courses	126	126	125	133	237	1.9 times
Website hits	6,939,361	11,898,397	20,273,740	29,291,453	39,482,461	5.6 times
Views of YouTube	–	6728	29,082	39,248	68,663	10 times
Indian viewers	679,794	1,605,117	2,853,507	4,207,569	5,728,909	8.4 times
US viewers	86,507	156,348	183,862	224,441	303,640	3.5 times
UK viewers	14,360	32,571	38,289	110,504	243,918	17 times

*NPTEL* National Programme on Technology Enhanced Learning

2. A framework for KM implementation needs to be developed according to the real need of the student community. The holistic scope of the NPTEL portal encompasses not only the operating models internal to the system but also its collaborators, customers, and environmental factors. So, a KM framework for a knowledge portal should be perceived according to the following organizational structure:

- (a) organization (people, processes, and technology)
- (b) stakeholders (government, students)
- (c) community

The NPTEL web portal has been initiated by Ministry of Human Resources Development (MHRD) to bridge the knowledge transfer gap that exists between premier IHLT and nonpremier engineering colleges. The NPTEL framework is based on the multi-institutional working pattern of technological universities. An attempt has been made to keep a uniform syllabus to maintain uniformity of education imparted. The interactions between the KMS and the operating models along with the dynamic mutual interactions among these operating models have been established. The KM framework can be perceived as follows:

1. Establish a portal for delivery of academic knowledge in the field of technical education for free distribution of knowledge among the student community and working professionals seeking quality knowledge to keep them updated for better service to the nation. The following tactical moves have been made in this regard:
  - (a) Establish a central knowledge repository to enable storage, reuse, and consistent dissemination of academic knowledge.
  - (b) Establish knowledge-sharing structures across the institutes to establish a virtual organization, which shares knowledge in the form of explicit knowledge.

- (c) Establish a separate, front-end, segment for enhanced faculty retention and capture of untapped knowledge.
  - (d) Utilize the knowledge on latest academic interest or topics on demand to develop future-oriented full-fledged subject.
2. Capture, leverage, and apply existing institutional knowledge and store the results:
- (a) Capture and storage of institution-wise knowledge in an explicit form through video or paper documents. In particular, codify the tacit knowledge of subject experts in an appropriate way.
  - (b) Incorporate preexisting knowledge bases.
  - (c) Develop the knowledge repository of academic knowledge on various subjects.
  - (d) Personalized access of knowledge for students and working professionals.
  - (e) Set up support for multiple channels of access (YouTube, video cassettes, website, etc.)
  - (f) Apply the flexibility offered by the ad hoc and loosely knit academic knowledge available in different collaborative institute.
  - (g) Relentlessly improve the knowledge base through innovation.
  - (h) Efficiently utilize individual capabilities of collaborators to improve operational excellence.
  - (i) Integrate the explicit knowledge in the repositories of collaborators.
3. Effectively deploy KM systems, a knowledge-sharing culture and IT as enablers:
- (a) Set up lucrative incentives for encouraging its faculty and student community to contribute in the growth of the portal in terms of quality and dimension of knowledge.
  - (b) Set up rewards as incentives to enable a culture of spontaneous knowledge sharing among faculty and technical officers along with sharing of experience.
4. Develop an enhanced focus on learners and improve the assessment of quality knowledge transfer:
- (a) Manage demand and growth of students' base and their growing expectation.
  - (b) Manage marketing costs and marketing complexities and document the exception reports in the knowledge repository for future use.
  - (c) Reach your students before they come to you.
  - (d) Develop an online question–answer bank.

## 9.7 Operational Issues

Students and other knowledge seekers are allowed to raise their query on any topic they have learned. A collection of these reviewed queries along with its answers is posted in the form of question–answer book of that specific topic. A student is



allowed to search on a specific topic. This enables visitors a quick access on knowledge repository. The following section analyzes the performance of the portal under the SWOT scanner.

## **9.8 Strengths, Weaknesses, Opportunities and Threats Analysis**

Methodologically, this chapter is based on the evaluation of the NPTEL portal with particular reference to the qualitative and quantitative analysis of evaluative strengths, weaknesses, opportunities, and threats (SWOT) of the feedback given by the students visiting the website. In this part, strategic elements have been distinctly identified for overall improvement of the portal like flexibility under the category “strengths,” competition under the category “weaknesses,” technological advancement under “opportunities,” and growing number of cyber crime under “threats.” The SWOT analysis is divided into four components.

### **9.8.1 Strengths**

1. The premier IHLTs are the contributors of NPTEL portal.
2. MHRD (Government of India) provides complete financial support.
3. Flexibility of learning exists, since students can choose any topics of their choice at any given point of time, read them at their own pace, and download any course at any given point of time.
4. The structure of the site is totally user-friendly and the design of the website is such that it helps all the visitors to access any course at its own comfort level.
5. Web hosting support from YouTube for hosting NPTEL courses.
6. A large pool of engineering faculty members with sound intellectual notes contributed for the NPTEL knowledge repository.
7. Supported by ICT.

### **9.8.2 Weaknesses**

1. One-way traffic. Virtual classroom session with two-way interaction (both side) can improve the popularity of the site.
2. Nonavailability of laboratory training courses is a distinct drawback.
3. Lack of collaborative learning scope.
4. Nonavailability of discussion forum.
5. Nonavailability of glossary: It has been suggested that key terms and abbreviations should be fully explained.

6. Internet penetration is still very low in rural India (as per the Internet and Mobile Association of India report, the Indian Internet users were only four million up to 2010, *Source: www.iamai.in*). Hence, the reach of NPTEL courses is still limited.
7. Inefficient functioning of the knowledge delivery mechanism.
8. Lack of personalized monitoring of knowledge gain by the individual visitors.
9. Lack of bookmark style of navigation: Qualitative evaluation suggests that without appropriate guidelines or tracking of progress, it becomes difficult for the students to keep a track of self-learning. It was also suggested that at the end of each module, there should be quiz questions. A small report may be sent to each visitor through e-mail/SMS automatically on a weekly basis to enable him/her to monitor his or her individual progress.
10. Lack of full coverage of contents: Many students suggest that some topics should have been covered more elaborately. In many courses, few topics have been kept untouched.

### **9.8.3 Opportunities**

1. Availability of EduSat: The dedicated educational satellite to transmit educational information to the masses with effect from 2004.
2. Lowering of cost of hardware and bandwidth.
3. There is no limit in age, time, and place of learning.
4. A large pool of young talent is eager to help NPTEL in providing support. The survey results state that 2150 respondents out of a total of 2323 (around 92.6%) are ready to participate in the NPTEL discussion forum to make the knowledge content of the web portal enriched.
5. The high growth of mobile connectivity (the wireless subscriber base was 811.59 million as on 31 March 2011 compared to 584.32 million as on 31 March 2010). It added 227.27 million subscribers in the financial year 2010–2011 registering an annual growth rate of about 38.89% (*Source: www.trai.gov.in*). NPTEL courses can be viewed from mobile also.
6. It is impossible to note down everything that a faculty discusses in a class; hence NPTEL knowledge repository is a good supplement to formal education.

### **9.8.4 Threats**

1. Other countries like the USA, UK, and Germany are giving high importance to knowledge creation through academic portals. If India does not act at the hour of initiation, then, in future, India may lose the global share in the education market.

2. The growing number of cyber crimes is a potential threat for any e-portal. According to the recently released Norton Cyber Crime Report for 2011, 431 million adults worldwide were victims of cyber crime last year. The total cost of those crimes amounts to some US\$114 billion (*Source*: <http://www.ewi.info/statistics-and-cyber-crime-epidemic>, last accessed on 4 February 2012).
3. Overdependence on technology is a threat since e-learning portals are totally dependent on the ICT.
4. Risk of technological obsolescence.
5. Regular students may start thinking that classroom education is redundant. Hence, students should know very clearly that NPTEL knowledge portal is only a supplement to classroom teaching and discussions and there is no replacement of classroom education.

After value proposition and SWOT analysis, the NPTEL portal has been further analyzed under the SAP-LAP scanner.

## 9.9 Analysis Under the SAP–LAP Scanner

The analysis is summarized as follows:

### 9.9.1 *Prevailing Situation*

Indian higher education has grown in an unplanned manner in terms of access and quality. After more than six decades since its independence in 1947, India has 300 million unemployed people who have limited skill sets, whereas employers face a huge shortage of skilled manpower (Om Vikas 2011). India's total faculty strength is around 69.9 million. Still there is an acute shortage of manpower in higher education (around 45% posts of professors, 51% posts of readers, and 53% posts of lecturers are lying vacant. *Source*: [www.ugc.ac.in](http://www.ugc.ac.in)). Such a huge shortage of faculty is difficult to be removed. A credible alternative may be the use of teachers and making them available to all using the capabilities of ICT and NPTEL is a platform for the said purpose. There exists a huge gap in the quality standard of higher education as per National Assessment and Accreditation Council (NAAC) standard and the present scenario. In spite of huge investment by the government in education, India's gross enrollment ratio (GER) is still lower than the world's average GER. The quality of education is in question in comparison to other developed countries. E-learning appears to be the most viable option to enhance GER.

### 9.9.2 *Main Actors*

**Institutional Infrastructure** Most of the private engineering colleges in India lack well-equipped laboratories. The knowledge repository of the NPTEL portal

can be used by these institutes as a supplement to regular teaching. In the survey conducted, 1185 respondents (51%) stated that the audio/video quality of the courses is “very clear or above” and 652 respondents (28%) stated that the quality is “average”, which signifies that knowledge access is smooth.

**Government of India** The growth of the Indian higher education system requires adequate funds. Only 1% gross domestic product (GDP) is allocated by the government to higher education, which is much lower than other developed countries. This is insufficient for the establishment of KM infrastructure in Indian universities (*Source*: [www.nationmaster.com](http://www.nationmaster.com)).

**Faculty** Most of the private engineering colleges do not have sufficient faculty. Moreover, faculty members from reputed IHLTs fail to perform industry interaction due to the nonavailability of facility and infrastructure. The NPTEL portal of the Government of India helps in transferring knowledge of the experienced faculty members in premier IHLTs to the masses and it may supplement the inadequacy of faculty in engineering education in India ([www.iitm.ac.in/nptel](http://www.iitm.ac.in/nptel)). The NPTEL knowledge portal can address an unlimited number of students. The survey results show that 46% of the respondents stated that the explanation provided by the faculty members on the NPTEL site is “sufficient” or “more than sufficient.” A total of 1906 respondents (82.1%) stated that the depth of knowledge in each course is of high standard.

**ICT** One of the policy decisions of the Distance Learning Division of the Department of Higher Education, MHRD, the Government of India, is to exploit the potential of ICT in the teaching and learning process (*Source*: <http://education.nic.in/dl/PolicyDraft-DL.pdf>).

Open and distance education (ODE) institutions have been created under the National Mission on Education through ICT. Its objectives are to build connectivity and knowledge network among institutions of higher learning in the country. The NPTEL survey results depict that a large number of students have already completed a specific course viewing.

**Curriculum Design** A common curriculum, which caters to the syllabus of most of the engineering colleges, was a big challenge. The NPTEL survey depicts that 1720 respondents (74%) confirm that the NPTEL syllabus matches their engineering college syllabus.

**Foreign Universities** A large number of foreign universities offer e-learning courses. Virtual university models supported and developed by Carnegie Mellon University (CMU), PA, USA, Massachusetts Institute of Technology OpenCourseWare (MIT OCW), Commonwealth of Learning, British Open University, Australian Open Universities, etc. are the most popular web-enabled courses. Unless the NPTEL initiative of the Government of India becomes very popular and captures a large market, there is a threat of losing a large market share of e-learning. NPTEL statistics states that its viewers are mainly from India (80%), the USA (14.66%), and few other countries like the UAE, Saudi Arabia, Singapore, Australia, Canada, etc. (4.71%; *Source*: [www.iitm.ac.in/nptel](http://www.iitm.ac.in/nptel)).

**KM Infrastructure of National Mission on Education Through ICT** It has established a strong communication network among institutions of Indian IHLTs.

### ***9.9.3 Process of Knowledge Creation Through the NPTEL Portal***

**Knowledge Creation Through NPTEL Knowledge Portal** The knowledge portal of NPTEL has created an impact on the technical education system in India in terms of acceptability to the students and academic community. The contents are freely available to all. The contents once uploaded are continuously being enriched due to contribution from all its stakeholders, namely students, faculty, working professionals, etc. Till date, more than 1260 courses of 40 h each (260 in phase I and 1000+ in phase II) are available online covering the most popular disciplines of technology and management (*Source:* <http://nptel.iitm.ac.in>, last accessed 14 February 2012). The number of viewers of this website has seen a steady increase and the trend is likely to continue.

**Knowledge Conversion from Tacit to Explicit** Faculty members share their life-long learning on a specific subject or topics through its 40-h lecture, which is permanently stored in the NPTEL portal. It is an exercise to convert the tacit knowledge of an expert faculty member into an explicit form. E-learning is a valid approach to convert tacit knowledge into explicit knowledge and share it (Camison et al. 2009). Faculty interaction with students through question–answer session modes offers sufficient opportunity to convert the tacit knowledge of a faculty into its explicit form.

**Knowledge Sharing** Computer as a learning tool promotes interactivity in teaching–learning. The Internet combines various media technologies and creates a new virtual world. It has now emerged as the most successful education tool because it offers an open access for information storage, display, and communication (Chaudhury et al. 2011). Knowledge sharing can bring about enhanced effectiveness (Gupta and Govindarajan 2000). Ideas breed new ideas and shared knowledge stays with the giver while it enriches the receiver (Davenport and Prusak 1998). The survey results depict that around 66% of the NPTEL viewers are students, followed by 23% of the working professionals, and 9.4% of the faculty members. Of the total visitors, 85.4% view the portal at least once in a week. Based on YouTube statistics, till date, total channel views are 6,663,379 and total subscribers are 96,807 (*Source:* <http://nptel.iitm.ac.in>, last accessed on 14 February 2012).

**Knowledge Retention** The comments and answers to the queries raised by the viewers are permanently available on the site and thereby it enhances the scope of knowledge retention. The permanent availability of a large pool of video courses along with the comments of users provides a case of knowledge retention.

**Knowledge Mentoring** A growing number of corporations and businesses are discovering that e-mentoring is a cost-effective way to improve the effectiveness

of distance training and education even while cutting training staff and training budgets (Jossi 1997). Students, who are raising any query on an NPTEL course, are answered by the mentors/authors. The mentoring process helps the student in knowledge gain and the interactions among them are recorded in the portal, which can be used by the others visiting the course.

**Knowledge Transfer** Research indicates that e-learning is perceived as a key enabler to knowledge transfer within the higher education sector (Owens 2002, 2006; Wang and Ahmed 2003; Macfadyen 2005; Hannon and D’Netto 2007). The popularity of the NPTEL site among the students community is high. Feedback reveals that 57.7% of the students have already completed 50% or above of NPTEL courses relevant in their areas.

### 9.9.4 *Learning Issues*

There is a continuous demand for the inclusion of new courses in the portal. E-learning attracts people from all walks of life. Viewers of NPTEL have diverse interests for which they view the portal for knowledge gain like academic interest (33%), competitive examinations (19%), interview preparation (11%), and interest in the subject (37%). The survey results further reveal that NPTEL is a highly knowledge-rich portal with 82% of its viewers grading its content as high standard or above. The NPTEL course outline matches with the technical syllabus followed in most of the engineering colleges across the globe, for example, 61% of the people from the USA stated that 80% of the NPTEL syllabus matches with US university syllabus, 83% of the citizens of Pakistan stated that 80% of the NPTEL syllabus has similarity with their university syllabus. The responses of NPTEL viewers on the quality of explanation provided by the faculty members are mixed. Forty-six percent of the viewers are of the view that the quality of explanation is sufficient. Around 92% of the viewers agreed to contribute to the growth of NPTEL portal by the way of participating in the discussion forum, which signifies the interest generated among the user community to make the NPTEL a successful e-learning portal. Around 97% of the viewers are of the opinion that the audio/video quality of the NPTEL portal is clear or better, which helps in the smooth transfer of knowledge.

### 9.9.5 *Suggested Actions*

Responses of 2323 respondents have been further analyzed on the problems faced by the NPTEL viewers. All of them appreciated the effort of the Government of India for creating the knowledge pool but they also provided many suggestions for improvement. The problems identified by the users group have been classified into eight distinct groups and its summary is listed in Table 9.4.

**Table 9.4** NPTEL problem/suggestion analysis

Problem classification	Number of respondents	Subcategory of problems/suggestions
Knowledge access	44	Nonavailability of PDF (30) Nonavailability of search option (8)
Knowledge content	359	Add course (313) Add laboratory courses (12) Add numerical courses (7)
Knowledge delivery	6	Pace of delivery is not uniform (6)
Knowledge index	15	Provide syllabus Provide table of contents Provide topic-wise index Please add synopsis, etc.
Knowledge sharing	17	Please provide discussion forum Please provide the contact details of the faculty
Knowledge supplement	24	Add question and answers Add reference materials
Knowledge transfer	67	Add more examples Add PPTs, animations, and diagrams Add transcript Many found lectures boring Many found video size is too large and it is suggested that lectures length should be small
Methodology	22	Many found syllabus as backdated Many proposed that faculty should not teach through PPTs
Technical	256	Many diagrams are not visible Many found the problems of download (57) Poor audio/video quality (140) Server problem Text background, etc.

*NPTEL* National Programme on Technology Enhanced Learning, *PPTs* PowerPoint presentations

### 9.9.6 Expected Performance

**Growth of NPTEL Viewers** Numbers of viewers of NPTEL have increased manifold over the years. Survey results depict that there is a growing demand for more and more NPTEL courses. There has been a significant increase in the number of technology courses and its growth in diversified fields has created an exponential demand for more web-based courses. The overall growth of NPTEL is summarized in Table 9.3. Users of NPTEL are growing every day.

Overall improvement in the quality of knowledge transfer in technology education through distance mode: The survey results of NPTEL viewers show that its visitors are happy with the quality content of NPTEL portal. Over 60.8% of the visitors view more than 3–5 courses at a time. Forty-six percent of its viewers indicate that the quality of explanation provided by its faculty members is sufficient. This is

significant to note that 51 % of its users are happy with the quality of audio/video, i.e., the knowledge transfer is substantially successful. Sixty-eight percent of the viewers feel that the pace of delivery of lectures is highly acceptable.

**Enhancement of Ranking of IIT System Globally** NPTEL is the brainchild of Indian premier IHLTs. NPTEL has contributed substantially in the enhancement of knowledge among its viewers and the huge success of NPTEL has helped in the development of the brand image of Indian IHLTs. The development of knowledge modules can be addressed to the personalized needs of the learners, standardization of e-contents in technology education to make them world class, and finally providing support for the creation of Virtual Technological University. The peer-group-assisted content development would utilize the Wikipedia kind of collaborative platform to create an interactive and a problem-solving platform through “Talk to a Teacher.” It would also provide a platform for sharing of ideas and techniques and pooling of knowledge resources. Vocational education would be strengthened through ICT and classroom teaching would be supplemented. Quality enhancement through digital empowerment of teachers would bridge the digital divide and there would be an online availability of experts and teachers to clarify the doubts of students.

## 9.10 Discussion

India is the third largest higher education system in the world after the USA and China, but the quality of higher education is in question since it cannot attract even 1 % of the total global foreign students (the USA, UK, Germany, France, and Australia take the maximum share of foreign students with 25, 11, 10, 9, and 8 %, respectively). Countries that have a strong education system attract more foreign students. Hence, there is a need to strengthen the Indian higher education system. There exists a large gap in the quality of education imparted in Indian higher education as per the assessment made by NAAC in the year 2007.

The Government of India and University Grants Commission (UGC) have set an ambitious target by taking the GER to 30 % by the year 2020. Thus, about 42 million students will have to be additionally enrolled by 2020 to achieve the target of 30 % GER of the increased population. With the help of a formal education system alone, it is very difficult for the Indian government to achieve the stiff target set by them. Education through distance mode seems to be the most viable alternative to meet the target. There has been a significant growth in the enrollment in higher education through the distance learning mode. NPTEL is probably the best alternative created by the Government of India to meet the growing demand of technical education, which is supplementary to the formal classroom education. An analysis of the results of the survey conducted reveals very positive results that it has the potential to act as an important support to higher education. The main results are summarized below:

1. Based on the data provided in descriptive statistics of important variables captured in this study, it is observed that the respondents ranked the depth of



knowledge provided on the NPTEL site as very high with a mean value of 4.17 in the range of a five-point scale. Similarly, the mean value of the attribute “pace of lectures delivered by the NPTEL faculty” is 3.35 in the scale of 5 (with 5 as fast paced and 1 as slow paced) justifies that knowledge transfer was smooth. The parameter “Quality of Video” with mean value 3.9 (on a five-point Likert scale) also validates smooth knowledge transfer through the portal. This justifies that NPTEL portal can successfully transfer knowledge to the student community.

2. Eighty-two percent of the respondents consider the depth of knowledge provided by the NPTEL site is “high standard.” It is important to state here that 68% of its viewers feel that the pace of delivery of lectures by the faculty members is average or above average, i.e., it justifies the chances of a student to follow the lectures are very much within the acceptable range.
3. An analysis of the NPTEL survey further reveals the kind of problems faced by the viewers.

Based on the overall assessment and feedback received on the NPTEL portal, the following are concluded.

NPTEL is an Indian-government-sponsored knowledge portal, which offers knowledge to its viewers through an e-learning mode with flexibility in learning. NPTEL helps in creation, sharing, and transfer of knowledge. NPTEL brings efficiency in knowledge delivery. The core processes of the portal have been designed in such a way that the selection of a specific course becomes easy through its advanced search options. Institutes that have allowed its students and faculty members to access the NPTEL portal regularly have been benefited by knowledge gain. It acts as a supplement to regular education imparted in universities and engineering colleges.

It helps in reducing knowledge loss. Academic knowledge of faculty members from Indian IHLTs can be retained in the NPTEL portal. Thus, retirement or resignation of faculty members will not lead to a severe knowledge loss for the institute. Moreover, a video lecture is a permanent asset which can be enriched further.

Most of the Indian premier IHLTs understand the value of capturing and sharing its people’s knowledge, and they have started to develop an e-learning and knowledge transfer strategy that includes Intranet content management, document management, data mining, online guidelines to students, and regular training sessions. Additionally, with the creation of an internal bulletin boards and a group of dedicated IT experts, they have started facilitating the knowledge transfer process in the institute.

## 9.11 Conclusion

The survey results reveal that the level of awareness, usage, and e-content of the NPTEL portal is very high. The result is uniform irrespective of diverse user groups. The portal can be made more powerful with the addition of a “discussion forum,”

where a student and teacher can discuss and clarify doubts. There is a growing demand for such courses as many of the engineering colleges lack sophisticated equipment and knowledgeable faculty members. The NPTEL portal helps the society at large by spreading technology education to the masses. NPTEL has created a great opportunity for all the teachers to pool their collective wisdom for the benefit of every learner and, thereby, reduce the digital divide. But, from a traditional perspective, for the time being, it appears that this mode of learning will act only in a supportive capacity to the traditional teaching. In future, NPTEL has the potential to become a standalone program for study offered by a virtual university for imparting technical knowledge.

A strategic framework of KM implementation for e-learning is understood and a value proposition framework for NPTEL e-learning portal has been developed. The framework is useful in assisting KM administrators and developers to understand the process and the components in the implementation of e-learning activities, and to understand how to improve the performance of IHLTs. The framework has the potential to help academic administrators to focus on factors which contribute towards performance. This research outcome emphasizes on elaboration and inculcation of knowledge-sharing culture in IHLTs, which is in line with the research of Kidwell et al. (2000) who stated that “there is tremendous value to higher education institutions that develop initiatives to share knowledge to achieve institutional objectives.”

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# Chapter 10

## Examining the Influence of Flexibility of Processes on E-Governance Performance

P. K. Suri

### 10.1 Introduction

Governments across the globe are increasingly exploring Information and Communication Technology (ICT)-based solutions for effective implementation of their respective governance agenda. The phenomenon is popularly known as e-government or e-governance as per the varying country contexts. It is clarified at the outset that the literature support for the study is largely taken from the journals having roots in the developed world where the popular term is e-government. However, the context of this study is India where it is termed as e-governance. Therefore, for the purpose of this study the terms e-government and e-governance are used interchangeably. E-governance involves leveraging ICT for strengthening internal government functioning and strengthening of government interfaces with its various stakeholders—particularly the citizens. There are, however, a number of administrative, socio-political, economic and technological challenges being faced by many governments in their journey towards effective e-governance. Owing to these challenges, many such initiatives—particularly in the context of developing countries—have failed or only partially succeeded in achieving their intended objectives (Heeks 2002; Weerakkody et al. 2011). An obvious implication of ICT infusion in a government setup is on the organizational processes that may generally have to be redesigned for better outcomes. Government departments are usually known to operate in silos due to their independent budgets and mandates. As a result, there may be several instances of redundant or repetitive processes across these organizations. Moreover, an intended ICT enabled government service to citizens may be based on several processes spanning across different departments. Due to this, addressing the issue of service ownership also gains significance. Effective

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e-governance, therefore, demands process oriented synergetic relationship across the related departments.

The complexities involved need a special attention in a country like India, which follows a federal government system. India launched the ambitious 'National e-Governance Plan (NeGP)' during May, 2006 ([www.mit.gov.in](http://www.mit.gov.in)). The NeGP, which comprises 31 national level Mission Mode Projects (MMPs), assumes cohesiveness among several central and state government level departments. The purpose of NeGP may remain unfulfilled if the underlying cross-departmental processes are left unchanged and the departments are allowed to function in a disjointed fashion. As an illustration, consider the Agriculture MMP covering 12 farmers centric services envisaged by the central department of agriculture for implementation in different states. Agriculture is a state subject in India. At the central level, the union government is responsible for formulating plans and policies for overall development of agriculture in the country by involving the state governments. The central government is also responsible for ensuring adequate supply of quality inputs like seeds, fertilizers, pesticides, etc. with the help of state governments by enforcing specific central legal acts. The large span of stakeholders of this sector include farmers, domestic traders, exporting firms, fertilizers and pesticides manufacturing companies, employees, central and state agriculture departments, etc. The complexities involved—due to a large number of stakeholders and processes—are likely to pose a big hurdle in the effective implementation of Agriculture MMP. To overcome this challenge, it may be required to form process centric strategic alliances across related government organizations as has been argued by Suri and Sushil (2006) in the context of building an effective agriculture marketing information system in India.

It is observed that even before launching of Agriculture MMP, concerted efforts were already being made, particularly by the central government, to improve service delivery at the grassroots through large-scale e-governance projects. It is, therefore, of utmost importance that lessons are drawn from such projects and empirical measures are brought out that can serve as guiding tools for the practitioners. Such measures can be helpful in taking corrective steps for effective implementation of Agriculture MMP in particular and other MMPs in general.

The conventional planning and implementation framework under which a majority of e-governance projects are being executed in India is characterized by several strategic gaps that have prevented the benefits from reaching the target beneficiaries (Planning Commission 2012, pp. 286–287, 291; Suri and Sushil 2012) and thus not suitable for e-governance projects (Suri 2009). In this chapter, constructs are developed for analysing flexibility of processes and e-governance performance from the perspective of government officials involved in the planning of agriculture related e-governance projects. The chapter is based on the main study (Suri 2009), which analyses planning and implementation aspects of e-governance based on a cross-case study of selected agriculture related projects in India and brought out a SAP-LAP-based (Sushil 2000a, 2001, 2009) framework for improving project performance.

## 10.2 Literature Review

### 10.2.1 *Flexibility of Processes*

Government system comprises of several independent organizations with specific mandates and stakeholders to deal with (Weerakkody et al. 2011; Gong and Janssen 2012). Efforts to infuse ICT in government functioning are generally directed at existing processes. Efficient e-governance, however, requires redesigning of work processes, organizational level changes and integration of databases within and across organizations to take advantage from the technological convergence offered by ICT (Heeks 2002; Koh et al. 2006; Silva and Hirschheim 2007; ARC 2008, pp. 71–79; Weerakkody et al. 2011; Cordella and Bonina 2012; Gong and Janssen 2012). For maximizing value to users from e-governance efforts, governments need to become citizens focused by according priority to modernizing of traditional structures, processes and culture (OECD 2003; Gong and Janssen 2012).

Information technology and business process redesign being natural partners (Davenport and Short 1990), many business entities have been able to use IT effectively by redesigning core business processes before applying IT. However, the context of public sector organizations being different, the complexity and institutional inertia associated with them need to be methodically handled through incremental process changes as continuous strategic initiative (Kawalek and Wastell 2005; Sundberg and Sandberg 2006). Adoption of such an approach is visible in the popular Indian e-governance projects like BHOOMI, CARD, e-Procurement exchange, e-Seva and KAVERI that were studied while conducting the main study.

Flexibility simplifies organizational change process (Palanisamy and Sushil 2001; Palanisamy 2014) and helps in modifying information systems strategies to meet the requirements of changing organizations; reduces the built in resistance for change. It results from ability to incorporate changes in policies and procedures quickly and proactively in response to or in anticipation of changes in external environment. In e-governance context, flexibility may be viewed as ability of a government organization to respond to the changing requirements of citizens by fine-tuning the key processes. Interdependent government systems can be made adaptable to changing environment by creating flexibility in processes (Gong and Janssen 2012). Process flexibility is a key requirement for strengthening links between partnering organizations (Stohr and Muehlen 2008). Processes can be made more flexible by introducing the levers of options, change mechanisms and adaptability (Sushil 2000a, b, 2014). Researchers have felt the need to evaluate processes in the context of e-governance (Weerakkody et al. 2011) though measuring processes in the context of IT impact is difficult (Danziger and Andersen 2002).

### 10.2.2 *E-governance Assessment*

The area of e-governance impact assessment is increasingly generating interest among scholars. For example, Bannister (2002) has classified IT value for public administration in terms of aspects such as timeliness, accuracy and convenience to citizens, strengthening of internal and external interfaces, etc. Andersen et al. (2010) have used a taxonomy based on earlier research (Andersen and Danziger 1995; Danziger and Andersen 2002) and reviewed several empirical studies to classify impact of e-government in terms of capabilities, interactions, orientations and value distributions. It has been found that majority of e-government studies have not focused on outcomes (Andersen and Henriksen 2005). Since the benefits from e-governance cannot be assessed using traditional financial measures, a few authors (Gupta and Jana 2003; Irani et al. 2005; Grimsley and Meehan 2007; Lawson-Body et al. 2008; Esteves and Joseph 2008) have proposed multi-methodology approaches, by integrating hard measures and soft measures with emphasis on outcomes. However, most of these assessment frameworks are either yet to be tested in real life situations or are relevant for only such few projects that have reached e-governance maturity (Karunasena and Deng 2012). Few more empirical studies are based on single case studies involving a narrow group of citizens, who use Internet for structured applications such as paying taxes (Wang and Liao 2008; Saha et al. 2012).

In Indian context, a few relevant research studies have emphasized on taking into account governance aspects in the performance measures (Mitra and Gupta 2008); predefining effectiveness parameters of e-governance programmes and cautiously managing factors of change for giving real benefits to stakeholders (Kumar 2009), managing continuity and change forces (Sushil 2013) and linking it to strategic outcomes for better value creation through e-governance (Nasim and Sushil 2010, 2014), and analysing e-governance performance from multi-perspectives (Suri and Sushil 2011).

Published evaluation reports (DIT 2003, pp. 32–57, 2004, pp. 30–64, 2005a, pp. 37–75; Bhatnagar 2004, pp. 95–136) of a few e-governance projects in India (AKSHYA, BHOOMI, CARD, e-Procurement, Exchange, e-Seva, FRIENDS, GYANDOOT, KAVERI, Lokvani, Nagarpalika) that were studied for the purpose of this research and have been found useful by the Administrative Reforms Commission also (ARC 2008), reflect upon governance reforms related benefits from these projects. Performance of these projects has been adjudged better in terms of ensuring easier access to service, offering of comprehensive and reliable service, time and cost savings, improved transparency in government functioning, improved interactions with government, faster processing of requests, improved monitoring and control, improved decision-making, etc.

It is observed from literature review that though empirical studies in the area of e-governance performance are growing, there is a gap with respect to empirical studies—particularly in the context of developing countries—which analyse flexibility of processes and performance in terms of outcomes related to governance reforms.

### 10.3 Methodology

The methodology adopted for the study broadly involves literature review, identification of projects for the study, conceptualization of research variables and conducting an opinion survey for empirical analysis. A review of literature was conducted on areas relevant to the study. Based on the review, six agriculture related e-governance projects of national importance in India have been identified for the study. Only such large projects were considered where it could be reasonably assumed that services have started reaching the intended beneficiaries. The basic criteria for selecting a project were, therefore, taken as that the project should have been operational for at least 1 year at the start of the main study in 2005 and that the project is of national importance with country-wide or multi-state implications. With these criteria, seven projects were short listed as summarized in Table 10.1. Out of CROP and PQIS projects, the study of CROP system was preferred over PQIS keeping in view its uniqueness in the form of amendment of a legal act for streamlining pesticides registration before applying IT.

An understanding about key processes and expectations from the identified projects is developed, which has led to conceptualization of constructs to measure flexibility of processes and e-governance project performance in the study context. To keep the research design simple and implementable, only such performance aspects and processes were considered that are commonly applicable across the six projects.

A questionnaire was developed to capture flexibility and performance related feedback. Key senior level officials involved in the planning and strategy formulation of each of the six e-governance projects were identified with the help of respective project nodal officers. It was observed that generally in each project, there are five to eight senior level officials who are involved in the planning and strategy formulation. These officials could be surveyed with census approach as their number was found to be small in each project. The observed mean values of the data collected have been used for analysing flexibility of processes and performance in the study context.

### 10.4 Conceptualization of Research Variables

A review of literature reveals lack of empirical studies that attempt to bring out validated measures to analyse flexibility of processes and performance from the perspective of government officials in e-governance context. This study attempts to address this gap. Appropriate constructs have, therefore, been conceptualized in terms of macro and constituting micro variables to measure these aspects. These variables, which are defined as follows, have been identified based on a review of literature (Suri 2009), insights gained through a pilot study of the ongoing agricultural marketing information system network (AGMARKNET) e-governance project (Suri 2005) and past experience of executing ICT-based projects in government departments.



**Table 10.1** National level agriculture related important projects in India. (Source: APEDA 2005; DAC 2005, pp. 127–128, 2006, pp. 73–75, 2007, pp. 69–71; NIC 2005; DIT 2005b, p. 82, 2006, pp. 89–90, 2007, pp. 67–70; DoF 2003, 2007; TCIL 2007; DMI 2008, project web sites)

Project and organization	Coverage	Focus/purpose	Key intended system beneficiaries	Implementation status
AGMARKNET www.agmarknet.nic.in, Directorate of Marketing and Inspection (DMI)	All India	Establishment of an ICT-based system for collecting and disseminating daily market information pertaining to several agricultural produce wholesale markets located throughout the country	Farming community, officials of markets, centre and state government officials	Operational since 2002
Kisan Call Centre http://agricoop.nic.in/PolicyIncentives/kisan-Callfirst.htm, Directorate of extension (DoE)	All India	Providing agricultural extension support	Farmers, government officials	Operational since 2004
DACNET www.dacnet.nic.in, IT Division, Department of Agriculture and Cooperation (DAC)	All India	Intranet for messaging, collaboration and implementing e-governance applications	Officials of DAC	Operational since 2005
GrapeNet www.apeda.gov.in, Agricultural and Processed Food Products Export Development Authority (APEDA)	Maharashtra, Karnataka, Andhra Pradesh	Web-based system integrating various stakeholders in the export of grapes	State/district level horticulture officials, labs, exporters, government officials at central level	Operational since 2004
Computerized registration of pesticides (CROP) www.cibrc.nic.in, G to B, Central Insecticides Board and Registration Committee (CIB and RC)	All India	Streamlining of procedures involved in registration of pesticides as per Insecticides Act, 1968	Pesticides industry and government officials	Operational since 2002
Integrated Fertilizers Management Information System (IFMIS) www.fert.nic.in, Department of Fertilizers (DoF)	All India	Ensuring adequate supply of good quality fertilizers to farmers at affordable price	Fertilizer companies, government officials of centre and states	Progressively being evolved and enriched as part of successive plans since 1995. Web-based interface for companies operational since December, 2003

**Table 10.1** (continued)

Project and organization	Coverage	Focus/purpose	Key intended system beneficiaries	Implementation status
Plant quarantine information system (PQIS) www.ppqqs.gov.in, Directorate of plant protection, quarantine and storage	All India	To prevent the entry of exotic pests into the country	Traders, government officials	Operational since 2002

### 10.4.1 Macro Variables

The macro research variables for the study, viz. ‘flexibility of processes’ and ‘performance of e-governance’ are defined as follows:

*Flexibility of Processes* This variable is conceived in terms of available options, change mechanisms and adaptability of processes to changing situations (Sushil 2000a, b, 2014). The processes conceived in the context of the study are: preparation of project plan/Expenditure Finance Committee (EFC)/Standing Finance Committee (SFC) memorandum, capacity building, content development, content delivery, and management of change.

*Performance* The performance macro variable is conceived as fulfilment of the project objectives in terms of realization of expected benefits of e-governance. The common benefits that are applicable across the e-governance projects under study are identified as achieving efficiency in government operations, bringing transparency, facilitating interactivity among internal and external actors, and aiding the decision support process.

### 10.4.2 Micro Variables

*Flexibility of Processes* The micro variables constituting the macro variable ‘flexibility of processes’ are defined as:

*Options:* This micro variable deals with options available in the key e-governance processes conceived for the project. A process with lesser number of controls is considered to be more flexible. For example, the process of capacity building can be viewed as more flexible if there is provision for continuous learning/skill upgradation of actors. A onetime capacity building programme introduces rigidity in the capacity building process. Similarly, confining the content development process to departmental boundaries introduces rigidity in the process.

*Change Mechanisms* This variable captures existence of change mechanisms that can act as levers that can gradually transform a rigid process and make it more flexible. For example, if employees are rewarded for upgrading their skills, they

will get motivated to take own initiatives in that direction and capacity building will not remain limited to predefined training programmes.

*Adaptability to Situation* The variable captures a process adaptability aspect. A process is considered as flexible if it can adapt to changing situations. For example, if employees are able to make effective use of the ICT tools made available to them, the capacity building process can be viewed as adaptable to the new environment.

*Performance of e-governance* The micro variables constituting the macro variable 'performance of e-governance' are defined as:

*Efficiency:* This micro variable deals with efficiency achieved through e-governance in terms of fast execution of the core process (UNESCO; Bannister 2002; Esteves and Joseph 2008; Mofleh et al. 2009; Andersen et al. 2010), simplification of government procedures (UNESCO; Bannister 2002; UN 2008; Mofleh et al. 2009; Karunasena and Deng 2012), reduced paper work (Evans and Yen 2006; Planning Commission 2007; UN 2008; Karunasena and Deng 2012), and decreased communication cost (Evans and Yen 2006; Planning Commission 2007; UN 2008) while transacting with government.

*Transparency* This micro variable addresses delivery of government service in a transparent manner, i.e. whether the service is reliable (Bannister 2002; OECD 2003; Andersen et al. 2010; Karunasena and Deng 2012), comprehensive (Bhatnagar 2004; Karunasena and Deng 2012), easily accessible (World Bank; Harris 2007; Esteves and Joseph 2008; Karunasena and Deng 2012), and delivered in a fair manner (UNESCO; Bannister 2002; Harris 2007; Planning Commission 2007).

*Interactivity* This micro variable deals with improved interactions facilitated by the e-governance service (World Bank; UNESCO; Bhatnagar 2004; Jaeger 2005; Tan et al. 2005; Evans and Yen 2006; Esteves and Joseph 2008; UN 2008; Mofleh et al. 2009; Karunasena and Deng 2012). The interactions can be with internal actors, with actors belonging to other related organizations, with beneficiaries and with government as per the respondent category.

*Decision Support* This micro variable reflects better decision support in terms of improved planning and decision-making (UNESCO; Bannister 2002; Evans and Yen 2006; Andersen et al. 2010), and better monitoring and control (Bhatnagar 2004; Andersen et al. 2010) made possible by an e-governance service.

## 10.5 Survey of Planners

### 10.5.1 Questionnaires Development

All the six projects identified for the study were studied to develop basic knowledge about the project objectives and expected benefits. Flexibility of processes and performance related questions are developed keeping in view the observed

commonalities in terms of respective micro variables across the six projects. Questions were standardized to ensure their applicability across the projects. For better understanding and interpretation, the standard performance related questions were qualified with project specific contexts. The questionnaires were subjected to face, criteria related and content validity tests (Kerlinger 1983, p. 458) for fine-tuning before launching the survey. The validation of questionnaires was followed by pretesting of questionnaires. Ambiguity in questions was removed and wording of questions improved based on learning from the field visits. A five point Likert scale was used with options as nil (N), to a small extent (S), to a medium extent (M), to a large extent (L) and to a very large extent (VL). The scale was transformed into five continuous classes as 0–0.2 (N), >0.2–0.4 (S), >0.4–0.6 (M), >0.6–0.8 (L) and >0.8–1.0 (VL) and applied on the observed data for the purpose of statistical analysis. The questionnaires along with mean observed values are presented in Appendix I in a compact form. Most of the prospective respondents were approached in person. This was feasible as the planners in each project were generally centrally located and their number in each project was also small. In all, 36 valid filled-in questionnaires were received with number of respondents ranging from five to eight in case of each of the six projects.

### ***10.5.2 Reliability and Validity Analysis***

The Cronbach's Alpha values, measuring internal consistency (Kerlinger 1983, pp. 451–452) of the performance constructs, are found to be 0.85 and 0.94, respectively. These values are well above the threshold level of 0.6 that is recommended as acceptable for empirical research of this nature (Hair et al. 2006, p. 118). The macro and micro variables are subjected to factor analysis for validating the constructs (Kerlinger 1983, pp. 659–678; Hair et al. 2006, pp. 90–114). The construct acceptability criteria are based on the values of cumulative extracted squared loading. Hair et al. (2006) have recommended that factor loadings greater than 50% may be considered practically significant. At the macro level the factor loadings in respect of macro variables 'flexibility of processes' and 'performance of e-governance' are found to be 65.3 and 80.9%, respectively, that are well above the threshold value. At the micro level, the factor loadings in respect of the constituting variables of 'flexibility of processes', viz. 'options', 'change mechanisms' and 'adaptability to situation', are found to be 57.1, 50.3 and 48.2%, respectively, that are above or near the threshold value. The factor loadings in respect of the constituting variables of 'performance of e-governance', viz. 'efficiency', 'transparency', 'interactivity' and 'decision support', are found to be 73.0, 65.2, 82.3 and 68.7%, respectively, that are above the threshold value. It has been further tested that all the items constituting the macro/micro variables are loading on the respective macro/micro variables.

Based on the factor analysis and reliability analysis conducted above, the constructs are treated as validated and used for further analysis.

**Table 10.2** Statistics for research variables (Base survey: Planners)

Planners											
Variable	N Valid	Mean	SE (Mean)	SD	CV (%)	Range	Min	Max	Percentiles		
									25	50	75
<i>Flexibility of processes (FP)</i>	36	0.46	0.03	0.15	32.61	0.77	0.08	0.85	0.36	0.43	0.55
Options (OPT)	36	0.49	0.04	0.23	47.01	0.90	0.10	1.00	0.30	0.43	0.69
Change mechanisms (CM)	36	0.42	0.03	0.18	42.06	0.80	0.05	0.85	0.30	0.35	0.55
Adaptability to situation (ADP)	36	0.47	0.03	0.17	35.94	0.75	0.10	0.85	0.35	0.50	0.59
<i>Performance of e-governance (PERF)</i>	36	0.70	0.03	0.17	24.28	0.69	0.31	1.00	0.59	0.70	0.82
Efficiency (EFFI)	36	0.73	0.03	0.19	26.16	0.69	0.31	1.00	0.63	0.75	0.86
Transparency (TRANSP)	36	0.73	0.03	0.16	22.41	0.69	0.31	1.00	0.69	0.75	0.81
Interactivity (INTER)	36	0.61	0.04	0.22	35.41	0.92	0.08	1.00	0.50	0.63	0.75
Decision support (DECSP)	36	0.63	0.04	0.22	34.08	0.75	0.25	1.00	0.50	0.63	0.75

## 10.6 Reflections from Survey of Planners

The observed values of statistics pertaining to macro and micro variables are shown in Table 10.2 and discussed as follows:

The observed mean values of the micro variables ('OPT', 'CM' and 'ADP') constituting the macro variable 'flexibility of processes' are found to be towards the lower limit of the medium-extent range. At the macro level, the aggregated measure of flexibility of processes is found to be 0.46, which also falls in the lower limit of medium-extent range of 0.4–0.60 on a scale of 0–1. These values clearly indicate the rigid nature of the processes studied in the context of six ongoing projects. The overall performance as perceived by the planners is just above the large-ex-

tent range. The mean values in respect of the constituting micro variables ('EFFI', 'TRANSP', 'INTER' and 'DECSP') are found to be fairly consistent and pertain to the large- or very-large-extent ranges. These observed macro/micro level mean values in respect of each of the five identified process and performance aspects considered in the study context are interpreted in Tables 10.3 and 10.4, respectively.

## 10.7 Research Contributions, Implications and Limitations

*Research Contributions and Implications* The need for redesigning of existing structures and processes at different layers of the government to achieve effective e-governance has been highlighted in many previous studies ([www.knowledgecommission.gov.in](http://www.knowledgecommission.gov.in), OECD 2003; Silva and Hirschheim 2007; ARC 2008, pp. 71–79). Further, there is a general lack of measures to monitor performance of e-governance projects (Hung et al. 2006; Yildiz 2007). This study, based on cross-case analysis of six agriculture related projects in India, may be viewed as a stepping stone for arriving at validated constructs to measure flexibility of processes and performance of e-governance. An opinion survey of select government officials belonging to the six ongoing projects, was conducted to populate the constructs and perform univariate analysis. The analysis reflects that planners are expected to keep in view the likely outcome from an e-governance project while formulating a project plan. For example, the performance variables need to be clearly identified in terms of likely improvement in efficiency, transparency, interactivity and decision support. These aspects may be prioritized as per their relevance in the project situation and metrics for measuring them need to be defined for periodically reviewing the outcomes. Similarly, the construct for measuring 'flexibility of processes' is expected to sensitize the planners for appropriate actions in order to transform the processes involved as versatile and adaptable. They can initiate actions to modify the conventional processes such that they are not only simple to execute but also flexible enough to change with changing times (Sharma et al. 2010).

From the viewpoint of researchers, the validated constructs can be further used to explore the relationship between the two by taking 'flexibility of processes' as independent variable and 'performance of e-governance' as dependent variable. Based on the conceived variables, following macro and micro level hypotheses of association are formulated. These may be statistically tested for examining the relationship between the conceptualized flexibility macro/micro variables with the performance macro/micro variables.

The macro level alternate hypothesis, conceptualized on the basis of this study, is:

HAP1: Flexibility of processes is a predictor of performance of e-governance.

The corresponding null hypothesis for HAP1 is:

HAP0: Flexibility of processes is not a predictor of performance of e-governance.

The general micro level alternate hypotheses of association are of the form:

**Table 10.3** Flexibility of processes—Interpretation of observed means (Base survey: Planners)

Sl. No.	Process	Micro variables			Macro variable	Interpretation
		Options	Change mechanisms	Adaptability to situation	Flexibility	
1	<i>Preparation of project plan/ EFC/ SFC memo</i>	0.29	0.29	0.41	0.33	E-governance project plans are apparently being prepared as a time bound static exercise. It is difficult to change plans during the course of execution ( <i>small extent</i> ). Such plans are not adequately equipped to handle emerging situations during implementation ( <i>small extent</i> )
2	<i>Capacity building</i>	0.78	0.38	0.54	0.57	The projects have adequate provisions ( <i>large extent</i> ) for capacity building of the officials. However, this aspect is not being emphasized upon ( <i>small extent</i> ). The employees do not seem to be in position to fully utilize the ICT infrastructure ( <i>medium extent</i> ) which is a reflection on the gaps in capacity building process
3	<i>Content development</i>	0.49	0.55	0.56	0.54	External stakeholders are not being adequately involved ( <i>medium extent</i> ) to develop contents for dissemination. It is only to a medium extent that the present setup is equipped to deliver contents as per specific needs of the end users based on their regular feedback ( <i>medium extent</i> )
4	<i>Content delivery</i>	0.47	0.34	0.37	0.41	Content delivery is limited to project specific database. Vertical and horizontal integration of related databases within and across organizations is being practiced insufficiently ( <i>small extent</i> )
5	<i>Management of change</i>	0.43	0.47	0.47	0.46	Restructuring of existing organizational framework/re-engineering of processes to support e-governance is inadequately being practiced ( <i>towards lower limit of medium extent range</i> ). It is only to a medium extent that the existing government setup is able to deliver services at grassroots ( <i>towards lower limit of medium extent range</i> )

**Table 10.4** Performance of E-governance—Interpretation of observed means (Base survey: Planners)

Sl. No.	Micro variable	Observed mean	Interpretation
1	<i>Efficiency (EFFI)</i>	0.73	Planners perceive E-governance performance to be of <i>large extent</i> in terms of improvement in efficiency, i.e. faster execution of processes, simplification of procedures, reduced paper work and lesser communication costs
2	<i>Transparency (TRANSP)</i>	0.73	Planners perceive E-governance performance to be of <i>large extent</i> in terms of improvement in transparency, i.e. dissemination of reliable and comprehensive information, easy access to information and ensuring fairness
3	<i>Interactivity (INTER)</i>	0.61	E-governance has helped in improving interactions within the organization ( <i>medium extent</i> ), interactions with external organizations ( <i>large extent</i> ), interactions with beneficiaries ( <i>large extent</i> )
4	<i>Decision support (DECSP)</i>	0.63	Planners perceive that E-governance has helped in improving planning and decision-making ( <i>large extent</i> ), and monitoring and control ( <i>large extent</i> )
5	<i>Performance of e-governance (PERF)</i>	0.70	Overall, the planners have perceived performance of e-governance to be of <i>large extent</i> . The observed means further reflect that the perceived improvement is more in terms of efficiency and transparency when compared with interactivity and decision support. The response of planners could possibly be having an inherent bias as they might be trying to justify their initiatives or they may be actually drawing more benefits from the e-governance initiatives due to their better access to the facilities created when compared with the indented beneficiaries at the grassroots or the officials operating in the field

HAP<sub>ij</sub>: *i*th micro variable of flexibility of processes is a predictor of *j*th performance micro variable; *i* ∈ {OPT, CM, ADP}; *j* ∈ {EFFI, TRANSP, INTER, DECSP}.

The predictive relationships which get revealed from such an analysis may be interpreted in the specific case contexts using interpretive matrix tool (Sushil 2005) to arrive at the interpretation of influencing links between ‘flexibility of processes’ and ‘performance of e-governance’.

*Limitations* The study is constrained by lack of similar past studies. As such, there is ample scope for improving the proposed constructs by studying more e-governance projects pertaining to different areas.



## 10.8 Conclusion

In the recent past, many e-governance initiatives have been taken across the world. Studies have, however, revealed high risk of failure associated with e-governance projects. In this chapter, two constructs have been proposed to measure flexibility of the key e-governance processes and performance in the study context. The constructs have been statistically validated. An opinion survey of government officials involved in planning of six agriculture related e-governance projects, has been conducted to populate the constructs for further analysis. It has been found that there is much scope for improving flexibility in the underlying processes as well as performance of e-governance. The analysis has brought out implications for both researchers and practitioners. It has also provided ground for proposing hypotheses of association for testing predictive relationship between ‘flexibility of processes’ and ‘performance of e-governance’.

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## Appendix I

### Questionnaires and Observed Mean Values

#### (a): Flexibility of Processes

Please assign a score towards the options applicable to (*project name*)

Ex.: In F1, if Project plan preparation is a one-time process—assign score 1; if it is dynamic process, i.e. the plan is changeable—assign score 5; If it is towards a dynamic process but not strictly a dynamic process—assign score 4; if it is more towards a one-time activity—assign score 2; If it is in between the two extremes—assign score 3)

	Process	Option	1	2	3	4	5	Option
F1	<i>Preparation of project plan/ EFC/SFC memo</i>	One-time process in a plan period						Dynamic process (changeable)
F2	<i>Capacity building</i>	One time activity						Provision for continuous learning
F3	<i>Content development</i>	Department's own perception						Based on regular feedback of stakeholders mentioned in SF1

	Process	Option	1	2	3	4	5	Option
F4	<i>Content delivery</i>	Confined to project specific database (without collaborating with other related projects)						Based on inter-organizational collaboration at centre/state level (integrated databases within and across related organizations)
F5	<i>Management of change</i>	Application of IT without undertaking any restructuring/process re-engineering						Restructuring of existing organizational framework/re-engineering of processes to support e-governance

Aspect		N	S	M	L	VL
<i>Preparation of project plan/EFC/SFC memo</i>						
F1.1	Extent to which it is easy to change an approved plan (EFC/SFC memo) in the present planning framework					
F1.2	To what extent the present planning framework is able to cater to emerging requirements which were not conceived while planning(at the time of preparation of project plan/EFC/SFC memo)					
<i>Capacity building</i>						
F2.1	To what extent employees are given incentives/encouraged for upgrading their IT skills					
F2.2	To what extent employees are in position to make best use of ICT infrastructure					
<i>Content development</i>						
F3.1	To what extent the present set up is equipped to develop customizing contents based on regular feedback from customers (citizens)					
F3.2	To what extent the present web-site/service is able to deliver information as per specific demands/needs of different users					

Aspect	N	S	M	L	VL
<i>Content delivery</i>					
F4.1	To what extent the established government system facilitate integration of databases across related departments at centre/state government level				
F4.2	To what extent the present Government system is able to provide domain specific unified service to citizens independent of departments at centre/state government level				
<i>Management of change</i>					
F5.1	To what extent the existing Government system at centre/state government level is suitable to support e-governance				
F5.2	To what extent the present Government system ensures reaching of e-governance benefits to the grassroots				
<i>N nil, S to a small extent, M to a medium extent, L to a large extent, VL to a very large extent</i>					

### (b) Performance of E-governance

	Extent to which the service (project name)	<i>P</i> ( <i>n</i> =36)
1	Helps in getting faster access to (-)	0.813
2	Has simplified the procedure to access (-)	0.708
3	Has helped me by reducing dependence on printed material/correspondence (-)	0.688
4	Has helped in reducing communication cost (-)	0.715
5	Provides (-) information which is reliable	0.722
6	Meets (-) information requirements	0.715
7	Helps in getting easy access to (-)	0.785
8	Has helped in ensuring fairness (-)	0.715
9		
9.1	Internal actors (Hqrs and field offices/operational level staff)	0.679
9.2	External actors belonging to other related organizations	0.549
9.3	Beneficiaries	0.611
10	Helps in (-) planning and decision-making	0.653
11	Helps in monitoring and control (-)	0.611

(-) project specific qualifiers are presented in Appendix I (c). In the respective questionnaires, care has been taken by forming the sentences properly

**(c): Project Specific Qualifiers for Performance**

S.No.	AGMARKNET	KCC
1	Country-wide market information	Agricultural related information
2	Market information	To get answers to agriculture related queries
3	For seeking agricultural marketing related information from government agencies	For seeking agriculture related information from government agencies
4	For accessing market information	For accessing agriculture related information
5	Commodity arrivals and prices	Agriculture
6	Agriculture marketing related	Agriculture related requirements of information seekers
7	Market-wise information	Agriculture related information
8	By providing unbiased/un-manipulated market information	By removing bottlenecks in seeking of agriculture related advice from government
9	Agricultural marketing related matters	Agriculture related matters
10	Agricultural marketing related	Agricultural related planning and decision-making at the level of citizens/government
11	Over market situation (arrivals and prices)	Different developmental schemes in agriculture
	<i>DACNET</i>	<i>GRAPENET</i>
1	Information exchange with Hqrs/other DAC offices/divisions	Country-wide grading activities
2	Execution of routine tasks	For issue of CAG/Phytosanitary Certificate
3	Has helped in reducing paper work	For issue of CAG/Phytosanitary Certificate
4	Seeking information	For implementing grapes certification programme
5	On agriculture	Grapes consignments inspected by approved labs/issue of CAG
6	Agriculture related	Requirements for issue of CAG/issue of Phytosanitary Certificate
7	Agriculture related information pertaining to other divisions	Approved labs reports/CAG
8	Office circulars/notifications/opportunities/new initiatives	By providing transparency and cutting down delay
9	Agriculture related matters	Grapes certification related matter
10	Related to work assigned to you	QC related
11	Agriculture schemes and taking corrective measures	Over issue of CAG/Phytosanitary certificate
	<i>CROP</i>	<i>IFMIS</i>

S.No.	AGMARKNET	KCC
1	Registration application	Preparation of monthly movement plan/ faster processing of financial claims related to subsidy, freights, etc.
2	Has helped in simplifying procedures	Industry-government co-ordination
3	Has helped in reducing paper work	Reducing paper work
4	Pesticides related information	Reducing communication cost
5	Pesticides related	Fertilizers related matters
6	Pesticides related	Fertilizers related information requirements
7	Application status/pesticides norms information	Monthly movement plan
8	In handling of applications by the government	In co-ordination between industry and government
9	Pesticides related matters	Fertilizers related matter
10	Pesticides related	Fertilizers related
11	Of pesticides availability	Fertilizers production and distribution

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# Chapter 11

## Workflow Automation Process for a Reinsurance Company Using BPM Tool: A Stakeholder Engagement Perspective

Anuradha Alladi and P. H. Anantha Desik

### 11.1 Introduction

Reinsurance is a complex business involving risk protection and advisory services extended to insurance companies (cedents). The reinsurers operate either directly with cedents or through intermediaries called brokers. The nature of the business involves an extensive information exchange between the reinsurer and cedents/brokers. This requires the reinsurers to spend a substantial amount of time in processing the information received from the brokers according to the business rules and validations applicable.

This complex and tedious manual process can be streamlined by adopting support from the information technology (IT) systems to define, monitor, and control the manual processes. The business process management (BPM) solution provided here requires a predefined set of business workflow processes, business validations, and end-to-end business flows.

The project is aimed at the development and implementation of accounts workflow system as part of an e-business program for the customer. The primary objective is to automate the finance department's processing of account information received from brokers to update the core reinsurance systems. The objectives of automation are to:

- Reduce the turnaround time for processing broker messages.
- Reduce data entry effort for the booking process of the technical accounting staff.
- Use the workflow process to streamline the transaction and tracking system.
- Bring transparency and accountability to the system through autonotifications to business users.

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### ***11.1.1 Context and Methodology Adopted***

The reinsurance domain has complex business processes. Reinsurance provides risk protection and advisory services to insurance companies. The information exchange between the reinsurer and intermediaries involves an extensive process flow and data exchange. The workflow process design should comply with ACORD standards as these standards are followed by brokers/intermediaries.

The reinsurance companies wanted to automate their accounting workflow process to have better control over daily operations they execute. The workflow automation process requires deep reinsurance domain knowledge along with the understanding of complex accounting business rules applicable for the industry.

The team applied the stakeholder engagement methodology for effective transitioning from a manual process to an automation process. The stakeholder engagement methodology included the principle of inclusivity. The principle of inclusivity refers to three important elements, i.e., materiality, completeness, and responsiveness. Materiality helps in identifying the needs and requirements of all the relevant stakeholders in the process. Completeness ensures that requirements are complete in all respects, not leaving any scope for omissions. Responsiveness ensures that the automation process responds to the needs or concerns expressed by the stakeholders, in manual processes as well as in the designing and development of the automation process.

The project team identified stakeholders involved in the automation process. The team also identified needs, requirements, and concerns of all the stakeholders, enabling the team to have a better understanding of the problem. The team had requisite business knowledge of the stakeholders' needs as well as customer's pain areas in terms of gathering data from different sources to define the workflow. Stakeholder engagement helped to address the concerns of the stakeholders in the workflow automation, effectively.

The stakeholder engagement methodology helped to satisfy all the stakeholders, as the methodology factored in all the stakeholders and their needs and concerns, while designing and developing the workflow automation. The workflow automation helped the reinsurance organization to cater to effective services in place of manual operations.

### ***11.1.2 Stakeholder Engagement***

Engaging the stakeholders is essential at the beginning of a project so that a buy-in can be obtained from stakeholders who are involved or affected by the given program/initiative.

A stakeholder is a person, group, or an organization, who has direct or indirect stake in an organization because it can affect or can be affected by the organization's actions, objectives, and policies. Key stakeholders in a business organization include creditors, customers, directors, employees, government and its agencies,

owners, shareholders, suppliers, unions, and the community from which the business draws its resources (Krick et al. 2005).

While automating the claims workflow process for the reinsurance team, the project team identified stakeholders who have stakes in the automation process. They are:

- Customer chief information officer (CIO)
- US Claims department head
- US Claims business users
- Canada business team
- Vendor domain team
- Vendor application development team
- Third-party vendor
- Application management team
- Global IT-Global
- Brokers/cedents/ACORD standards

Stakeholder engagement comes into the picture whenever any organization initiates an open two-way dialogue seeking understanding and solutions to issues that are equally important for both parties. Stakeholder engagement involves time, resources, and commitment to take the engagement forward (Krick et al. 2005).

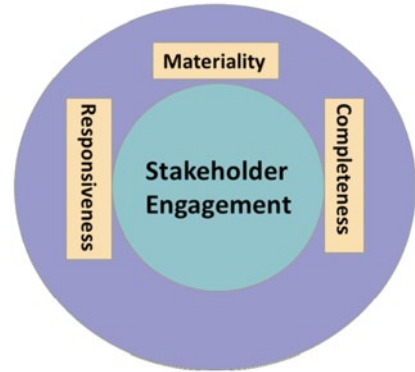
It is extremely important to involve stakeholders in all phases of a project for two reasons: First, experience shows that their involvement in the project significantly increases the chances of success by building in a self-correcting feedback loop; second, involving them in the project builds confidence in the product and will greatly ease its acceptance among the target audience.

### ***11.1.3 Why Business Process Management Tool?***

The team envisaged the following benefits from the tool:

- Supports rapid application development
- Helps to set up a standard framework for enterprise-wide processes
- Brings the disconnected system processes and management together in a connected environment
- Defines rules, allowing governing business calculations whereas the integrated workflow provides the application-specific rules that are either automated or manual
- Requires less effort in changing the existing workflow processes

The BPM tool has the flexibility to connect to external systems for data and documents interchange. It is easier to customize the administration, workflow, and rules validation using the tool instead of using a programming language from the initial phase ([www.metastormguru.com](http://www.metastormguru.com)).

**Fig. 11.1** Principle of inclusivity

## 11.2 Principle of Inclusivity

The AA 1000 series guides organizations in establishing a systematic accountability process that involves stakeholders in building policies, strategies, and programs in alignment with the organizational performance. The AA 1000 framework is based on the “principle of inclusivity” (Fig. 11.1).

**Inclusivity**—For an organization that accepts its accountability to those on whom it has an impact and who have an impact on it, inclusivity is the participation of stakeholders in developing and achieving an accountable and strategic response for its sustainability.

An organization striving for inclusivity means that an organization is committed to reflect the views and needs of all stakeholder groups. Stakeholder views are expressed/obtained without fear or restrictions. The term inclusivity also refers to the unsaid needs of the environment, future generations, etc.

The principle of inclusivity comprises materiality, completeness, and responsiveness, providing guidance in ensuring that the stakeholder engagement supports the accountability of the automation team.

- **Materiality**—Understand what is important to you and to your stakeholders. The material issues that will influence decisions and actions and performance of an organization or its stakeholders. What concerns are important to their stakeholders and the project they are working for? What concerns are important to you and to your stakeholders?
- **Completeness**—Requires understanding and management of material impact and associated stakeholder views, needs, and performance perceptions and expectations. It is essential for understanding the impact and what people think of you collecting and analyzing information from within and outside the organization to make an informed decision.

**Fig. 11.2** Stakeholder engagement phases with communication at the center



- **Responsiveness**—Requires coherently responding to stakeholders’ and organizations’ material issues. Does response to stakeholder issues affect its sustainability and performance? It helps to respond to the stakeholders’ concerns and expectations. The main principle applied in this phase is responsiveness, which means the team commits to ensuring that they respond to the stakeholders’ material expectations, needs, and issues adequately (AA1000 SES (2005) and AA 1000 Accountability Principles standard 2008).

### 11.3 Stakeholder Engagement Methodology

We all feel the need for engaging the stakeholder is important for a program’s success and for sustainability. The application team has made a similar approach to engage stakeholders before the program initiation to get a buy-in from them. This approach led to building trust and a long-term relationship with the stakeholders of the program. The stakeholder engagement model has five phases, with communication being at the center, occupying a key position. The five stages of the stakeholder engagement are as listed below (Krick et al. 2005; International Finance Corporation; Stakeholder Engagement; Alladi and Vadari 2011):

1. Communication
2. Think strategically
3. Analyze and plan
4. Strengthen engagement capacities
5. Design the process and engage
6. Act and review (Fig. 11.2).

### **11.3.1 Communication**

Communication plays a key role, revolving around the stakeholder engagement process. It has helped in ensuring that the feedback within the engagement system is derived from the value chain during the process. Communication enabled the team to engage in a self-correcting loop.

Good communication is essential for motivating stakeholders and is also critical for motivating the program's own members. It helps in maintaining enthusiasm and support and can convince neutrals to render support. A well-planned communication with stakeholders can help them to understand the following (Alladi and Vadari 2011):

- the need for the program and how it will contribute to the objectives of the organizations
- the benefits and rewards that will be obtained from the success of the program such as greater opportunities for promotion, reduced risks, enhanced satisfaction, and elimination of redundancies in the department
- the ways in which their work will be made easier through improved information or faster access
- the assurance that particular issues that concern them will be dealt with effectively, for example, through appropriate training and the provision of additional support during transition periods

Communication is a vital tool for influencing stakeholders to understand the program's benefits and its effect on the stakeholders' interests. Communication strategy will vary based on the type of the stakeholder, i.e., if the stakeholder is an ally, neutral, or an opponent, the strategy has to be appropriate.

Communication can be sent through one or many of the following channels within the program:

- regular progress meetings
- program board meetings
- company intranet
- face-to-face meetings with key individuals
- group meetings, workshops, seminars
- individual and group e-mails
- program plans

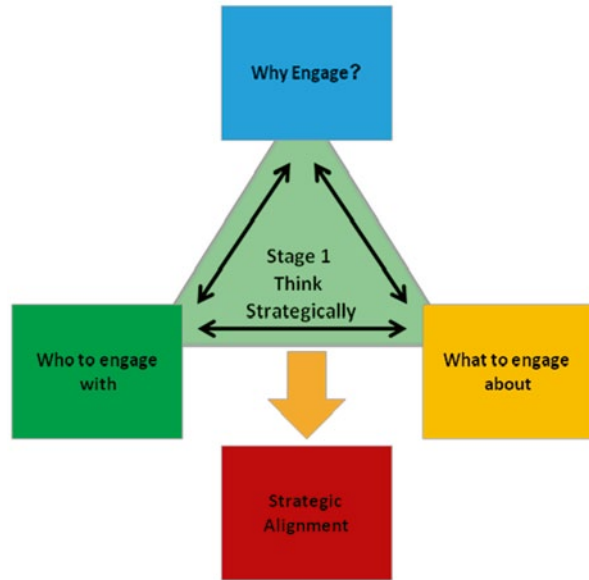
The mode of communication that took place during the automation process between both the customer's team and application team is provided in Table 11.1.

The team communicated with all the stakeholders after the completion of each phase of the engagement by playback sessions, workshops, and demonstrations on the progress of the application. This process ensured that the needs/issues of the stakeholders were considered while developing the application.

**Table 11.1** Communication shared between customer and application team

Sl. No	Customer managers	Application team managers
1	CIO	Client manager
2	Business unit head	Program manager
3	VP—IT team	Delivery head
4	IT manager	Project manager
5	Lead architect	Technical architect

**Fig. 11.3** Think strategically to identify the stakeholders



### 11.3.2 Think Strategically

The key phase in stakeholder engagement is to identify strategic priorities for stakeholders in the organization. The team needs to answer questions with respect to who are the stakeholders of the program. What material issues are important for them? Are these needs/issues/requirements within the scope of the program? Whom to engage? What strategy needs to be applied for engagement? (Krick et al. 2005; International Finance Corporation) (Fig. 11.3).

#### Workflow Automation Team Influence/Interest Grid

The stakeholders were placed at different quadrants in the influence and interest grid, based on the initial understanding of the automation workflow process. The influence and interest grid will provide details about how each stakeholder is

**Table 11.2** Influence versus interest grid for automation process (Alladi and Vadari 2011)

High Interest	Business Unit Team Customer Group IT-Global	Customer IT team IT CIO Business unit Head BPM Vendor
	Brokers/Cedents/ACORD Services Group	Application Team Application Mgmt Team
	Low Influence	High

placed in the workflow automation process. The initial understanding is shared in Table 11.2.

- **High influence and high interest**—The customer IT team, customer IT CIO, business unit head, and BPM vendor had a high interest and influence over the program.
- **High influence and low interest**—The application management team and application development team had high technical knowledge and experience of the automation process.
- **Low influence and low interest**—Brokers/cedents/ACORD and services group had low interest and influence over the program.
- **Low influence and high interest**—The business unit team and customer group IT-Global had a high influence over the program, but were not interested in implementing the BPM tool, as they wanted to use Dot net technologies to automate the workflow process (Alladi and Vadari 2011).

### Stakeholder Needs

The application team carried out a needs analysis based on the interest each stakeholder had over the automation workflow program. The team listed out the following stakeholders and their needs and expectations from the program, so that they could be accommodated in the automation process (Table 11.3).

#### 11.3.3 Analyze and Plan

Successful stakeholder engagement involves prioritizing and developing a plan for the engagement. It is essential that the team is aware of the stakeholders, and their needs and expectations from the automation process. The needs gathered should



**Table 11.3** Stakeholders and their needs/expectations from the workflow automation process

Sl. No	Name of the stakeholder	Needs of the stakeholder
1	Customer CIO	Owns the automation process, highest stakes in BPM process, pioneer in BPM product implementation
2	Customer IT team	The automation process to be complete within budget, time, error free, the new tool to enable them to perform the job functions much faster, gain business satisfaction, which enables them to do more transformational initiatives
3	Business unit head	Being a sponsor of the program, is one of the key stakeholders to initiate and move the program from manual to automation process; to reduce the workload, cost, and increase the productivity. Faster accounting process which will enable them to handle more number of requests in a day
4	Customer business team	Move from tedious manual process to automatic process, increased productivity, error-free functioning
5	BPM vendor	By successful implementation of their tool, will increase the market share and more product sales in reinsurance domain, to become a preferred tool vendor to implement the automation process, other than application tam. But the customer insisted application team to automate the workflow process
6	Application management team	To gain a different experience while executing the process in reinsurance domain, resulting in more business, gain experience in tool implementation, more integration opportunities going forward
7	Application support team	Good opportunity for the team to learn about the BPM tool, understand the standards involved in reinsurance domain, and business from the customer
8	Services group	Providing services on time for the integration with other applications, improved services by centralizing the processes, and sufficient time for providing the services
8	Customer group IT-Global	Wanted to implement the DotNet technology, as global IT workforce is dominated by Dotnet technologies, was reluctant to implement the BPM tool
10	Brokers/cedents/ACORD	Transparent processes, error-free data exchange per ACORD standards, less time to process, new tags are being derived for brokers and enhancing the tags standard

be complete in all respects, to ensure that the automation process does not omit the needs and requirements expressed at this “think strategically” stage. This also involves capturing unstated business requirements.

There is a need to understand if the needs expressed by the stakeholders are adequate for designing the engagement process with the stakeholders. For example, the needs addressed were being performed manually, and the automation process would bring a difference to the workflow process in terms of quality, productivity, and increasing accuracy, in a shorter span of time (www.PMI.Org).

The application team did a study on how other projects of a similar domain are addressing the needs of the stakeholders. The automation team was cognizant of

various factors before designing the engagement model, like the mode of their engagement with stakeholders, what are the lessons learnt while automating, whether the needs/issues expressed by the stakeholders are addressed adequately, limitations of the tool, etc. These factors were considered, before coming up with the strategy for the engagement.

### ***11.3.4 Strengthen Capacities for Engagement***

It is essential at this stage that the team is equipped to understand who their stakeholders are, the needs and issues of these stakeholders, in complete form, and the engagement enables the team to respond to the needs and requirements in a coherent manner.

The application team had a list of stakeholders and the needs of the stakeholders; the team was also aware of the manual process hindering the existing performance levels for the customer. With the automation of the accounting module using the BPM tool, processing was carried out at a faster pace, while eliminating manual errors and omissions.

In the feedback, the customer expressed: “Business Process Management enabled this carrier to implement eAccounting in lesser time it would have taken, using traditional development methods. The resultant highly adaptable digital business platform enables real-time execution of its business value chain, with flexibility to adjust business processes with minimal coding changes. The platform should include independent rule engine and flexibility in updating business rules. The application has to follow the ACORD Reinsurance Technical Accounting standard for seamless data exchange between reinsurer brokers and cedents.”

The application team preferred the BPM tool over the other tools available in the market based on the following:

- The BPM tool has many elements and features which are user and developer friendly.
- The BPM tool is an administration tool which facilitates user role management, is easy to use, customize, and configure.
- The tool has report generation ability to design reports and port into various file formats like access, excel, etc.
- The BPM tool also has online technical support for quick resolution ([www.metastormguru.com](http://www.metastormguru.com)).

#### **Features of the BPM Tool**

- Ability to configure the roles (static, dynamic) during the execution
- Built-in features like document management system (DMS), error logging/reporting
- It mandates to design the process with actors, stages, roles before the development
- The support to connect external components via web services
- Quick online helpdesk support ([www.metastormguru.com](http://www.metastormguru.com))

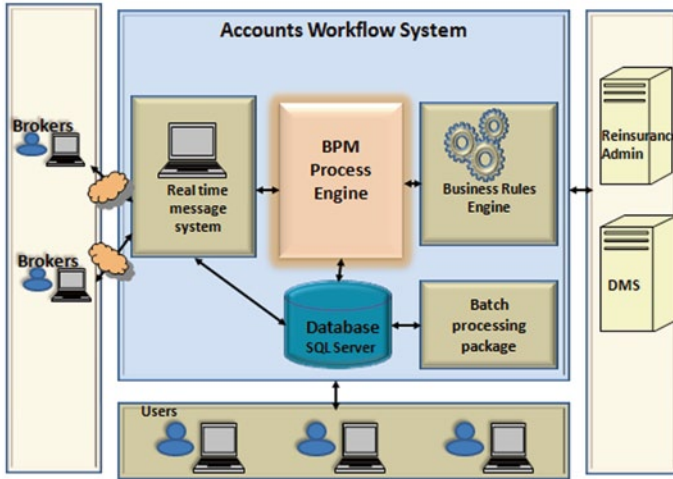


Fig. 11.4 Workflow automation system architecture (www.metastormguru.com)

### Accounting Workflow System Architecture

The core architecture was designed to consider the functional requirements of broker message retrieval, validation from Re-admin system, storing in DMS system, worksheet creation, accounting process, and sending the processed messages as per ACORD standards, back to brokers/cedents (Fig. 11.4). The architecture has emerged after integration with different technologies to meet the business demands in all phases of the software development lifecycle. The process consists of:

- Real-time message system: Brokers/cedent messages will validate against ACORD standards and capture required field from messages. And vice versa with the fields, form an ACORD message to send it to the brokers/cedents with certification.
- BPM process engine: Workflow management, accounting processing, and user management.
- Business rule engine: All the business will be stored and allows flexibility to change the business rules without any impact.
- Batch processing: Batch processing for reporting and sending it to users based on the schedule (www.metastormguru.com).

The application team had a pool of experienced resources in the field of automation to bring different perspective to the table, knowledge on different architecture, experts from reinsurance domain, etc. The team over a period of time built stakeholder engagement skills in terms of project management and analysis, personal behavior, credibility, issues knowledge, engagement techniques, etc. This is to ensure one of the principles of inclusivity for completeness.

**Table 11.4** Influence/interest grid of the engagement process (Alladi and Vadari 2011)

Interest	<b>High</b>	<b>Empower</b>	<b>Partner</b>
		Application Team Application Mgmt Team	Customer IT team IT CIO Business unit Head BPM Vendor
		Brokers/Cedents/ ACORD Services Group	Business Unit Team Customer Group IT- Global
	<b>Low</b>	<b>Monitor</b>	<b>Engage</b>
		<b>Influence</b>	<b>High</b>

### 11.3.5 Design Engagement Process and Engage Stakeholders

This stage of engagement is very crucial for the application team as all the principles will be applied here, i.e., materiality, completeness, and responsiveness. The aim of the application team here is to plan effectively to carry out the engagement process with the identified stakeholders in terms of influence and interest, each stakeholder has over the automation program.

#### Engagement Strategy over Influence/Interest Grid

The application team prepared the influence and interest grid of each stakeholder over the automation program. Depending on the quadrants, the customers were placed and the engagement strategy was prepared. The grid was revised, based on the complete understanding of the process over a period of time (Table 11.4).

- **High influence and high interest**—If a stakeholder has high influence and high interest, he needs to be partnered, e.g., the customer IT team and customer CIO, business unit head, and BPM vendor have high interest and influence over the automation process; hence, they were made partners.
- **High influence and low interest**—The business unit team and customer group IT-Global have high influence but low interest; hence, they were engaged in the process of automation.
- **Low influence and low interest**—Brokers/cedents/ACORD and the service group have low influence and interest; hence, they need to be monitored. They were informed on the developments with respect to progress.
- **Low influence and high interest**—The application team and application management team have high interest but low influence; hence, the teams were empowered for their active contribution in the success of automation process (Alladi and Vadari 2011).

The team also worked out a plan in terms of the best way of engaging stakeholders, designing the engagement process, and engaging stakeholders. Some of the ways in which the stakeholders were engaged are listed below:

- written responses
- telephone hotlines
- one-to-one meetings
- periodical status updates at the operational level
- governance meetings
- involving stakeholders in investigating issues
- workshop for detail requirements

While engaging the stakeholders, the project team shared best practices and lessons learnt with stakeholders who, in turn, helped in involving them to contribute more actively toward the program's success. The process of involving the stakeholders while providing regular updates on the program progress led to trust building among the team and enhancing the relationships with stakeholders.

### ***11.3.6 Act, Review, and Report***

In the overall development life cycle, the communication to the stakeholders was based on the stakeholder's influence and interest grid. The engagement was carried out based on the quadrant each stakeholder was placed at, i.e., partner, engage, empower, and monitor. Stakeholders were informed about the solution development and its progress over telephone calls, periodical team meetings, status updates, and workshops, and the same was shared with the leadership teams over governance meetings ([www.Projectstakeholder.com](http://www.Projectstakeholder.com)).

### **Solution Development using the BPM Workflow Automation Tool**

During the solution development phase, the majority of the work was carried out on the BPM tool and integration was carried out with the rule engine, the real-time messaging system, and other internal services, while incorporating ACORD standards in the functionality. The three major components of the tool that complement other technologies leading to solution development are:

- Administration: Facilitates user role management
- Designer: Sets the stage actors' roles (star) matrix, which helps in creating process diagrams, which include actors, stages, processes, events, and screens for solution implementation
- Database: Creates folders, actors-process mapping, actors-roles mapping in a highly normalized way ([www.metastormguru.com](http://www.metastormguru.com))

Keeping in view the stakeholders' needs and importance, the best practices followed by the team throughout the development of the workflow automation process are as follows:

- Standard object naming convention was followed for the development and maintainability of the tool
- A STAR matrix specific to the tool was followed by the team to understand the processes
- Extensive training undertaken on the tool prior to development helped the team to overcome tool-specific challenges
- Flexible rule engine and tool design to alter rules and process design were incorporated into the workflow
- Defined orchestration (executable business processes), for easy code integration, as and when required was carried out
- The team had an excellent backup plan with an experienced resource pool to meet unforeseen challenges
- The team worked with the stakeholders closely and kept them posted about tool limitations and sought approvals for work around ([www.metastormguru.com](http://www.metastormguru.com))

After every successful engagement, the team took a relook at the needs of the stakeholders and how the automation process transformed needs/issues of the stakeholders. Requirements expressed during the materiality phase were addressed in the automation process, enabling responsiveness—one of the principles of inclusivity. The engagement results were shared with the stakeholders to ascertain areas that need to be improved in future automation management.

At this stage of the engagement, both materiality and responsiveness were addressed adequately. The needs and issues gathered from the stakeholders at the beginning of the engagement and automation process were responded to in the development of the automation workflow process. This process helped by involving the stakeholders at every phase of the development, resulting in the stakeholder's high satisfaction index. The process of gathering and responding helped the team maintain transparency in the process. The team has received feedback to ascertain that the objectives listed in the beginning of the automation process have been met.

## 11.4 Integration of Principle of Inclusivity, Stakeholder Engagement, and Workflow Automation Process

**Materiality** The principle materiality applies stakeholder engagement phases of think strategically, analyze and plan, and engage with stakeholders. The needs/issues that matter to the stakeholders are collected in the think strategically phase. The requirements are analyzed for their relevance to the automation program and planned for inclusion in the development of applications during the analyze and plan phase.

**Table 11.5** Principle of inclusivity encompassing stakeholder engagement and workflow automation process

Stage/dominant principle	Think strategically	Analyze and plan	Strengthen engagement capacities	Strategy to engage with stakeholder	Act review and report
Materiality	✓	✓			
Completeness		✓	✓	✓	
Responsiveness			✓	✓	✓

**Completeness** The principle completeness is applied in analyze and plan, strengthen engagement capacities, and engage with stakeholder, as part of the principle of inclusivity. The requirements/needs/issues gathered at the think strategically phase should be complete in nature. The application team is required to carry out an analysis of the needs and requirements expressed by the stakeholders. These requirements need to be transformed as enablements of the end product. While engaging the stakeholders, the application team has to ensure that they use the right medium/strategy/mode of engagement.

**Responsiveness** The principle of responsiveness is applied to strengthen engagement capacities; engage with stakeholders; and act, review, and report phases of stakeholder engagement. While designing the engagement strategy, the team had a thorough understanding about the needs/requirements, the solutions, and the automation process. While engaging with the stakeholders, the application team was aware of the best strategy to engage. While in the act, the review and report phase ensured that the end product, i.e., the automation workflow process addressed the needs/requirements provided by the stakeholders initially (Krick et al. 2005). The principle of inclusivity as applied to stakeholder engagement and workflow automation process is depicted in Table 11.5.

## 11.5 Conclusion

Both the customer and the application teams adopted the right approach in identifying stakeholders involved in the program and engaged them strategically to get a buy-in. This proactive approach by the teams helped in completing the automation process on time. Another key factor that contributed to the success of the automation process was communication. The team provided regular updates on the automation process, to all the stakeholders, which in turn fostered transparency among stakeholders. The stakeholder engagement methodology followed, which enabled building a rapport with the stakeholders and ultimately resulted in a healthy and successful relationship.

The use of the BPM tool provided solutions to complex workflow systems by offering configurable designs, business object integration, and support to external

interfaces, which took less development effort and time compared to development in traditional languages. The stakeholder engagement methodology employed in the workflow automation process facilitated effective management of diverse stakeholders mix in the project besides resulting in faster development of the project.

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**Part III**  
**Flexibility, Innovation and**  
**Business Excellence**

# Chapter 12

## Localization, Cultural Preferences and Global Commerce—Software Like a Cooperative Partner

Gerhard Chroust

### 12.1 Introduction

Modern technology enables contact between people from different countries, nations, and continents: physically this means travelling to distant places and virtually to utilize internet and electronic communication. We can exchange ideas and products, often software products, which have been created by other and different cultures.

We notice cultural differences. Some of them are of an ancillary nature, for example, driving on the “wrong” side of the road, use of different currencies, preference for alternative food, strange, uncommon signs (Fig. 12.1).

Some of these differences can be easily overcome and grown accustomed to. Others cannot be easily changed, some of them are essentially unchangeable (the color of the skin). Beyond their apparent physical differences there also exist deeply rooted differences with respect to beliefs, good behavior, traditions, treatment of other humans, and the overall view of the world (“Weltanschauung”). In the commercial world, cultural differences are involved in a threefold way (Fig. 12.2): People are the consumers of goods, they also produce the goods, and they are mediators between producers and consumers (tradespeople, user representatives).

In this chapter we will discuss cultural differences in behavior and way of thought and will organize them with respect to five essential cultural dimensions, also discussing some impacts of the varying cultural preferences of various nations. We will point out a few of those differences which have an impact on business and on the way software interfaces should be designed.

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Fig. 12.1 Ancillary cultural differences

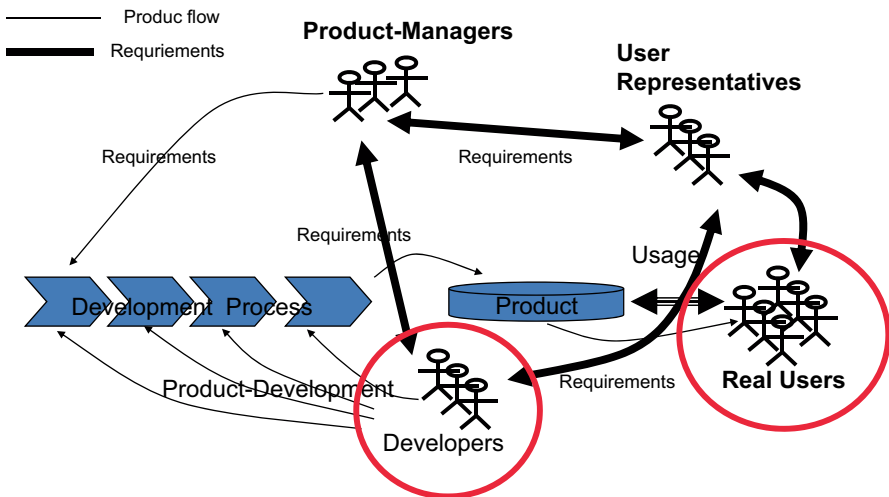
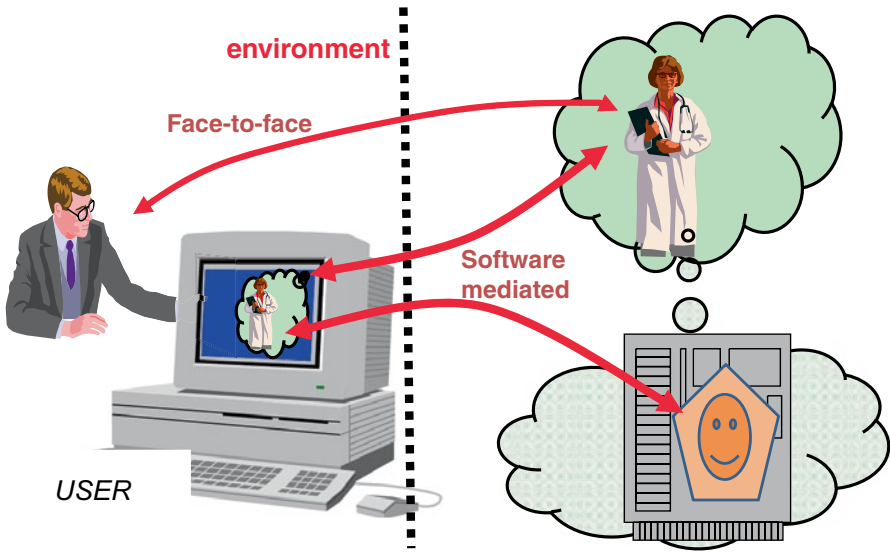


Fig. 12.2 Human influences in a development process

## 12.2 Localization and Cultural Differences

The seamlessness of global networks (e.g., e-mail and world wide web) offers access to the electronic world throughout the globe. Technological progress allows communication via pictures and also via colorful, animated displays showing people in their natural surroundings, presenting software products as part of our daily environment. Computers today execute more complex tasks in closer imitation of human behavior than ever before. The dramatic increase in computer system usage with the use of automatic answering systems and avatars, has to a large extent



**Fig. 12.3** Human or avatar?

blurred the difference between a human responder and an automaton, an avatar (Fig. 12.3).

A human being communicating with another human being expects a certain code of behavior and also a certain overall view of the world. Both vary considerably from one nation/culture ethnic group to another. In today's technocratic world, humans tend to ascribe human qualities to complex sophisticated computer interfaces. As a result, they "expect good behavior, etc., ... plus the sensitivity of an intuitive, courteous butler" (Miller 2004). The more realistic the human/computer interface becomes (varying from simple textual descriptions to animated interactive displays with software agents (avatars)), the more the computer interface must obey social conventions. People expect the computer to blend into their individual culture.

Thus, it becomes necessary to explicitly transfer a software product into a geographically (and culturally!) different environment: localization. This implies much more than a simple language translation:

We speak of *localization* (Ishida and Miller n.d.), that is, *the process of adapting a product to reflect the local standards, culture, and language of another market* (GSSI n.d.), or *the infusion of a specific culture into an international product*.

### 12.2.1 Dimensions of Cultural Differences

Every tourist soon realizes that certain obvious different habits exist between different countries/nations (Fig. 12.1): In Austria, the salt-dispenser usually has three

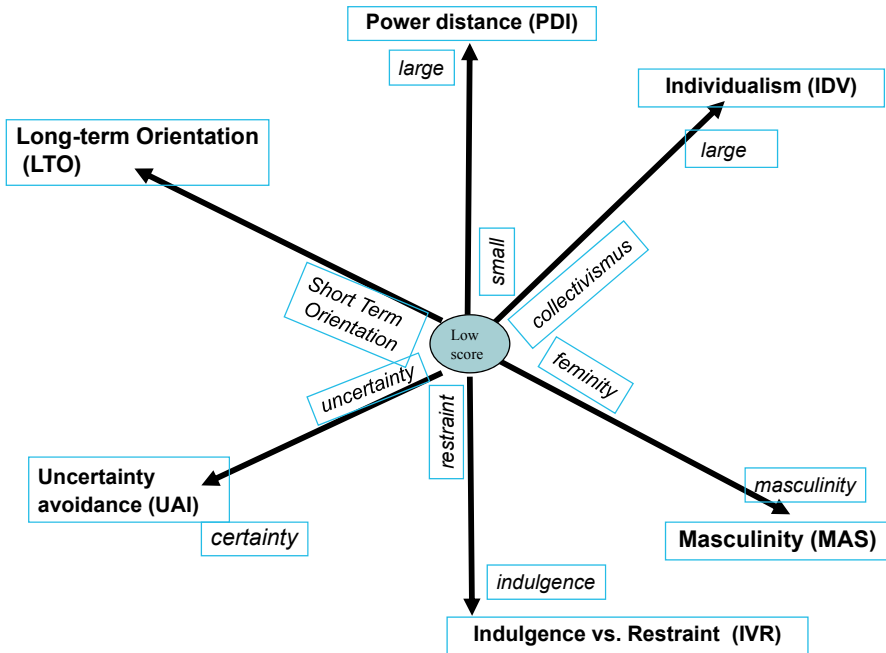


Fig. 12.4 Cultural differences. (Hofstede and Hofstede 2005)

holes and pepper has one, in Great Britain it is the other way round. In Turkey, first aid is (obviously) signaled by the Islamic Crescent and not by the Christian Cross. Numerous varying ways exist to express numbers by the use of fingers (Wikipedia-English n.d., keyword “finger counting”). But the fundamental differences between cultures are much more deeply rooted.

*Culture* can be defined as *the shared complex system of language, value system, norms, religion, myths, beliefs, manners, behavior, and structure which is characteristic of a society or part of it*. The broadness of this definition encompasses both superficial habits and views which can easily be changed and a person’s long time deeply ingrained basic values of life: the *Weltanschauung* (world view), see also Sect. 12.3.2. These deeply routed differences need special attention and care.

A widely accepted model of the basic dimensions of cultural differences is presented by Hofstede and Hofstede (2005) and Hofstede (n.d.). The Hofstedes (father and son) developed their original model as a result of using factor analysis to examine the results of a worldwide survey of employee values by IBM in the 1960s and 1970s. The theory was one of the first that could be quantified, and could be used to explain observed differences between cultures. As the results are based on a 1960/1970 survey, several more recent publications have modified and refined the findings, the basics of which are still accepted. The model uses five essential dimensions (see Fig. 12.4).

The dimensions are:

**Power Difference Index (PDI)** This is the extent to which the less powerful members of organizations and institutions (like the family) accept and expect that power is distributed unequally. The inequality is endorsed by the followers as much as by the leaders.

**Individualism Index (IDV)** This is an indication of how loose the ties between individuals are as compared to (collectivistic) societies in which individuals from the moment of birth are integrated into strong, cohesive in-groups, often extended families which continue protecting them in exchange for unquestioning loyalty.

**Masculinity (MAS)** This characterizes how big the gap in the behavior of men and women is by only following the values linked to their gender: that is, men's values (assertiveness and competitiveness) versus women's values (modesty, care, consolation, etc.).

**Uncertainty Avoidance Index (UAI)** This deals with a society's tolerance for uncertainty and ambiguity, of how uncomfortable the individual feels in unstructured situations which are novel, unknown, surprising, or different from the accustomed. Cultures striving to avoid uncertainty try to minimize the possibility of these situations occurring by enforcing strict laws, rules, and safety and security regulations. On the philosophical and religious level certainty is gained by a belief in an absolute truth.

**Long-Time Orientation Index (LTO)** LTO stands for the fostering of virtues oriented toward future rewards—in particular thrift and perseverance; values associated with short-term orientation stand for fostering of virtues related to the past and the present—in particular with respect to tradition, fulfilling of social obligations, the keeping of countenance, and “saving one's face.”

Each dimension enables indication on a scale (usually between 0 and 100) as to how much or how little a person (or an average of the persons in a region) possesses the indicated property.

When defining the dimensions Hofstede and Hofstede (2005) took great care to show that these dimensions are, by and large, independent of one another. They showed that for every binary combination of pairs of dimension values, one of the four possible combinations of “high” and “low”, examples exist in the world.

Based on the model (Hofstede and Hofstede 2005; Hofstede n.d.) the world is divided into 74 regions, in many cases a country. For each region, a numerical value is assigned to each dimension (usually between 0 and 100) indicating the fulfillment of the specific property.

Based on the numerical values the regions can also be ranked, which is also a very interesting basis for comparison.

In 2010, G. Hofstede added a sixth dimension (“indulgence versus self-restraint”), as a result of coauthor Michael Minkov's analysis of data from the World Values Survey. Hampden-Turner and Trompenaars (2000) proposed a similar model, based essentially on the same data.

### ***12.2.2 Cultural Differences and Information and Communications Technologies (ICT)***

With the growth of ICT the cultural differences have gained more prominence for two reasons:

**Global Information Exchange** The world-wide Internet, television, and also software products have blurred local boundaries between cultures: Anybody has access to internet pages from anywhere. The same software products (Windows, Linux, Google, and games) are distributed worldwide.

**Global Work Sharing** Work is distributed throughout the world, “outsourcing” is part of it, but also international teams working remotely together are gaining importance. This collaboration implies that persons of different cultural background and orientation have to work together.

Many persons are prosumer (producing and consuming) ICT-products which are used by other humans, as shown in Fig. 12.2. The key stakeholders are the developers of the products and the real users. The latter are often substituted by user representatives (with all pros and cons).

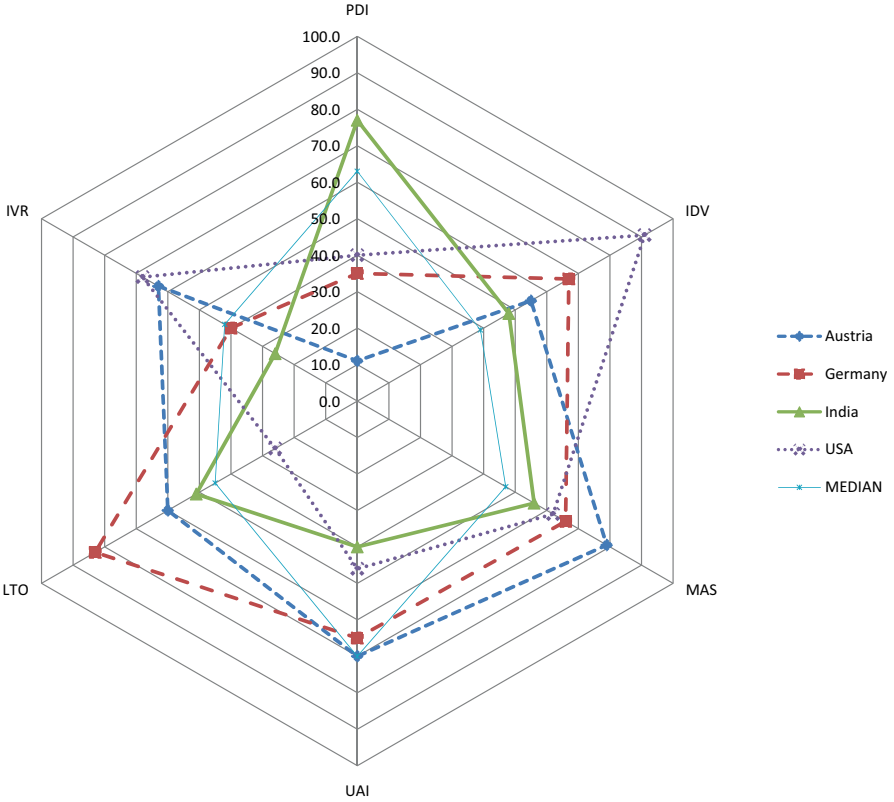
### ***12.2.3 Specific National Differences: Austria, Germany, India, The USA***

The data provided by Hofstede and Hofstede (2005) not only give a general overview but they also allow for comparison of individual nations with one another. When performing the comparisons the warnings and caveats listed in Sect. 12.2.4 should also be taken into account. We also can state (see Sect. 12.3) that these cultural differences gain more and more importance the high in the layers of localization they are located.

With respect to global cooperation and global outsourcing, it is interesting to see what differences exist between the source and the target of outsourcing projects. In Fig. 12.5, the scores of Austria, Germany, USA, and India are presented together with the rank of these four countries (Fig. 12.6). The score diagram also shows the median of all scores. The total number of compared regions is indicated for the rank, because for long-term orientations data were not available for all regions.

With respect to the nations selected for comparison we can make the following observations.

**Power Difference Index (PDI)** Indian employees are much more likely to obey instructions given by management and are less likely to challenge them openly. Privileges for higher management will be less tolerated in the USA or Austria. When writing e-mails Indians will use a much more formal style and will be much more careful in their formulations (Krishna et al. 2004) as compared with Americans.



**Fig. 12.5** Austria, Germany, India, the USA—cultural difference: Score (Hofstede and Hofstede 2005)

**Individualism Index (IDV)** Developers in the USA are more likely to try new, individual methods of solving a problem as compared to Indians. Austrians and Germans are on middle ground.

**Masculinity (MAS)** Austrian employees are less likely to perform “typical secretarial (female!) work,” such as making coffee, writing standard letters, etc., than the other nations. Typically in Austria fewer women are found in higher management positions (this is gradually changing!). The median line in the diagram also shows that all four nations are relatively high on the masculinity index.

**Uncertainty Avoidance Index (UAI)** Typically Americans and Indians would be willing to take higher development risks while Austrians and Germans would prefer to “play it safe”. The computer industry has to a great extent been driven by American enterprizes moving into new directions and taking the risk of failing.

**Long-Time Orientation Index (LTO)** Here India is looking further into the future than other countries, for example, by establishing longer term investments, etc.



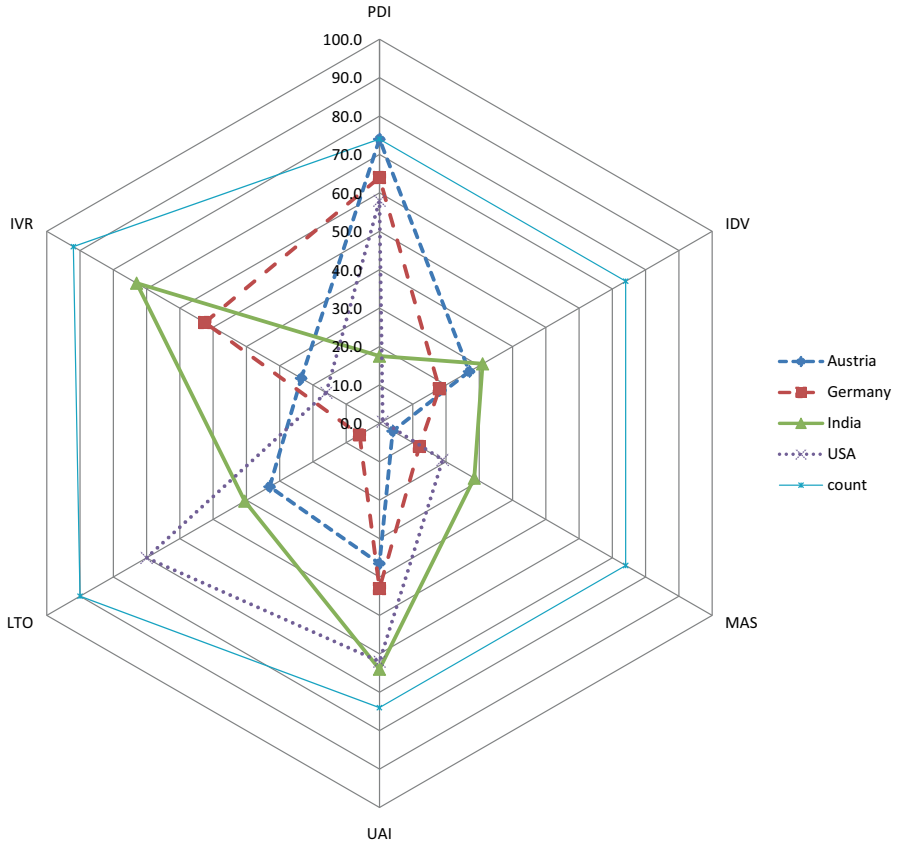


Fig. 12.6 Austria, Germany, India, the USA—cultural difference: Rank

### 12.2.4 Caveats and Restrictions

The classification given by Hofstede and Hofstede (2005) and by the similar model by Hampden-Turner and Trompenaars (2000) has to be read with care and caution, taking into account other later publications (Peppas 2001; Huo and Randall 1991; Winkler et al. 2007; Winkler 2002).

**Granularity, Geographic, and Ethnic Subdivisions** A classification based only on whole nations (i.e., 74 regions) must by necessity be coarse-grained. Especially for India and China with their billion inhabitants consisting of many different ethnic groups, one number cannot be accordingly sufficient. “South Asia” was treated as one region despite certain essential differences between the different ethnic and religious groups there. This is of importance since small differences between “brothers” often carry more weight than major differences with “foreigners.”

**Blind Spots** The survey was conducted largely by IBM. Due to the lack of access to certain social strata like poor Chinese farmers, nomadic tribes, etc., were probably not covered at all.

**Time Evolution** The survey material was collected between 1960 and 1970. As a consequence, many of the modern trends modifying behavior and a person's view of the world could not show up, for example, global television, internet, transborder work force migration, end of communistic world hegemony, etc.

**National/Ethnic Division** Certain cultural differences do not necessarily follow along the lines of the national differences.

**Generation Gaps** Psychologists observe that Chinese youngsters and American youngsters—despite all their cultural differences—might have more in common than these youngsters have in common with other age groups in their home country.

**Sociological Strata** “Horizontal strata” within a society needs more attention, for example, young people, elderly people, different economic power, etc.

**Digital Gap** ICT brings drastic changes to society: A split in those who are able to afford digital technology and those who are not able will be of consequence.

**Technological Communication Means** It means access to Internet and other sources of knowledge is a matter of income but also to some extent still a matter of geographic location.

**Material Wealth** Although material wealth was not accepted as a key dimension, the wealth of a nation obviously has an impact, at least by modifying the general tendency. The wealth of certain nations has changed in the 50 years since the survey.

**Religious Differences** The growing globalization of commerce together with the growing self-consciousness of the second and third world countries will have to be considered. This will involve a stronger commitment to consider and honor religious preferences and sensibilities.

**Religious Mix** Migration of people has reduced the predominance of a single religion in a country.

## 12.3 Layers of Cultural Differences

Cultural differences differ in their importance and persistence. The change from left-side to right-side driving is a matter of an organizational change (extensive and expensive as it may be) and the process of unlearning/learning. Changing a person's worldview is an unlikely event due to the more subtle, often unconscious influences.

We distinguish two major types of cultural differences: the communication-oriented layers (Sect. 12.3.1) which are mainly concerned with enabling and chan-

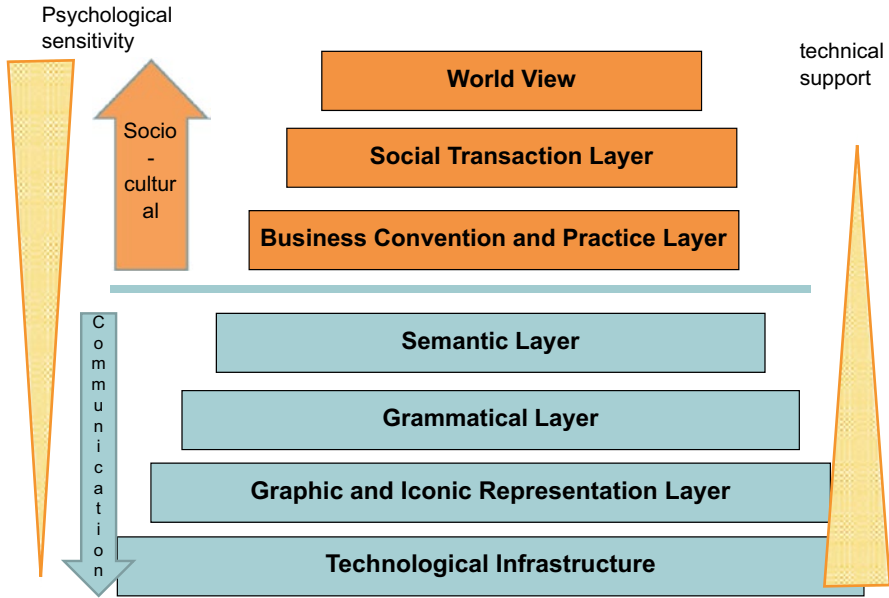


Fig. 12.7 Layers of localization

nelling communication and information exchanged between persons. The socio-cultural layers (Sect. 12.3.2) are concerned with how people understand the world, and derive their behavioral norms, reactions, and duties.

We can distinguish seven layers whereby a higher layer usually builds up on the lower layers (Fig. 12.7).

### 12.3.1 Communication-Oriented Layers

These four layers are concerned with establishing communication between humans and contain many conventions, some of which have come to us many years ago. National differences often result from local situations and thus vary from the situation in other geographic areas.

**Technological Infrastructure Layer** This layer has little relevance outside of ICT. With respect to communication via computers and networks, this layer establishes the technical and organizational provisions and is closely connected to the technical representation of information. The conventions and provisions are mostly invisible (and also irrelevant) for the user and provide the basis for making a product ready to be localized (Barbour and Yeo 1996; Chroust 2000, 2008, 2009). It is concerned with the separation of text and code, reserving sufficient storage space for texts in computer memory, proper coding of characters (including national ones), applying correct sort order, taking care of two-byte languages used in Asia (Adams 1993), providing for correct writing and reading direction (left-to-right, right-to-left), see

(He et al. 2002; Kim 1999; Trager 2006). This holds also for the so-called locale which defines the proper representation of date, currency, time, word order, etc. (He et al. 2002; Herden n.d.; Kubota n.d.; Trager n.d.).

**Grammatical Layer** Every nontrivial message needs a certain structure in order to be understood: the grammar. It defines the rules of the positions of words in a sentence and establishes what a so-called “well-formed” utterance is and what not. When learning our mother tongue, we also have to learn the grammar—and when learning foreign languages, we become often unpleasantly aware of dramatic differences in grammar: The “Red Cross” becomes in French the “Croix Rouge.” These issues, since a long time taught to human translators, have now to be inserted into the rule scheme of translation machines.

**Semantic Layer** Even in a person’s mother tongue it is often difficult to define the precise meaning of a specific word, and when translated into another language, it may generate surprises. Numerous jokes are based on the fact that words usually have more than one meaning and very often also a symbolic meaning beyond the obvious translation (a “hot dog” has nothing to do with this animal, but is a heated sausage in a roll). In ICT this layer is concerned with the use of technical versus common language, expressiveness of languages, and abbreviations. It is to a large degree the domain of (human) language translators.

**Graphic and Iconic Representation Layer** To an increasing extent, software products rely on graphical representations in panels, demos, and animations. The use of correct symbolic meanings, color codes, taboos, and body language when showing people in their national, private setting is often difficult and can lead to severe misunderstanding or even embarrassment.

### ***12.3.2 The Socio-Cultural Layers***

The topmost three layers of Fig. 12.7 are closely related to the ingrained, deep-seated aspects of culture.

#### **Business Convention and Practice Layer**

Business practices show dramatic cultural differences, as described by Hofstede and Hofstede (2005), Hampden-Turner and Trompenaars (2000), Winkler et al. (2007), and Winkler (2002). They cause misunderstanding, friction, and alienation between partners (Krishna et al. 2004). Especially animations, but also texts, can contain cultural blunders.

**Leadership Approach** Leadership approach varies in different countries and within organizations (democratic, authoritarian, and participative). Interfaces and procedures of management support tools have to conform to their users’ cultural predisposition and expectations.

*EXAMPLE (information policy)* In Spain it is customary to first inform the management before disseminating any information to the employees. *BOOTSTRAP* (a European software processes assessment method (Haase et al. 1994)) had to be modified in order to cater for this effect in Spain.

**Organizational Structure** Depending on whether the society is preferably egalitarian or hierarchical, both the structure of interfaces and web-sites—and obviously representations—must conform to cultural expectations (Hofstede and Hofstede 2005).

*EXAMPLE (Indian employees)* The rather large Power Distance Index (PDI) of India reflects itself in strict and well-distinguished management levels (Winkler et al. 2007).

*EXAMPLE (team photo)* In egalitarian cultures when showing a “team-photo” the boss usually stands in the middle of the group, not separated at all, a leader on equal level with the led. This type of picture would not be understood in India due to a high PDI, in which the boss would be singled out and given a predominant position in the photographed group.

**Navigation in Web Sites** Many of the national preferences, for example, low-versus high-context cultures (Hall 1976), specificity versus diffusion (uncertainty avoidance!) have to reflect themselves in the design of web pages.

*EXAMPLE (access to web pages)* Users in highly hierarchical cultures (large PDI) may view a site positively if it provides a “member only” access, whereas an egalitarian culture may find it disagreeable.

**Dates and Deadlines** Commitment to dates and deadlines vary considerably in different cultures—uncertainty avoidance!—as expressed in (Hampden-Turner and Trompenaars 2000) by the sequential versus synchronous time dimension. Vague deadlines have to be catered for in project management tools to make the tools culturally acceptable.

*EXAMPLE (deadlines)* In Sri Lanka the author was told that a deadline is just a noncommittal promise for delivery. An attitude of this kind makes it difficult to impossible to market an elaborate electronic time-planners.

**Performance Measures** Performance measures vary according to cultural divergence, especially with respect to individualism–collectivism (Hofstede and Hofstede 2005) and inner direction versus outer direction in Hampden’s model (Hampden-Turner and Trompenaars 2000).

*EXAMPLE (pharmaceutical sales person)* Even neighboring countries like Austria and Switzerland have different ways of evaluating salespersons. In Switzerland a pharmaceutical salesperson has to pay in order to be given an appointment with a practicing doctor.

*EXAMPLE (lone sheriff versus team)* Typically in the USA scientific and business awards go usually to an individual, in Japan usually to the team in total.

## Social Transaction Layer

Social transaction between human beings are a subtle and misunderstanding-prone situation (Stewart and Joines 1987; ITAA n.d.), governed by many implicit and intuitive rules.

Humans have the tendency to ascribe human qualities to complex sophisticated computer interfaces. As a result they “expect good behavior, observation of etiquette and politeness, subservience, helpfulness, and the sensitivity of an intuitive, courteous butler” (Miller 2004). The more realistic the human/computer interface becomes (from simple text-based to animated interactive displays with software agents (avatars; Payr and Trappl 2004)), the more the computer interface has to obey social conventions. Fiadeiro (2007) even speaks of “social complexity” when considering federations of individual (software) modules or components.

*EXAMPLE (Eliza) The misinterpretation of a socially well-designed computer interface was dramatically shown back in 1966 by Joseph Weizenbaum’s famous “Eliza-Experiment” (Weizenbaum 1966; Wikipedia-English n.d., keyword “Eliza”).*

**Addressing and Greeting the User** Rules for addressing and greeting persons vary greatly both with respect to the chosen phrases (use of family name, title...) and the accompanying gestures (Herden n.d.). Expressing the various degrees of familiarity is of especial subtlety. Scenes and animation presented on the computer screen must conform to these conventions.

*EXAMPLE (names) In Japan the suffix “-san” is attached to the family name in order to express one’s appreciation, the academic or business title (“Dr.,” “Director”, etc.) must be used in Austria. In Cambodia the (positional) title is preferred to the name.*

*EXAMPLE (personal addressing) American manuals address readers directly (e.g., “In order to switch panels you press key F10”) which is considered impolite and improper in Germany. Here a neutral, nonpersonal wording is expected: “...to switch panels, key F10 is pressed.” Personal address is usually reserved for immediate emergency actions: “If ..., switch off immediately!”*

**Answering a User** A “polite” system is expected to conform to the ways of saying “no” in a culturally compatible manner.

*EXAMPLE (Avoiding to say “no”) In many Asian countries a “no” is avoided in favor of no answer at all or a “yes,” which is to be interpreted as a “no” (Herden n.d.).*

**Communication Styles** Communication styles permeate interactive web sites. High-context cultures with their reliance on the context and the nonverbal aspects are to be distinguished from low-context cultures which depend more on explicit, verbally expressed forms of communication (Hall 1976; Schneider 2001).

*EXAMPLE (high context/low context): The USA is a low-context culture (Hall 1976) that generally relies heavily on information communicated explicitly by*

words (*uncertainty avoidance!*). Asian and Hispanic cultures, by contrast, resemble high-context audiences that generally accept communications which are deeper and more complex than spoken or written messages (Lang 2006).

*EXAMPLE (Advertising)* With respect to advertising Japanese audiences prefer indirect verbal communication and symbolism over the direct “face to face” communication approaches used by Americans. American advertising traditionally relies on words for explaining the product and its features and how the product differs from the competitors. In contrast, advertising communications used in high-context countries such as Japan rely on nuances and overall differences in the tone, music, scenery, and other nonverbal cues to differentiate the product (Lang 2006).

**Puns, Jargon, Metaphors** Metaphors, puns, and jargon are especially prone to cultural divergence. Their use easily causes misunderstandings and ineffective communications. They are best avoided (Lang 2006). Typically sport metaphors may not come across if the specific discipline is not played in certain countries.

*EXAMPLE (sport metaphor)* Asking for a “ballpark figure” as an effort estimate shows a typical American cultural influence as this relates to American baseball.

**Social Classes** Social class affiliation may play a dominant role in communication (Davidson 2002; Hampden-Turner and Trompenaars 2000; Hofstede and Hofstede 2005; Soh et al. 2000). Differentiation must be made depending on the users and their individual subculture (class), including difference with respect to age, education, etc. (Payne 2006; Marsh and Morris 1989).

*EXAMPLE (English)* In English we have to distinguish between “posh” vs. “street” English.

*EXAMPLE (Khmer word variations)* In the Khmer-language even such simple words as “eat” or “yes” have different linguistic stems depending on social status (from the king to a person’s younger brother) (Herden n.d.).

**Social Position—Age** The importance and respect for age and the resulting social or economic position varies in different countries (Hampden-Turner and Trompenaars 2000).

*EXAMPLE (seniority)* In China, seniority is expected to go hand-in-hand with higher positions in management, i.e. honoring the ascribed status (Hampden-Turner and Trompenaars 2000), in contrast to Western management in which hierarchies rely on achieved status.

*EXAMPLE (groupware)* In electronic groupware systems the question as to whether persons with lower status (PDI (Hofstede and Hofstede 2005)) are allowed to respond to persons with higher standing has to be taken into account.

**Social Position—Gender** The social position of women varies in different cultures. In Western societies it is politically correct to show women in leadership positions. This is not expected in some Arabic countries. In Western societies gender-independent language is preferred, especially if otherwise gender-specific role

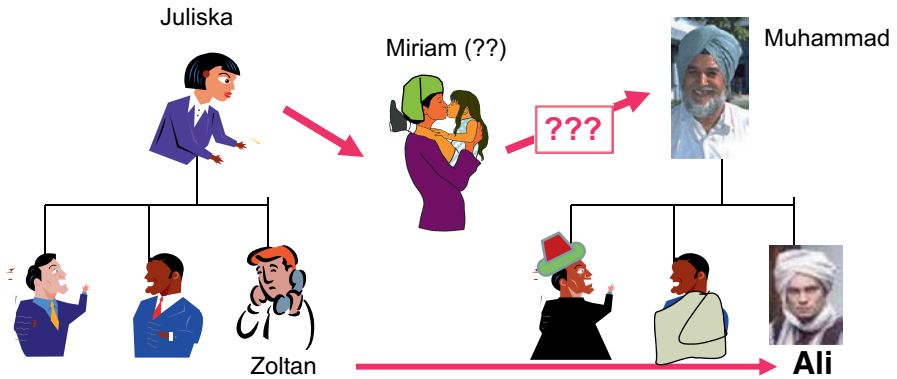


Fig. 12.8 Women as manager?

behavior is implied. The distribution of gender-dependant and gender-independent words differs in the national languages and should be considered. This can be well mapped on the masculinity index of (Hofstede and Hofstede 2005).

*EXAMPLE (position of women)* Consider a demo (Fig. 12.8 showing a Juliska and her three male subordinates). Due to pregnancy she will use a work flow system to automatically distribute her work to her subordinates. This demo cannot be salvaged for an Arabic country by simply recoloring and renaming Juliska to Miriam because usually a women cannot be superior to men. And turning Juliska into a Muhammad does not work because of the assumed pregnancy.

*EXAMPLE (nonsexist)* In English student means both male and female students while in German one has to revert to “Student” and “Studentin” or in a rather awkward new form “StudentIn” (with an upper-case “I” inside the word!)

**Acceptable Overtime** The acceptable amount of unpaid overtime work varies and has to be reflected in attendance recording and payroll programs.

*EXAMPLE (Austrian versus Japanese overtime regulations)* In Japan many companies expect their employees to work overtime. Austrians rather strict labor laws require employers not only to pay for overtime work but they are also required by law to ensure that employees under normal conditions do not work more than the legal limits.

## World View

World view (derived from the German word “Weltanschauung”) is the fundamental cognitive orientation of an individual or society encompassing the entirety of the individual or society’s knowledge and point-of-view, including natural philosophy; fundamental, existential, and normative postulates; or themes, values, emotions, and ethics (Wikipedia-English n.d., keyword ‘world view’).



“World views” are “mental models” that people bring to their roles. These mental models are made up, in each case, of a mix of the understanding and values that individuals have gathered through their “experience and education” (Jackson 2003, p. 10). A world view “serves as a framework for generating various dimensions of human perception and experience such as knowledge, politics, economics, religion, culture, science and ethics” (Wikipedia-English n.d., keyword “world view”).

Some of the basic constituents of a world view would be:

**Religion** What are the basic tenets of one’s religion. Does God (or a higher being) exist or not.

*EXAMPLE (oath) What does an oath on the Bible mean to an atheist?*

**Ethics** What should/must/must not be done to keep the ethical principles?

*EXAMPLE (false evidence) May one in good conscience give false evidence in order to save a brother’s life?*

**Religious Versus Civil Laws** What is of a higher value, the state’s law (somewhat implying a separation of state and religion) or the religious laws.

*EXAMPLE: The (conservative) Islamic view is that the sharia (Islamic Law) overrules secular law, while in the Western countries religious rules are subordinate to secular laws.*

## 12.4 Conclusion

This chapter provides a survey of the growing demands on localization. We relate localization to the hierarchical cultural layer defined by Hofstede and Hofstede (2005), showing the dimension and complexity of the challenge.

We have to recognize that inadequate localization can have adverse business effects by reducing effectiveness and productivity due to misunderstood communication, misinterpretation of messages, signs, and environment, also causing offence and hence anger. It can be the source of ridicule, embarrassment, or offence and in the worst case result in broken personal and economic opportunities. Interpreting inadequate localization as incompetence will diminish trust and thus endanger business contacts. Users will experience less satisfaction even going as far as rejection of products.

It must be accepted that localization is an absolute necessity in the global economy. It is not cheap, but the extra expenses are usually compensated by increased usability of the product and thus by larger marketing revenue.

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# Chapter 13

## Critical Processes for Organization Vitality: A Conceptual Study

Sumant Kumar Bishwas and Sushil

### 13.1 Introduction

In 1990, in one of the studies, it was found that within the last 15 years nearly one third of the Fortune 500 companies had disappeared. The average lifetime of the largest organization has been defined as less than 40 years (Senge 1990). The question that becomes important is to know the reason why some organizations survive and grow for a longer period of time while many fail. What are the causes of these failures and what are those processes or forces due to which organizations may survive for a longer duration?

Darwin's principle says that those who can adapt the changes will survive more. The same is supposed to be true for organizations as living systems. Organizations that change themselves with respect to the environment are expected to survive for a longer period than those that cannot. It is the vitality state of the organization because of which it survives more than others. Shimizu (1991) defined the ability of an organization to cope with the environmental changes as one of the prime factors of high vital organization.

In the highly turbulent environment, it is required to establish a good fit between the organization and its environment, and management is supposed to take care of this (Eppink 1978). The overall long-term fit is often defined as strategy that can be further broken down into shorter plans. *Dutch Postbank in Netherlands was facing the problem due to emergence of new technology and service in banking services. Initially, it was using the old technology but to fit with the environmental changes it developed the concept of flexibility mix and welcome the new and innovative services in its work culture* (Volberda 1997).

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Organization vitality has been defined as organization's health or growth. Financial, intellectual, and creative growth of an organization are the determinant factors for measuring vitality (Vicenzi and Adkins 2000). Similar findings were found by Kark and Carmeli (2009), which say that the involvement in creative working helps in achieving high vital state. Organization vitality is enhanced by the number of new possibilities within the uncertain environment and helps in organizational survival (Loveerde 2005). Reimann (1982) has defined sales growth, profit growth, and customer service as some of the key dimensions of organizational growth. Agarwal (2004) considered customer service as one of the important aspects of long-term survival of the organization.

To remain vital in a competitive era, an organization has to change itself with respect to the environment. Aggressive competition change (tends to directly and strongly challenging its rivals to achieve entry and develop position to outperform industry competitors in the marketplace) is crucial to the survival and success of organization (Allred and Swan 2004). Firms that successfully achieved the competitive aggressiveness can perceive excellent competitiveness and greater business outcomes. *To remain competitive, Unilever has considered vitality as its new mission which says "add vitality to life." Vitality should be evolved into the business itself and into the people who are working in the business. Delivering vitality is one of the five pillars of the strategic goals defined in Unilever. Research and development, and acquisitions have been given more importance for achieving the required goal, i.e., high vital state* (Smith 2009).

Organization vitality has been classified into four types: (i) operational, (ii) intellectual, (iii) emotional, and (iv) spiritual. Organizations are like human beings, as human beings require a proper diet, lifestyle, mental, and physical exercises to remain healthy; in the similar way organizations also require some kind of life ingredients to become and remain a vitalized organization (Sushil 2005, 2013). These life ingredients for the organizations are the processes that are critical for long-term organizational survival and growth. These processes are the continuous vitalization processes required to remain healthy for a longer period of time (Bishwas 2011).

Two perspectives for a vital organization have been identified as survival and growth aspects of organization. This study further explored these two issues in organizations and discussed how these two issues are affected by some of the organizational processes. Growth perspective has been defined as a vital indicator of any thriving firm (Gilbert et al. 2011). The key processes for achieving long-term survival and growth have been discussed with real-life implementation examples based on secondary caselets study.

## 13.2 Methodology

This chapter is based on the literature review and the caselets method. The caselets have been done using secondary data. The review of literature has been done first related to the organizational vitality issue to identify the perspectives of vital-

ity in any organization. Survival and growth concerns have been identified as two perspectives of vitality. Further, the review has been extended to identify the key processes that effects the survival and growth of organizations. These key processes and then their linkages have been discussed with suitable caselets describing the real-life implementation of these processes in organizations.

### 13.3 Four Pillars for Long-Term Survival and Growth

The review of literature on organization vitality raises two issues about a vital organization; survival and growth perspectives in the emerging uncertain environment (Bishwas 2011). Four processes have been identified that play a critical role in organizational survival and growth. Learning, innovation, flexibility, and entrepreneurship have been defined as four processes for long-term survival and growth (Sushil 2013). These four processes can be considered as the four pillars for long-term survival and growth of any organization. These processes are further discussed in the subsequent sections into two parts based on their interrelatedness with each other. The first part discussed about the learning and innovation issues, while the second part discussed about the flexibility and entrepreneurship processes.

#### 13.3.1 Learning and Innovation

Garrat in 1987 has first coined the term learning for organizations that experimented new ways of conducting business in order to survive in uncertain and highly competitive markets (Ortenblad 2004). Organizational learning is an essential element for successful competition in a global market (Prahalad and Hamel 1990). Learning organization develops the ability to renew and adapt the changing conditions and requirements in a continuous manner (Sushil 2003). According to Maurer and Weiss (2010), continuous learning in an organization helps it to stay ahead of the competitors.

Organizational learning is a prerequisite for organization well-being and survival. Failure to learn is the prime reason behind the failure of organizations and raises the survival issue (Senge 1990). The learning should not be limited within the organizational boundary but it should focus on the learning also from the external environment. Learning from environment helps organizations to know about the external changes and also to know about itself (its capability to deal with the changes) in a much better way. This kind of learning is not a one-time process; it's a continuous process (Epstein 2003).

*The importance of learning has been reflected in CNGC during the problem in acquiring new customers. CNGC was facing the problem during one of its project of acquiring new customers in Whale Industrial Park, Taiwan. The organization took this problem as a learning opportunity and learned from both the internal*

*(employees) and external environment (customers, suppliers, government, etc.). This kind of learning attitude helped CNGC to predict about the future and serve its customers in a better way. It communicated with customers directly to develop more trust. This kind of learning attitude helped the organization to react proactively towards crisis or to minimize the losses incurred (Wang and Belardo 2009).*

Organizations have always been connected with learning over time. The primary need for the organization is to know the process of learning. Learning how to learn is considered as a basic need for any organization to survive in an uncertain business world. It starts first from individual learning and then transferred to the organization through a process which is not completely known (Molina and Callahan 2009). This learning process may be different for different kinds of organizations.

Pascale (1991) has defined two kinds of learning: (i) little “l,” and (ii) big “L.” The distinction between this has been defined using learning in General Motors (little l) and Honda (big L). *General Motors learning was focused on the incremental improvement over previous performance. On the other side, Honda demonstrated the quality of both kinds of learning. The focus was on quality, enduring values, trust, empowerment, conflict management, and innovation. Some of the initiatives taken like idea contest to inspire the people to come forward with their ideas, developing a culture of problem finding and having trust on others. These kinds of initiatives improved the agility and adaptive quality of Honda.* Organizational learning is not the only way in which learning occurs at the collective level, but it also includes the surrounding environment that facilitates collective learning (i.e., an organizational learning culture) (Molina and Callahan 2009).

Effectiveness of learning organization depends on the combination of organizational learning (continuous improvement, continuous questioning of how to do things and how to improve and develop awareness), work learning (on the job training), learning climate (set an environment), and learning structure (organic) (Ortenblad 2004). Adaptation through learning process contributes towards the organizational ability to survive (Gorelick 2005). Organization vitality and adaptive nature of an organization depends on the learning capability of that organization (Pascale 1991). Permanent learning capacity helps organization to adapt to the changing situations (Diez et al. 2005).

In the hypercompetitive environment having continuous and unanticipated changes, learning capability of an organization makes it capable to cope with the changes and compete effectively. This learning capability has been considered as the strategic capability of the firm (Jitnom and Ussahawanitchakit 2010). Strategic learning capability has a positive influence on the performance both ways: directly and indirectly, and this performance is positively associated with sustainable growth. Learning inside an organization should be either equal to or greater than the changes outside the organization; otherwise, the survival may be problematic (Schwandt and Marquardt 2000).

To survive and prosper in the current economic climate, organizations are required to develop learning process faster than its competitors, which helps it to stay ahead of the competition (Zhao 2005). In one of the study, the importance of learning process for organizational survival has been defined by Schwandt and

Marquardt (2000), which says that within the next 10 years' time frame only those organizations will survive that will be able to develop the learning process.

Due to globalization, the competition has increased drastically and companies are supposed to come out with innovative solutions for long-term survival. Learning and innovation have been defined as linked concepts. The outcome of the study by Xu et al. (2011) also supports the critical role of innovation in organizational growth and success. According to the authors, successful companies produce 75% of their revenues from new services and products that were not in existence 5 years before. Resource-based view (RBV) of the organization establishes the importance of innovation and the creation of new knowledge for its growth (Guadamillas et al. 2008). Organization's ability of creating something new for commercial value gives it new strength for the long-term survival and growth (Sushil 2003). A positive way to learn faster and stay ahead of competitors is to unlock the creative power of organizational members and to engage staff in improvement and innovation processes. Survival means creating new business practices that are better than accepted industry best practices in both customer care and product value perspectives (Zhao 2005).

*In Teletechnics (a US firm operating in the area of development and manufacturing of a wide range of highly advanced communication systems), creativity, learning, and innovation are the central themes of company strategy. It has developed a new performance management system with key focus on enhancing the learning and innovation in the organization. Creativity, knowledge creation, personal growth, mutual support, and development of new learning strategies have been considered as the central issues in the organization (Molleman and Timmerman 2003).*

Continuous learning in an organization develops more creativity and finally leads to innovation in the organization. Creativity and innovation are the source of strength and competitive vitality in an organizational system (Vicenzi and Adkins 2000). For promoting innovation, organizations have to use their learning in an appropriate way to make them effective like through total quality management practices (Hung et al. 2010). This kind of initiative is strongly associated with effective innovation in the organizations.

A learning organization can stay ahead of the competition through innovation by using the knowledge gained from different kinds of learning processes (Chermin and Nijhof 2005). Innovating firms grasp the new opportunities in the industry, attract new customers and by venturing into new markets that help it to achieve growth and profitability (Michael and Pearce 2009). Innovation process has been considered as one of the critical dimensions for the success and growth of organizations (Julienti et al. 2010).

In the changing environmental conditions, innovation process in the organization integrated with flexibility, make it easy for the organization to manage the changes. Liao et al. (2008) have defined these two as the key processes for long-term survival and success. Innovation can be enhanced in the organization if flexibility issues taken as a concern in the communication process. This allows top-down, bottom-up, and lateral communications within organizations and promote the innovation process (Egbu 2004).



*3M has developed a culture where employees have been given flexibility to use their time in some innovative process other than their regular work. Further, a successful innovation acts as a catalyst for other employees to work more in a flexible manner for contributing more. 3M has innovative culture, which supports learning and experimentation in the organization. It brings people together (using different tactics like organizing activities like technical audits of the various labs regularly) from diverse backgrounds that generates more new ideas. Its well-known 15% rule has supported the growth of innovation process a lot. In 3M, money and time have been considered as two basic requirements of innovation (Brand 1998).*

*The vision of JAC “providing better products for a better tomorrow” itself says its dedication about the innovation in the organization. In the first phase of its learning, it set a team for learning organization project to link the learning organization theories to the core values of the company. Its “40+4” program during the second phase led to a learning environment in the organization and motivated employees to innovate. The program says that besides the 40 h of working time, everyone is encouraged to come for training every Sunday. This kind of flexible approach promotes learning in the organization (Kolb and Jiang 2005).*

Innovation and entrepreneurship are complementary to each other. The combination of both is vital to organizational success and sustainability in current dynamic and changing environment (Zhao 2005). Entrepreneurship and innovation are closely interrelated and the former one stipulated the later (Michael and Pearce 2009). Entrepreneurial attitude provide more resources and promote risk taking in the organization that foster the innovation process and performance of the organization (Molina and Callahan 2009).

### ***13.3.2 Flexibility and Entrepreneurship***

Flexibility has been defined as one of the key attributes that is related with learning and innovation (Sushil 2003). The vital enterprises are more adaptable towards changing environments. Organizations adapt itself with the changing environment by way of developing more “flexibility.” Customers are the key stakeholders of any organization and customer service is one of the most important things and a matter of concern for any organization. Flexibility has a direct impact on customer service which has been considered as a vital area for organizational survival (Agrawal 2004). The firms that are having more flexibility serve their customers in a better way than their competitors.

In the twenty-first century, flexibility has become an issue for survival of many organizations (Becker 2001). For firms to survive and prosper in an unstable and unpredictable environment, flexibility plays a vital role. Flexibility provides the capacity to adjust itself with respect to the changes and convert the changing situation as new opportunity by making it favorable for organization. It can be considered as a company-specific skill or a resource for the organization (Dreyer and Gronhaug 2004). The current knowledge age and highly uncertain environment demand some

kind of proactive and adaptive nature with respect to the changes. Incorporating flexibility in organizational processes develops a supportive internal environment to fulfill this requirement.

*The R&D department in The Dutch National Gas Company was facing the problem due to the complex, dynamic, and unpredictable environment. Its information-processing capacity was not up to date and the R&D department was defined to be in chaotic form. The department faced many failures in its new research initiatives because of unclear structures and shared values, and lack of adequate information related to work hours, costs, and technical progress report. The organization has developed a wide flexibility mix. It has defined a clearer organic structure and with a strong focus on department's core culture. To preserve a significant flexibility potential, it had started social events for creating a higher order core culture. Managers started to provide more direction and feedback. This kind of cultural changes developed flexibility in the organization (Volberda 1997).*

Flexibility is considered as the vital force of strategy development in the changing business environment (Agrawal 2004). Flexibility is a way by which an organization can increase control in highly unstable environment. Organizational flexibility is considered as a strategic option in situations where accurate predication about the changes is not possible and the probability of getting surprises is more. *As a strategy of the organization, ASE's first focus was on the continuous innovation, diversification, and flexibility perspective to exceed customer expectations and satisfy their needs (Yeh et al. 2006).*

Jitnom and Ussahawanitchakit (2010) have suggested that an organization can achieve a sustainable growth if it knows how it can manage its strategic learning capability to improve the strategic actions including operational flexibility effectiveness, intelligence marketing response, and firm performance as mediating factors. Sharma et al. (2010) have analyzed the flexibility issues and discussed its impact on performance and growth aspects of organizations.

Flexible working time in the organizations is one kind of flexibility that is useful for many organizations. This kind of flexibility aspect increases self-motivation among the organizational members and promote knowledge creation which is useful for organizational development (Brench and Sloka 2010). Providing more free time for employees allows possibilities for professional growth without any extra investments. Part-time working has been defined as one of the fastest growing forms of flexible working while short-term contracts, although less significant in growth terms, are also described as widely adopted forms of contractual flexibility used by employers (Mayne et al. 1996). *3M has flexible working culture that provides enough time to its employees to use their time in some innovative process other than their regular work. Further, a successful innovation works as a catalyst for others to work in a flexible manner for contributing more (Brand 1998).*

Another kind of flexibility, which is required by the organization and played an important role but not easy to achieve, is strategic flexibility (Sushil 2014). Strategic flexibility in any organization can be increased by two ways. First, organizations can try to reduce the relative impact of a specific event on the whole organization and second, organizations can try to increase its response capacity (Eppink 1978).

But both of these tasks are not easy to develop. Top management awareness about the need of higher degree of strategic flexibility is a prerequisite for both methods.

Customer service has been defined as one of the vital areas for any organization. Flexibility is important for providing better customer service, and this can be developed using various systems like KM systems in the organization (Agarwal 2004). Customer demands are not unique in nature and this varies from one customer to other. These different kinds of demands can be better managed by using a flexible approach.

In an era which is driven by accelerating change, with flexibility, entrepreneurial actions are essential for survival of any organization. Ireland et al. (2001) have found that entrepreneurship and strategic management processes contribute to firm's growth and success. According to Sushil (2003), enhancing flexibility promotes entrepreneurship in the organization. Using the technical infrastructure, knowledge, organizational flexibility, and entrepreneurship the organization can achieve high growth path (Guadamillas et al. 2008). Increased entrepreneurial activity helps the organization to remain vital. *The role of technical infrastructure in knowledge exchange can be seen in H-Bank where the infrastructure pushed the knowledge interchange in the organization and save money, time, and organizational resources and ultimately leads to better customer service and satisfaction* (Chua 2009).

Entrepreneurship helps in gaining the competitive advantage by way of product, price, and market innovations. Top management plays an important role for developing entrepreneurial attitude in an organization. Omerzel and Antoncic (2008) have found that entrepreneurial knowledge is critical for survival of any organization. Successful entrepreneurs develop competences, skills, and techniques in a constant manner and acquire specific knowledge for survival, and innovate new entrepreneurial opportunities in their industries. According to Carsrud and Brannback (2011), entrepreneurial actions, and risk taking nature in the organization lead to organizational growth.

Organizations can discover and exploit the market opportunities using its entrepreneurial talent (Fedrici et al. 2008). Corporate entrepreneurship is positively associated with a company's growth and profit (Covin and Slevin 1991, Zahra 1991). Managerial practice intensity is one of the prime requirements for successful corporate entrepreneurship. Incorporating flexibility issues in planning, use of strategic controls, and involvement of people in the processes develop more entrepreneurial behavior. Barringer and Bluedorn (1999) have also considered corporate entrepreneurship as an important aspect for organization's survival and performance. A government policy may affect the entrepreneurship by developing a policy which reduces the risks and increases the returns for the entrepreneurs (Michael and Pearce 2009).

*Philips semiconductors was facing the problem due to new technology, unpredictable product-market combination, and lack of required flexibility. Although it was having operational flexibility but that alone was not enough. It included the structural and strategic flexibility in the organization. It has gone for an entrepreneurial revitalization by transforming the firm from a bureaucratic and conservative company into an innovative and responsive one. This revitalization resulted in a hybrid form of planned/flexible organization. The transformation was done by*

*developing autonomous task groups, interdisciplinary teams, less formal planning and control, organizing social events, and providing some special training (Volberda 1997).*

Gilbert et al. (2011) have identified some of the factors like characteristics of an entrepreneur, access to resources like human capital and finance to explain why some ventures grow more than their counterparts. Growth has been defined as functions of the entrepreneurial decisions. These decisions are related to the issues like about how and where the organization should grow and the extent to which other factors are in place that enable the growth. *Syndicom can be seen as the perfect example of collaborative entrepreneurship which was established based on the concept of collaborative entrepreneurship. It had assisted in creating medical device design communities which involves surgeons, patent attorneys, medical engineers, and device manufacturing firms* (Miles et al. 2009). Entrepreneurial people not only benefit the organization but they also play a central role in economic growth of the countries, and the availability of high quality of entrepreneurial skills influence the potential of development, growth, and innovation in the organization (Michelacci 2003).

Survival and growth are the two key dimensions of a vital organization. Organizations can survive and grow for a longer period of time if they can manage the changes better than their competitors. For this, organizations should have better understanding about the changes. *Learning* is the process by which an organization can achieve this knowledge. After having the knowledge about the changes an appropriate action is required as per the change. *Innovation* is the process which is required to deal with changing demands. *Flexibility* and *entrepreneurship* are the other key processes that are crucial in the organization for developing learning and innovation and achieving long-term success. These four processes are the vitalization processes in an organization that deal with operating characteristics of a living system, and can be taken as a measurement framework for organization vitality.

## 13.4 Conclusion

The current era is known as knowledge era where environment is uncertain and changes can occur at any point of time. With this situation, it is not an easy task to survive and grow without having some different approach than other organizations. To become successful in this kind of environment, organizations should develop ability to become aware and predict the changes. A continuous learning process helps in getting this knowledge about the external changes and internal organizational capability to manage the changes. Using the organizational learning as a tool for developing innovating ideas, organizations can manage the changing needs. Learning and Innovation, combined with a flexible approach and entrepreneurial attitude would help organizations to survive for a longer period of time and grow faster than their competitors. These four processes: learning, innovation, flexibility, and entrepreneurship can be considered as LIFE for the organization as this boosts organizational capability to survive and grow for a longer period.

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# Chapter 14

## How Flexible is the Strategic Innovative Performance Target Design without Sacrificing Lead Time?

R. C. Pathak, Rajesh Pathak and Shreya Virani

### 14.1 Introduction

Connecting strategy to execution, building organisational capabilities that allows companies to achieve and further sustain the continuous change and innovation has been the prime concern of the top management. Ceaselessly enhancing flexibility and efficiency in all customer-centric and back-end processes decidedly requires cocreating value and unique experiences at a continual pace. Thus, CEOs, executives and managers at every level require striving transformation of the business breakthrough technologies like supply chain management (SCM) for strategically creating ongoing innovative advantages.

Designing a flexible performance target is the crux of the ‘fast innovation’ system—may have more than one performance level. The knowledge arises from experience and investigation—which can very rarely be predicted before the start of the project. (Prahlad and Ramaswamy 2004; George et al. 2005). Govindrajan et al. (2010) observe that the real challenges of innovation lie beyond the idea. It lies in a long hard journey—from imagination to real impact. ‘Performance engines’ may not be able to tackle every innovation initiative; nevertheless, they are incredibly powerful tools. Though it is a heavy-duty solution, it is dire essential and is absolutely necessary. Govindrajan has successfully suggested an innovation model, which is certainly beyond IDEA:

$$\text{Innovation} = \text{idea} + \text{leader} + \text{team} + \text{plan}. \quad (14.1)$$

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It is very much evident that innovation must include organizing and planning capabilities beyond only an idea. ‘Making it happen’ from the idea to the product is the whole crux of the journey.

Strategic innovation proceeds with ‘strategic experiments’—high growth potential of new businesses that test the viability of unproven business models. Strategic experiments have characteristics and are generally ‘non-linear’. As today’s market place is characterized by rapid and non-linear changes, we can firmly retort that strategic innovation is a process of exploring experimental strategies. And more importantly, a ‘performance engine’ is made of two parts: one, dedicated team and two, shared staff. To make a right choice, we have to accurately access the capabilities of the ‘performance engine’, i.e. the project team.

Before, we embark upon further details, some basic clarity of the definitions is tried out here.

- *Innovation*: ‘Innovation involves the creation of a product, service, or process that is new to an organisation’ (Khalil 2000).

or

Innovation redefines the marketplace in such a way that a new set of factors determine profitability and success. (George et al. 2005).

At the same time ‘invention’ is:

- *Invention*: ‘Invention is either a concept or the creation of novel technology’.  
Inventions and innovations are intimately related, however, they are not the same. An invention can be thought of as an *event*, whereas innovation can be clubbed as a ‘process’, which is in project management parlance and can be called as ‘*activity*’.
- *Strategic innovation*: ‘*Strategic innovation*’ involves testing new, unproven and significant answers to at least one of the three fundamental questions of strategy: One, who is your customer? Two, what is the value you offer to the customer? Three, how do you deliver that value? (Govindrajana 2007, 2010).

All the above ingredients require ‘core competencies’, which need the development of a new skill, technology, and last but not the least attitudinal change. ‘Lead-time principles’ and what is lead time and closing lead-time gap, shortens the logistics lead time, which simultaneously move the customer’s order cycle closer by giving earlier warning of requirements having improved visibility of demand.

In this chapter, we have further discussed the ‘designing of flexible performance targets’ and some suggested ‘innovation blitzkrieg model’. Also, the case studies of Toyota and Nokia have been briefly presented in this chapter along with the philosophy of ‘Toyota Way’ working in the flexible designing system.

**Disruptive Innovation** Offerings, process, methods, technologies, etc. represent a major shift from everything that has come before. ‘Disruptive innovation eliminate or marginalize the revenue growth and value-creation potential of an incumbents offerings’ (George et al. 2005).

Christensen (1997) and Raynor (2007) also discussed the disruptive (a disruption in technical sense) innovation, arising not only out of two industries colliding with each other regarding technology improvements, but also due to a kind of big explosive change.

Disruption as has been observed from ‘Differentiation’ and fast ‘time to market’ is more vigorous in nature, which creates entirely new curves altogether—redefining the market place in such a way that a new set of factors determine profitability and success. As is evident, innovations that help redefining the marketplace are called ‘disruptive innovation’, and those merely changing the dynamics within the existing frameworks are termed as ‘sustaining innovations’.

Disruptive innovations though not only offer explosive growth but also have the following challenges and risks:

- May require new technologies or core competencies.
- May not interest the company’s current best customers.
- May require completely different sales channels.
- Will have unpredictable sales volumes and profits.
- Cannot be evaluated by net present value (NPV) analysis.

**Sustaining Innovations** They are that improvements that build on existing technology, product/services, market strategy, etc. (these are also referred to as incremental innovations). Sustaining innovations apply existing core competencies and indicate:

- Offer only modest to moderate improvement in cost per unit.
- Have low risk of failure.
- Can be quickly copied and commoditized.
- Can be evaluated using NPV analysis.
- Create growth in revenue and shareholder’s value.
- Would pass through existing channels.

**Lead-Time Gap** Most industries/companies face a basic problem: the time taken to procure, make and deliver the finished goods/products to a customer is longer than the time the customer is prepared to wait for it. This is the basis of lead-time gap, which is explained by Figs. 14.1 and 14.2 (Christopher 2001).

From the customer’s viewpoint, there is only one lead time—the elapsed time from on-time delivery (OTD). Clearly, this is a crucial competitive variable as more and more markets become increasingly time competitive. Whilst clearly zero lead times are hardly likely to exist in the real world (practical world practice), the target for any organisation should be to reduce the lead times, at every stage in logistics pipeline, as close to zero as possible.

From Fig. 14.1, it is evident that the customer’s order cycle refers to the length of time that the customer is prepared to wait, from when the order is placed through to when the goods are received. This is the maximum period available for order fulfillment.

In the conventional organisation, the only way to fill the gap between the ‘logistics lead time’(i.e. the time taken to complete the process from goods inwards to

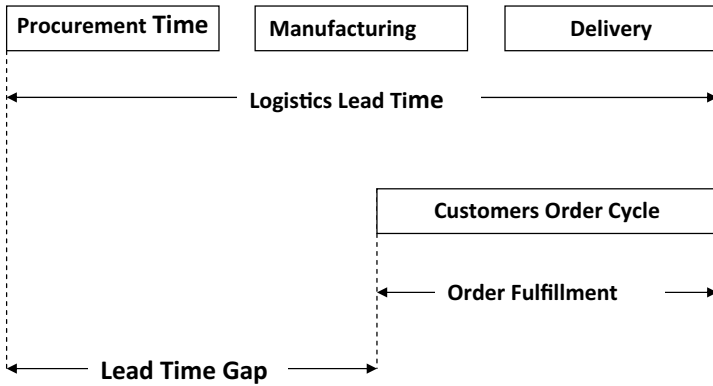


Fig. 14.1 The lead-time gap

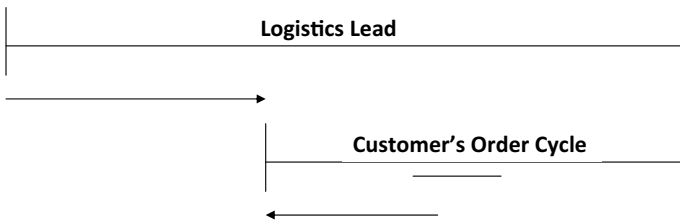


Fig. 14.2 Closing the lead-time gap

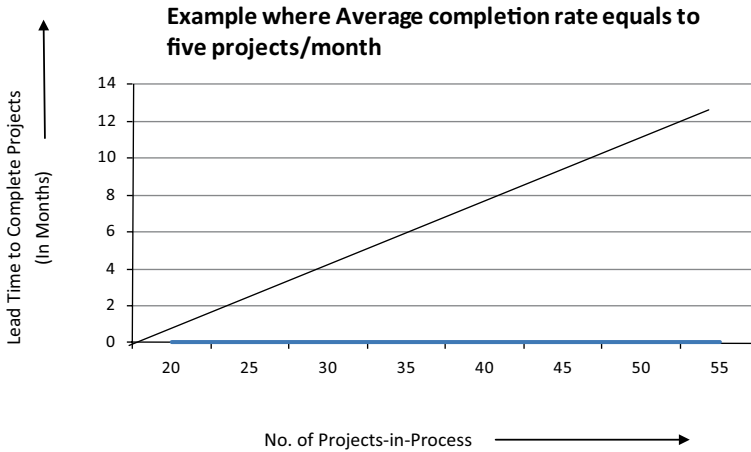
delivered product) and the ‘customer order cycle’ (i.e. the period they are prepared to wait for delivery) is by carrying inventory and forecast management. It can be retorted that all the mistakes in forecasting end up as an inventory problem, whether too much or too little.

The company that achieves a perfect match between the logistics lead time and the customer’s required order cycle has no need of forecasts and no need for inventory. Now, the challenge for logistic management is to search for the means, whereby the gap between the two lead times can be reduced if not closed (refer Fig. 14.2).

Reducing the gap can be achieved by shortening the logistics lead time (end-to-end pipeline time) whilst simultaneously trying to move the customer’s order cycle closer by gaining an earlier warning of requirements through improved visibility of demand (Christopher 2001).

**Law of Lead Time** Law of lead time can best be explained by Little’s law equation (after the mathematician, who first proved it in 1961):

$$\text{Average lead time of any process} = \frac{\text{number of things in process}}{\text{average completion rate}} \quad (14.2)$$



**Fig. 14.3** Relationship between projects in process and lead time

In manufacturing, ‘things in process’ is ‘work in process’ (WIP); in product development, it is the number of ‘projects in process’; and for services, it can be ‘number of work items in process’ (job requests, files, invoices, etc.). For any single innovator, it is the number of ‘tasks in process’. The average completion rate is simply how many of the ‘tasks in process’ the employee can complete per week or month on average. From the graph in Fig. 14.3, it can be observed that if we have no control over the number of ‘projects in processes’, we have no control over the lead time.

Figure 14.3 also depicts that there is a simple relationship between the number of active projects or tasks in process and lead time—the more active projects, the longer time it takes to complete all the projects.

**Strategic Flexibility** Sushil (2000, 2014); Pathak et al. (2006; 2007); and Pathak and Patil (2014) have amply defined ‘flexibility’ and its various manifestations. Simply said, flexibility is options, agility, versatility as well as robustness, and can be defined as:

- *Flexibility*: ‘Flexibility is the ability to change or react with little penalty in time, effort, cost or performance’ (Sushil 2000).

or

Flexibility is defined as ‘changing within the existing constraints’ (Raynor 2007).

Fast strategy (Doz and Mikko 2008) calls flexibility as agility. Strategic agility and strategic flexibility are synonymous, and is defined as:

*Strategic flexibility* ‘is an approach that allows organisations to prepare effectively for a future they cannot predict’. ‘Also it encompasses “strategic uncertainty”, which is the ability to change strategies, which is something made largely possible by the commitments required for success’ (Raynor 2007).

or

‘Strategic Agility is about the capability to think and act differently’ (Doz and Mikko 2008).

*Strategic flexibility* ‘is firm’s intent and capability to identify major changes in the external environments, to create option, bundles of product development resources, and to ensure the sustained competitive advantage of the firm’ (Wang 2005; Pathak and Sumati 2009; Agnieszka 2011).

Or

*Strategic flexibility* can be defined as ‘an organization’s capability to identify major problems/changes in the external environments, quickly mobilise the resources to new course of actions in response to those changes, and recognize and know promptly when it is time to halt or reverse existing resource commitments’ (Pathak and Sumati 2009a).

Strategic flexibility has the following framework or components:

- Anticipate multiple scenarios.
- Formulate strategies for each.
- Acquire and accumulate the capabilities to execute those strategies.
- Operate or execute the most likely strategies.
- Be prepared to rapidly adopt one of the alternatives, if market forces dictate.

**Strategic Paradox** ‘Strategies with the greatest possibility of success also have the greatest possibility of failure. This is further amplified by a verdict, a compelling vision, bold decision, motivated leadership, bold decisive action, deliberate planning, etc. Unfortunately all these prerequisites of success are almost always the ingredients of failure too. Managers make the choices or assumptions about the future which they cannot predict. It is this collision between commitment and uncertainty that creates the “strategy paradox”’. Strategic flexibility has a significant role in the flexible performance design (Pathak 2008).

Prahlad et al. (2008) have suggested an approach about future planning as ‘folding in the future’. Hence, as it is evident that no organisation knows about the future of 10–15 years or may not be able to extrapolate the past or the current state of affairs. Therefore, it is prudently suggested that a ‘long-term focus’ with ‘short-term’ demonstrated ground actions will be the essence of organisational transformation.

## 14.2 Designing Flexible Performance Targets

Flexible performance target designing is a key parameter of ‘fast innovation’. Fast innovation delivers highly differentiated offerings to the market, probably in half the time of the competition as compared to a slow or normal innovation process. It is generally impossible for customers to specify completely, precisely, and correctly the exact requirement of the product before trying some version of the product. Herein, fast innovation technique/methodology reduces the lead time as well as improves accuracy through differentiation, speed-to-market and disruption activities. In this way, on-time delivery (OTD) to the customer takes place, delighting the customer.

It will be observed that ‘flexible performance target design (FPTD)’ seeks to achieve the best possible design that meets the maximum number of customer delighters within the required time-to-market deadlines (George et al. 2005). FPTD is different from the traditional design approach including concurrent engineering (CE). We know that CE approach is better than the formal approach as it inserts formal feedback reviews, checks and modifications, but it also lacks co-creation of customer value and experience as well as ‘evolvability’ (Prahalad and Ramaswamy 2004).

The principles of FPTD are as follows:

- It is based on voice of customers (VOC) and voice of business (VOB) and the flexible approach.
- Understanding the intended needs and providing outlines of specifications: All the ethnographic inputs and then adding more details during developments.
- Allow specifications to emerge or evolve with time: The specifications emerge due to co-creation of the customer value system and experience as well as ‘evolvability’ embedding intelligence in the design for faster midcourse corrections/changes and further expectations. Even modular smart design techniques are welcomed flexibly.
- Early freeze re-used design elements delay the freeze for critical differentiation: All specifications ultimately must be finally frozen for a release of the product. Fast innovation techniques like Laws of Lead Time and closing the gap, designing for ‘Lean, “Six Sigma” principles’ and applying the ‘innovation blitz’ (discussed in the next paragraph). This ensures all the three dominant dimensions of innovation: differentiation, fast time -to -market and disruptive techniques to be inbuilt.
- *Technology Management—Understanding the technology feasibility point (TFP)*: McGrath (1996) recommended that at some point and shortest lead time (Fig. 14.4), wherein all the technical uncertainties or risk elements are smallest and controllable enough for product development (customer can never be satisfied fully), TFP gives a better product—a best fit result (TR1-technology review). The technology feasibility point (TFP-TR1; refer Fig. 14.4) is the agreed upon confidence level that defines the end of a technology development programme at TR1 of the final product/service/offering.

**Innovation Blitzkrieg** Innovation blitzkrieg is probably the last step of the ‘fast innovation’ techniques and differs from ‘slow innovation’ in the sense that this model has the shortest lead time, designed for lean Six Sigma and finally obeys most of the rules of disruptive innovations (refer Fig. 14.5). This fast innovation technique thus offers more offerings compared to slow innovation process and also satisfies customer’s experientially co-creation of value-based customer’s expectations.

The innovation blitzkrieg model (George et al. 2005; Shreya 2012) distinctly depicts the following salient parameters:

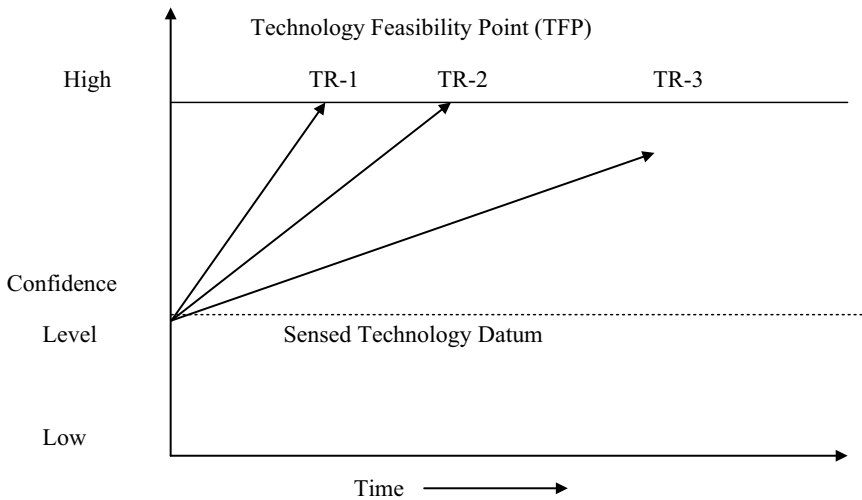


Fig. 14.4 Representation of feasibility point

- Ethnographic observations of customers and focusing on three innovative parameters.
- Opportunities are to be grabbed.
- Early freezing specifications and later during developmental stage and finally freezing of specifications as per TFP, late freezing specifications is the crux of process.
- Shortening of lead time and closing of the lead-time gap as early as possible.
- FPTD and innovation blitzkrieg help in achieving the desired product, efficiently.
- Designing for 'lean Six Sigma'.
- Thus, many offerings are provided to the desired satisfaction of customers.

Apart from the above salient points, innovation blitzkrieg has the capability to generate further manifestations of disruptive offering.

### 14.3 How Flexible Is the Flexible Performance Target Design?

Herein, an integrated team for designing, inspection and customer work, right from the very beginning with 'evolvability', is needed, i.e. embedding intelligence in the design for catering futuristic modifications/midcourse corrections, etc. Some other significant parameters are:

- Customer requirements/reactions are catered right from the very beginning.
- Various 'review teams' and sub-groups work who do the design validation/changes, etc.

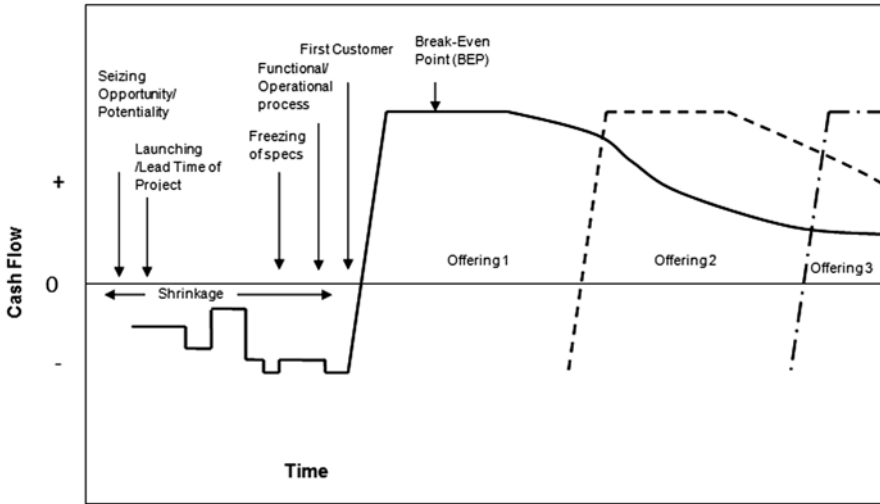


Fig. 14.5 Innovation blitzkrieg model

- The timing of final freezing of specification is also flexible and in our control—designs control.
- Also, the evaluation of additional developmental time for creating delighters/satisfier from the customer's angle is done.
- Process and intermittent feedback system is the crux of flexibility system approach.
- Even a pilot product sample can be evaluated/tested in presence of all concerned, i.e. users, developers, inspection, authorities, etc. for final validation.

## 14.4 Case Study 1: Toyota

*Toyota Flexible Designing* The story of Toyota began with the founder Sakichi Toyoda, an inventor and pioneer in the late 1800s, in a remote farming community outside of Nagoya with a weaving industry. Later, his worthy son Kiichiro Toyoda started the 'Toyota Automotive Company' during 1929–1930. Later, Kiichiro formally did engineering in the mechanical discipline to understand the automotive car business unlike his father Sakichi who was the inventor of 'Toyoda Automatic Loom Works' and did not go to any engineering college.

Today, there are books written on 'The Toyota Way' and its 14 principles by Liker K. Jeffrey (2011) along with two other best sellers like 'Toyota Talent' and 'Toyota work-book'. Before we discuss the 'flexible target design', the very strong tenets adhered to by the Toyota family of manufacturers are given below:

- Toyota is serious about long-term thinking strategically.



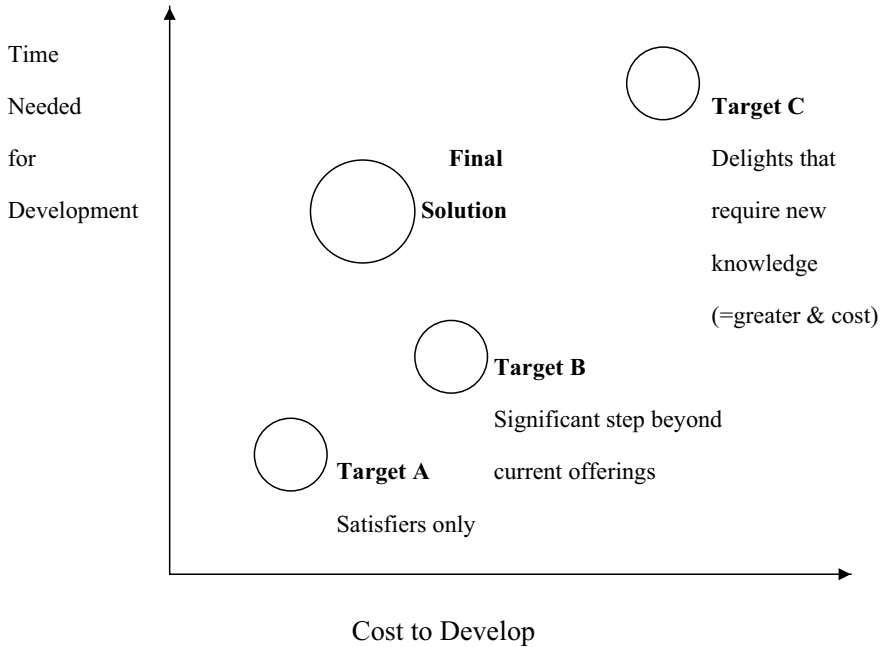


Fig. 14.6 Flexible target design

- Toyota believes in the right process and they will only produce right results.
- Value is added to the organisation by developing ‘people and partners’.
- Continuously solving root problems drives organisational learning.
- Toyota Production System (TPS) works on responsibility rather than tasks.
- Productivity is enhanced by eliminating wastivity.
- The knowledge rules of Toyota are:

Nature and markets make the rules. We profit by learning them,

Every learning is from new mistakes-learn from mistakes and do not make one again.

Herein (Fig. 14.6), it will be observed that Target A is a safe target and Target C provides the customer with delighters, as is desired. Here, the FPTD is a set-based design (SBD), which gives a great deal of credit for higher performance. In this case study, the chief developer is totally responsible and monitors the project status by continually reviewing prototypes and analyses (as opposed to doing an after the fact review of completed tasks).

Further, we observe that in TPS, by exploring multiple targets (difficult set of specifications) simultaneously/concurrently a team can often come up with solutions that were not originally anticipated. Also, herein the chief developer sets the schedule for system-level events such as a body design, related toolings, dies, drive train, etc. All subsystem work groups know this schedule and strive to meet those dates.

If a back-up option on hand (probably based on reuse of an existing element) can be substituted; even if the solution ideas fail, they are not wasted and are stored in archive—as they may be useful for future designs as a breakthrough (and at the least can help prevent future failure too).

*Toyota the Power of Partnership* On 3 February 1997, on Monday, Japan's largest motor manufacturer, Toyota announced that all of its Japanese assembly lines had been brought to a halt following a devastating fire at the premises of one of its affiliated suppliers, Aisin Seiki. This company supplied brake master cylinders for several Toyota models and was its only supplier of brake fluid proportioning valves (Liker 2004).

The fire had shown one of the weaknesses of Toyota's famous lean manufacturing system of TPS (which is opposite to flexibility/no alternative), which runs on minimum stock level, using just-in-time (JIT), Kanban and Genba Kaizen principles. The fire left Toyota only holding half a day's stock of the vital components. This was not the first time it happened, the Hanshin earthquake had severed the supply lines of Toyota Kieretsu to components manufacturers in and around the city of Kobe in 1995.

Toyota's founder Shoiehiro Toyota admitted that the employer's brand of JIT 'is still not perfect', but is convinced that the system is still the best available solution. Harnessing around 20 of Toyota's other affiliated suppliers, they were asked to rally round, on war footing. The suppliers immediately set about retooling, retaining employees and setting up new production lines in a co-ordinated fashion to provide the missing components.

And further, the reports indicated that by Friday, 7 February 1997, Toyota had restarted assembly lines at all of its plants, successfully restoring the output to 90% of its usual level (Valerie 1997). Full production was resumed by the following Monday. This case amply justifies the flexible manufacturing performance design target as well as that of strategic flexibility of Toyota as such and 'evolvability' at the helm of affairs. This is also the case of co-creation of values, evolvability combined with experiential learning as well as passionate work culture taking Toyota to dizzying heights.

## **14.5 Case Study 2: Nokia's Strategic Flexibility or Agility Manifestations**

Pathak and Sumati (2009) have discussed the strategic agility at length and its very manifestations in their technical paper. Nokia has outmanoeuvred Motorola and Ericsson mobile (cell phones) by strategically changing its technology from analog to digital mode and its very many derivatives. Nokia also enables people to experience music, maps, media, messaging, games, pictures (photography) and many other functions.

Initially, Nokia produced forest products, cable, rubber goods (rubber boots or so), chemicals and consumer electronics. It has only been in the mobile telephone industry since the 1970s and GSM digital system and handsets products were manufactured only during the early 1990s. It can be observed that Nokia had a complete success march from 1996 to 2006, wherein it became the largest supplier of mobile devices with some even embedded with digital cameras.

Right from 2004 onwards, the other applications like audio, video, gaming and entertainment miscellaneous items were also a progressive growth trajectory. Now, Apple's I-Pod, etc. has got the latest configuration compared to Nokia. But Nokia's mobile phones of the future (1) and (2) on YouTube have got comparable configurations and Nokia in mobile telephony is world-class and a top leader—Nokia 97 has secured an eminent position in the world.

## 14.6 Conclusion

Connecting strategy to execution building organisational capabilities that allow companies to achieve and further sustain the continuous change, as well as innovation has been the prime concern of the top management. And this certainly requires ceaselessly strategic flexibility as well as disruptive innovation techniques and customer-centric back-end processes require co-creating values (with experience) at a continual pace.

Designing a 'flexible performance target' precisely means completely specifying a product and freezing the specs later during the developmental process with the customer's active participation and is the crux of strategic flexible norms. In these processes, shortest lead time, i.e. closing the lead-time gap at the earliest is the essence of design. This with further breakthrough technologies and evolvability, co-creation of value of customer and experiential learning decidedly shows the express highways of the product developmental benchmark.

The above disruptive innovations and strategic flexibility plus freezing of specifications during the product developmental continual stage will decidedly ensure the sustained competitive advantage of the organisations.

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# Chapter 15

## Time-Bound Formalization and its Role in Building Team Flexibility in Product Development Organizations

K. Srikanth and K. B. Akhilesh

### 15.1 Introduction

It is quite overwhelming to find that research work related to flexibility has a history of more than 100 years. The concept of flexibility achieved prominence during the nineteenth century after the invasion of Japanese car makers into the US auto market. The invasion forced the US auto industry to switch from the rigid system of ‘mass production’ to a system capable of dealing with dynamic market conditions. Simultaneously, there was also a transition in the management philosophy followed by these organizations—from classical principles of stability and control to modern principles of embracing change and uncertainty. Thus, building the ability to cope with the challenges of dynamic environment (i.e. flexibility) became an important consideration (Pine and Davis 1999).

Flexibility can be implemented at various levels of organization—at the individual, group or organization level—depending upon the context and the requirements. In this chapter, we deal with building flexibility at the team level (i.e. team flexibility) in the context of product development (PD). Specifically, we intend to focus on the factors that help to build team flexibility. The study discusses about one such new factor named ‘time-bound formalization (TBF)’ and its impact on team flexibility and team performance. This new factor was derived as a part of major study that was carried out on 108 PD teams from the public and private sector. We start off by providing a brief background about flexibility followed by a discussion on the role of formalization in building team flexibility. Finally, we discuss about TBF and how it influences team performance.

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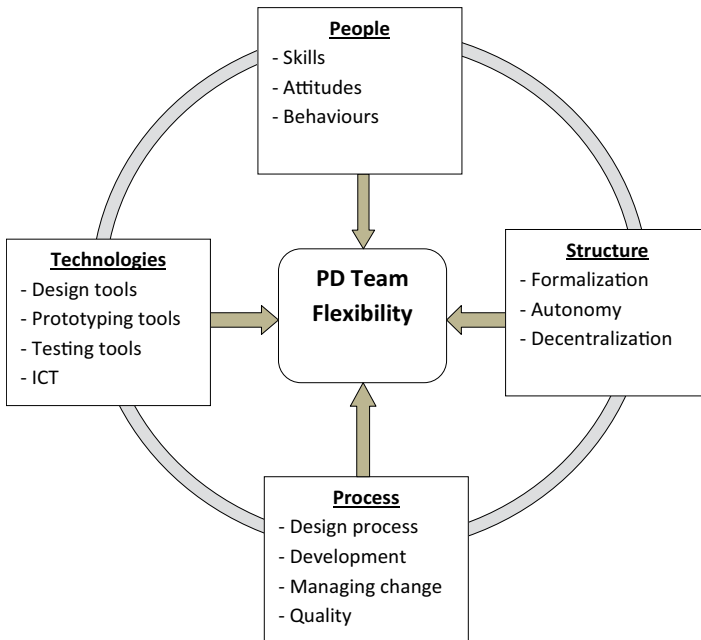
## 15.2 Flexibility

The word flexible is intuitively understood as ‘being adaptable’. However, the difficulty arises when we attempt at providing a concrete and comprehensive definition of flexibility. Researchers have always found it to be a ‘hard-to-capture’ construct because of its polymorphous and multidimensional nature (Sethi and Sethi 1990). Despite the difficulties, we can observe a common theme surrounding various definitions of flexibility, i.e. its association with change and uncertainty (Sethi and Sethi 1990; Evans 1991; Volberda 1999; Golden and Powell 2000; Sushil 2014). So in a broad manner, flexibility can be considered as the ‘ability of an entity to deal with change and uncertainty’. Further, the entities, type of change and type of uncertainty can vary from one context to another. In this study, the entities are the PD teams, and consequentially we term the flexibility associated with these teams as PD team flexibility.

### 15.2.1 *PD Team Flexibility*

PD is a process of transforming an idea into a product (Ulrich and Eppinger 2004). It consists of a sequence of steps ranging from the identification of market opportunity to the production and sale and delivery of the product (Ulrich and Eppinger 2004). To conduct the PD activity, organizations most popularly use cross-functional (or multifunctional) teams amongst the many organizational forms (Griffin 1997). These cross-functional teams are formed with personnel from different functional departments to support the design, development and production of a new product. These teams usually enjoy greater autonomy in deciding the course of the PD (Smith 2007). The importance of using cross-functional teams is widely acknowledged with many research studies highlighting the critical role played by them in achieving product success (Ernst 2002; Smith 2007). Since PD teams are at the centre of the development activity, making these teams flexible and responsive to changing market conditions would help the PD organizations to operate in a dynamic environment. Such a capability will provide organizations with a competitive edge to achieve success. According to McComb et al. (2007), cross-functional teams have the ‘potential to exhibit highest level of flexibility’. To make use of this potential, we first have to understand what PD team flexibility is and how a team derives its flexibility.

Li et al. (2010) explain how a team derives its flexibility using the concept of dynamic capability and resource-based view (RBV). According to them, the competitive edge (in our case flexibility) is derived out of the capabilities of the heterogeneously distributed resources. These capabilities are the mechanisms with which entities (teams or organizations) achieve new resource configurations to deal with the emergence of situations as ‘markets emerge, collide, split, evolve and die’ (Li et al. 2010). Thus, by extending the logic of RBV perspective to the PD teams, we can now consider PD teams as a collection of entities (resources). These



**Fig. 15.1** PD team flexibility from an RBV perspective

entities, both individually and together, provide teams with the required capabilities to become flexible. Based on the above conceptualization, we can define PD team flexibility as the ‘ability of a PD team to deal with changes and uncertainties that may arise during the course of PD by means of appropriate resources’. The resources commonly include people, structure, process and technology. These resources and their interactions are graphically depicted in Fig. 15.1. Also, it can be inferred that each of these resources have their own flexibility enabling potential. Of the many resources, structural mechanisms represent an important resource, which can enable the team to achieve higher levels of flexibility. Formalization is one such mechanism.

### ***15.2.2 Formalization and Its Impact on Flexibility***

Formalization refers to the ‘degree of work standardization and the amount of deviation that is allowed in the standards’ (Aiken and Hage 1966). It is one of the structural characteristics of the organization. An organization having a high degree of formalization would be highly predisposed to governance by rules and procedures. According to Aiken and Hage (1966), formalization at a task level can be achieved by task standardization, i.e. by prescribing who, when and how the tasks are to be executed. Formalization techniques standardize employees’ behaviour and reduce

variability in their output. A greater degree of standardization (i.e. formalization) ‘not only eliminates the possibility of employees engaging in alternate behaviours, but it even removes the need for employees to consider alternatives’ (Aiken and Hage 1966). This strategy is arguably more suitable for tasks that can be codified, i.e. routine and repetitive. For tasks like PD, teams regularly come across unique situations and hence a high degree of formalization might prove to be a drawback in responding to changes (Langfred and Moye 2004).

According to Tatikonda and Rosenthal (2000), formality (i.e. formalization) in PD refers to the use of structured processes for managing the project. These structured processes include rules, procedures, periodic reviews for project control and execution. The phase-gate system currently employed by majority of the PD organizations is a classic example of a structured process. A point to note here is the degree of formalization that can vary from being highly formal (highly structured) to informal (ad hoc). A formal process can contribute towards improving the overall team effectiveness by reducing ambiguity and help in quicker resolution of potential problems. However, excessive formality can impair flexibility. Excess formality means more time is spent on reviews and procedures, rather than the ‘real’ work. Further, these rules and procedures would force the teams in a predetermined direction taking away the adaptability that is needed for solving problems that may arise during the course of PD (Tatikonda and Rosenthal 2000).

### 15.3 Time-Bound Formalization

TBF refers to the usage of structured practices, which are bound by strict time limits for control and management of PD activity. In the context of PD, the structural practices include rules, procedures and review techniques adopted during the different phases of PD. TBF represents those formalization practices that have a time factor associated with it. The mode of specifying this time factor can vary—it can be expressed in terms of a fraction of the total project duration or can be specified as a ratio with respect to a given standard or in any appropriate manner.

To illustrate the difference between TBF and formalization, we consider the hypothetical example of defining a strict review practice for monitoring the progress of the PD activity. Normally, implementing a high degree of formalization (i.e. standardization) for such a review practice would imply specifying who, when and how the review should be performed. To categorise a practice under TBF, the presence of the time factor alone is sufficient; the details such as review parameters and who does the review are optional. In the hypothetical example, if the review practice requires that the time between two successive stage-gate reviews should be less than one third of the total project duration, then such a practice can be categorised under TBF. Likewise, many practices can be brought under the ambit of TBF by associating them with a time factor.

Based on the above example, we can argue that conceptually TBF is a subset of formalization. TBF lays more emphasis on the time aspect of work standardization.



**Table 15.1** Factor loadings of items related to TBF obtained after VARIMAX rotation ( $N=108$ )

Items	Loadings
Product-related decisions were taken on time	0.263
Formal rules exist for carrying out a task	0.668
Formal procedures exist to deal with situations that may arise during the course of execution of tasks	0.770
The team does not have to strictly adhere to the procedures for doing the tasks (R)	0.576
% variance explained	16.317

Since the time element of work standardization is already well defined in TBF procedures, the degree of formalization one can achieve in a given time frame gets automatically defined. In fact, TBF can be considered as one of the means of implementing a low degree of formalization. In the light of our findings in the literature about a low degree of formalization facilitating flexibility (Langfred and Moye 2004), we can infer that TBF helps the teams to achieve higher flexibility. While a high degree of TBF would eventually mean a well-timed PD plan, lower or moderate levels of TBF would indicate time constraints only on limited activities. Implementing TBF practices indirectly results in imposing boundary conditions on certain critical activities during PD and these imposed conditions can translate into either narrowing or broadening the horizon of flexibility. Because of its potential influence on PD team flexibility, we regard TBF as an important factor.

## 15.4 Methodology

We arrived at this new factor of TBF during the course of factor analysis of the data related to 108 PD teams. The data were collected about the practices adopted by these teams to cope with change and uncertainty during the course of PD activity. The teams were surveyed about the practices related to decision making, formalization, autonomy, review procedures and flexibility in delaying decisions. During the course of exploratory factor analysis, we deduced five factors, TBF is one amongst them. We have culled out the results of factor analysis related to TBF and presented it in Table 15.1.

As can be seen in Table 15.1, the derived factor has items related to existence and adherence of formal rules along with a definitive time frame for making and executing decisions. This factor has dimensions of time and formal rules describing it. In a broad sense, the factor denotes a time-bound implementation of rules and procedures during the course of PD. Hence, we have named this factor as ‘time-bound formalization’. The factor emphasizes the importance of time limits when implementing formal rules and procedures governing task execution or decision making.

Prior to the collection of data and their analysis, we had to devise an appropriate methodology to ensure the correctness of the data. For this study, we adopted an ex post facto, survey-based, cross-sectional design. A survey instrument was developed

**Table 15.2** Pearson product moment correlation ( $r$ ) between TBF and performance

Variable(s)	Team type	Performance ( $r$ )	$p$ value
TBF	Small ( $n=59$ )	0.083	0.538
	Large ( $n=44$ )	0.334	0.027*

\* $p < 0.05$

exclusively for this study and underwent two rounds of testing. A five-point Likert scale was employed for capturing the responses. The final questionnaire consisted of 48 items. Cronbach's  $\alpha$  was used as a measure of reliability. The derived factors had an  $\alpha$  value of greater than 0.6, which is satisfactory. Content validity was also ascertained. Data required for the study were collected in two phases (pilot and main). A convenience sampling strategy was adopted for this study. The unit of analysis was teams. The population for the study was PD teams in public and private sector companies. The public sector was represented by teams in defence-based R&D companies, whereas the private sector by software PD organizations. Companies with more than 10 years of PD experience and employing more than 1000 employees were preferred. Contact was made with respective HR heads or through known individuals in the top management. The teams that participated in this study were identified by the HR heads or PD heads. Target respondents were team leaders or/and managers involved in the design and development phase of the PD. A total of 120 responses were collected, out of which 108 were subjected for analysis.

## 15.5 The Effect of TBF on Team Performance

To better understand the nature of TBF, we explored the impact of TBF on team performance. Team performance can be measured in terms of both short-term and long-term perspectives. While short-term measures focus upon adherence to costs and schedules, long-term measures relate to the value added to the project (Olsson 2006). For this study, we consider the short-term perspective and define team performance as the 'ability of a team to produce the desired output as per agreed costs and schedules'.

To conduct this study, we categorised the teams into small and large ones. Teams that had more than 10 team members were considered to be large teams. Factor scores of TBF and team performance were used for conducting analysis. Since the variables TBF and performance are continuous variables, Pearson's correlation coefficient ( $r$ ) was calculated between them for both small and large teams. Table 15.2 presents the results of correlation analysis.

In the case of small teams, the correlation between TBF and performance emerged insignificant ( $r=0.083$ ,  $p=0.538$ ), whereas for large teams the correlation was significant ( $r=0.334$ ,  $p=0.027$ ). The results from the table indicate that introducing TBF and performance is correlated only in the case of large teams. This result has to be interpreted keeping in mind the nature of small and large teams. Small teams

differ from large teams differ in many of their characteristics. Generally, small teams are usually associated with better performance compared to larger teams. One of the important reasons attributed for better performance of smaller teams is that the communication and coordination is much easier (Hoegl 2005). This type of efficient communication structure helps in reducing uncertainty and facilitates efficient reaction to changes, resulting in improved team flexibility. Small teams are usually subjected to a lower degree of formalization, thus, providing greater autonomy and making them self-managed. In the case of large teams, extensive efforts have to be made to promote communication through participation. With its inherent difficulties, large teams provide an advantage in handling complex tasks as they can accommodate people with diverse background and problem-solving skills. With this background, a possible explanation of the result is that introducing TBF helps to improve the performance of large teams by limiting the time consumed in decision making. The excess amount of time consumed by encouraging participation can be overcome by introducing practices of TBF. However, in the case of smaller teams, that are already perceived to be efficient, TBF introduction might result in creating an upper bound on time which might be a redundant condition considering their higher efficiency.

## 15.6 Limitations and Scope for Future Work

This study has made an attempt to understand the role played by TBF and has been successful in shedding light on the aspects of both TBF and PD team flexibility. However, there are some limitations that have to be addressed before we can agree on some of the findings conclusively. Firstly, TBF is a new factor that has emerged from our study. Hence, it becomes imperative to validate the existence of such a factor through future studies. Secondly, we did not find any impact of TBF on performance of small teams. Although it is an interesting finding, it cannot be taken as the final word. This result has to be probed further in future studies. Thirdly, the sampling strategy adopted does not allow for generalizability of the results. Devising a better sampling strategy would be helpful in overcoming this drawback. Further, due to confidentiality reasons, we were not able to get data related to the teams working on new products. Such data would be helpful in accurately assessing the flexibility aspects. Future research on TBF would be helpful in getting a better picture about TBF.

## 15.7 Conclusion

The research related to team flexibility is still in its nascent stages. Through this study, we have attempted to contribute to the sparse literature on team flexibility, in general, and PD team flexibility, in particular. We have proposed a new factor named TBF and explored its relationship with respect to team flexibility and team performance. This new factor was derived as a part of major study involving PD teams.

TBF is an important factor that helps to build PD team flexibility. TBF lays emphasis on time aspect in the work standardization and can be considered to be a subset of formalization. Thus, being a representative of a low degree of formalization, TBF can be inferred to contribute to the increase of team flexibility. In addition to its influence on team flexibility, we found that TBF also impacts the performance positively only in the case of large teams. TBF appears to compensate for the loss of time during decision making by large teams, which otherwise would have been consumed for facilitating participation in large teams. Thus, TBF maintains the required balance between flexibility (which requires team participation) and performance in the case of large teams. With all its limitations, the chapter has made a modest effort to contribute some interesting findings related to PD team flexibility. We hope this chapter will act as a guide for future studies in this area.

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# Chapter 16

## Next-Generation Business Excellence Model: Integrating Flexibility Dimension

Rakesh Kumar Gupta and Sarita Nagpal

### 16.1 Introduction

Business in today's environment is facing various challenges. Globalization, changes in the global economy, increase in the number of regulations, national and international environmental concerns, corporate social responsibility, and increased and intense competition are some of the major external factors making a significant impact on the business. The outstanding organizational practices and results call for the continuous need for creativity and innovation, sustainability, inclusiveness, corporate governance, and organizational agility/flexibility.

Business excellence (BE) models have been created to help and guide the business on the path of excellence. Since the method of business is changing, the reflection must be there on the BE models as well. Therefore, BE models are in the evolution stage. Flexibility and organizational excellence seem to be interrelated. The type and extent of relationship is a matter of examination of the study.

It has been observed that "flexibility" dimension is not seemingly well integrated in the existing BE models; therefore, the need is felt to examine it in light of ever-increasing importance of this topic. Although the BE models, viz., the European Foundation for Quality Management (EFQM) and the Malcolm Baldrige National Quality Award (MBNQA) models have undergone revisions in 2010, and there is an attempt to address these concerns, the study was done and the gap existing in the BE models was highlighted (Gupta and Nagpal 2011).

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## 16.2 Objective of Study

The objective of this study is to identify some key parameters which represent flexibility dimensions in each criterion of the BE model (EFQM BE model). The purpose of this research is to integrate flexibility dimensions in the BE model. Agility, adaptiveness, balance, responsiveness, and autonomy are some of the connotations of the flexibility dimensions. The concept of flexibility is multidimensional in nature. Flexibility is related to multiple options, change mechanisms, and freedom of choice.

It has been observed that the flexibility dimension is able to find its place in the BE models in a limited way. This exercise is related to capturing the flexibility dimensions for all the nine criteria of the EFQM BE framework through the inputs from experts. The outcome of the research would be to present an enhanced BE model with flexibility constructs.

## 16.3 Literature Review

A representative literature review has been carried out related to BE, flexibility and integration of flexibility and BE. Table 16.1 presents the literature on flexibility and Table 16.2 presents the literature on BE.

### 16.3.1 *Business Excellence*

Business excellence, as described by the EFQM, refers to “outstanding practices in managing the organization and achieving results, all based on a set of eight fundamental concepts.” These eight fundamental concepts are “result orientation, customer focus, leadership and constancy of purpose, management by processes and facts, people development and involvement, continuous learning innovation and improvement; partnership development and public responsibility.”

Some authors tend to use the term quality, total quality management (TQM), and BE. The term “business excellence” has gained popularity in recent years. Hence, there is a need to frame a suitable definition of BE, which focuses on two aspects: achievement of all-round business goals for satisfaction of all those who have a stake in the existence and continuation of business and the efforts which include strategies, tactics, initiatives, and practice enablers. It is necessary to have a balanced perspective about excellence. Thus, the sustained achievement of goals builds sustained competitive advantage and results in sustainable excellence, which in fact is the real challenge.

Select opinions on the concept of BE are given in Table 16.2.

In recent years, the emphasis of Deming Prize and MBNQA and EFQM model has “shifted from technical quality to excellence of all organizational processes” (Kumar 2007). There are of course authors who have questioned the academic and practical validity of the quality/BE award models (Fagerhaug and Anderson

**Table 16.1** Views on the concept of flexibility

Author	View/contribution
Eppink (1978)	In relation to environmental changes, flexibility has been defined as operational, competitive, and strategic flexibility
Baharami (1992)	Flexibility is a multidimensional concept demanding agility and versatility, associated with change, innovation, novelty coupled with robustness and resilience, implying stability, sustainable advantage, and capabilities that may evolve over time
Upton (1994)	Flexibility is the ability to change or react with little penalty in time, effort, cost, or performance
Boyer et al. (1996)	Application of advanced manufacturing technologies in design, planning, and manufacturing increases manufacturing competence
Volberda (1997)	Organizational “flexibility mix” also includes operational and strategic flexibility with structural flexibility
Sushil (2000, 2014)	Flexibility is the exercise of free will or freedom of choice on the continuum to synthesize the dynamic interplay of thesis and antithesis in an interactive and innovative manner, capturing the ambiguity in systems and expanding the continuum with minimum time and efforts

**Table 16.2** Views on the concept of excellence

Author	View/contribution
Savolainen (2000)	Business excellence emphasizes the aspect of competitiveness enhancement
Kanji (2002)	To achieve business excellence, outstanding performance is extremely important
Dahlggaard and Dahlggaard-Park (2006)	Organizational excellence is a result of building quality into the four P’s: people, partnership, processes of work, and products
Kano (2007)	Deming Application Prize is given for setting challenging objectives and strategies, applying TQM for achieving the objectives and realizing the outstanding effects

*TQM* total quality management

1998; Williams et al. 2006) and the need has been felt for studying the case of award winners (McDonald et al. 2002) and identifying factors critical for sustaining excellence.

### 16.3.2 BE Models

The BE model is a practical, nonprescriptive framework that enables organizations to:

- Assess where they are on the path to excellence; helping them to understand their strengths and potential gaps in relation to their stated vision and mission.
- Provide a common vocabulary and way of thinking about the organization that facilitates the effective communication of ideas, both within and outside the organization.

- Integrate existing and planned initiatives, removing duplication and identifying gaps.
- Provide a basic structure for the organization's management system.

While there are numerous tools and techniques commonly used, the BE model provides a holistic view of the organization. The model can be used in conjunction with any number of tools based on the needs and function of the organization as an overarching framework for developing sustainable excellence.

There are many BE models available in the world today; the most prominent ones are:

1. EFQM Award—This has been instituted and followed in the European countries.
2. MBNQA—This has been instituted by the US government.
3. Deming Application Prize—This has been instituted by the Union of Japanese Scientists and Engineers (JUSE), Japan.
4. Shingo Prize for Operational Excellence—This has been instituted by Utah State University, USA.

The EFQM BE model has undergone a major revision in the year 2010 and reflects the current business situations facing the issues related to corporate governance, environmental challenges, globalization, and economy changes.

In this study, the EFQM model has been selected because it has been adopted by the Confederation of Indian Industry (CII) in India and CII-EXIM Bank Business Excellence Award has been instituted.

## **16.4 The Next-Generation EFQM BE Model**

The next-generation BE model can be used by the organizations as a fundamental framework for managing, reviewing, and improving their businesses in a holistic manner.

### ***16.4.1 The Framework of Excellence***

The structure of the next-generation of EFQM BE model is shown in Fig. 16.1.

The next-generation BE model integrates the flexibility dimensions in all the nine criteria of the framework. Five of these are “enablers” and four are “results”. The “enabler” criteria cover what an organization does and how it does it. The “results” criteria cover what an organization achieves. “Results” are caused by “enablers” and “enablers” are improved using feedback from “results.” The arrow emphasizes the dynamic nature of the model, showing learning, creativity, and innovation helping to improve the enablers that in turn lead to improved results.

Each of the nine criteria has a definition, which explains the high-level meaning of that criterion. To develop the high-level meaning further, each criterion is



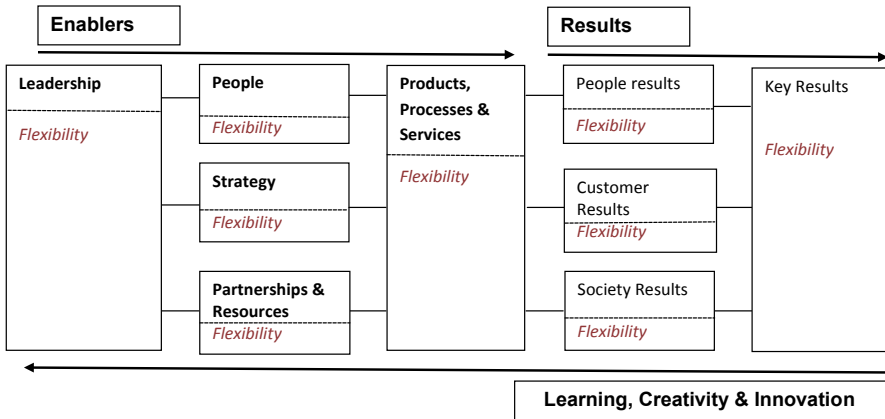


Fig. 16.1 Structure of the next-generation EFQM model (The original model has been adapted from EFQM Excellence Model 2010)

supported to a number of criterion parts. The criterion parts are statements that describe in further detail what typically can be seen in excellent organizations. Below each criterion part are guidance points. Many of these guidance points are directly linked to the fundamental concepts mentioned above.

### 16.4.2 Definitions of Each Criterion

**Criterion 1: Leadership** Excellent organizations have leaders who shape the future and make it happen, acting as role models for its values and ethics and inspiring trust at all times. They are *flexible*, enabling the organization to anticipate and react in a timely manner to ensure the ongoing success of the organization.

**Criterion 2: Strategy** Excellent organizations implement their mission and vision by developing a stakeholder-focused strategy. Policies, plans, objectives, and processes are developed and deployed to deliver the strategy.

**Criterion 3: People** Excellent organizations value their people and create a culture that allows the mutually beneficial achievement of organizational and personal goals. They develop the capabilities of their people and promote fairness and equality. They care for, communicate, reward, and recognize, in a way that motivates the people, builds commitment, and enables them to use their skills and knowledge for the benefit of the organization.

**Criterion 4: Partnerships and Resources** Excellent organizations plan and manage external partnerships, suppliers, and internal resources in order to support strategy and policies and the effective operation of the processes. They ensure that they effectively manage their environmental and societal impact.

**Criterion 5: Processes, Products, and Services** Excellent organizations design, manage, and improve processes, products, and services to generate the increasing value for customers and other stakeholders.

**Criterion 6: Customer Results** Excellent organizations:

- Develop and agree a set of performance indicators and related outcomes to determine the successful deployment of their strategy and supporting policies, based on the needs and expectations of their customers.
- Set clear targets for the key results based on the needs and expectations of their customers, in-line with their chosen strategy.
- Demonstrate positive or sustained good customer results more than at least 3 years.
- Understand how the key results they achieve compare to similar organizations and use these data, where relevant, for target setting.
- Segment results to understand the experience, needs, and expectations of specific customer groups.

**Criterion 7: People Results** Excellent organizations:

- Demonstrate positive or sustained good people results for more than at least 3 years.
- Segment results to understand the needs and expectations of specific groups within their organization.

**Criterion 8: Society Results** Excellent organizations:

- Set clear targets for the key results based on the needs and expectations of their external stakeholders, in line with their chosen strategy.
- Demonstrate positive or sustained good society results for more than at least 3 years.
- Segment results to understand the experience, needs, and expectations of specific stakeholders within society.

**Criterion 9: Key Results** Excellent organizations:

- Set clear targets for the key results based on the needs and expectation of their key stakeholders, in-line with their chosen strategy.
- Demonstrate positive or sustained good key results for more than at least 3 years.

## 16.5 Research Methodology

The literature has very limited discussion about the constructs related to flexibility dimensions in the EFQM BE model. Therefore, we have decided to identify the flexibility dimensions by grounded theory approach. In this approach, semi-structured interviews have been conducted with eight experts. The profile of experts is

whole-time director, executive director, business consultant, business advisor, and senior counselor. The semi-structured review was related to identification of flexibility dimensions in each criteria of the BE model. The responses were noted and consolidated in some constructs that are discussed in the next section.

## 16.6 Identification of Flexibility Constructs

The flexibility constructs have been shown in each criteria box for easy understanding. The details of the flexibility constructs have been explained below each criteria box.

### Criterion 1: Leadership

**1. Flexibility in Leadership**  
 .....

*1a. Leading Change*

*1b: Communication & Decision making*

*1c: Reverse Mentoring*

#### 1a: Leading Change

- Challenging status quo and reexamining the established processes
- Developing shared leadership culture
- Ability to see the change in the horizon
- Preparing the organization for an expected change in the future
- Review, adopt, and realign the direction of the organization
- Responsiveness to the changing market needs
- Adaptiveness to new environment

#### 1b: Communication and Decision Making

- Regular communication within the organization
- Communicate for preparing the organization mind-set
- Openness in functioning
- Promoting a culture of empowerment, involvement, and ownership

1c: Reverse Mentoring

- Leaders are willing to appreciate and accept the new ideas and suggestions from juniors
- Leaders adopt juniors as mentors on the identified subject
- Leaders assist others to understand complex situations

**Criterion 2: Strategy**

<p><b>2. Flexibility in Strategy</b> .....</p> <p><i>2a. Managing confluence of continuity &amp; change</i></p> <p><i>2b. Managing strategic risk</i></p>
---

2a: Managing Confluence of Continuity and Change

- Balance of continuity and change forces leverage strategic change with continuity
- Generating multiple options for strategies
- Limiting strategy to broad choices, not details
- Scenario planning and risk analysis
- Recognition of emergent factors even when inconvenient
- Adopting an effective mechanism to manage strategic risk
- Understand the future scenario and manage strategic risk

2b: Managing Strategic Risk

- Achieving optimum balance of efficiency and effectiveness
- A bias for excellence in implementation or execution
- Having annual operating plans derived from the strategy
- Monthly and quarterly review of the annual plan and adjusting/making changes regularly
- Viewing execution as dynamic
- Maintaining and aligning organizational structure and a framework of key processes to the strategy

**Criterion 3: People****3. Flexibility in People**  
.....***3a. Learning organization******3b: Alignment******3c. Flexible HR policies*****3a: Learning Organization:**

- Allocation of time for learning on an ongoing basis
- Openness to new ideas
- Help people match the future capability needs of the organization
- Creating a constant learning and evolving organization
- Creative and innovative thinking
- Learn faster about the customers and other business aspects to follow increasing pace of change
- Unlearn and relearn
- Ensuring that people have an open mind-set and use creativity/innovativeness to respond quickly to challenges

**3b: Alignment**

- Mind-set change towards change
- Aligning people plans with organization strategies, structure, and technology
- Aligning individual and team objectives with organization's targets, reviewing, and updating them in a timely manner
- Right attitude, skill, and knowledge of people will ensure positive and winning mind-set—most essential in an organization

**3c: Flexible HR Policies**

- Involve people in continually reviewing, informing, and optimizing the effectiveness and efficiency of the processes
- Adopting approaches to ensure responsible work/life balance
- Establishing stretch in setting goals
- All the people should get involved and engaged in continuous improvements and innovations

## Criterion 4: Partnerships and Resources

### 4. Flexibility in Partnerships and Resources

.....

#### *4a. Flexibility in partnership and relationships*

#### *4b. Resource management*

#### 4a: Flexibility in Partnership and Relationships

- Regular communication with suppliers and other stakeholders
- Establish extensive networks to identify potential partnership opportunities
- Adopting appropriate policies and processes to effectively manage partners and suppliers
- True relationship with suppliers, collaborators, government, etc.
- Ensuring flexible supply chain

#### 4b: Resource Management

- Effective utilization of IT and other technologies for providing a quick response
- Manage technology portfolio by optimizing the use of existing technology and replacing outdated technology
- Identify and evaluate alternative and emerging technologies for their impact on an organization's performance
- Emphasis on the use of resources and not on the ownership of resources
- Global sourcing of resources
- Efficiency in resource management

## Criterion 5: Processes, Products, and Services

### 5. Flexibility in Products, Processes and Services

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#### *5a. Operational Flexibility*

#### *5b: Flexible New Product Development and technology*

#### *5c. Flexible Customer Service*

**5a: Operational Flexibility**

- Lean product and process design
- Reduce breakeven point through lean approaches
- Processes designed to reflect customer requirements
- Adopting appropriate approaches to effectively manage and improve end-to-end processes

**5b: Flexibility in New Product Development and Technology**

- Modularity in product design
- Platform concept in product design
- Flexibility in launching new products
- Flexible product design
- Value proposition is based on the latest product portfolio
- Use creativity to design and develop new and innovative products and services

**5c: Flexible Customer Service**

- Committed to customer's utility of products
- 24×7 working and serving customers
- Comparing product and service delivery performances with benchmarks and adopting approaches to maximize the value for customers
- Monitoring and reviewing the experiences/perceptions of customers and responding quickly and effectively

**Criterion 6: Customer Results**

<p><b>6. Flexibility in Customer Results</b>  .....</p> <p><b><i>6a. Flexible Customer needs</i></b></p> <p><b><i>6b: Change in customer perception</i></b></p> <p><b><i>6c. Responsiveness to customer needs</i></b></p>
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**6a: Flexible Customer Needs**

- Reduce cost and lead time
- More responsive to any of customer needs
- Ability to meet the changing customer demands in terms of:
  - Volume
  - Mix
  - Model change

6b: Change in Customer Perception

- Anticipate future performance and results

6c: Responsiveness to Customer Needs

- Real-time approach for customer complaints and handling
- Speed of response

**Criterion 7: People Results**

**7. Flexibility in People Results**  
.....

*7a. Innovation*

*7b: Engagement*

7a: Innovation

- Number of innovative products launched

7b: Engagement

- Flexibility in working hours
- Options in pay packages, equity participation, etc.
- Career growth options
- Flexibility in rewards and recognition systems
- Motivated employees

**Criterion 8: Society Results**

**8. Flexibility in Society Results**  
.....

*8a. Sustainable development*

*8b: Inclusive growth*

8a: Sustainable Development

- Reduce wastages of natural resources—material, time, and effort
- Conservation of natural resources—water, soil, and air

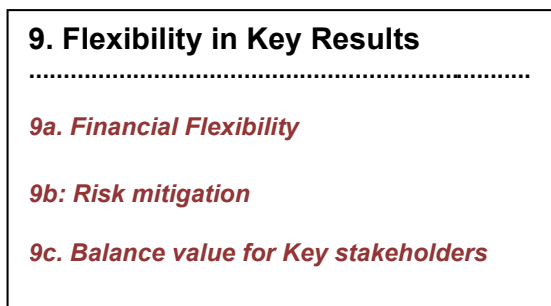


- No negative impact on society
- Respect for nature

#### 8b: Inclusive Growth

- Satisfied employees
- Satisfied suppliers
- Sustained growth of the enterprise and hence creating job opportunities

### Criterion 9: Key Results



9a: Financial Flexibility

9b: Risk Mitigation

9c: Balanced Value for Key Stakeholders

## 16.7 Conclusion

The literature review shows the gap which exists for flexibility dimension representation in the existing EFQM BE model framework. Through the grounded theory approach, an attempt has been made to capture the flexibility dimensions in each of the criteria of the BE model through experts' inputs. The flexibility constructs have been identified in each criteria of the BE model. The results of the criteria need to be further studied for the identification of flexibility dimensions. Furthermore, the flexibility constructs need to be empirically tested. This is also a further area of study.

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# Chapter 17

## Flexibility as a Strategy for Reducing Cost of Renovation in Building Construction Projects

Rashmi Shahu, Ashok K. Pundir and L. Ganapathy

### 17.1 Introduction

Flexibility of a building is one such characteristic that influences the sustainability of an existing building, as well as the functional value of a new building. It has been seen in many big cities that there is continuous redevelopment of old industrial buildings that were degenerated due to various reasons into offices or residential buildings. (Blok and Harwijnen 2005) Most of the buildings are planned to have a life span of minimum 50 years and during this life span many buildings are demolished, while some buildings are renovated and given a second functional life. There are some built-in characteristics in every building that makes it suitable for redevelopment and renovation, compared to others. It has been observed in most of the renovation cases that the conditions that made these buildings suitable for renovation with changed functional value were not foreseen in the design process and buildings were not designed to serve functional changes. There are a few thumb rules in the construction industry, for example, a large floor-to-ceiling height of the building, that make it possible to accommodate new changes in a building with new appropriate functions. (Saari and Heikkila 2008) As there is continuous change in the requirements of the occupants of a building, more changes/renovation work usually takes place in relatively young buildings. (Arge 2005) The present study explores the scope of structural design characteristics of a building (flexible building

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structure) that can make the renovation work much easy and relatively less costly. The study uses 15 renovation cases of old building projects for exploring the scope of design flexibility in building structures, out of which five cases are discussed in this chapter.

## 17.2 Literature Review

There is a huge mismatch between what the occupant requirement is and how the building is functioning (Gereadts 2001). Most of the large construction projects are planned at least 5–6 years in advance. During this time, demands on the infrastructure are likely to change significantly. Changing demands may result from new forms of construction technology, changes in government regulations, change of rules in funding agencies, etc. (Arge 2005). There are many key stakeholders who are directly linked with a construction project such as project owners, users, project managers, architects, consultants, and contractors. With so many stakeholders playing key roles, there is a scope of frequent changes in the requirements of each stakeholder. This creates a need of flexibility in the construction projects (Paslawski 2008). It has been observed that a little thought has been given on the design of flexible building structure to meet future requirements. The building developers do not want to invest for attaining future flexibility of buildings, particularly when the future requirement is not known (Cowie and Schwehr 2008). In the present dynamic society, where the occupant's requirements are changing very fast, the buildings need to be designed so as to adapt to the changing needs of its occupants. It has been observed that in order to cater to the occupant's requirements, relatively young buildings (10–25 years old) are demolished. This is not a desirable situation in terms of investment, waste generation, energy, materials, and sustainability of a building (Blok and Harwijnen 2005). There is a need to increase the functional life span of buildings, which could be achieved if the buildings could easily be adapted to new occupant requirements (Gereadts 2008). It is therefore important to look at buildings from a broader perspective than just the first occupant requirements. "Flexibility can be defined as the ability to change or react with little penalty time, effort, cost or performance" Upton (1994). This means that flexibility describes the ability of the project to cope with changes in the project definition or scope and compensate them with little influences on schedule (time), costs, and quality by appropriate management policies and actions. Mandelbaum (1978) defines flexibility in relation to the construction industry as the ability of the system to respond to change by taking an appropriate action and the inner capability of the system to function well in more than one state. To understand how flexibility can be applied in a building structure, it is important to understand a building model.

Brand (1994) and Worthington (1994) have defined seven layers of a building namely:

- Scenery (furniture, interior finishes, ceilings)
- Space plan (partition walls)

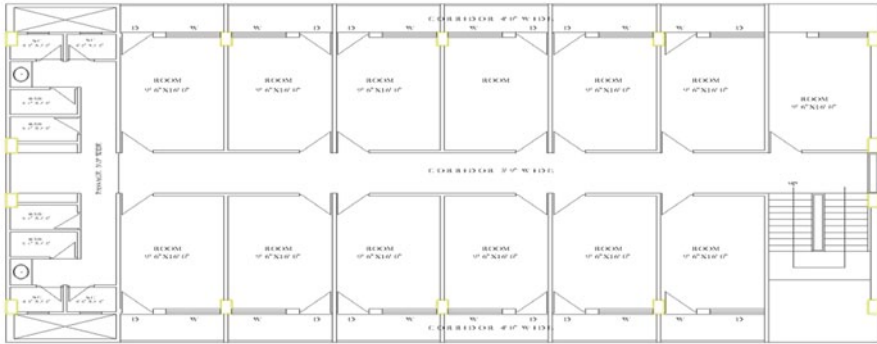
- Access (stairs, corridors, and lifts)
- Servant elements (building services, pipes, cables, and involved spaces)
- Envelope (façades, base, roof)
- Compartments (firewalls)
- Structure (floors, columns, beams, load-bearing walls)
- Location (building environment)

In order to achieve the flexibility of a building structure, the building should have a capacity to accommodate changes to the structure itself with or without minor consequences to other building layers. Such kind of flexibility will allow changes in one or more other building layers (for example scenery, space plan, servant elements) without the necessity to change the structure itself (Blakstad et al. 2009). Blok and Herwijnen (2005) defined a flexible building as a building with the capacity to accommodate, in a relatively easy way, future changes in use. This can be achieved by allowing for “relatively easy” changes to one or more of the following building layers: scenery/servant elements/envelope (skin)/access/structure (location). In other words, it means that building is flexible which can be renovated in a relatively easy way with comparatively less cost. These are typical factors that serve as a basis for all construction projects. Although certain flexible solutions are repeated from one project to the next, hardly any serious thought is given for making flexible allowances for the potentially different needs of future users of the building (Patrizi et al. 2006). If a building is not readily flexible or is poorly adaptable to different uses, this will restrict its later use and have a negative impact on its value (Saari and Heikkila 2006). Flexibility is a property of a building that is realized to some extent in all projects, even if it had not been actually taken into account during the design phase. There are certain design characteristics of a building that make it feasible for a building for renovation work. There is a need to understand these design characteristics in order to save the future renovation cost.

*Strategy for Flexibility* By using a strategy of flexibility based on the structural design of a building and its installations, it is possible to achieve the sustainability of a building with an increased functional value throughout its life span. Such a type of flexibility of buildings will reduce the gap between the occupant’s requirements and the building functions by making the renovation of buildings easy and less costly.

### 17.3 Research Method

A case study approach was used in this study to explore the scope of flexibility in design structures that makes renovation work easy. All 15 cases of renovation of old buildings were studied. Almost all the buildings were at least 20–30 years old. The 15 cases of renovation and extension contain residential buildings, offices, malls, hospitals, hotels, and guesthouses. In few of the cases, there is a complete change of the occupant creating a need of conversion of present building function into a completely new one. After a careful analysis of all the cases, it has been observed



**Fig. 17.1** Existing design of *dharamshala*

that wherever there was flexibility in the existing design of the building it made the renovation work easy and less costly. The authors in this chapter give details and drawings of only five cases as discussed in the following sections.

## 17.4 Case Analysis

### 17.4.1 Case 1

This case is of a *dharamshala* (pilgrim's lodge) which is located near Adasa Ganesh Temple, Nagpur. Built almost 45 years ago, the purpose was to provide shelter for the devotees who come to the temple and want to stay for 1–2 days. The existing *dharamshala* had rooms and there were no attached toilets with individual rooms. Since the number of devotees coming to this temple was increasing day by day, the trustees of the temple thought of providing comfortable stay at the temple campus to the devotees. Hence, they decided to convert this *dharamshala* into a lodge/hotel, which will have attached toilets, a reception area, pantry, and a dormitory so as to provide a comfortable stay to the devotees. The existing rooms were given attached toilets as shown in Fig. 17.1. The two rooms were converted into dormitory with a provision of eight beds and a common toilet for families. There was a requirement of a duct to the rooms attached toilets for which extra treatment to the front elevation was done. This required additional expenses. This duct was opened out on the terrace for repair and maintenance of the pipe network.

### Flexibility in Initial Design

1. The initial design (Fig. 17.1) did not have a flexible sewage system so as to incorporate additional requirements of toilets. Due to modifications in the existing

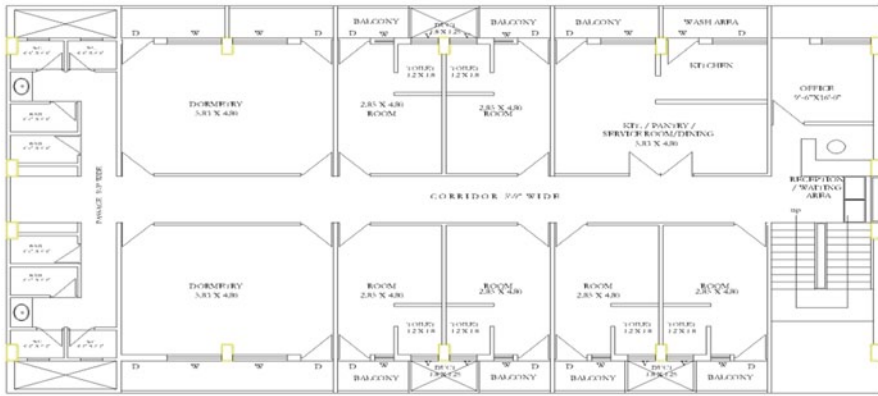


Fig. 17.2 Changes done in the existing design of dharamshala

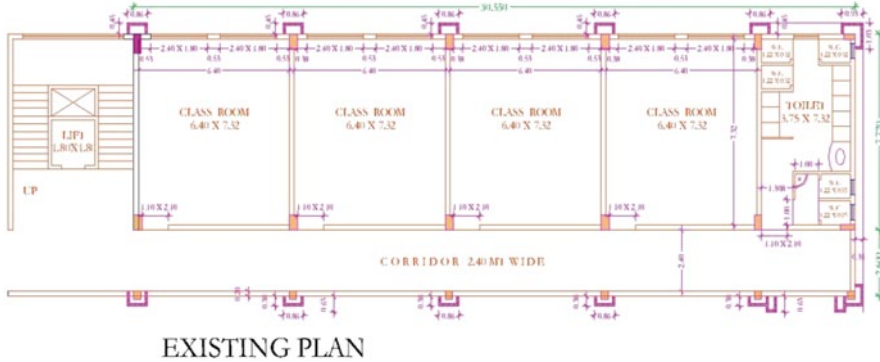


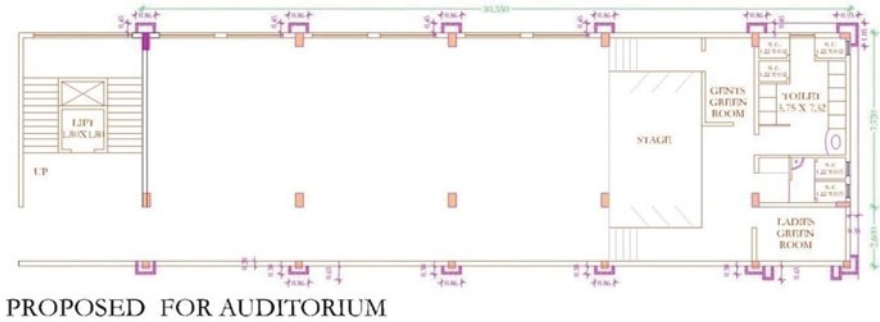
Fig. 17.3 Existing plan of school classrooms

- building for installation of new sewage lines, additional treatment for front elevation was required to improve the aesthetics. This cost could have been saved if there would have been additional sewage lines given in the initial design.
2. There was a column beam frame structure constructed 45 years ago, which proved to be supportive in giving flexibility of removing internal walls. If there was a load-bearing structure (open foundation), which used to be made during those days, then it would have been difficult to remove internal walls.
  3. The structure was stable due to framed behavior.

Figure 17.2 shows the changes made to the design.

### 17.4.2 Case 2

Figure 17.3 exhibits the drawing of a school building situated in Nagpur. The building has three floors consisting of classrooms and laboratories on all the floors with



**Fig. 17.4** Proposed plan for auditorium

sizes as shown in Fig. 17.3. The drawing shows only one floor and one side of the building. There are four such classrooms on the right side of the toilets. There is an administrative office and staffrooms on the ground floor. The building was built 15 years ago and at that time the school had only primary classes till the fourth standard. Later, the school also started with higher classes till the tenth standard. The initial school building did not have a fully equipped auditorium. It was the requirement as per the new rules of school building codes. The school management thought to combine four classrooms as shown in Fig. 17.4 and convert it into auditorium. The drawings were built as follows but the auditorium (Fig. 17.4) could not be constructed because the building structure was not flexible enough to support these changes. Because of this problem, the school had to build a new auditorium in the adjacent plot, which they purchased later so as to fulfill the school building requirements. This cost of making a completely new auditorium could have been easily saved if during the planning of the school building a thought on the flexible design structure was given.

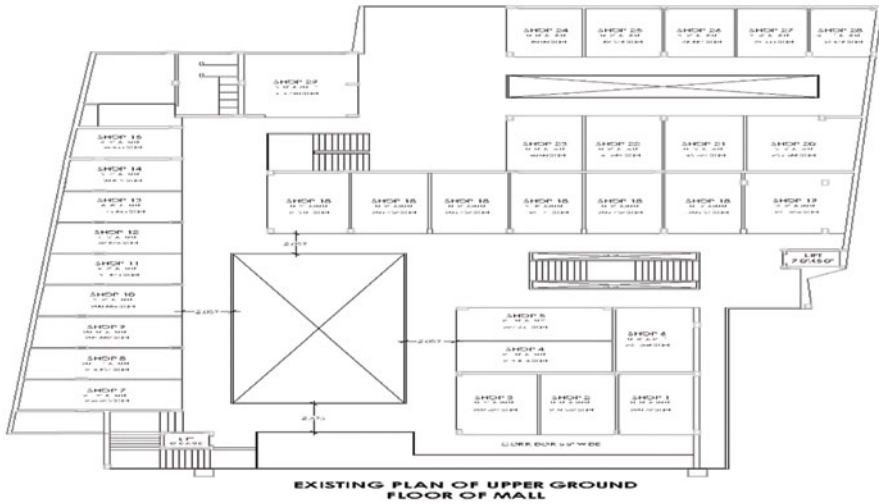
### Flexibility Problems in Existing Design

1. The ceiling-to-floor height was less due to which the auditorium could not be planned.
2. The classrooms' columns will come in between the auditorium, which will hamper the view on stage. These columns cannot be removed from the structure. The dais cannot have sufficient height because of constraint of the ceiling–floor height.

### Flexibility Strategy

1. If the ceiling–floor height was sufficiently built at the initial design phase, an auditorium could have been easily constructed in this space by just removing the partition walls.





**Fig. 17.5** Existing plan of upper ground floor of a mall

2. The structure is a framed structure and not a load bearing structure, which gives flexibility of removing the walls.

### 17.4.3 Case 3

Figure 17.5 shows the existing plan of a shopping complex situated in Nagpur. The drawing shows the upper ground floor of the mall. As shown in the Fig. 17.5, there were different sizes of shops owned by the shopkeepers. The shopping complex was built almost 10 years ago. Shops 1, 2, 3, 4, 5, and 6 were not sold for 6 months. After 6 months, a client approached the builder to purchase all the six shops provided the builder makes an arrangement to convert all those six shops into a big showroom. The six shops are shown in Fig. 17.6. Since it was a column structure (framed structure), it was easy to remove the partition walls and convert the small shops into a big showroom as shown in Fig. 17.6.

#### Flexibility Strategy in the Existing Design

1. The existing design was a column structure (framed structure) that had partition walls which could be easily removed on the requirement of a big showroom.
2. If the initial structure was load bearing, it could have been difficult to remove the walls.
3. The size of the shops was easily converted into a big showroom as per the requirement of the client because of this flexibility.

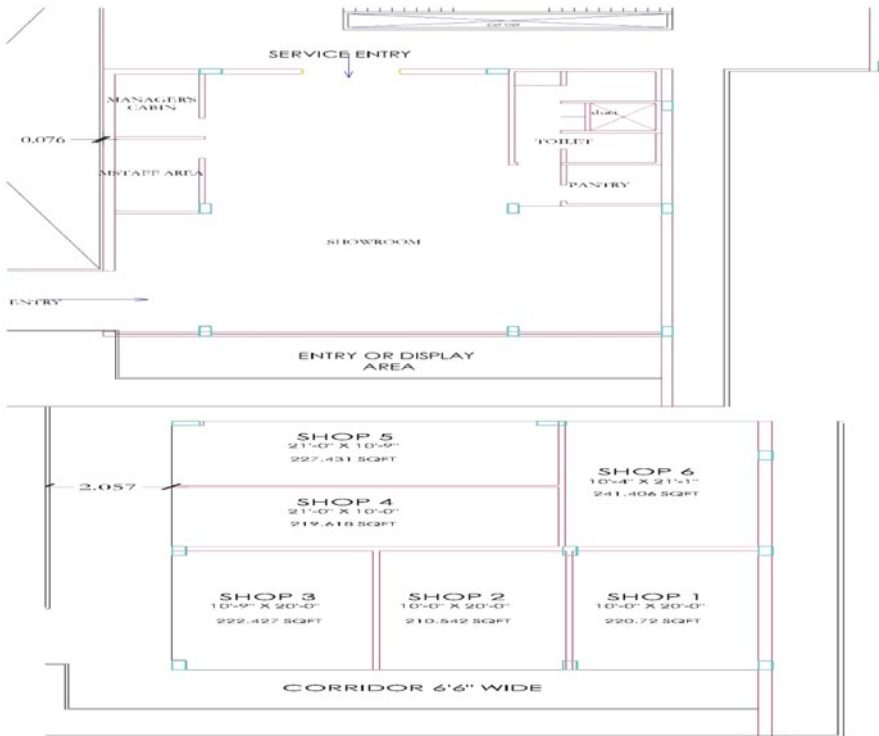


Fig. 17.6 Proposed plan for showroom

### 17.4.4 Case 4

Figure 17.7 presents the drawing of an apartment owned by a couple in 1998. The total square feet area of the apartment is around 1000 sq ft. The couple got newly married at that time and as per their requirement and budget, they bought this apartment. In 2009, the couple thought that there was a need of one extra bedroom. But they did not want to shift from this place, nor did their budget allowed them to purchase a two-bedroom apartment in the same location. Hence, they thought of converting their one-bedroom apartment into a two-bedroom apartment. Their existing apartment of one bedroom was converted into two bedrooms with a little renovation done and with the cost within their budget; due to the initial design structure of columns, this was quite feasible. Figure 17.8 shows the new drawing.

### Flexibility Strategy

1. The initial design of the apartment was column structured due to which it was easy to move the walls.

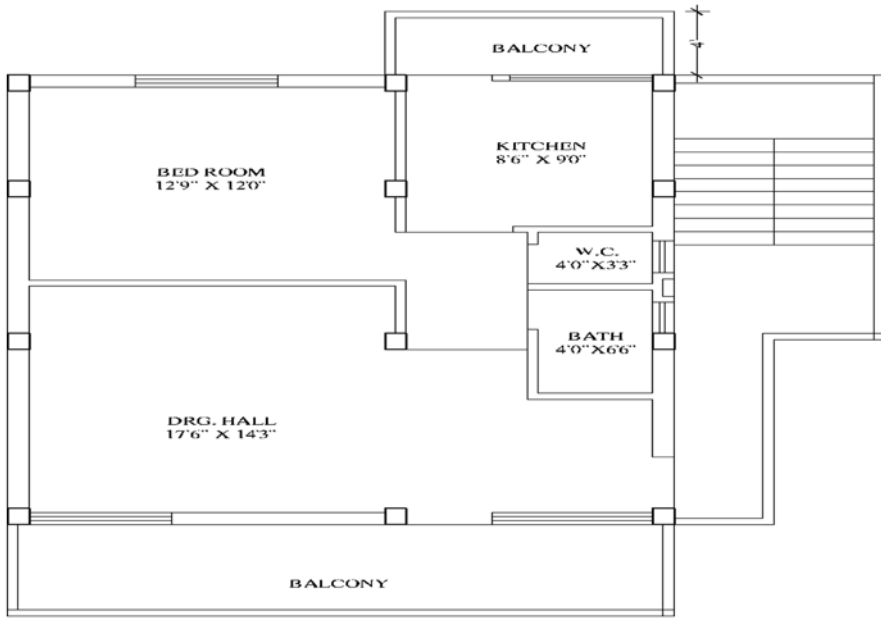


Fig. 17.7 Initial plan of a residential apartment

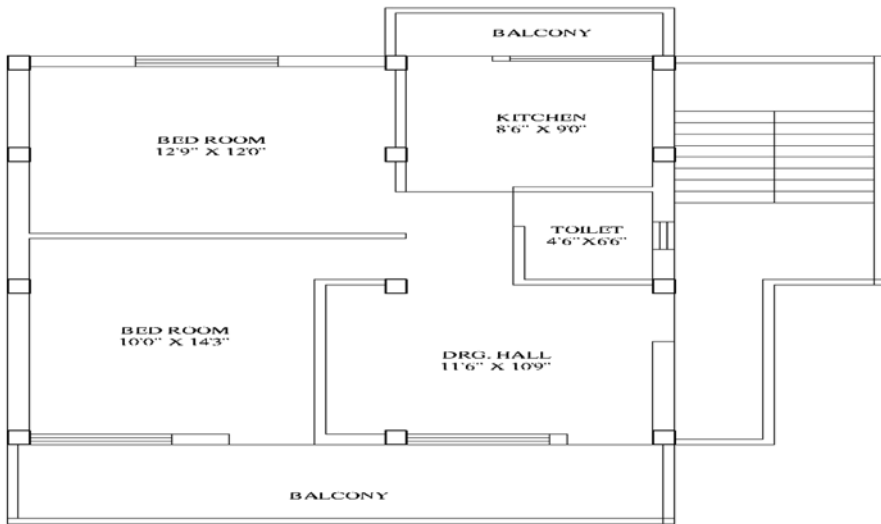


Fig. 17.8 Changes incorporated in the initial plan

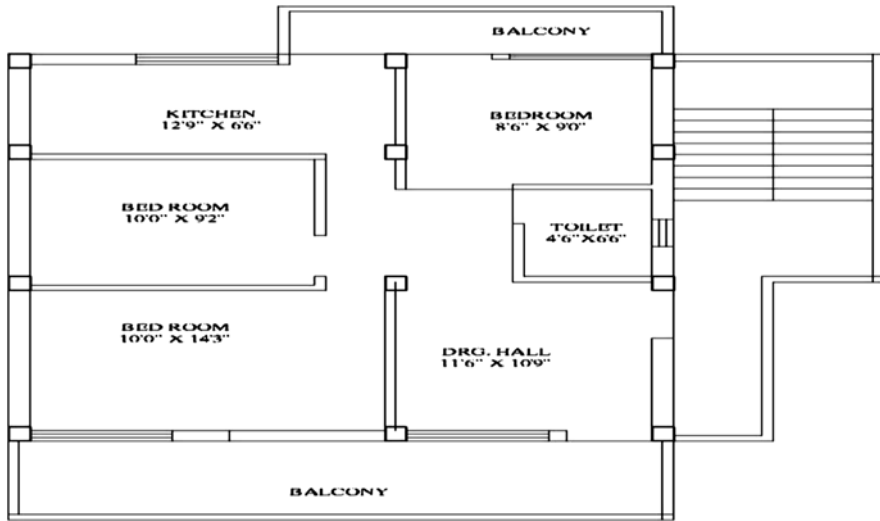


Fig. 17.9 Changes incorporated in the initial design of the one-bedroom apartment

2. The initial drawing room size and the position of the columns provided a scope for reducing the drawing room size for making an extra bedroom.
3. The columns in the existing design allow changing the setting of build profile as per the need/requirement changes.

### 17.4.5 Case 5

In the same apartment scheme, there was another couple who had purchased another apartment in the year 1998. The requirement at that time was only of one bedroom. But later in 2010 when their requirement was of three bedrooms with increase in their family size they too thought of converting the 1000 sq. ft. one-bedroom apartment into a three-bedroom apartment. There were a lot of constraints for not leaving this apartment like budget, location, etc. The existing one-bedroom apartment was converted into a three-bedroom apartment with little renovation and cost within their budget. As shown in Fig. 17.9, the kitchen was shifted from its existing place to give provision for the third bedroom. Figure 17.9 shows the changes incorporated in the existing plan.

### Flexibility Strategy

- The initial design of the apartment was column structured due to which it was easy to move the walls.

- The initial drawing room size and the position of the columns provided scope for reducing the drawing room size for making extra bedrooms.
- The kitchen was shifted from its place to give provision for the third bedroom. The balcony was increased to provide wash area for the kitchen.
- The only drawback is of the compact room size in this design, which is the compromise due to lack of sufficient funds to go for a new three-bedroom big apartment in the same location.
- The columns in the existing design allowed changing the setting of build profile as need/requirement changes.

In a similar way, the remaining ten cases of renovation were studied that brought out how a flexible design structure helped the renovation work.

## 17.5 Value of Flexibility

In order to have flexible buildings, it is necessary to see how much investment cost is required to make such flexible arrangements in the buildings in order to cater to future needs. For this, one should compare (first cost premium + operating cost premium) with (future cost savings + mitigated disruption).

- First cost premium—Additional cost of flexibility
- Operating cost premium—Additional operating cost
- Future cost savings—Savings derived from flexibility at time of modifications
- Mitigated disruption—Disruption not experienced due to built-in flexibility

Such a kind of comparison will give the benefits of having flexible building design structures in the form of future savings. The new role of the design project is to guarantee future flexibility and sustainability. If requirements on a building change, the primary and secondary structures often need to be modified.

## 17.6 Conclusion

A flexible design strategy in the initial building design can bring significant savings in total material flows with economic benefits to building owners, facility managers, and tenants over the building life. Incorporating a flexible design for renovation/remodeling of buildings will contribute to more sustainable buildings by extending the useful life of a building and optimizing material reuse and recycling potential. Flexibility cannot be a universal property of a building. Thus, no universal aims and goals can be set for flexibility in building structures nor can an “absolutely flexible” building be built. Flexibility is a property of a building, which is relative. It must be determined which alternative use situations one should prepare for since it is not possible, in practice, to be prepared for arbitrary changes. Likewise, one must

estimate acceptable conversion costs and disturbances to activities. This definitely will help us for preparing ourselves for the “unknown future” mainly by flexible solutions related to the building structure.

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- <http://www.projectsmart.co.uk/>

**Part IV**  
**Flexibility in Value and Supply Chains**

# Chapter 18

## Establishing Visibility Across the Value Chain of a Beverage Giant by Implementing Flexible Systems

Kamal Karnatak and Arnab Mitra

### 18.1 Introduction

Today's businesses are getting complex day by day. Businesses are no longer limited to single geography or single territory but are getting spread in multiple geographies. If we take the case of a country like India, which looks like a commonwealth of states with distinct identities and culture, the businesses need to think differently. As Ruchir Sharma says, "Brand managers need to think of India as a United States of Europe and deal accordingly with the problem of selling goods in a nation where even the dates and names of holiday season-as well as the peak seasons for brand advertising-shift state by state". (Sharma 2012) In order to serve the customer better and to meet local needs, businesses are trying to use differential pricing across territories. The moment the seller tries to sell the same good at different prices, the buyer at the lower price can arbitrage by selling to the consumer buying at the higher price but with a tiny discount. If we take the case of soft drinks in India, then companies use differential pricing at the level of distributor keeping the retail price the same. This leads to cross-territory infiltration, which can only be controlled through the traceability of the product/product lot.

Apart from infiltration, in recent years, the increased demand for material traceability has been driven by competitive pressures for improving product quality and to meet certain regulatory guidelines; especially in food and beverage items. In Europe, requirements set down in Article 17 of the Framework Regulation (Regulation (EC)

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No 1935/2004) on materials and articles in contact with food is one such example. The most internationally recognized definition of traceability defines it as the “ability to trace the history, application, or location of an entity by means of recorded identifications” (ISO 8402). There are, however, other definitions, such as the one contained in the General Food Law—Council Regulation (EC) No. 178/2002 and the one established by the Codex Alimentarius Commission.

This chapter addresses the business objective of physical tracking of finished goods material through use of technology across the supply chain in the beverage industry and also the challenges in implementation of the said solution. This chapter also points out to the current state of business processes, problems in the current state, and the future state of business processes.

## **18.2 Flexibility, Supply Chain Management Flexibility, and Traceability: Review of the Literature**

Flexibility is one of the most talked subjects in today’s world in the context of an organization. In this section, we would review the flexibility concept and would elaborate on Situation, Actor, Process—Learning, Action, Performance (SAP—LAP) frameworks proposed by Sushil (Sushil 2001).

According to (Bahrami 1992), flexibility is “a multidimensional concept demanding agility and versatility, associated with change, innovation, and novelty, coupled with robustness and resilience, implying stability, sustainable advantage and capabilities that may evolve over time.” All these definitions suggest that flexibility is something which is desired in a positive context. According to Sushil (2000), flexibility has various meanings as per the context. Some of the important ones are: adaptive to the changes in environment, adjustment to situation, agility in action, amiability in relationships, autonomy in functioning, balance in competing opposites, broadening of mind, compromising for betterment, contingency in planning, etc. This is only a partial list. Besides, there are various types of flexibilities in an enterprise, such as strategic flexibility, organizational flexibility, manufacturing flexibility, information systems flexibility, operational flexibility, technology management flexibility, supply chain flexibility, etc.

So the concept of flexibility is multidimensional in nature. Sushil uses the concept of paradox to further elaborate this multidimensionality of flexibility. A paradox is in the form of a pair of polar opposites: A thesis and an antithesis, forming a continuum from thesis to antithesis. In the organizational context, some leading paradoxes are centralization—decentralization, continuity—change, stability—dynamism, and so on. He argues that simply by moving from the thesis to the antithesis, one does not necessarily bring in flexibility; rather the system may lose its identity if pushed to antithesis. For example, if an organization with a high degree of centralization opts for extreme decentralization, then it may lead to disintegration or fragmentation of the organization. A flexible organization would be a collective

bimodal or multimodal organization having centralization and decentralization at the same time and changing their degree over time as per the requirement.

From the above elaboration, Sushil (2014) defines flexibility as “the exercise of free will or freedom of choice on the continuum to synthesize the dynamic interplay of thesis and anti-thesis in an interactive and innovative manner, capturing the ambiguity in systems and expanding the continuum with minimum time & efforts.”

(Sushil 2001) has developed a flexible methodology to analyze a particular organization. This methodology or framework was used by various researchers in the past. This methodology envisages a SAP–LAP framework. The SAP analysis first maps these three components, namely, “situation,” “actor,” and “process” out of the existing organizational state to define the dynamic interplay of reality. “Situation” is the present status, potential for growth or decay, and present and future state of the art, etc. The participants who influence the situation and alter it by their actions or inaction are termed as “actors.” The procedural steps taken by the “actors” who alter the “situation” are termed as the “process.” Any dynamic behavior that alters the “situation” has the potential of being a “process.” The situation, actor and process, and their interplay comprise the SAP framework, where the freedom of choice lies with the actors. If the actors have more freedom, the processes will become flexible and adaptive to cope with the changing situation.

The SAP analysis leads to the second phase called LAP synthesis, which has three components, namely, “learning issues,” “actions,” and “performance.” Learning issues emphasize the typicality of the situation as well as some features of its uniqueness. One has to learn about the situation, actor, and process and bring out key learning issues of interest. Based on the learning, action is to be taken on the fronts of the situation, actor, or process or the relevant interfaces. Depending upon the effectiveness of actions, performance is generated in terms of improved processes/actors and better situational parameters. In a business situation, the performance parameters could be market share, profitability, quality, productivity, competitive advantage, core competence, etc.

A supply chain is a network of retailers, distributors, transporters, storage facilities, and suppliers that participate in the sale, delivery, and production of a particular product (Kumar 2001; Min and Zhou 2002; Castro et al. 1998). It is composed of distributed, heterogeneous, and autonomous elements, whose relationships are dynamic. Supply chain flexibilities should be measured from an integrative, customer-oriented view. Vickery et al. (1999) presented an analysis of supply chain flexibility in the furniture industry and its relationship to firm performance, in the form of product, volume, launch, access, and responsiveness. These dimensions are applied to evaluate the impact of supply chain flexibility components on the firm’s performance. Flexibility allows organizations to make a shift in its process within the existing supply chain structure and without changing the entire design of the supply chain (Singh and Acharya 2013).

Traceability is a concept that involves several types of activities and refers to the ability to describe and to follow the life of a conceptual or physical element, preserving its identity and its origins. In database systems, traceability is associated with the execution of transaction logs. In software engineering, it is related to all

phases of software development from the requirements to the final product. It is also present in fault tolerance studies or in system auditing. Most scientific papers on agricultural traceability ignore implementation aspects. They are concerned with logistics (Thomas and Griffin 1996) and strategies of chain execution (Guiffrida and Nagi 2006).

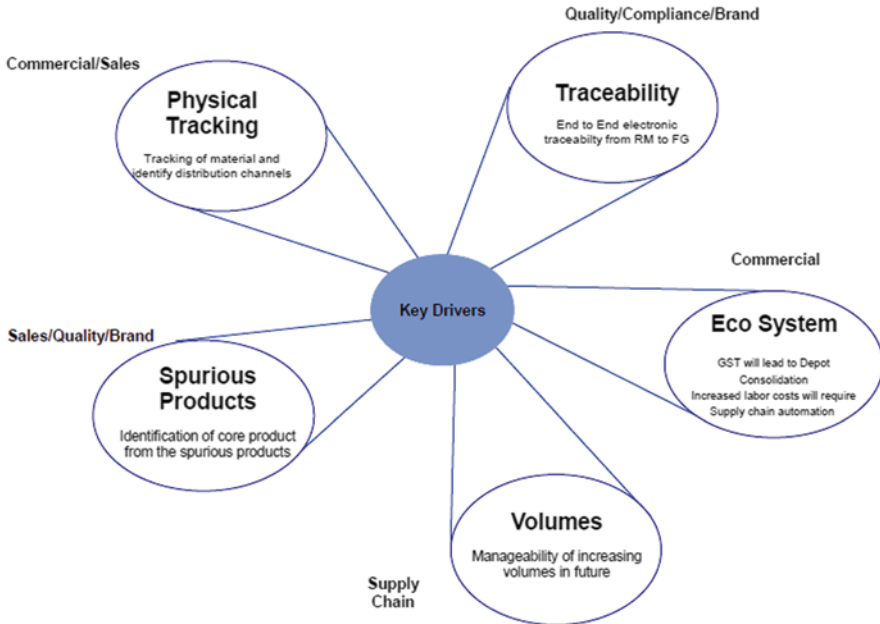
In order to improve product quality, ensure food safety, and sustain a competitive advantage, many food and beverage producers are turning to “supply chain traceability.” The ability to trace the origin, movement, and destination of products along the supply chain has been associated with improvements in operational performance, inventory optimization, product quality, and food safety. Increasingly, consumers, retailers, customers, suppliers, and regulators are encouraging food producers to be able to trace the origin of ingredients and products “one step forward and one step back” along the supply chain. In parallel with this trend, recent technological developments, such as radio frequency identification (RFID), have enabled food producers to trace and track products using real-time data. However, the increasing complexity of global food chains means that many firms find it difficult to successfully trace products along the farm-to-fork food chain.

Moreover, comparatively little attention has been given to which supply chain management (SCM) strategies and management practices can help managers to successfully trace the origin, movement, and destination of products within the agri-food industry. Consequently, this project seeks to examine which business strategies and management practices, such as total quality management (TQM), statistical process control (SPC), quality training, inter-firm computer integration, just-in-time (JIT) delivery, supply base reduction, supplier integration, supplier development, information transmission, and collaborative relationships, help firms to trace products along food chains.

### **18.3 The Relevance of Material Traceability in Varun Beverages Ltd**

Beverage manufacturers that successfully navigate the traceability maze will ultimately win the game. While they might not ever be free of organic hazards, they will significantly reduce the risk and cost associated with mass recalls and useless inventory. Furthermore, these leaders will position themselves ahead of the compliance curve and improve their competitive advantage. Farm-to-fork traceability does not have to be an information technology (IT) nightmare, when you arm yourself with the right information technology system. The objective is to set up a system that addresses specific needs and risks of a beverage manufacturer:

- Uncovers and reports every element along the supply chain, from origin to the shelf or plate.
- Offers unlimited layers of trace in both directions—inbound and outbound supply chain.



**Fig. 18.1** Key drivers for material traceability in supply chain

- Delivers robust, recipe-based, day-to-day materials management.
- Forecasts and reports production, consumption, and fulfillment.
- Processes orders and delivery on a “day 1 for day 1” basis.
- Captures multiple product attributes and grades, retailer-specific packing, and catch-weight labeling.
- Streamlines planning and production activities.
- Optimizes bill of materials (BOMs) for formulations, recipes, and multiple units of measure.

Varun Beverages Ltd (VBL) has been a Pepsi bottler for nearly two decades. Apart from operating in India, VBL also operates the Pepsi bottling business in Sri Lanka, Nepal, Mozambique, Morocco, and Zambia. VBL has been bottling Pepsi products in India since 1991. VBL needs to do a differential pricing across territories to promote sales and counter competition. This is normally administrated by giving some free products along with the main product. Sometimes, this leads to infiltration from one territory to another territory. These cross-territory movements can lead to financial loss and incorrect volume (sales) reporting. Apart from preventing cross-territory movements, this exercise has other business drivers also as shown in Fig. 18.1.

## 18.4 Problem Definition

One traditional use has been to identify and locate unsafe beverages and remove them from commerce. Later, track and trace systems have been used to validate the presence or absence of attributes important to consumers (e.g., organic components). Traceability has also become one tool in fighting product counterfeiting and protecting brands. Most recently, traceability of foods has become a regulatory requirement to protect against bioterrorism. Traceability can be used for these specific objectives as well as a tool to assess other business systems and tools such as quality management, risk management, information management, logistical flows, commercial advantage, and evaluation of management demands. In particular, traceability in food supply chain has attracted considerable attention in the past few years for a variety of reasons (Jansen-Vullers et al. 2003). First of all, it has become a legal obligation within the European Union (EU) since 1 January 2005; similar requirements for traceability systems are present in the USA and Japan too. Then, food companies tend to consider the significant expenditure required to build a traceability system as a long-term strategic investment to create consumer confidence both in the company image and in the specific product. Consequently, other requirements for traceability exist besides the legal ones. In fact, in addition to systematically storing information that must be made available to inspection authorities on demand, a traceability system should also take food safety and quality improvement into account. This means, for example, enabling the system to trace back so as to discover the cause of a problem and to prevent it from happening again, or to trigger a proper recall of potentially unsafe products, thus protecting public health. Of course, the implementation of a complete and efficient traceability system has to cope with several problems, such as the lack of alignment of the possibly different systems adopted in the various segments of the supply chain, or the nonhomogeneous information kept at the various supply chain units (de Castro et al. 2003).

## 18.5 Methodology Used

To analyze the supply traceability issue at VBL and to arrive at a future direction, SAP-LAP model was used.

SAP-LAP Model: The SAP analysis brings out key learning issues, which act as a base to take actions leading to performance. Largely, SAP-LAP models that are developed are naïve or atomic models treating the basic components of SAP-LAP framework independently without explicitly considering their interdependence or interrelationships.

SAP-LAP is an integrative framework consisting of six basic components:

- The “situation” to be dealt with, which can be external or internal to the organization.

- The “actor(s)” dealing with the situation, which can be “internal” or “external” with reference to the organization under study.
- The “process(es)” dealing with the situation, which can again be “internal” or “external” to the organization.
- The key “learning” issues, in terms of the achievement of objectives or problem areas.
- The “action(s)” to be taken based on learning, affecting the performance areas or objectives.
- The “performance” areas in terms of “objectives” to be achieved or key result areas (KRAs).

An illustration of external and internal elements under situation, actor, and process shown in SAP–LAP is a generic framework, which can be used in a variety of contexts, such as problem solving, change management, strategy formulation, SCM, marketing management, technology management, human resource management, and so on. The first step in any problem context would be identification of SAP elements, both external and internal. Care should be taken to identify only key elements. Similarly, key elements are to be identified for learning, action, and performance, as is done in LAP synthesis in general.

### **Situation**

- Soft drink market in India is increasing (6–7%).
- VBL is growing around 20–30% (sales volume) every year.
- Soft drink business is a seasonal business.
- Peak-season dispatch is very high (1.2 lakh physical cases per day during season).
- Dispatch window is limited; hence, truck-loading time should be fast.
- There are multiple bays where simultaneous loading happens.
- Need to track only PET (bottles made of polyethylene terephthalate) packs and not returnable glass bottles (RGB).
- Trucks normally take mixed loads (multiple brand/pack simultaneously).
- Palletized movement is preferred but not always feasible.

### **Actor**

- Production operator
- Production supervisor
- Dispatch person
- Warehouse in-charge
- Shipping in-charge
- Production head
- Supply chain head
- Commercial head

**Processes** *Distribution Channel*—We have studied the existing distribution channels of VBL. The material movement takes place as per Fig. 18.2.

Business processes are studied in one plant (Kosi) of VBL. VBL uses SAP ERP central component (ECC) 6.0 as a business application which supports production,

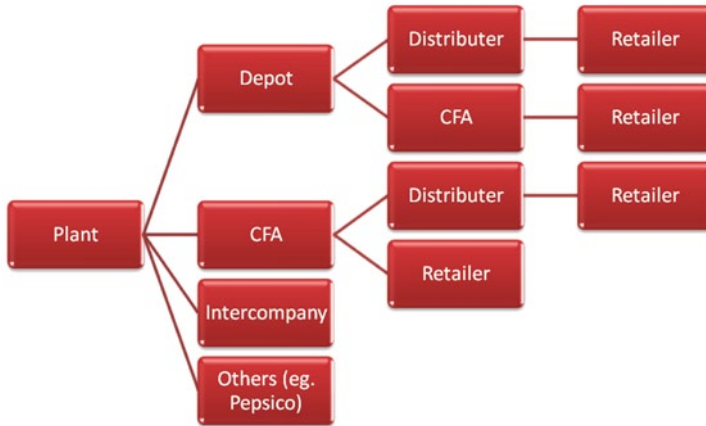


Fig. 18.2 Different distribution channels of VBL

dispatch, and sales process. In Kosi plant, the fastest line is of 600 bottles per minute (BPM). With 90% of efficiency, this line produces 32,400 cases/day, which turns out to be around 23 cases/min. We have focused our attention to this line as any solution working with this high-speed line is bound to work for other slow lines (200 BPM).

*Production Line* The production process starts with bottling of beverage in PET bottles. The time of bottling along with maximum retail price (MRP) details are printed on each bottle. The sealed bottles are then put in cartons/shrink packs by automatic process. Once sealed, the cartons/shrink packs move towards the unloading area. Here, the workers lift this case/carton and put it on the pallet. They have to be very fast as they receive a new case every 3 s. Normally, three pallets are filled simultaneously.

Pallet movement takes place using a forklift. In the case of hot loading, the pallet created on the line is directly moved to the loading area/truck or the pallet is moved to a designated storage area in the warehouse.

*Batch* Currently, only one type of batch is being maintained (offline and also in SAP) by the quality department which is called a production batch. This batch is a unique ID allocated to the flavor concentrate of designated units to be produced across production line(s) of a given plant. The production batch is a unique four-digit sequence prefixed with “B,” for each plant (all production lines) which is refreshed every new calendar year. This batch along with other information is printed on each and every individual bottle in laser print or continuous ink-jet print or both.

*Batch Monitoring* The production batch is monitored at periodic intervals by the quality department for measuring variations in quality parameters. This interval currently is approximately 1 h and the beverage within this duration is considered

as homogeneous in terms of quality. This is the lowest level at which the product quality is considered as static for any changes in the quality parameters from tracking purpose.

*Warehouse* The pallets are moved from the production line to the storage bays by the forklift and stored there. At the time of dispatch, the pallets are picked from the respective storage bays by the forklift operators and moved to predesignated loading bays as per dispatch instructions. Within the warehouse, sometimes pallet-to-pallet transfer of cartons also occurs. In case there is shortage of space or shortage of pallets, then pallets are first de-palletized and stored in the warehouse. At the time of loading, cartons are manually palletized, and then transferred to loading bays.

*Dispatch Area* The dispatch process begins by creating an outbound delivery against the sales order in SAP ECC 6.0. Based on this, a loading slip is generated and handed over to the forklift driver for the picking operation. The forklift moves to the respective storage bay, and the entire process of warehouse-out operation is followed based on where the stock is kept.

*Dispatch Scenarios* We found that there are three kinds of dispatch scenarios for transferring the material to loading bays. We will call them A, B, and C scenarios.

- A. Loose stacking: Pallets created on the production line are de-stacked at specific warehouse locations manually. During the loading process, cartons from the warehouse locations are palletized manually once again and transferred to loading bays.
- B. Hot loading: During peak seasons, pallets created on production line are picked by forklifts and loaded directly into trucks rather than to specific warehouse locations. So there is no need of any storage, stacking, or de-stacking.
- C. Pallet stacking: Pallets created manually on the lines are picked by forklifts and stacked to specific warehouse locations in palletized form. During loading operation, these pallets are picked as it is and loaded on to the trucks.

A proposed solution should be able to cater all three scenarios.

Soft drink is a seasonal industry. Maximum sales of soft drinks in India occur during the summer period; and, in order to cater that sale, VBL prebuilds the stock of certain stock-keeping units (SKUs). This affects the dispatch scenarios across months. During our study, we found that during peak season, the production line runs 24 h in a day and clocks an efficiency of 85–90% for a single flavor. Theoretically, the dispatch department also works 24 h so that the loading of trucks and dispatch should happen throughout and uniformly, but practically the dispatch rate is different at different time periods, and it normally peaks during evening hours and comes to nearly zero in the morning hours. During season, in order to cater a very high volume of dispatch, multiple bays of truck loading are used. The peak volume of dispatch from one plant can touch up to 1.2 lakh physical cases/day, which roughly turns out to be 120–130 trucks/day.



**Learning Time and Motion Study**—The following processes were studied and detailed time and motion study was carried out

- Truck load time
- Carton stacking times (de-palletization on truck)
- Forklift turnaround times

Some of the results of the same are attached in Appendix 1. Some of the observations after the time and motion study are as follows.

The average truck-loading time is around 2 h with a maximum of 2 h 40 min and minimum at 1 h 45 min. If there is only one product to be loaded on the truck, then the truck-loading time reduces, while it increases for mixed-load (multiple SKU) trucks. Truck-loading time is a function of three main activities. Forklift turnaround time, carton-stacking time, and carton-counting time.

The average forklift turnaround time is 115 s or 1.9 min, while the average carton-stacking time for one pallet is around 2.65 min. So for a big truck in which 33 pallets are being loaded, this would come to around 2 h 30 min. We assume that the carton-counting time would overlap with the forklift turnaround time. The proposed solution should not increase the truck-load time and hence any activity of identification (like scanning) must overlap with the existing timelines.

- In production line, the unloading workers are unskilled.
- Dispatch peaks in the evening time and all truck must be loaded within that narrow window.
- Any solution should be fast enough so that the current time limits are maintained.
- The solution must be integrated with the existing ERP SAP.
- The solution should be able to work in off-line mode, so in case there is no connectivity, dispatch should continue.
- Since the volume is very high, the consumable cost should not be high. In such a case, RFID cannot be used as tags cannot be reused.

The solution envisages individual tracking of both sales and handling units in the system. Sales unit in our case is a carton or shrink-wrap and the handling unit is the pallet. Sales units will be tracked using a unique ten-digit alphanumeric code. The ten-digit code will contain the complete information of the carton. All pallets would be uniquely identified with a permanent ten-digit bar-coded ID. During the production, one unique bar code would be placed on each carton or shrink-wrap. During unloading from the conveyer, an association would be built between a pallet and cartons, which are loaded in that particular pallet. During the process of pallet building on the production line, technological solutions will allow the tracking of the cartons which constitute the pallet. This information will be stored in the system. During dispatch, technology will be used to track the pallet, which is being shipped against the given delivery.

The solution will store information of each carton and the delivery against which it was shipped out of the plant. The information that is stored for each carton will also have the time slot during which the bottling was done. This will enable the system to establish a link between the time of bottling and the carton. The solution

enabled using the bar code will bring about complete visibility of movement of physical material and will enable reverse tracking of the same at the time of market visits.

**Action** The purpose of this section is to synthesize the information gathered during interview phase and transpire that knowledge into a detailed designs document for implementation. The analysis was done keeping in mind the concept of flexibility. The objective was to increase the visibility across the value chain by implementing flexible management systems.

*Scope* Part of the project solution involves three functional areas:

1. Production line activities
2. Warehousing activities
3. Dispatch-related activities

*Production Line* The scope of solution includes generating and printing of bar-code labels on the cartons automatically using a label printer applicator (LPA), scanning carton labels using fixed-mount scanners and forming carton ID–pallet–ID associations at the end of the production line using a hand-held scanner to scan the pallet bar-code labels.

*Warehouse*—the solution covers activities related to transferring associations within:

- a. Pallet to virtual pallet
- b. Pallet to pallet
- c. Allocation/de-allocation of carton IDs to/from pallets/virtual pallets

*Dispatch* The activities will briefly cover the following areas:

- a. Dispatch confirmation from pallet (physical as well as virtual)
- b. Dispatch confirmation from cartons
- c. Allocation/de-allocation of carton IDs to/from pallets

*Assumptions*

- The solution is being designed assuming that the PET line of business will be covered in the first phase.
- Only primary dispatches are being considered from the plant.

*Process Flow* The process starts with bottling of PET bottles. These bottles then move forward over the conveyer belts towards the bottle-labeling point. At this point, a label consisting of batch, line, date, time, MRP, and price is printed onto the bottles using a laser printer or an ink-jet printer or sometimes both. Post the labeling, the bottles move towards the carton-making or shrink-wrapping point on the conveyer belts. These bottles are then picked up by sleeves in bunches, depending upon the SKU-per-carton combination. At the carton-making point, multiple cartons are created at the same time, where the number of cartons created in parallel may vary.

The cartons/shrink-wraps then move towards the bar-code application point on the line. At this point, a bar code is applied on the carton using an LPA machine. At the end of the line, the pallet building begins by first scanning the empty pallet bar code, thus triggering the transaction to start association of cartons to pallets, i.e., all cartons scanned after the empty pallet scan shall be associated with this pallet. Each carton to be stacked on the pallet is scanned individually by a fixed bar code scanner on the line and is manually stacked on the pallet. Once the pallet is complete, the next pallet bar code is scanned to start the next pallet making, and this closes the transaction for association of the cartons to the first pallet. The pallet is then physically checked by a checker, and, only upon his confirmation, the pallet movement takes place using a forklift. In case of hot loading, the pallet created on the line is directly moved to the loading area/truck, or else the pallet is moved to a designated storage area in the warehouse.

During the warehouse-in operation, stock can be moved from the line to:

a. Storage bays

Here, the stock is stacked in the palletized form. The pallet is moved from the production line to the respective storage bay and is stacked in the palletized form using a forklift. Once stacked, a count check is done by the checker and a stock reconciliation is done between dispatch and production. In case of any differences, adjustments are passed or else the stock is updated in the inventory management.

b. Demarcated stacking zones or virtual pallet

Here, the stock is stacked in de-palletized form with each stacking zone physically demarcated and identified by a zone placard consisting of a bar code that determines the details of that stacking zone and the stock held by it. The pallet is moved from the line to the identified stacking zone using a forklift. The bar code placard of the stacking zone is checked to confirm the right stacking location. Pallet is staged near the stacking zone using a forklift. The cartons are manually de-palletized and stacked in the stacking zone.

Once the cartons have been stacked, the bar codes of the pallet and stacking zone placard are scanned so that all the cartons of the particular pallet are now associated to the particular stacking zone or virtual pallet and dissociated from the existing pallets.

Once stacked, a count check is done by the checker and a stock reconciliation is done between dispatch and production. In case of any differences, adjustments are passed or else the stock is updated in the inventory management.

Process Flow: During the warehouse-out operation—If the stock is in the palletized form, based on the loading slip details, the forklift reaches the respective storage bay, picks the pallet and moves towards the loading area. Activities at the loading area have been described in the Dispatch section. If the stock is in a non-palletized form, i.e., in visually demarcated stacking zones or virtual pallets, then the stacking zone placard is scanned, which associates all the cartons in that zone to the respective loading slip. Cartons are then un-stacked and manually palletized.

A forklift picks up this pallet and moves towards the loading area. Activities at the loading area have been described in the Dispatch section.

**Dispatch Process Flow:** The dispatch process begins by creating an outbound delivery against the sales order in SAP. Based on this, a loading slip is generated, which details the quantity and flavor of stock to be loaded onto a particular truck. The loading slip is handed over to the forklift driver for the picking operation. The forklift moves to the respective storage bay, and the entire process of warehouse-out operation is followed based on whether the stock is kept in palletized form or in de-palletized form (i.e., in virtual pallets).

Once the picking operation is complete, the forklift moves from the picking location to the loading area. How the loading operation proceeds from here depends upon the location of the picking operation: If the pallet-picking operation was done from a stacking zone, the pallet is directly staged onto the truck floor by a forklift, followed by manual stacking of the cartons onto the truck floor. Once the truck is completely loaded, the loading is confirmed by the checker. If there is a case of hot loading, then the pallet moves directly from the production zone to the dispatch zone.

Documents, viz., gate pass and invoice are handed over to the transporter, and the truck moves out of the warehouse/yard. If the pallet-picking operation was done from a palletized zone, the pallet is directly staged onto the truck floor by a forklift. Here, the pallet bar code is scanned so that all cartons are dissociated from the particular pallet and are associated to the respective loading slip. This is followed by manual stacking of the cartons onto the truck floor. Once the truck is completely loaded, the loading is confirmed by the checker.

*Batch: Future Process* To enable physical tracking of the product at the lowest possible level (quality batch slot\*), it is proposed to create a sales batch which has a consistent correlation with the production batch. Also, this batch will be unique across all plants/lines within VBL. This sales batch with a unique serial number will be imprinted on every carton being produced.

\* A quality batch slot is the lowest consistent time interval at which quality-related measurements of the beverage are taken by the quality department. It is suggested to streamline this interval across all plants to a consistent value (e.g., 1 h) so that more accurate sales batch alignment with production batch is achieved.

The sales batch will be a unique ten-digit code with static and dynamic information. This information will be maintained in the custom application and will be printed as a bar code on each individual carton/case.

**Batch Information Dynamics:** The information related to the plant/line combo is static for a given plant and line at all times and is least susceptible to change under given circumstances.

The production batch information is static for a particular batch of beverage.

The quality slot is the unique slot in the day during which measurements were taken. Example: 0000–0100 h designated as Slot A. Similarly, 0100–0200 h designated as Slot B.

The serial number is unique for every individual case created during a given slot. The serial numbers are recycled for every slot.

#### People, Process, and Technology

*People* The role of people is very important in implementing the solution. In this solution, the following persons would require to work differently in a future state of process.

1. Unloading operator
2. Production checker
3. Warehouse checker
4. Dispatch operator
5. Purchase manager
6. IT assistant

All persons need to be trained in the proposed system and proper hand-holding is required for some days. They would be told about the exceptions and about the ways to handle them. The change management process would be monitored by a change management board. In case of any problem, a help desk with clear escalation matrix is proposed.

*Process* Standard operating procedure can be developed to help users to understand the entire process.

*Technology* The technical solution will consist of developing the bar-coding application and integrating the same with SAP ECC 6.0 for exchanging delivery-related information. Additionally, the application will also integrate with multiple warehouse devices, viz., hand-held terminals, fixed-mount scanners, etc., via LAN/WiFi. This integration will enable the capture of real-world information into the application on a near-real-time basis.

The proposed approach will involve conducting a pilot solution development on one of the production lines at Kosi plant, which will act as a prototype for subsequent rollouts to other lines within that plant and other plants.

**Performance** This traceability solution would help in making one part of supply chain more flexible. The next step is to achieve full supply chain traceability. As per (GS1 2005), the main requirements for handling product withdrawals<sup>1</sup> and recalls<sup>2</sup> across the supply chain are having reliable data, the possibility to exchange the data, and properly mapped business processes. A good internal traceability system is a prerequisite to a chain traceability system. The investments in an internal traceability system will not be wasted in moving towards chain traceability. All good

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<sup>1</sup> A procedure to withdraw products from the market where they have left the immediate control of the brand owner.

<sup>2</sup> A procedure to withdraw products from the market where they have left the immediate control of the brand owner, and where they may have reached the consumer.

supply chain traceability software should be able to integrate seamlessly to any internal system.

Since most of the proposed system is automatic in terms of capturing the data, it would help in getting reliable data. We have tried to integrate the proposed system with the existing internal system SAP.

The proposed system would help in achieving the following:

- By capturing the bar code of a carton/case, the entire movement of that case can be tracked. For example, at what time the material was produced, what was the quality batch, etc.
- A material can be tracked back to the raw material which would help in case there is a quality problem in some batch.
- In the case of cross-territory movement, the dealer who is indulged in that practice can be identified. Even in case a carton was destroyed, hence no bar code, the system would be able to track the offending distributor through the date and time printed on the individual bottle. This information may not be 100% correct, but this would help in narrowing down the distributor search.
- The proposed system would help in withdrawal and recall of the products.

As of now, the proposed solution takes care of only primary dispatch, i.e., the dispatch from the manufacturing plant to either the own depot or to the distributor. This would bring the visibility only on that part of the supply chain. In the future, the same solution can be extended to secondary dispatches, i.e., dispatches occurring from the depot to the distributor and to tertiary dispatches, i.e., dispatches occurring from the distributor to the retailer.

Few key pointers at this stage would be helpful:

- Since some of the key users are not very skilled, the solution should be easy to use with minimum key strokes.
- The dispatch area is outside of the mail plan so the devices should be rugged enough to withstand the weather, dust and dirt.
- Since the production line runs very fast, the bar-code sticking and scanning at the line should be automatic.
- The creation of a standard operating procedure should be part of the solution.
- The automatic LPA should be selected at the production line.
- Automatic fixed-mount scanner should be selected.
- The proposed software should have a picture-based graphical user interface.
- The actual time of the dispatching process (truck-loading time) is either the same or less than the existing time.

## 18.6 Conclusion

While a number of effective traceability systems are already being used in the beverage industry, there are challenges for ensuring the compatibility and cost-effectiveness of traceability efforts. The complexity of the beverage supply chain and the increasingly globalized beverage market structure create challenges for the designers of traceability systems, such as how to meet the ultimate need to mitigate infiltration, price and expiration risks while ensuring quality in a world of integrated global supply systems, and rising international trade where a single product may contain ingredients from more than a score of countries. This complexity leads to many different designs. The elements of an effective traceability system vary depending on the type of beverages, the relative infiltration, price arbitrage and expiration risks, size and type of firm, and the supply chain involved. However, at a minimum, an effective traceability system must be able to trace at least one step forward and one step back along the supply chain. Effective traceability systems can and should benefit both public and private interests. Raising the awareness of the importance and the full range of potential benefits of traceability is the key to increasing uptake in the beverage industry. Already, industry players that do see its value in helping their suppliers and customers tend to value traceability enough to invest now. As more firms learn the value of traceability to their own private interests, in addition to safeguarding public interest, they too will engage. To encourage more firms in the beverage supply chain to participate in traceability efforts, the main public and private benefits of investing in traceability should be communicated and promoted.

Governments have more than one role to play in traceability. They can create helpful regulations that encourage the industry to implement practical and efficient traceability systems. They can share expert knowledge of the value of traceability systems and best practices to help improve effectiveness. And, they can provide funding or tax incentives that would stimulate broader industry uptake. The cause for the comprehensive use of traceability systems has grown over the years. Industry and government can obtain the best possible outcomes from heightening the use of traceability by working together collaboratively.

## Appendix 1

Time and motion study—carton composition on truck and truck load time

Kosi Plant													
Bay #	Truck #	Truck Type	Capacity	SKU Flavor	SKU Unit	Rows	Columns	Layers	Total Cartons	Orientation of Carton	Start Time	End Time	Total Time
3.2	4849	Trailer	20 Ton	Slice	500 ml Carton	11	6	17	1440	Parallel to Truck Wall			1:45
						43				Random on Top			
						11	1	25		Perpendicular to Truck Wall			
3.1	4939	Trailer	20 Ton	Slice	500 ml Carton	11	6	17	1440	Parallel to Truck Wall			1:45
						43				Random on Top			
						11	1	25		Perpendicular to Truck Wall			
9425	Canter 112	9 Ton	Soda	24x600 ml Carton	7	6	11	600	Parallel to Truck Wall	6:45 PM (LT)	9:25 PM (LST)	2:40	
					26				Perpendicular to Truck Wall				
					20				Random on top				
3.2	6995	Trailer 2213 10 Tyre	18 Ton	Pepsi	9x2L	7	7	20	400+ 300+ 300	Square Carton Stacking	7:45 PM (AT) 8:05 (LT)	2:00	
				Mountain Dew		20				Random on Top			
				Marinda Orange									
2.2	3175	Trailer 2518 10 Tyre	18 Ton	Mountain Dew	9x2L	7	7	22	1078	Square Carton Stacking	8:20 (AT) 8:30 (LT)	2:30	

Kosi Plant Carton Composition									
Truck Type	Capacity	SKU Flavor	SKU Unit	Rows	Columns	Layers	Layer Line Orientation	Total Cartons	
Trailer	16 Ton	Pepsi	9x2L	7	7	20	Square Carton Stacking	980	
Trailer	18 Ton	Aquafina	1L	8	8	19	Parallel to Truck Wall	1264	
				8	6	1	Perpendicular to Truck Wall ("Dunda")		

Carton-stacking times (de-palletized process on truck)

Carton - Pallet Composition		27 (9 x 2 litre) boxes on 1 Pallet		
Sl. No.	Labor Count	Carton Breakages	Time (seconds)	
1	1	0	172	
2	2	0	77	
3	2	0	120	
4	2	1	152	
5	2	4	238	
6	2	1	195	



Forklift turnaround time

<b>Carton - Pallet Composition</b>	27 (9 x 2 litre) boxes on 1 Pallet
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Sl. No.	Complete trip Time (seconds)
1	90
2	220
3	107
4	77
5	50
6	133

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# Chapter 19

## Structural Flexibility in Supply Chains: TISM and FISM Approach

P. R. S. Sarma and V. R. Pramod

### 19.1 Introduction

In a typical supply chain (SC), raw materials are procured and items are produced at one or more factories, shipped to warehouses for immediate storage and then shipped to retailers or customers (Simchi-Levi et al. 2010).

Modern SCs comprise a lot more than ‘technology, warehouses, distribution centres, trucks or planes (they are the hard assets)’, and are defined as ‘any combination of processes, functions, activities, relationships and pathways along which products, services, information and financial transactions move in and between enterprises’. It also involves any and all movement of these from original producer to ultimate end-user or consumer; and *everyone* in the enterprise is involved in making this happen. Any service organization that believes that its products are intangible and logistics and SC principles do not apply, most likely suffers from SC blindness (Gattorna 2008).

SCs, as their name indicates, are virtual chains linking customers’ customers to suppliers’ suppliers. The origin of an SC can be from ‘idea generation’ to the delivery of product/service and back to the supplier after end-of-life of the product. Management of SCs can be defined as the ‘integration of all the activities across the four verticals of logistics systems of any organization.’ The four verticals are namely, (1) information; (2) inventory; (3) facilities; and (4) transportation. Each vertical has its own set of activities. A list of select activities is:

*Information* Research, design and engineering, required raw material, sources of supplies, transportation routes, order placement, material procurement, payments, storage, throughput process, packing of finished goods, labelling, transportation for

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distribution, product information to customers, customer requirements to the manufacturer, customer orders, order fulfilment, product maintenance and returns, inventory at various levels in the chain, etc.

*Inventory* Inventory in the in-plant warehouse namely, about raw material, work-in-progress inventory, finished goods and inventory in the market warehouse namely, stock available in the shelves and the buffer available in the stock-keeping units (SKUs) of retailers and finally the inventory in-transit, etc.

*Facilities* Includes manufacturing facility and warehousing facilities, etc.

*Transportation* Includes transportation of information (EDI), people, material for the inbound-logistics and outbound-logistics, etc.

Many of the firms have discovered the magnitude of savings through planning and managing logistics networks more efficiently as logistics has emerged as 'Big Business' (Lambert and Stock 1993). The logistics in a given firm has increased in importance from a 'bare minimum necessary function' to (1) an activity of significant cost savings; (2) an activity that had enormous potential to impact customer satisfaction; and (3) a marketing weapon that could be effectively utilized to gain sustainable competitive advantage. The improved logistics capabilities have complemented the SC operations. It is therefore not surprising that many firms are involved in the analysis of their logistics networks.

The mission of logistics management is to plan and coordinate all the activities necessary to achieve desired levels of delivered service and quality at lowest cost. Therefore, logistics can be seen as the link between the marketplace and supply base. The scope of logistics spans the whole organization (Christopher 2011).

The recent advances in information and communication technologies have made the SCs more complex to be coordinated through a single channel. As the markets have reinvented themselves as 'customer-driven' markets, the SCs of all the organizations have also become 'customer centric'. With the technology adoption and integration, it was made possible for the firms to introduce high degree of flexibility to their customers in identifying a product of their choice, placing order and request for a convenient delivery. As a result, 'teleshopping', 'online shopping', etc. have emerged. This led the firms to reinnovate on their SCs and start operations in multiple channels. On the other hand, firms have availed the advantage of technology support in terms of increased visibility of the information on their products (specifications, price, etc.) every time when a customer is in search of it.

After having traversed through paths of understanding SCs, it is required to understand the concept of 'flexibility'. The literature supports with definitions of extended forms of flexibility namely, design flexibility, process flexibility, workplace flexibility, etc. The basic definition of flexibility in a systems perspective can be defined as 'the ability of a system to respond effectively to changing circumstances' (Piore 1989).

Others define flexibility as 'the ability to change without losing identity'. In the context of an enterprise, the identity of an enterprise can be analysed as a set of norms and beliefs about these norms held by its stakeholders, such as customers, employees, suppliers and investors (Ravi and Shankar 2005).

As per the situation, flexibility can have several connotations; some noteworthy are: ‘adaptiveness to the changes in the environment, amiability in relationships balance in competing opposites, responsiveness to customer requirements and versatility in solutions and operations, etc.’ (Sushil 2000, 2013, 2014).

In the current scenario, SC has been observed as an essential part to be concentrated to make the organization be more profitable. Flexibility makes the chain more vulnerable to the rapidly changing industrial environments, which ultimately make it more robust and sustainable. Flexibility is one of the most talked subjects today in the context of an organization (Rao and Wadhwa 2002).

In the context of SCs, the flexibility can be understood as the ‘ability of the SC to accept and respond to the demand variations in the market for the products and services’. This calls for the ability of the SC to create multichannel operations to meet the demand variations. This is termed as ‘structural flexibility’. The structural flexibility reflects the ability of SC to adapt or reconfigure its architecture in response to major changes on the ‘demand side’ or the ‘supply side’. SCs with high levels of structural flexibility are well able to cope with the levels of volatility that are a feature of the twenty-first century business environment (Christopher 2011).

As flexible supply chains support organisations to respond to the swings in both demand and supply side, this chapter has been intended to analyse the fuzziness in the flexibility of SCs. In continuation to this, most of the manufacturing and service sectors adopted these strategies, which in succession got dittoed to various service sectors.

## 19.2 Analysing Select Enablers of Structural Flexibility in SCs

The enablers of structural flexibility can be identified from the literature, researchers and the practitioners in the domain of logistics and supply chain management. For the purpose of analysis, a select set of enablers are identified for analysing their interrelationships in support of structural flexibility.

*Methodology* The identification and measurement of the interrelationship between various enablers will be diagnostic in nature. Therefore, the scope of the analysis is confined to select Indian firms (irrespective of their sector of operations), in and around select major cities in the state of Andhra Pradesh (A.P.). The selection criterion for including a firm into the sample is that the firm should have well-defined supply chain systems in place and manage all the activities that are essentially involved in an effective supply chain. Fuzzy interpretive structural modelling is used to derive the intensity of interrelationship between the enablers of structural flexibility in SCs.

The qualitative data for the analysis were collected through (i) study of various available documents in the select firms and (ii) semi-structured interviews with the SC managers of the firms. Total interpretive structural modelling (TISM) and FMICMAC (Fuzzy Matrice d’Impacts Croisés Multiplication Appliquée à un Classement) methodologies were used. The objectives of the study required quali-

tative data. The qualitative data were collected through semi-structured interviews with SC managers in the select firms. Many brain-storming sessions and personal interviews were conducted to identify the elements that are supporting the structural flexibility in the supply chains, and a contextual relationship was established. The selection of firms into the sample is based on 'random sampling'. In random sampling, which is also known as 'probability sampling' or 'chance sampling', every item of the universe has an equal chance to be included in the sample. The results obtained by random sampling can be assured in terms of probability. Random sampling ensures the law of statistical regularity which states that 'if on an average the sample chosen is a random one, the sample will have the same composition and characteristics as of the universe' (Kothari 1990).

### 19.3 Interpretive Structural Modelling

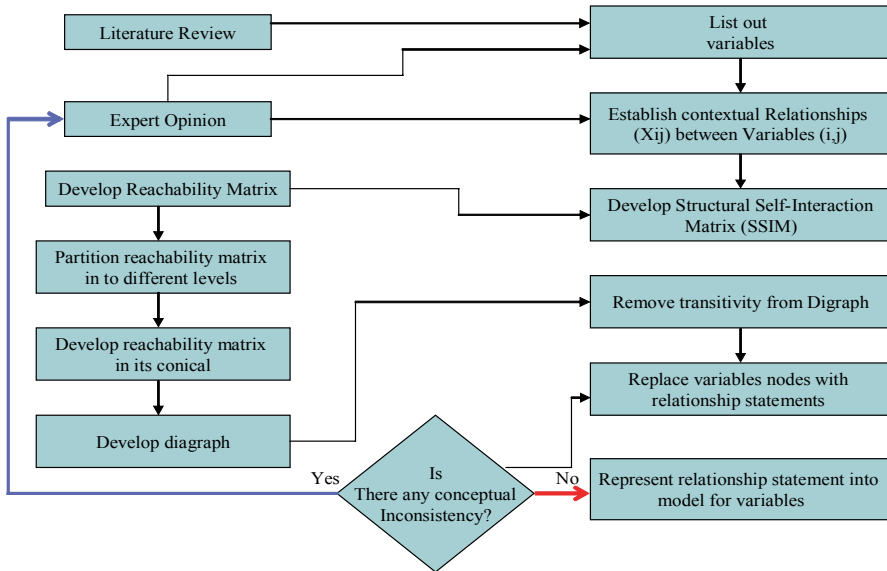
ISM is based on group judgment on the extent and nature of relationship among the elements. The interpretations of the group have been used to draw the overall structure from the complex set of elements. The final structure has been portrayed in a digraph (Sage 1977). ISM is an interactive learning process (Pramod and Banwet 2010). In this, a set of different directly and indirectly related elements are structured into a comprehensive systemic model (Warfield 1974; Sage 1977).

The model so formed portrays the structure of a complex issue, a system of a field of study, in a carefully designed pattern employing graphics as well as words (Thakkar et al. 2008). ISM methodology helps to understand the order and direction on the complexity of relationships among elements of the case problem (Sage 1977). For complex problems, like the one under consideration, a number of elements may be affecting the structural flexibility in the SCs, thereby affecting their productivity. The direct and indirect relationships among various elements depict the situation more accurately than the case when an individual factor is considered in a stand-alone mode. ISM develops insights into the collective understanding of these relationships. ISM is interpretive as the judgement of the group of experts decides whether and how the variables are related. It is structural, as on the basis of the relationship an overall structure is extracted from a complex set of variables. It is a modelling technique as the overall structure and specific relationships are portrayed in a graphical model. It is primarily intended as a group learning process but can also be used individually.

The flow chart for the ISM methodology is shown in Fig. 19.1.

#### 19.3.1 *Structural Self-Interaction Matrix (SSIM)*

The scenario was discussed in detail with reference to the study carried out with the concerned experts in the select banks, and also an expert opinion was sought from the experts of the academia. ISM methodology suggests the use of expert opinions



**Fig. 19.1** Flow chart for the ISM methodology. (Adapted from Kannan and Haq 2007; Kannan et al. 2009)

using brain storming, nominal group technique, etc. (which are some of the management techniques for developing the contextual relationship). For analysing the barriers in developing SSIM, the following four symbols have been used to denote the direction of relationship between the elements ( $i$  and  $j$ ):

- V** Variable  $i$  will help achieve variable  $j$
- A** Variable  $j$  will help achieve variable  $i$
- X** Variables  $i$  and  $j$  will help each other
- O** Variables  $i$  and  $j$  are unrelated

Through detailed discussions with senior managers of select banks, the following list of key elements was identified for understanding the objectives:

1. Visibility
2. Information flow
3. Information sharing
4. Access to capacity
5. Access to knowledge and talent
6. Interoperability of processes
7. Network orchestration
8. Structural flexibility

These elements were subjected to approval of the interviewees for representation of the study variables in this study. Considering these elements, a structural self-interaction matrix (SSIM) was developed by determining a contextually relevant

**Table 19.1** Structural self-interaction matrix (SSIM)

		8	7	6	5	4	3	2
1	Visibility	O	V	V	V	V	A	A
2	Information flow	V	V	V	V	V	O	
3	Information sharing	V	V	V	V	O		
4	Access to capacity	V	V	V	V			
5	Access to knowledge and talent	O	V	A				
6	Interoperability of processes	A	V					
7	Network orchestration	A						
8	Structural flexibility							

**Table 19.2** Initial reachability matrix

	1	2	3	4	5	6	7	8
1	1	0	0	1	1	1	1	0
2	1	1	0	1	1	1	1	1
3	1	0	1	0	1	1	1	1
4	0	0	0	1	1	1	1	1
5	0	0	0	0	1	0	1	0
6	0	0	0	0	0	1	1	0
7	0	0	0	0	0	0	1	0
8	0	0	0	0	0	1	1	1

subordinate relation among the select elements. Following the consultation and approval of interviewed experts from select banks, the final SSIM representing the pair-wise comparison of the elements was developed. The development of SSIM requires depicting dependence among all possible pairs of elements by choosing a contextual relationship that shows the conversion of elements leading to some particular element. Also, the derived SSIM was subjected to the consensus of interviewed experts of banks under the population. Based on their feedback, the SSIM was modified and is shown in Table 19.1.

### 19.3.2 Reachability Matrix

- (i) SSIM has been converted into a binary matrix called ‘initial reachability matrix’. It is developed by substituting V, A, X and O by 1 and 0. The substitution of 1 and 0 is as per the rules of ISM methodology.

The initial reachability matrix for the relationships among the select elements is made and is shown in Table 19.2.

After incorporating the transitivities, i.e. if one element A leads to element B (A=>B) and element B leads to element C (B=>C) then element A should also



**Table 19.3** Final reachability matrix with driver power and dependence

Element	1	2	3	4	5	6	7	8	Driving power
1	1	0	0	1	1	1	1	0	5
2	1	1	0	1	1	1	1	1	7
3	1	0	1	1	1	1	1	1	7
4	0	0	0	1	1	1	1	1	5
5	0	0	0	0	1	0	1	0	1
6	0	0	0	0	0	1	1	0	2
7	0	0	0	0	0	0	1	0	1
8	0	0	0	1	0	1	1	1	4
Dependence	3	1	1	5	5	6	8	4	

lead to element C ( $A \Rightarrow C$ ), the final reachability matrix is developed and is shown in Table 19.3.

### 19.3.3 Level Partition

From the final reachability matrix, the reachability and antecedent set for each criterion can be attained (Sushil 2005a). The reachability set includes criterion itself and others, which it may help to achieve, similarly the antecedent set consists of itself and other criterion which helps in achieving it. Thereafter, the intersection between reachability and the antecedent set is attained. If the membership in reachability and the intersection completely agree then the top priority is obtained and the criterion is removed from the subsequent iteration, so on. This procedure leads to final iteration leading to the lowest level. The reachability set and the antecedent set for each criterion is depicted in APPENDIX.

## 19.4 Development of Fuzzy ISM

### 19.4.1 Fuzzy Logic

Fuzzy logic (FL) is well known for providing a cost-effective solution to a wide range of real world problems (Yen and Wang 1999), while incorporating the uncertainties. It is based on the perception that there is a third region other than true and/or false. That dimension is defined by a possibility figure, named as membership function. FL emphasizes on approximate rather than exact images. It poses the ability to mimic the human mind to effectively employ modes of reasoning. With FL, it is possible to specify mapping rules in terms of words rather than numbers. This is because, computing with the words explores imprecision and tolerance. A fuzzy

**Table 19.4** Fuzzy initial reachability matrix

	1	2	3	4	5	6	7	8
1	1	0	0	1	7	1	1	0
2	2	1	0	1	1	9	1	7
3	1	4	1	0	1	1	6	1
4	0	0	0	1	1	1	1	1
5	0	0	0	0	1	0	4	0
6	0	0	0	0	0	1	1	0
7	0	0	0	0	0	0	1	0
8	0	0	0	0	0	5	1	1

set allows perfect and partial memberships. This is represented by the value of the membership function. It represents the probability of the unit to be a part of that cluster. In other words, it is the degree an object belongs to a fuzzy set. Membership function takes a real number value in the interval 0–1. A variable can have membership in more than one cluster with varying or same membership functions.

‘Fuzzy ISM’ is the plot showing the prioritized matrices with inhibitors on the X and Y axis and power on the Z axis. It is an advanced model of ISM by conglomerating the fuzziness among the relationships into numerical form. Instead of representing the relationships in Boolean numbers, the relationships are expressed in quantified form to make them much vivid. The possibility of interaction is depicted in the reachability matrices, thus transforming the model into a quantitative school of thought. In continuation to the appropriate refinement that has to be pursued in the MICMAC.

*Development of Fuzzy Initial Reachability Matrix* Initial reachability matrix gives an assessment whether one variable leads to another variable or whether one is influenced by the other. However, the power by which the variable led to another variable or whether it is influenced by the other is a handicap in the analysis. In order to plug the missing link, the attempt for quantification has been carried out. By collecting the inputs from ten earlier respondents, priority for relationship of each inhibitor was finalized on a 1–10 scale. Each decision maker was requested to judge the interpretive characteristics of each inhibitor appraising the contribution degree and importance of it. One indicates very low interrelationship and 10 indicates very high interrelationship. The values showing the fuzzy interrelationship are shown in Table 19.4.

*Development of Fuzzy Final Reachability Matrix* Similar to the previous case, while considering the transitivity, fuzzy final reachability matrix was made. In this case, the values representing transitivity were assumed to be one. The fuzzy final reachability matrix thus constructed is shown in Table 19.5.

**Table 19.5** Fuzzy final reachability matrix

Element	1	2	3	4	5	6	7	8	Driving power
1	1	0	0	1	1	1	1	0	5
2	2	1	0	1	1	9	1	7	22
3	1	4	1	1	1	1	6	1	16
4	0	0	0	1	1	1	1	1	5
5	0	0	0	0	1	0	4	0	5
6	0	0	0	0	0	1	1	0	2
7	0	0	0	0	0	0	1	0	1
8	0	0	0	1	0	5	1	1	8
Dependence	4	5	1	5	5	18	16	10	

### 19.4.2 Fuzzy ISM

Fuzzy ISM gives a pictorial representation of the interrelationships between the elements in the cluster. Instead of representing the relationships by 0 and 1, clear quantified relationships always give a better value addition. A picture is thousand times worthy than an enumeration. In this regard, a three dimensional view of Fuzzy ISM is plotted using the software MATLAB. The Fuzzy ISM thus is plotted and is shown in Fig. 19.2. *X* and *Y* axes indicate the elements. Their interrelationships in terms of intensity on a Likert scale of 0–10 are shown on the *Z* axis.

The interrelationships are expressed by the term intensity in the Fig. 19.2. The elements having no interrelationship have the intensity values of 0 (zero). Here, for element 2 (information flow) and 6 (interoperability) of the processes, the maximum interrelationship value is 9. This reflects the reality of efficiency of SCs. The interrelationship value between element 2 (information flow) and element 8 (structural flexibility) is 7. This supports the argument that the flow of information across the SC is resulting in the required levels of structural flexibility in the chain. Thus, the intensity gives a vivid representation of the degree of fuzziness among the interrelationships. The intensities of other combinations also can be visualized in Fig. 19.2.

## 19.5 Classification of Elements

Based on the dependence and driving power, the elements under study are subjected to MICMAC analysis (Fig. 19.4; Duperrin and Godet 1973) and classified into four sectors, namely autonomous, dependent, linkage and driver/independent.

From the figure, the sector classification is made and is as follows:

- I Autonomous
- II Dependent

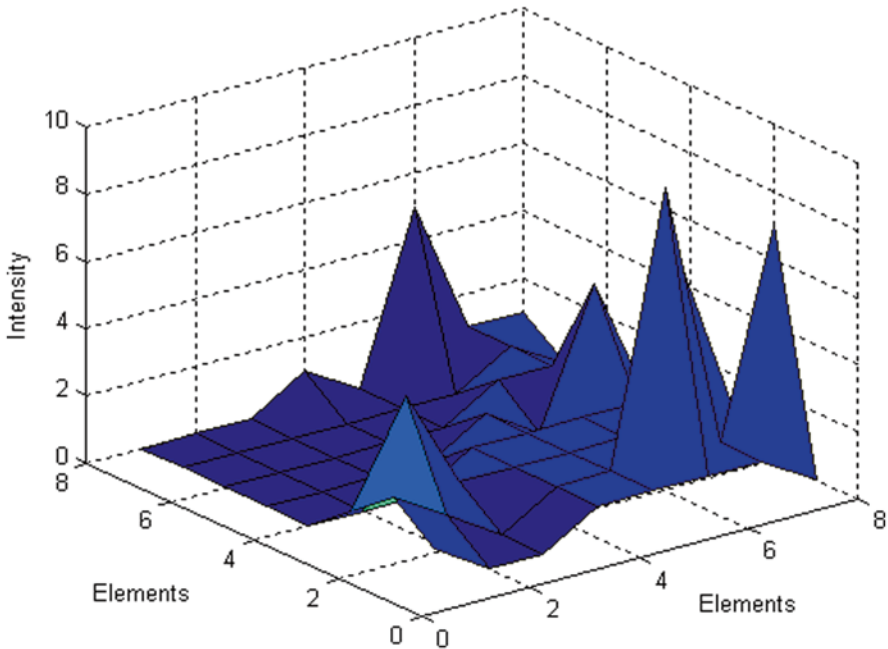


Fig. 19.2 Fuzzy ISM

- III Linkage
- IV Independent (driver)

The autonomous elements have a weak driving power and weak dependence and are relatively disconnected from the system. These elements have few links which may be strong. The dependent elements have weak driving power but strong dependence. The linkage elements on the other hand have strong driving power and dependence. These elements are unstable due to the fact that any action on these elements will affect the other and also have an impact on themselves. The driver or independent variables condition the rest of the system (Mandal and Deshmukh 1994). It is observed that the key variables with strong driving power fall into the category of independent or linkage elements (Ravi and Shankar 2005). The key elements viz., visibility, information flow and information sharing have fallen in the independent sector in the MICMAC analysis and have proven to be the conditioning elements of the rest of the elements. The linkage elements such as ‘access to capacity’ have shown strong driving power and strong dependency on the other elements of the system.

### 19.5.1 MICMAC Analysis Without Considering Fuzziness

The driving power of an inhibitor is the potency of the inhibitor to cause other inhibitors to emerge. In other words, it is the sum of the elements in the row. Dependence

**Fig. 19.3** MICMAC Analysis

	8							
D r i v e r  P o w e r	7	2,3						
	6		IV				III	
	5			1		4		
	4				8			
	3		I			II		
	2					6		
	1					5		7
		1	2	3	4	5	6	7
	Dependence							

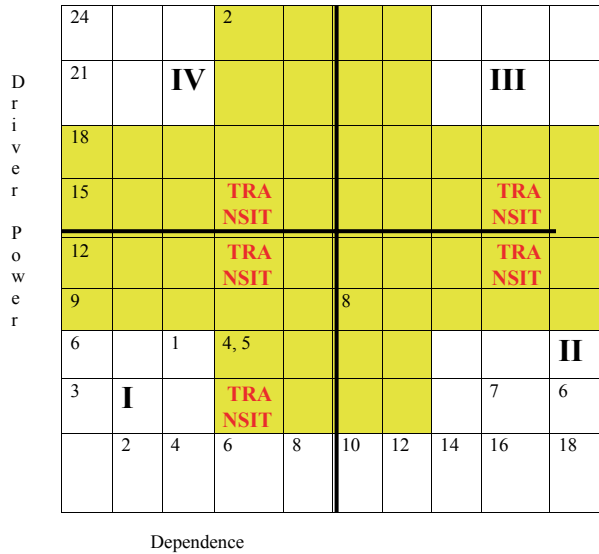
is the measure of of the value to which each variable leads the other variable. It is the sum of the elements in the column. Driving power and dependence of each element without considering fuzziness are shown in Fig. 19.3.

### 19.5.2 Fuzzy MICMAC Analysis

Similar to the previous case, the driving power and dependence of each element considering fuzziness were calculated. Driving power is the arithmetic sum of the row ranks whereas dependence is the arithmetic sum of the column ranks. They are shown in Fig. 19.4. Based on the driving power and dependence, inhibitors have been classified into four clusters. They are (i) autonomous, (ii) dependent, (iii) linkage, and (iv) independent inhibitors (Mandal and Deshmukh 1994). The driving power and dependence of each of these inhibitors is found from Fig. 19.3. Based on that, a Fuzzy driving power-dependence diagram is constructed as shown in Fig. 19.4.

The key elements, viz. information flow has shown highest driving power in the Fuzzy MICMAC analysis while, visibility, access to capacity and access to knowledge and talent have fallen in the Linkage category and proven to be the conditioning elements of the rest of the elements. The elements, viz. structural flexibility, interoperability of processes and network orchestration have shown highest levels of dependence in order, compared to all other elements.

**Fig. 19.4** Fuzzy Driving Power and Dependence Diagram



### 19.5.3 Comparison Between MICMAC and Fuzzy MICMAC Approach

Only binary number-based interrelationships between elements are considered by conventional MICMAC, while the fuzzy set theory is used to increase the former’s sensitivity. In fuzzy MICMAC, an additional input of possible interrelationships between the elements is introduced. The possibility of interrelationships is defined by qualitative consideration on a 1–10 Likert scale. ISM shows the interpretive behaviour of elements influencing the system. However, the degree of interpretiveness is still a question for researchers and practitioners. In this regard, Fuzzy ISM plays a significant role. The MICMAC analysis helps to categorize the elements into four clusters based on driving power and dependence. In Fuzzy MICMAC, a new region named ‘transition region’ also appears. The transition region is due to the influence of fuzziness (Pramod and Banwet 2012). In the present study, elements 2, 3, 4, 5 and 8, i.e. information flow, information sharing, access to capacity, access to knowledge and talent and structural flexibility are in transition region. They will be subjected to higher degree of fuzziness.

### 19.6 Total Interpretive Structural Model (TISM)

Though the ISM model has depicted the importance of structural flexibility in SCs, an attempt has been made to interpret the links in the interpretive structural model, using the tool of interpretive matrix (Sushil 2005b) and the framework and methodology of total interpretive structural modelling (TISM) (Sushil 2012).

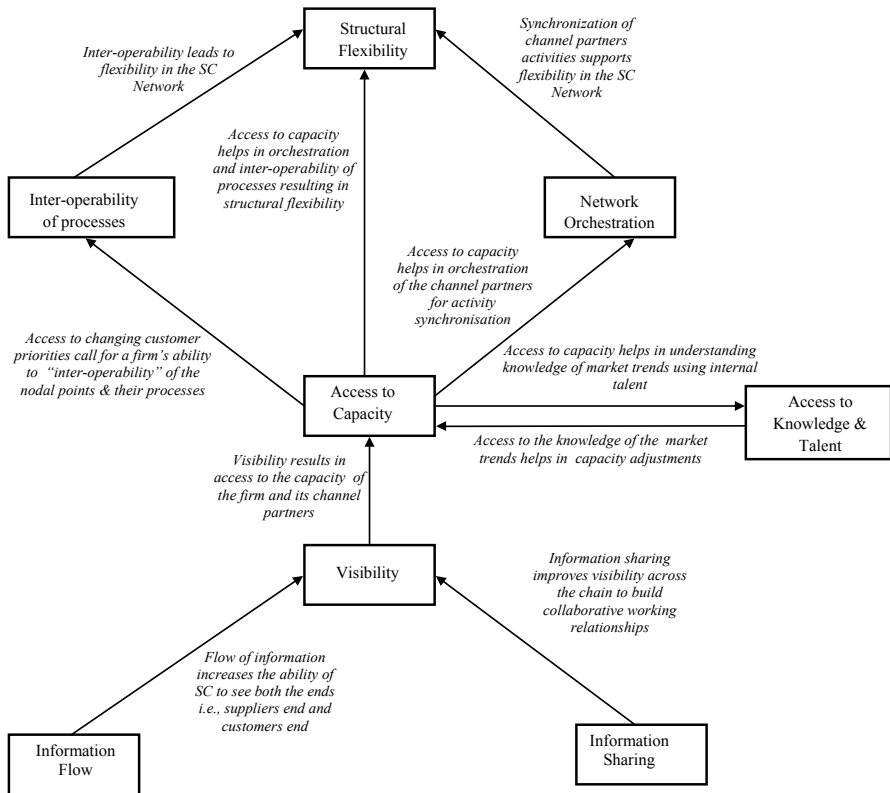


Fig. 19.5 Total interpretive structural model

The framework and methodology of total interpretive structural modelling (TISM) is used to delineate the hierarchical relationships among the enablers of structural flexibility.

The nodes in the ISM model depicted in Fig. 19.2 are supplemented with the interpretation of elements placed in boxes. By the side of respective links in the ISM model, the interpretation in the cells of interpretive direct interaction matrix is described. This completes a total interpretation of the structural model in terms of the interpretation of its nodes as well as links. This is shown in Fig. 19.5.

### 19.7 Results and Discussion

In the present scenario, a paradigm shift has already taken place. The mass production and mass marketing strategies are getting replaced by global customization and one-to-one marketing strategies leading to the concept of extended enterprise systems. These facts are being validated by the structural model that has been

derived from TISM in the present study. The key element of structural flexibility has shown high dependence on the other structural elements. The information sharing among all the verticals of the given firm is the driving power of its SC and helps the firm to cope up with the demand uncertainties. For a given firm, its ability to view end-to-end of its SC (from both ends, i.e. from supplier to customer and back to supply side) is its visibility. According to Christopher (2011), information sharing through the channel of information flow provides a powerful platform for a firm on which it can build collaborative working relationships across its SC. This has been proven by the TISM model.

With the improved visibility, a firm can have an increased access to its capacity and to its knowledge and talent resources. Visibility helps firms to evaluate its capacity in terms of capacity with every channel partner viz., raw material procurement, manufacturing, warehousing, packing, inbound and outbound logistics, marketing, sales and distribution, reverse logistics, etc. Access to the knowledge of the changing market trends and customer priorities is highly essential for a firm to initiate innovation on the product as well as the process using its internal talent. This will help the firm for capacity adjustments thereby resulting dyadic relations between the two. The rapidly changing customer priorities call for a firm's ability to operate multiple SCs to serve for a specific market. This leads to 'inter-operability' of the nodal points representing the various channel partners and their linkages within firm's SC. As several relevant instruments are used in a way to portray any musical aspect such as melody or harmony, the orchestration of the channel partners for activity synchronisation is becoming more essential for a firm for effective SCs. The TISM model has proven that the ability of the firm to access market knowledge and firm's capacity that supports in re-engineering its SC network, orchestrating the channel partners and synchronising the activities across the SC resulting in the structural flexibility, i.e. the ability of SCs to reconfigure its network design in compliance to the rapid changes on both sides of the SCs.

## 19.8 Conclusion

This research analysis pinpoints the impact of various elements on the structural flexibility. By analysing the contributions of various elements to the overall system, and incorporating the fuzziness among the interrelationships, it is possible for the managers to plan their future strategies in a much precise and deterministic manner. The research undertaken in this case revealed that 'Access to capacity' is the most crucial element for which maximum attention has to be focused. Instead of making decision by intrusions and prior judgement, a much better situation can be visualized from this research. Ultimately, this adds to the body of flexibility study with a new insight of strategy which is highly useful to the future researchers in the domain of supply chain management. The findings provide guidelines of importance to the supply chain managers that they should evaluate the identified elements to build flexibility in the structure of their supply chains.



## APPENDIX

### Level partition of Elements

#### Level partition of Elements

<b>Level - 1 :</b>				
Element	Reachability set	Antecedent Set	Intersection	Level
1	1,4,5,6,7	1,2,3	1	
2	1,2,4,5,6,7,8	2	2	
3	1, 3,4,5,6,7,8	3	3	
4	4,5,6,7,8	1,2,3,4,8	4	
5	5,7	1,2,3,4,5	7	
6	6,7	1,2,3,4,6,8	6	
7	7	1,2,3,4,5,6,7,8	7	I
8	4,6,7,8	2,3,4,8	4,8	

<b>Level - 2 :</b>				
Element	Reachability set	Antecedent Set	Intersection	Level
1	1,4,5,6	1,2,3	1	
2	1,2, 4,5,6,8	2	2	
3	1, 3,4,5,6,8	3	3	
4	4,5,6,8	1,2,3,4,8	4	
5	5	1,2,3,4,5	5	II
6	6	1,2,3,4,6,8	6	II
8	4,6,8	2,3,4,8	4,8	

<b>Level - 3 :</b>				
Element	Reachability set	Antecedent Set	Intersection	Level
1	1,4	1,2,3	1	
2	1,2, 4,8	2	2	
3	1,3,4,8	3	3	
4	4,8	1,2,3,4,8	4,8	III
8	4,8	2,3,4,8	4,8	III

<b>Level - 4 :</b>				
Element	Reachability set	Antecedent Set	Intersection	Level
1	1	1,2,3	1	IV
2	1,2	2	2	
3	1,3	3	3	

<b>Level - 5 :</b>				
Element	Reachability set	Antecedent Set	Intersection	Level
2	2	2	2	V
3	3	3	3	V

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# Chapter 20

## TISM-Based Model to Evaluate the Flexibility Index of a Supply Chain

R. K. Singh and P. B. Sharma

### 20.1 Introduction

A supply chain (SC) is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. SCs exist in both service and manufacturing organizations. Figure. 20.1 shows a simple SC for a single product, where raw material is procured from suppliers, transformed into finished goods in a single step, and then transported to distribution centers, and then to retailers and ultimately, to customers. Realistic SCs have multiple end products with shared components, facilities, and capacities. Various modes of transportation may be considered, and the bill of materials for the end items may be both deep and large. The complexity of the chain may vary greatly from industry to industry and firm to firm (Chopra and Meindl 2003). In the globalized economy, the market has become highly uncertain. Requirements of customers are fast changing in terms of cost, quality, and delivery. Therefore, to sustain in such an environment, organizations need to have a flexible SC.

Flexibility is the ability of a system to perform proactive and reactive adaptations of its configuration in order to cope with internal and external uncertainties. Under an uncertain environment, flexible strategies help in sustaining competitiveness (Singh et al. 2005). Upton (1995) defines flexibility as the ability to move from making one product to making another and the ability to perform comparably well when making any product within a specified range. Singh et al. (2013) have considered flexibility as a major competitive weapon for manufacturing organizations operating in increasingly uncertain environments and turbulent markets that

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Flexible Systems Management, DOI 10.1007/978-81-322-2151-7\_20



**Fig. 20.1** A supply chain network

provide organizations with the ability to change levels of production rapidly. The increasing complexity of the value-added processes and the shortening of response times to demand changes are the main causes for having flexibility in SCs (Wilding 1998). A fast response to changing demands is necessary for a competitive advantage in today's markets. Customers expect their needs to be satisfied at the time of their expression. Companies therefore must have quick response times to changing needs, in order to gain or hold market shares (Talluri et al. 2004). Thus, flexibility is necessary to stay in this competitive environment. According to Shimizu and Hitt (2004), organizations need to develop flexibility at the strategic level in order to cope with the external pressure posed by frequent changes in the customer's expectations, changing market trends, and competitor action. The complexity of business processes is increasing as companies attempt to respond to their customers' needs with an increasing number of highly customized products. At the same time, the offered products themselves are becoming increasingly complex. This complexity results from the different embedded technologies. A single company can no longer produce or handle these technologies alone. The general trend of outsourcing and decreasing the vertical range of manufacturers intensifies the need of flexibility.

The objective of this chapter is to identify different attributes of flexibility and develop a structural relationship between them. This chapter is organized as follows. Section 20.2 discusses the literature review. Section 20.3 discusses the research methodology. It is followed by results and discussions and finally, concluding remarks.

## 20.2 Literature Review

In today's scenario, the survival and growth of the organization depend on the competitiveness of the SC. Consumers are highly sophisticated. They demand customized quality products, timely delivery, and low cost. Therefore, in order to compete in this scenario, organizations and their respective SC need to be more flexible. Flexibility reflects the ability of a system to respond rapidly to changes that occur inside and outside the system. Vickery et al. (1999) defined five SC flexibilities, which include product, launch, volume, access, and responsiveness flexibility. They considered flexibility dimensions that directly impact firms' customers and share responsibilities of two or more functions along the SC. Information plays a key role in decision making regarding changes in customers' needs, delivery dates, storage, and transportation (D'Souza and Williams 2000, Duclos et al. 2003, Martinez and

Perez (2005). The promptness and the degree to which the SC changes its speed, destinations, and volumes in response to changes in customer demands gives the benefits of mass customization and positive relationship between each node of the SC (Das and Abdel-Malek 2003, Garavelli 2003, Lummus et al. 2003). Motivation and growth of employees (Efstathiades et al. 2002) and adoption of the total quality management (TQM) culture in the organization leads to better understanding among the workers in the organization thereby developing a sound relationship with the suppliers and distribution personnel. A combination of the entire flexibilities gives rise to SC flexibility. It should be seen as a tool for competitive advantage to the company and gaining success in all areas as well as satisfying customers.

The present study tries to develop a framework for managing the flexibility in the SC. For this, 29 enablers of flexibility in the SC have been identified. For developing the framework, interpretive structural modeling (ISM) has been used. These enablers have been categorized into seven groups. These groups are:

### ***20.2.1 Information Flow Flexibility***

According to Closs et al. (2005), the flow of information (information connectivity) and flexible logistics programs can positively impact the performance of the SC. They have also observed that the overall competitiveness of the SC depends on reducing time to market with the right products. To achieve this, speeding up of the flow of information and expediting logistics activities through the entire SC is extremely important and hence logistics is a key factor in organizational competitiveness (Bhatnagar et al. 1999). Lau and Lee (2000) have described the role of information systems in attaining enhanced responsiveness. Crum et al. (1998) have stated that information exchange between channel members is important for successful supply chain management (SCM) as timely and accurate information is essential for flexibility, responsiveness, and dependability. Parthasarthy and Sethi (1993) have felt that structures that emphasize a high differentiation of task and vertical information flows are incongruent with a commitment to flexibility.

### ***20.2.2 Suppliers' Flexibility***

Mason-Jones et al. (2000) argued that lean manufacturing has triggered organizations to reengineer their supply mechanism to be flexible through the value chain. According to Soon and Udin (2011), the flexibility value can be achieved through extending the manufacturing practices (just-in-time (JIT), efficient and real-time material requirement planning (MRP)) with management support and coordinating collaborative forecast with a network of suppliers. They have also indicated that supplier selection is not based solely on cost but equal consideration needs to be given to the responsiveness of the suppliers to reconfigure supply response without additional cost. By engaging suppliers early in the SC process or product design,

manufacturers can gain cost reduction in material cost, improved material quality, and reduced development time (Paulraj et al. 2008). Gunasekaran et al. (2008) stated that the information technology that connects the suppliers, customers, and organizations provides a platform where all the parties mutually understand and are responsive to each other's needs.

### ***20.2.3 Organizational Flexibility***

Koste and Malhotra (1999) and Lummus et al. (2003) have found that organizational flexibility is mainly associated with the flexibility of the top management. If the organization has a higher logistics flexibility, it will have an opportunity to be more customer-responsive with respect to product delivery (Kumar et al. 2008). Efstathiades et al. (2002) have suggested that motivation and growth of employees with proper training and empowerment are necessary for developing organizational flexibility within the firm. D'Souza and Williams (2000) have also emphasized the development of multiple skills and multiple capabilities of the workforce. Kumar et al. (2008) have observed that a workforce with higher levels of cross-training facilitates more possible job assignment combinations can be made in order to adapt the changing production schedules. Integrated sourcing flexibility in the SCM improves the organization's ability to deliver products and services in a timely and effective manner (Tan et al. 1996). Sourcing flexibility refers to the ability to change sourcing decisions such as the number of suppliers per part and delivery schedule (Kumar et al. 2008).

### ***20.2.4 Production System Flexibility***

The availability of methods such as building smaller production units, cellular manufacturing systems, multipurpose machines, material handling, and workforce agility have been cited as manufacturing flexibility approaches being integrated from the shop floor to the plant level (Koste and Malhotra 1999). If the end products are very sophisticated in terms of technology content and are experiencing a high growth in the market, the intermediate product manufacturers need to design their system with a higher level of flexibility (Kumar et al. 2006).

Seamless coordination between the operation and supply network provides the flexibility to response to different product life cycle, ramp different production ramp-rate and the ability to mix match supplier selection in anticipation of demand changes (Perez and Sanchez 2001). Production system scheduling with enterprise resource planning (ERP) system has been given primary reference with a customized MRP system configured around it to provide flexibility in analyzing the demand-supply and execution strategies. The organizations also need to adopt lean manufacturing techniques in order to reduce cycle time and align their SC by establishing a common goal and reward system (Soon and Udin 2011).

### ***20.2.5 Transportation and Warehousing Flexibility***

Koste and Malhotra (1999) have defined transportation flexibility as the ability of a firm to serve distinct customers' shipping requirements with an acceptable level of quality and at the right time. Kumar et al. (2008) have considered the mode of transportation as the first measure of logistics flexibility. They have observed that the product that can be delivered through multiple modes (i.e., ship, train, plane, etc.) provides more logistics flexibility than the product transported via a single delivery mode. Flexibility in warehousing and storage facilities also seeks importance in SCM. Martinez and Perez (2005) and Garavelli (2003) have considered warehousing flexibility as the ability of a firm to vary its warehouse space according to the changing customer demands and product variety. Changes in overall warehouse locations, distribution of products among the warehouses, transportation network, and mode of transportation impact the SC performance significantly (Kopczak 1997). Baumol and Vinod (1970) have determined a shipper choice of transportation option in a single market and it may be viewed as a cost model that provides the total transportation and inventory cost associated with each transportation option. Buffa and Reynolds (1977) have also developed a transportation model which includes number of transport-related variables.

### ***20.2.6 Product Development and Design Flexibility***

Kumar et al. (2006) have defined product flexibility as the ability of the SC partners to produce a customized product or upgrade existing ones economically and with no additional time to meet customer's specifications. Carter (1986) and Gerwin (1993) suggest that product flexibility allows the company to be responsive to the market by enabling it to bring newly designed products quickly to the market. Schneider and Bowen (1995) have observed that in order to achieve long-term relationships, firms are seeking direct customer contact, collecting customer information, and using this information to design and deliver enhanced products and services.

### ***20.2.7 Flexible SC***

Flexibility has been proved to be a crucial weapon to increase the competitiveness in a volatile market (Upton 1994). Adrian et al. (2007) have described the SC flexibility as operation systems flexibility, market flexibility, logistics flexibility, supply flexibility, organizational flexibility, and information systems flexibility. According to Kumar et al. (2008), flexibility in the SC means to maintain the customer service levels adapting disturbances in supply and sudden changes in demand. Stevenson and Spring (2007) categorized the flexibility on various levels of operations in the SC: operational flexibility (resource and shop floor level), tactical flexibility (plant



level), strategic flexibility (firm level), and SC flexibility (network level). Kumar et al. (2007) reviewed the flexibility perspectives in the global SC and categorized the entire SC into five flexibility perspectives such as product development flexibility, manufacturing flexibility, sourcing flexibility, logistics flexibility, and information systems flexibility. Gupta and Gautam (2002) used the analytic hierarchy process (AHP) to calculate the global weights for the variables of flexibility in the SC.

These groups along with the sub-factors are shown in Table 20.1.

## 20.3 Research Methodology

To develop a structural relationship between different groups of flexibility in the SC, ISM is used, which is upgraded as TISM.

### 20.3.1 *Interpretive Structural Modeling*

ISM is an interactive learning process, which systemizes the different and directly related elements into a structured system (Warfield 1974; Sage 1977). It transforms a complex problem into visible, well-defined models serving the purposes (Sage 1977). It helps in identifying the interrelationships among variables and to impose order and direction on the complexity of the relationships among elements of a system. It is very difficult to handle all the enablers of a complex problem if the number of enablers is large. ISM develops a collective understanding of relationships among the enablers. ISM is a modeling technique in which the specific relationships of the variables and the overall structure of the system under consideration are presented in a digraph model. It is primarily intended as a group learning process, but it can also be used individually. Jharkharia and Shankar (2005) applied ISM for understanding the barriers in IT-enablement of SCs. Singh et al. (2007a, b) applied ISM for improving the competitiveness of small and medium enterprises (SMEs) and for the implementation of advanced manufacturing technologies (AMTs) in firms. The various steps involved in the ISM technique are:

1. Identification of elements, which are relevant to the problem or issues, could be done by any group problem-solving technique.
2. Establishing a contextual relationship between elements with respect to which pairs of elements will be examined.
3. Developing a structural self-interaction matrix (SSIM) of elements indicates pair-wise relationship between elements of the system.
4. Developing a reachability matrix from the SSIM, and then checking the matrix for transitivity. Transitivity of the contextual relation is a basic assumption in ISM which states that if element A is related to B and B is related to C, then A will be necessarily related to C.
5. Partitioning of the reachability matrix into different levels.

**Table 20.1** Enablers of flexibility in supply chain

<i>Suppliers' flexibility</i>	<i>References</i>
Ability to meet changes in volume requirement on short notice	Kumar et al. (2008), Singh et al. (2012), Gunasekaran et al. (2008), Mason-Jones et al. (2000)
Ability to alter the supply of products in line with customers' demand	Duclos et al. (2003), Singh (2011), Soon and Udin (2011)
Ability to change delivery dates of raw materials to the suppliers	Duclos et al. (2003), Paulraj et al. (2008), Kumar et al. (2008), Sumita and Yoshii (2013)
<i>Transportation and warehousing flexibility</i>	<i>References</i>
Ability to serve distinct customers' shipping requirements	Koste and Malhotra (1999), Kumar et al. (2008)
Ability to vary warehouse space	Martinez and Perez (2005), Garavelli (2003), Kopeczak, (1997); Baumol and Vinod (1970)
Ability to vary transportation carriers	Garavelli (2003), Buffa and Reynolds (1977)
<i>Production system flexibility</i>	<i>References</i>
Ability to reconfigure assets (equipments) in line with customer needs	D'Souza and Williams (2000), Koste and Malhotra (1999), Kumar et al. (2006), Perez and Sanchez (2001)
Ability to change processes as demand changes	Das and Abdel-Malek (2003)
Ability to adjust capacity	Das and Abdel-Malek (2003)
Ability to produce parts in different ways	Vickery et al. (1999)
Ability to produce a part by alternate routes through the system	Duclos et al. (2003), Soon and Udin (2011), Martinez and Perez (2005)
Ability to reduce the machine downtime	Lummus et al. (2003)
<i>Organizational flexibility</i>	<i>References</i>
Flexibility of top management	Koste and Malhotra (1999) Lummus et al. (2003)
Motivation and growth of employees	Efstathiades et al. (2002)
Training and empowerment of employees	Efstathiades et al. (2002)
Development of multiple skills and capabilities of workforce	D'Souza and Williams (2000), Tan et al. (1996), Kumar et al. (2008)
Ability to form personal links with other nodes	Duclos et al. (2003)
Cultural flexibility	D'Souza and Williams (2000)
<i>Information flow flexibility</i>	<i>References</i>
Ability to get point-of-sales data	D'Souza and Williams (2000); Closs et al. (2005)
Ability to synchronize information systems with supply chain partners	Duclos et al. (2003), Crum et al. (1998), D'Souza and Williams (2000)
Ability to share information across internal departments	Duclos et al (2003), Parthasarthy and Sethi (1993), D'Souza and Williams (2000), Kumar et al. 2013

**Table 20.1** (continued)

Ability to pass information along the supply chain	Duclos et al (2003), Bhatnagar et al. (1999), Lau and Lee (2000), Martinez and Perez (2005)
<i>Product design and development flexibility</i>	<i>References</i>
Ability to introduce and design new product	Vickery et al. (1999), Carter (1986), Gerwin (1993), Martinez and Perez (2005)
Ability to mass customize	Lummus et al. (2003), Kumar et al. (2006)
Postponement of final product	Martinez and Perez (2005), Schneider and Bowen (1995)
<i>Flexible supply chain</i>	<i>References</i>
Ability to change the volume	Duclos et al. (2003), Upton (1994), Adrian et al. (2007), Martinez and Perez (2005)
Ability to change delivery time	Duclos et al. (2003), Kumar et al. (2008), Stevenson and Spring (2007), D'Souza and Williams (2000)
Ability to change design of product	Martinez and Perez (2005), Kumar et al. (2007), Gupta and Gautam (2002)
Ability to adapt processes to specific products	Duclos et al. (2003)

6. Drawing a digraph based on the relationships given above in the reachability matrix and removing transitive links.
7. Converting the resultant digraph into ISM, by replacing element nodes with statements.
8. Reviewing the ISM model to check for conceptual inconsistency and making the necessary modifications.

The above-described steps, which lead to the development of the ISM model, are discussed below.

### Structural Self-Interaction Matrix

For analyzing the criteria, a relationship of “leads to” is chosen here. For developing contextual relationships among variables, expert opinions based on various management techniques such as brainstorming, nominal group technique, idea engineering, etc. were considered. For expressing the relationship between different critical factors, four symbols have been used to denote the direction of the relationship between the parameters  $i$  and  $j$  (here  $i, j$ ):

1. V: parameter  $i$  will lead to parameter  $j$ .
2. A: parameter  $j$  will lead to parameter  $i$ .
3. X: parameter  $i$  and  $j$  will lead to each other.
4. O: parameters  $i$  and  $j$  are unrelated.

Considering the above notations, SSIM is developed in Table 20.2.

**Table 20.2** Structural self-interaction matrix

S. No.	Factors	1	2	3	4	5	6	7
1	Information flow flexibility		V	V	V	V	V	V
2	Suppliers' flexibility			X	X	V	V	V
3	Organizational flexibility				X	V	V	V
4	Production system flexibility					V	V	V
5	Transportation and warehousing flexibility						O	V
6	Product design and development flexibility							V
7	Flexible supply chain							

**Initial Reachability Matrix**

The SSIM has been converted into a binary matrix, called the initial reachability matrix by substituting V, A, X, and O by 1 and 0 as per the case. The substitution of 1s and 0s are as per the following rules:

1. If the (i, j) entry in the SSIM is V, the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0.
2. If the (i, j) entry in the SSIM is A, the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1.
3. If the (i, j) entry in the SSIM is X, the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1.
4. If the (i, j) entry in the SSIM is O, the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0.

Following the above rules, the initial reachability matrix for the critical success factors is shown in Table 20.3.

**Final Reachability Matrix**

The final reachability matrix is obtained by incorporating the transitivity as enumerated in Step (4) of the ISM methodology. This is shown in Table 20.4. In this, the driving power and dependence of each factor are also shown. The driving power (DP) of a particular factor is the total number of factors (including itself), which it may help achieve, while the dependence is the total number of factors, which may help achieving it. On the basis of driving power and dependencies, these factors will be classified into four groups of autonomous, dependent, linkage, and independent (driver) factors.

**Table 20.3** Initial reachability matrix

S. No.	Factors	1	2	3	4	5	6	7
1	Information flow flexibility	1	1	1	1	1	1	1
2	Suppliers' flexibility	0	1	1	1	1	1	1
3	Organizational flexibility	0	1	1	1	1	1	1
4	Production system flexibility	0	1	1	1	1	1	1
5	Transportation and warehousing flexibility	0	0	0	0	1	0	1
6	Product design and development flexibility	0	0	0	0	0	1	1
7	Flexible supply chain	0	0	0	0	0	0	1

**Table 20.4** Final reachability matrix

S. No.	Factors	1	2	3	4	5	6	7	D. P.
1	Information flow flexibility	1	1	1	1	1	1	1	7
2	Suppliers' flexibility	0	1	1	1	1	1	1	6
3	Organizational flexibility	0	1	1	1	1	1	1	6
4	Production system flexibility	0	1	1	1	1	1	1	6
5	Transportation and warehousing flexibility	0	0	0	0	1	0	1	2
6	Product design and development flexibility	0	0	0	0	0	1	1	2
7	Flexible supply chain	0	0	0	0	0	0	1	1
	Dependence	1	4	4	4	5	5	7	

### Level Partitions

From the final reachability matrix, the reachability and antecedent sets for each factor are found. The reachability set consists of the element itself and other elements to which it may help achieve, whereas the antecedent set consists of the element itself and the other elements which may help achieving it. Then, the intersection of these sets is derived for all elements. The element for which the reachability and intersection sets are same is the top-level element in the ISM hierarchy. The top-level element of the hierarchy would not help achieve any other element above their own. Once the top-level element is identified, it is separated out from the other elements. Then by the same process, the next level of elements is found. These identified levels help in building the digraph and final model. From Table 20.5, it is seen that the performance improvement is found at level I. Thus, it would be positioned at the top of the ISM hierarchy. This iteration is repeated till the levels of each factor are found out (Tables 20.5–20.8).

**Table 20.5** Iteration 1

Factors	Reachability set	Antecedent set	Intersection set	Level
1	1, 2, 3, 4, 5, 6, 7	1	1	
2	2, 3, 4, 5, 6, 7	1, 2, 3, 4	2, 3, 4	
3	2, 3, 4, 5, 6, 7	1, 2, 3, 4	2, 3, 4	
4	2, 3, 4, 5, 6, 7	1, 2, 3, 4	2, 3, 4	
5	5, 7	1, 2, 3, 4, 5	5	
6	6, 7	1, 2, 3, 4, 6	6	
7	7	1, 2, 3, 4, 5, 6, 7	7	

**Table 20.6** Iteration 2

Factors	Reachability set	Antecedent set	Intersection set	Level
1	1, 2, 3, 4, 5, 6	1	1	
2	2, 3, 4, 5, 6	1, 2, 3, 4	2, 3, 4	
3	2, 3, 4, 5, 6	1, 2, 3, 4	2, 3, 4	
4	2, 3, 4, 5, 6	1, 2, 3, 4	2, 3, 4	
5	5	1, 2, 3, 4, 5	5	<i>II</i>
6	6	1, 2, 3, 4, 6	6	<i>II</i>

**Classification of Factors**

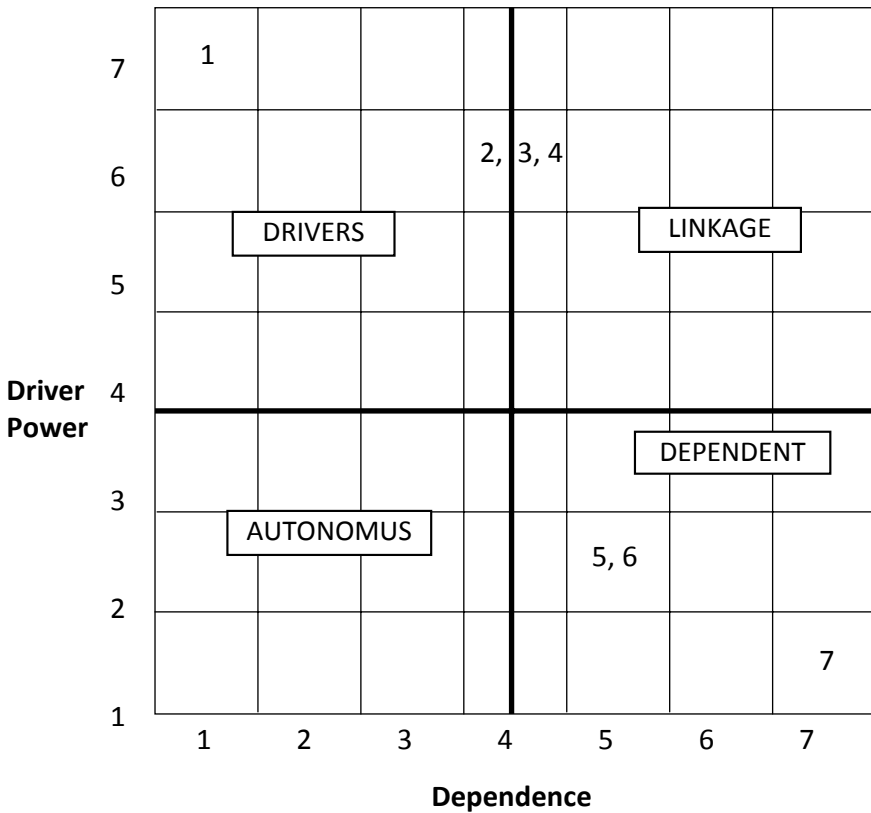
In this section, the critical success factors described earlier are classified into four clusters (Fig. 20.2). This classification is similar to that made by Mandal and Deshmukh (1994). The first cluster consists of the “autonomous factors” that have a weak driving power and weak dependence. These factors are relatively disconnected from the system, with which they have only few links, which may not be strong. The “dependent factors” constitute the second cluster which has a weak driving power but strong dependence. The third cluster has the “linkage factors” that have strong driving power and strong dependence. These factors are unstable due to the fact that any change occurring to them will have an effect on others and also a feedback on themselves. The fourth cluster includes the “independent factors” which have a strong driving power but weak dependence. The driving power and dependence of each of these factors are shown in Table 20.4. In this table, an entry of “1” added along the columns and rows indicates the dependence and driving power, respectively. Subsequently, the driver power-dependence diagram is constructed as shown in Fig. 20.2. For illustration, the factor five having a driving power of 2 and dependence 5 is positioned at a place corresponding to driving power of 2 and dependency of 5 in Fig. 20.2. Similarly, all other factors considered in this study are positioned on different quadrants depending on their driving power and dependency.

**Table 20.7** Iteration 3

Factors	Reachability set	Antecedent set	Intersection set	Level
1	1, 2, 3, 4	1	1	
2	2, 3, 4	1, 2, 3, 4	2, 3, 4	III
3	2, 3, 4	1, 2, 3, 4	2, 3, 4	III
4	2, 3, 4	1, 2, 3, 4	2, 3, 4	III

**Table 20.8** Iteration 4

Factors	Reachability set	Antecedent set	Intersection set	Level
1	I	1	I	IV



**Fig. 20.2** Driving power and dependence diagram

### 20.3.2 Formation of a Total Interpretive Structural Model

From the final reachability matrix (Table 20.4), the structural model is generated by means of vertices or nodes and lines of edges. If there is a relationship between

the flexibility factors  $i$  and  $j$ , this is shown by an arrow which points from  $i$  to  $j$ . This graph is called a directed graph or digraph. After removing the transitivities as described in the ISM methodology, the digraph is finally converted into a total interpretive structural model (TISM). The connective and interpretive information contained in the interpretive direct interaction matrix and digraph is used to derive TISM (Sushil 2012). The nodes in the digraph 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 respective links in the structural model. This leads to a total interpretation of the structural model in terms of the interpretation of its nodes as well as links as shown in Fig. 20.3.

Some of the observations based on this analysis are:

1. The driver power-dependence matrix shows that there is no autonomous factor for flexibility in the SC.
2. Information flow flexibility has a strong driving power and is capable of leading the organization to achieve the desired objective independently.
3. Suppliers' flexibility, organizational flexibility, and production system flexibility have a strong driving power and medium dependence. Thus, they also act as drivers next to information flow flexibility. They are categorized as linkage variables.
4. Dependence increases as we move from transportation and warehousing flexibility to product design and development flexibility till flexible SC. A flexible SC has the highest dependence and represents the ultimate goal to be achieved in the SC.

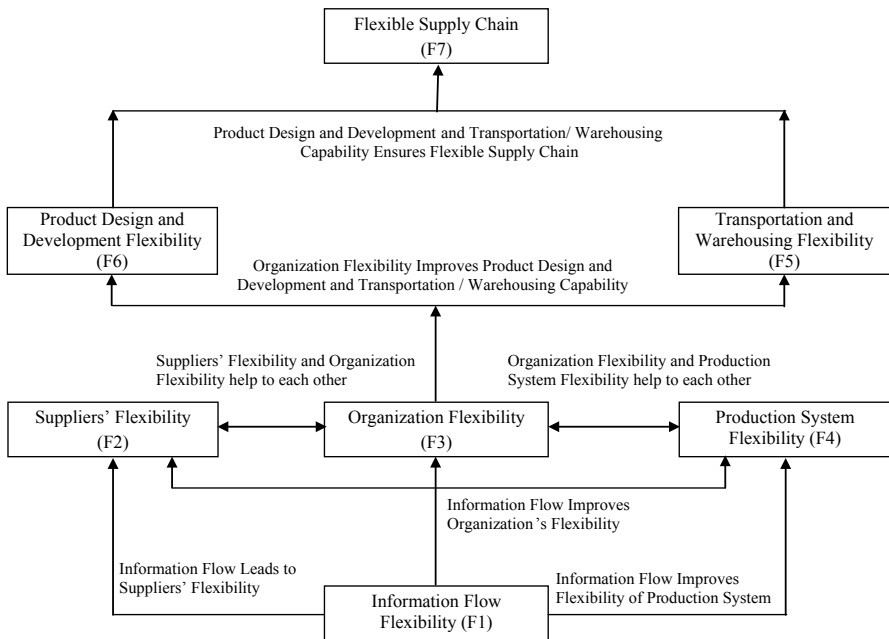


Fig. 20.3 Total interpretive structural model (TISM) for enablers of supply chain flexibility



## 20.4 Model for Evaluating the Flexibility Index of SC

Based on interaction from experts and the literature review, different factors have been identified for evaluating the flexibility index of the SC. These factors have been grouped into seven areas/issues (Table 20.9). These are suppliers' flexibility, transportation and warehousing flexibility, production system flexibility, organizational flexibility, information flow flexibility, product design and development flexibility, and measures for flexible SC. The framework of Cleveland et al. (1989) for production competence is extended to compute the SC flexibility index. Singh (2011) has used this framework to evaluate the competitiveness/coordination index of a medium-scale organization. On the basis of the Cleveland et al. (1989) model and competitiveness index model, the SC flexibility index can be given as:

$$S_{\text{Flexibility}} = \sum \{W_i \log K_i\},$$

where  $S_{\text{flexibility}}$  is the SC flexibility index for a the given SC,  $i$  is the SCM issue ( $i=1$  to 7),  $R$  is the rank of the SCM issue,  $K_i$  is the inverse rank (if  $R=1$ ,  $K=7$ , when  $i=7$ , if  $R=2$ ,  $K=6$ ), and  $W_i$  is the weight assigned to a particular SCM issue.

For assigning the weight to different issues of flexible SC, the highest and lowest values of a five-point Likert scale, i.e., 5 and 1 are mapped 100 and 0%, respectively. For each of the seven issues of flexible SC, a weight is assigned. The criteria for weight ( $W_i$ ) is as under:

$W_i = +1$  (strength), when percentage score  $> 60\%$  (mean value  $> 3$ );  $W_i = 0$  (neutral), when percentage score is between 40 and 60% (mean value between 2 and 3); and  $W_i = -1$  (weakness), when percentage score  $< 40\%$  (mean value  $< 2$ ).

For illustration, an example of computation of weight is given below. Say, the mean score for a flexible SCM issue = 4.2 on a scale of 1 to 5. Using a two-point equation, the percentage may be calculated, i.e.,  $4.2/5 = 84\%$ ; therefore, it is assigned a weight of +1.

The computation of the SC flexibility index of Alpha Ltd. is illustrated with the help of a worksheet as shown in Table 20.10. First of all, key items of different issues of the flexible SC framework are graded in the Likert scale of 1–5 (1, very low; 5, very high). The mean for a particular issue is calculated after taking the average of scores for all its key items. After this rank, the inverse rank and weight for each issue is decided. The sum of the entries of the last column ( $W_i \log K_i$ ) will give the SC flexibility index of Alpha Ltd. On the basis of the score, the organization can visualize its position in the industry/sector and identify gaps with respect to market leaders. It can also help in strengths, weaknesses, opportunities, and threats (SWOT) analysis of organization.

**Table 20.9** Score on flexibility measures for Alpha Ltd.

Flexibility attributes	Rating in scale of 1–5	Mean value
<i>Suppliers' flexibility</i>		3.67
Ability to meet changes in volume requirement on short notice	4	
Ability to alter the supply of products in line with customers' demand	4	
Ability to change delivery dates of raw materials to the suppliers	3	
<i>Transportation and warehousing flexibility</i>		2.33
Ability to serve distinct customers' shipping requirements	3	
Ability to vary warehouse space	2	
Ability to vary transportation carriers	2	
<i>Production system flexibility</i>		4.00
Ability to reconfigure assets (equipments) in line with customer needs	5	
Ability to change processes as demand changes	4	
Ability to adjust capacity	3	
Ability to produce parts in different ways	4	
Ability to produce a part by alternate routes through the system	4	
Ability to reduce the machine downtime	4	
<i>Organizational flexibility</i>		4.67
Flexibility of top management	5	
Motivation and growth of employees	5	
Training and empowerment of employees	5	
Development of multiple skills and capabilities of workforce	5	
Ability to form personal links with other nodes	4	
Cultural flexibility	4	
<i>Information flow flexibility</i>		4.5
Ability to get point of sales data	4	
Ability to synchronize information systems with supply chain partners	4	
Ability to share information across internal departments	5	
Ability to pass information along the supply chain	5	
<i>Product design and development flexibility</i>		3.33
Ability to introduce and design new product	4	
Ability to mass customize	3	
Postponement of final product	3	
<i>Measures for flexible supply chain</i>		3.50
Ability to change the volume	4	
Ability to change delivery time	3	
Ability to change design of product	3	
Ability to adapt processes to specific products	4	

**Table 20.10** Illustration for SC flexibility index of AB Ltd.

Sr. No.	Factors of coordination	Mean	Rank	Inverse rank ( $K_i$ )	Log $K_i$	Weight ( $W_i$ )	$W_i \log K_i$
1	Suppliers' flexibility	3.67	4	4	0.60	+1	0.60
2	Transportation and warehousing flexibility	2.33	7	1	0.00	0.00	0.00
3	Production system flexibility	4.00	3	5	0.70	+1	0.70
4	Organizational flexibility	4.67	1	7	0.85	+1	0.85
5	Information flow flexibility	4.50	2	6	0.78	+1	0.78
6	Product design and development flexibility	3.33	6	2	0.30	+1	0.30
7	Measures for flexible SC	3.50	5	3	0.48	+1	0.48

$$SC \text{ flexibility index} = S_{\text{Flexibility}} = \sum \{W_i \log K_i\} = 3.71$$

SC supply chain

### 20.4.1 Case Illustration of the Model

For Illustrating the Use of this Model a Two-Wheeler-Manufacturing Company Has Been Considered

#### Background of the Case Company

Alpha Ltd. (name changed) is the world's largest manufacturer of two-wheelers, based in India. In 2001, the company achieved the coveted position of being the largest two-wheeler-manufacturing company in India and the "World No.1" two-wheeler company in terms of unit volume sales in a calendar year by a single company. Alpha Ltd. has retained that coveted position till date. Alpha Ltd. has sold more than 15 million motorcycles and has consistently shown a double-digit growth since its inception.

Alpha Ltd. bikes are manufactured across three globally benchmarked manufacturing facilities. Two of these are based at Gurgaon and Dharuhera, which are located in the state of Haryana in northern India. The third and the latest manufacturing plant is based at Haridwar, in the hill state of Uttarakhand.

In 2010–2011, the total unit sales were 4,600,130 two-wheelers with a growth of 23.6%, the total net operating income was 158,600 million INR with a growth of 28.1%, and the net profit after tax was 22,310 million INR with a growth of 74.1%.

The key strategy of Alpha Ltd. has been driven by innovation in every sphere of activity, i.e., building a robust product portfolio across categories, exploring new

markets, aggressively expanding the network, and continuing to invest in brand-building activities. In the 1980s, Alpha Ltd. pioneered the introduction of fuel-efficient, environment-friendly, four-stroke motorcycles in the country. Today, it continues to be a technology pioneer. It became the first company to launch the fuel injection (FI) technology in Indian motorcycles, with the launch of the Glamour FI in June 2006. The Alpha Ltd. product range includes a variety of motorcycles that have set the industry standards across all the market segments. The company also started manufacturing scooters in 2006.

The company's growth in the two-wheeler market in India is the result of an intrinsic ability to increase reach in new geographies and growth markets. The extensive sales and service network of Alpha Ltd. now spans close to 4500 customer touch points. These comprise a mix of authorized dealerships, service and spare part outlets, and dealer-appointed outlets across the country. The company has been continuously investing in brand building not only utilizing the new product launch and new campaign launch opportunities but also through innovative marketing initiatives revolving around cricket, entertainment, and ground-level activation. The quality policy of the company is "We are committed at all levels to achieve high quality in whatever we do, particularly in our products and services which will meet and exceed customer's growing aspirations through, innovation in products processes and services, continuous improvement in our TQM systems, teamwork, and responsibility."

### **SC Flexibility Index for Alpha Ltd.**

Alpha Ltd. is aggressively trying to make its SC flexible. In this regard, this organization has taken multiple initiatives. To evaluate the flexibility index of its SC, different attributes of SC flexibility were rated in a Likert scale of 5. These are shown in Table 20.9. The above-discussed model was applied to evaluate the flexibility index as shown in Table 20.10. The overall SC flexibility index for Alpha Ltd. was found equal to 3.71. Based on these results, it is observed that Alpha Ltd. needs to improve its performance in terms of transportation and warehousing flexibility as well as in terms of product design and development flexibility. This model can also be used to compare the flexibility index of two SCs. It can also be useful to do SWOT analysis of a given SC for taking different initiatives to improve its flexibility.

## **20.5 Conclusion**

In today's scenario, the demand of the customer changes very rapidly, and there are lots of complexities in the products. Also, the competition is very high. So, in order to survive, flexibility is necessary in the SCs, which allows them to adapt to market uncertainties. This chapter has identified important enablers of flexibility

in the SC. These enablers are categorized into seven flexibility subgroups and the ISM approach has been applied to develop a structural relationship between these groups for managing flexibility in the SC. Information flow flexibility has emerged as major driving force for flexibility in the SC. It implies that an organization should focus on generating accurate information and its availability at the right time. Based on this model, further a framework is suggested to evaluate the flexibility index of the SC. Based on this framework, any organization can evaluate its SC flexibility index. It can be also used for SWOT analysis and strategy development. ISM has some limitations such as the interpretation of links being partial, thereby exposing the mode of multiple interpretations by the user. To overcome such limitations, TISM has been used.

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# Chapter 21

## Decision Modeling Approach for Eco-Driven Flexible Green Supply Chain

Jitendra Madaan and Sachin Mangla

### 21.1 Introduction

Sustainability and going green with flexibility are not the terms that managers can avoid any longer. For years, environmental responsibility has been increasing in importance not only with managers but also with consumers who become more aware, as well as with other stakeholders affected by unsustainable business. Due to environmental consideration, green supply chain (GSC) proves to be an attractive area for researchers and the growth in this green supply chain management (GSCM) literature extends back to the early 1990s with the advent of corporate environmental issue and environmentally focused manufacturing policies, i.e., “environment concern.” In the mean time, many researchers have explained the application and importance of GSCs in various manners. Wang et al. (2004) demonstrated its importance in reducing and limiting carbon emissions and waste by closing the loop of a supply chain. Also, the sustainability of GSC is increasingly recognized as a vital component of corporate perspective and it is explained as an art to manage environmental, social, and economic aspects and the encouragement of good governance practices in a supply chain (Linton et al. 2007). With growing awareness, environment is becoming a major concern in GSC (Zhu and Zhao 2004; Srivastava 2007). Moreover, GSC organization consisted of several departments within the

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structure that work together closely to fulfill the needs of consumers and the maximization of productivity (Vachon and Klassen 2006). With increasing attentions of preserving natural resources worldwide, the green trend of going with sustainability and protecting the environment is overwhelming, thereby exerting pressure on corporations in the world. Today, in highly competitive (mature) markets, supply chain management (SCM) plays a very important role for firm's growth, and we have recently seen also in performance downturns. In today's market place, liberalization and globalization together with the changing demand of the consumer are the crucial drivers for the growing competition. Giannoccaro et al. (2003) demonstrated that several aspects of "flexible" GSCs encompass with changing market demand, differing supplier lead time, product quality, and information delay are the sources of uncertainty that create a need for building environment-focused system and preferably in a better way than their rivals.

In today's manufacturing climate, the organizations are trying hard to reduce wastage and are moving towards quick responsive supply chains to increase their performance. Also, because of government legislation, the potential for recovering economic value and consumer demand for green practices, the producers are being compelled to incorporate flexibility and reverse logistics into their supply chains. The pressure and drive accompanying globalization, a crucial aspect for supply chains, has prompted and motivated the enterprises to improve their environmental performance (Zhu and Sarkis 2006). According to Wadhwa et al. (2009), as a result of rapid progress in technology and the shrinking of product life cycles faster than ever before, it has led to a creeping realization of additional profits by performing the effective and efficient product recovery operations at a world-class level quintessential. Further, with the advent of rules and various regulations, due to pressure and changing customers' taste, the corporations have shown greater concern for the environment over the past few years (Sheu et al. 2004). Besides globalization, the localization pressure also plays significant role in improving their environmental performances (Sarkis and Tamarkin 2005). Madu et al. (2002) emphasized that environmental concern should be a part of the overall corporation culture to incorporate economic performance into the preplanning of strategies. Further, for any organization, the environmental issues become crucial these days but at the same time flexibility and cost aspects associated with GSC should be examined. Srivastava (2007) explained the application of green principles in many departments within organization, including supply chain. This idea covers every stage in manufacturing from the first to the last stage of life cycle, i.e., from product design to recycle and the emphasis on environmental concern. In this chapter, we focus on the interaction of flexibility and green, i.e., environmental perspective in a supply chain that led to a sustainable behavior with the consideration of environmental pressures.

### ***21.1.1 Motivation***

The aim of this chapter is to research the environmental pressure-driven flexible GSC and its implications. In an early environmental management literature,

operating managers and executives were involved only at limited extent. There was a need of separate organizational units in product development, process design, operations, logistics, marketing, regulatory compliance, and waste management to excel and ensure the environmental achievements. Today, this has changed. Moreover, the quality revolution of the 1980s and the supply chain revolution of the 1990s suggest that the integration of environmental perspective and flexibility of the system with ongoing process proved to be the best practices for sustainability and economic growth for an organization.

Current market nature and demand behavior already emphasized the need for flexibility and green perspective in their supply chain practices. The possibility to respond to short-term fluctuations in demand or supply situations of other external disturbances together with the adjustment to, operational, strategic, and structural changes in the behavior of the supply channel considering environmental pressures can be termed as the flexibility in GSCs. But substantial research reviews are still required to incorporate flexibility with a motto to improve the productivity of GSCs. Further, we concentrate on what has already happened in this field and what marks can be defined for further research, considering the recent practices in GSCM. In order to fill the research gap as stated above, we collected a wide variety of the literature, trying to analyze the issues from a broad perspective. This chapter investigates the current situation of developing flexible GSCs. Our target objectives are to study and integrate green flexibility in a supply chain, which can handle environmental pressures and respond to demand quickly. We also use impact wheel diagram to study the problem systematically and further rank the various criterion associated with a flexible GSC using analytical hierarchy process (AHP) method. In addition, we figure out certain critical aspects that should be improved in carrying out flexible GSCs and highlight some valuable remarks.

The following sections of this chapter are characterized as follows: GSCM, GSC—their importance—implementation, and the term “flexibility”—its interaction with green supply and its importance—are explained in Sect. 21.2. Impact wheel diagram illustration under a tool and cognitive mapping along with a multicriteria decision making technique (MCDM; AHP method, IRP) to rank the various parameters/criteria are demonstrated in Sect. 21.3. Results are given in Sect. 21.4 and discussion, conclusions, and the scope for future work are given in Sect. 21.5.

## 21.2 Green Supply Chain Management

In an era of competition, environmental awareness and sustainability regulations have been putting pressure on many producers and consumers, to produce such products which can be disposed of easily. Hervani et al. (2005) sketched GSCM in the form of an equation. They demonstrated that reverse logistics is a major component of GSCM as it turns a forward supply chain into reverse after closing its loop:

$$\text{GSCM} = \text{green purchasing} + \text{green manufacturing} + \text{green distribution} \\ + \text{reverse logistics.}$$

Although general agreement about the definition has not been reached, academic authors however do realize that environmental standards in supply chains are important and greening the four aspects mentioned above is an absolute necessity to stay competitive. For enterprises, environmental management can be regarded as a start of sustainability development. Pressures from government and customers lead corporations to adopt environmental management, which mainly aims to reduce environment pollutions and cut natural resources consumptions. It is essential for the companies to add sustainability into their strategy level, since it helps to gain and maintain competitive advantage. Nevertheless, one thing that should be emphasized is the sustainable strategy should be consistent with the organizations' business goals, because putting sustainability into practice is more likely to change the internal structure. On the one hand, sustainability initiatives of a firm and its corporate tactics always overlap and interact with each other (Srivastava 1995). It is impossible to manage one of them separately. On the other hand, fundamental changes in core business processes are required when company transfers the sustainable strategies into practice. Savitz and Weber (2006) argued that when firms choose to become sustainable enterprises, they are able to integrate corporate governance mechanism with sustainability initiatives. In fact, the priority of a firm is profit maximization, whereas some supply initiatives may hurt the goal. To better achieve sustainability and with emphasizes on minimizing environmental influences, there are a series of articles that refer to GSCM. Srivastava (2007) gave most widely used definition of GSCs, i.e., "integrating environmental thinking into supply chain management, including product design, material selection, manufacturing and processes, delivery of the final product to the consumers (distribution processes) as well as end-of-life management of the product after its useful life." It focuses on conserving energy and preventing disposal of dangerous materials into the environment by eliminating or minimizing the wastes within the industrial system (Bansal and Roth 2000; Shalishali et al. 2009).

The word "green" stands for go, i.e., sustainable but not on the account of compromise with environmental loss, social aspects, performance issue, and economy. GSCs differ significantly from traditional supply chain, and for today, managers need to make use of this term and facilitate in their organization and should take appropriate steps when carrying it out. Generally, green confines wastes generated by the procedures along with the supply chains. It is a practical approach for a company to be sustainable and it is obvious that GSC is more concerned on environmental issues. Shalishali et al. (2009) highlighted the various aspects to differentiate GSC from traditional supply chain. Those differences can be divided into five perspectives: the objectives and values, the scope, supplier selection criteria, cost pressure and prices, and speed and flexibility as shown in Table 21.1. Furthermore, Mangla et al. (2012) state that the life cycle design seeks to maximize the life cycle value of a product at the early stages of the design, while minimizing the cost and environmental impact can be achieved by incorporating GSC. GSCM proves to be highly profitable along with concentrating on environment perspective (Srivastava 2007). Moreover, companies also understand the economic benefits such as value maximization and competitive edge via applying GSCs.

**Table 21.1** Difference between traditional and green supply chains

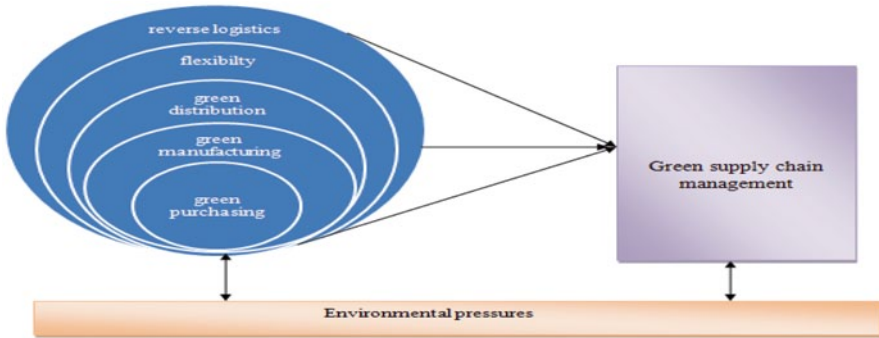
Aspects	Traditional supply chains	Green supply chains
Objectives and values	Economic motivations—control of final products	Ecological causes—production process
Scope	Merely consider human toxicological effect	Pay attention to environment
Supplier selection criteria	Price is the key factor—easily switch suppliers	Consider ecological perspectives of suppliers—long-term relationships
Cost pressure and prices	Low price	High price
Speed and flexibility	High	Low

However, GSCM might result in slightly improved environmental and operational performance, but it has not resulted in significant improvement in economic performance (Zhu et al. 2008). It illustrates that GSC is a long-term investment and results some promising benefits in future.

### 21.2.1 *Various Aspects of Implementation of GSCM Practices*

There are various drives or pressures upon companies to implement GSCM. Zhu and Sarkis (2006) listed some of them as regulations, marketing, suppliers, competitors, and internal factors. The demands of regulations cannot solely be a cause of environmental protection because consumers and clients also pressurize respective organizations (Hall 2000). Further, Sarkis (1998) explains that regulations, standards, policies, and competition have together helped organizations to better understand the consequences for the environment. On the other hand, the organizational, regulatory, community, and media stakeholders have helped companies to study and analyze environmental management effectively (Henriques and Sadorsky 1996). According to Sarkis (1998), Hall (2000), and Zhu and Sarkis (2006), external stakeholders and environmental regulations consider the significant factors that affect GSCM practices.

Here, in this work, we focus on some significant components of a multidimensional decision environment that a management faces. Given among the various components are the influences and relationships of the product life cycle, green operational life cycle, and environmentally focused regulations driven by environment pressures and organizational performance measurements. These elements act as the basis for a decision framework for prioritizing systems by the organization that will aid in managing flexibility in GSCs. Also, environmental pressure drives the GSC, and the relationships between green purchasing, green manufacturing, green distribution, flexibility, reverse logistics, and economic performance will be discussed through the literature review, and the hypotheses relating to these variables will be developed as shown in Fig. 21.1.



**Fig. 21.1** Research framework of GSCM practices

### ***21.2.2 Influence of Product Life Cycle***

The life cycle of the product(s) is considered as an important factor that influences the management of a supply chain in an organization. This typical product life cycle is composed of four phases: an introduction phase, which is defined as the investment in product research and development, a growth phase includes the increase in production capacity and logistics network of product, a maturity phase is characterized by the implementation of the process and cost-efficiencies, and finally, a decline phase, which is characterized by the divestment of the product. The product life cycle phase will necessarily affect the greening and flexibility in supply chains.

### ***21.2.3 The Green Operational Life Cycle***

The operational life cycle provides a strategic set of organizational components that will show how the supply chain is to be managed within an organization. Green purchasing, green production, green distribution, flexibility, and reverse logistics are being stated as the major elements of the operational life cycle. The purchasing of materials that are easily disposed, recyclable, or reusable or have already been recycled will affect the GSC considerably. The vendor's selection will also be a crucial decision at this stage. Vendors who carrying ISO 14000 certification may be preferred, because the environmental risks associated with these vendors will be less. The greening of the supply chain is greatly affected by the production processes and can be demonstrated: capability of a process to use certain materials to integrate remanufactured/recycled or reusable elements into the system, and how well the processes are designed and planned to minimize the wastage. The distribution of a product to the distributors and transportation channels will also significantly affect the GSC. This includes a number of decisions including number and locations of distribution centers, possible mode of transportation, control

systems, and just-in-time inventory policies; these influence not only the forward channel but also the reverse channel. Flexibility in supply chains may be stated as the characteristic to respond to short-term fluctuations in demand or supply pattern along with the managing strategic and structural changes in the environment of the supply chain. It is recommended that flexibility enables a supply chain to react on changing customer demand. Last but not least, the reverse logistics operation is probably the least developed and studied from the operational functions' perspective. Tibben-Lembke and Rogers (2002) defined the reverse logistics as "the process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal." Reverse logistics include various activities such as returning the products to suppliers, reselling, selling via outlet, reconditioning, etc. Further, Pohlen and Farris (1992) identified a number of stages within a reverse logistics network, i.e., collection, separation, densification, transitional processing, delivery, and integration. They explain that along with the network for the reverse logistics collection process, a number of systems and processes may need to exist for the stages in the reverse channel. Moreover, the requirements may vary among the stages as per the type of product, organization, and industry.

#### ***21.2.4 Various Aspects Involved in Implementation of Green Supply Chain Management***

Considering why firms apply GSCs, a series of studies argue that environmental policies and regulation are major drivers that contribute to implementation of GSCs and impel to conduct GSCs into practice at the same time. Legitimation reflects the inclination of a company to enhance their actions under the instruction of certain regulations, norms, values, or beliefs (Suchman 1995). According to Bansal and Roth (2000), corporations that regard regulations as one of their incentives often set up environmental policies in order to comply with environmental regulations. For instance, taking those regulations into consideration, firms began to notice the importance of cooperation with suppliers in order to satisfy environmental requirements. Moreover, for firms that pay special attention to legitimation, stakeholders are more influential in stressing legitimacy concerns. These environmental concentrated legislation or campaigns play a crucial role in managing solid waste and therefore affect the fraction of used products that are properly collected and handled. Within a supply chain, these influences may affect directly or indirectly, yet the consideration of a take-back obligation for the original manufacturers or the merchandisers is said to be direct. On the other hand, an indirect influence may be in the form of penalty for each uncontrollably disposed product, i.e., take-back fee included in the price of the product, which is to be paid back when the product is returned to a proper collection point.

Environmental pressures directly drive GSCM as shown in Fig. 21.1. Traditionally, external systems impact a lot on the decisions and behavior of an organization; various elements within external systems are regulations, professional standards,

the law, interest organization, and social belief (Oliver 1991). Meyer et al. (1987) explained the effects of external pressures on organizational structure. In this chapter, we examine the effect of environmental consideration in a flexible GSC and various elements studied under the environmental regulations stated as domestic environmental regulations, government environmental policies, and international environmental agreements according to Sarkis (1998), Hall (2000), and Zhu and Sarkis (2006). Further, these elements considered under environmental rules and regulations are explained as follows:

*Domestic Environmental Regulations* This is a very important element under environmental pressure and the national/domestic law can be defined as a legal system applicable to a defined territory over which a sovereign power has jurisdiction. These domestic or national environmental regulations and laws prompt organizations to adopt relevant strategies and methods to enhance their productivity and environmental performance. Zhu and Sarkis (2006) found out that for an organization, stated domestic regulations and corporations environmental missions acted as important driving pressures. Furthermore, Handfield et al. (1997) explained the importance of government regulations for a corporation and described this major driver to increase environmental awareness among them.

*The Role of Government and Various Agencies* In order to create competitive markets and protect the environment, government implementation and enforcement of domestic rules and regulations play an important role for safeguarding individual rights. There are many countries around the world that have laws focusing on these environmental issues, but due to the lack of resources and an inadequate institutional infrastructure some countries cannot effectively execute these laws. The only long-term solution to such barriers is for governments to create a healthy environment for investment-led domestic growth that will provide the necessary resource base to initiate and implement the law on all companies. Hui et al. (2001) explain that environmental conscience is increasing among the masses, and for company's perspective, the statutory requirements due to government rules and regulations and various other pressures from different groups are traditionally considered to be important drivers toward adopting a green implementation policy. These government regulations and standards have a very significant impact on the GSCM practice. Moreover, there are large number of government agencies controlling guidelines, regulations, and rules in the USA. It is also examined that some agencies are controlled by the government while some are managed only in the local area. These agencies and corporations are responsible for various similar and different issues such as the effect of industrialization, sustained growth perspective, and how to manage solid and chemical wastes. Furthermore, the Environmental Protection Agency (EPA) is a government organization established to protect the environment and concerned with human health. ISO 14000 series is an example of environmental guideline. It was formally adopted in 1996 by the International Organization for Standardization (ISO) and represents a model of new standard and policies for improving environmental performance.

*International Environmental Agreements* International environmental agreements significantly affect the GSCM. Various international environmental agreements across the world, such as the Kyoto Agreement, the Climate Change Treaty, and the Montreal Protocol, influence the performance behavior of enterprises and organizations. The implementation of agreements depends on political will which frequently lacks strong compliance provisions. Further, Gottberg et al. (2006) explain that although domestic environmental regulations seem to have a greater and valuable effect on eco-design, the impact of international policies associated with waste electrical and electronic equipment cannot be underestimated.

*External Stakeholders such as Suppliers and Customers* In 1984, Freeman published his book titled *Strategic Management: Stakeholder Approach* and explained the importance of stakeholders such as suppliers and customers, etc. Hervani et al. (2005) explain the importance of external stakeholders in GSCM. Greenwood (2001) defined stakeholders as the inclusion of any group or individual who can affect or is affected by the corporation. According to Henriques and Sadorsky (1996) and Hall (2000, 2006), major external stakeholders of GSCM process generally consist of customers suppliers and community stakeholders. The relationships between supplier and manufacturer are considered important in developing a sustainable competitive advantage (Cannon and Homburg 2001). Sarkar and Mohapatra (2006) found out that the suppliers play an important role in increasing the overall performance of a supply chain, and poor supplier performance affects its performance adversely. The screening of suppliers has now become a key deciding factor for regulating the environmental performance in many organizations (Clark 1999). Customers, the ultimate users, are the deciders and determined as the most important type of external pressure (Doonan et al. 2005). Zhu and Sarkis (2006) explain that within a supply chain, customers are the ultimate deciders, although the environment should be highly focused issue, necessary environmental characteristics of products and services must satisfy customer needs. Today, consumers can pay for environment-friendly products; according to a study report in the USA, the buying decisions of 75% of the consumers are influenced by the organization's environmental reputation. Furthermore, Sarkis (2003) illustrates that the implementation of the natural environment organizational decisions influences not only the organization that makes the decision but also its customers and suppliers.

### ***21.2.5 Why Firms Consider Carrying out Green Supply Chains?***

During the past few years, GSC is gaining increasing interest among academicians and developers of SCM. This growing importance of GSC is driven mainly due to increasing environmental awareness and the motivation of preserving resources for future generations. Moreover, GSC is primarily not just environmentally concerned but it also shows a good business perception and generates economic benefits in long run. However, a sustainable and green supply chain can be described as the process of using environment-friendly processes and methods in the form of inputs



and transforming these inputs through change agents—whose by-products can improve or be recycled/reused/remanufactured within the existing environment. GSC is the demand of today, because environment as a base for sustainability and for better and long-run performance should be focused.

A number of articles investigate why firms carry out GSCs and offer in-depth analysis of several drivers. Cordeiro and Sarkis (1997) argue that there are two types of drivers that drive firms to take environmental performance into consideration. The first driver is reactive pressures that include governmental and legal regulations and preservations. The second driver is proactive pressures that can lead to sustainable competitive advantages. However, Zhu and Sarkis (2006) classify those drivers into five dimensions: various rules and regulations, marketing strategies, supplier's behavior, competitors, and other internal factors. The most frequently quoted drivers are: impact of competitiveness, government regulations, social changes, and preference of customers (Sundarakani et al. 2010). In addition, some authors state that primary stakeholders may have a more significant influence on the firm's environmental performance. Among certain drivers, we concentrated and explained some of the crucial drivers above, which include environmental regulations and policies, role of government, and the effect of external stakeholders such as suppliers and customers to implement GSCM program.

### ***21.2.6 Flexibility and Green Supply Chains***

Flexible GSC corresponds to the responsiveness of the system considering environmental issues that come into existence for those situations where demand is either unstable or fluctuating. As per recent developments in the literature of SCM, quick responsive and low-cost supply chains have been listed as the important aspects for the organizations. Moreover, we have already been studied the importance of GSCs, but in corporate market, GSCs may work perfectly in steady conditions; but these supply chains are not high-speed responsive and not being able to react on sudden changes in demand. Growing competition and advancement in technology emphasize the need for the detailed study of current market conditions which require supply chains that are capable of handling sudden fluctuations in demand and strategies. Giannoccaro et al. (2003) found out certain sources of uncertainty, i.e., market behavior, quality of product, competition, and information delay, which further creates a need for building environmental concern “flexible green supply chains.” However, flexibility is being described as the ability of a supply chain to effectively manage or react to changes with little penalty in cost, time, or performance (Samar et al. 2013), whereas the fundamental goal of flexible GSCs is to create customer value. Also, the marketing with green perception plays an important role in achieving it. Flexibility in decision making and different flexibility-based models influences the supply chains significantly, which proves to be very beneficial and further improves the performance of system (Wadhwa et al. 2009). Further, the flexible ability of an organizational supply chain has been

described in terms of three distinctive components (Lee 2004). These components are the general characteristics of integrating flexibility with GSCs and are given as follows:

1. *Adaptable*: Capable of adapting (of becoming or being made suitable) to a particular situation in current volatile market is termed as adaptability of GSCs. To attain sustainability, it proves to be a very important component. It involves certain adjustment in the design of supply chain to compensate structural fluctuations in markets and to modify supply channel frameworks, methods, and technologies.
2. *Alignment*: The act of adjusting or aligning the parts of a device in relation to each other within a GSC is called as the alignment. Adjust is a little word but means a lot and it involves creation of inducement along the various horizontal and vertical partners within the GSC for enhancing overall productivity.
3. *Agility*: A GSC should be agile enough to compensate shifts and changes in demand. Agility means market sensitiveness, representing the ability of GSCs to respond to the actual demand in market. The real philosophy behind agile paradigm has a motto of improved customer service by speedy response to their demands. Further, agility is described as a well-executed business idea in flexible manufacturing system (Christopher and Towill 2006).

All the three components described above are considered to be important aspects of flexibility. Further, all these are considered as a prerequisite for a GSC in order to manage various uncertainties, because a GSC can only sustain in volatile market when common agreement is made among all supply chain partners along with the preplanning of strategies, which is also necessary (Madaan et al. 2012). Briefly, flexibility in GSCs is defined as the ability to respond to short- and long-term fluctuations in demand or supply situations along with the adjustment to strategic and structural changes in supply chain's behavior driven by various environmental pressures.

### **21.3 Cognitive Mapping Applicability: A Tool to Identify and Solve the Cause of Problem**

Over the past decades, causal maps have emerged as an interesting tool for operations management. These maps are very simple to use and easy to work. This technique is proving to be a very useful tool for academicians and researchers in certain ways. They can provide clear graphical representation of a problem and also act as a diagnostic tool which helps the user to identify and solve the various causes associated with the problem. From the quality improvement and operations management's perspective, causal maps have been given different names, such as fishbone (Ishikawa) diagrams, issues trees, impact wheel diagram and, cause-and-effect diagrams. Hays and Hill (2001) and Meyer and Collier (2001) demonstrated the usability of causal maps as a basic tool for framing and communicating a comprehensive theory,

particularly in support of research based on experimental findings and results. In this chapter, the applicability of causal mapping with impact wheel diagram has been used to study and solve the problem. The details and construction of impact wheel diagram are given in the following section.

### ***21.3.1 The Impact Wheel Diagram***

The impact wheel can be defined as a visional tool which investigates the future, i.e., prospect and chances related to an event. It is a worldwide accepted method to solve a problem qualitatively and found applicability in many firms, private, and government organizations. By understanding this tool, managers can easily cover and manage both unexpected and unintended consequences of a decision. It can be named as a simple structured brainstorming process designed to help experts while solving a problem. Moreover, this method also has some own limitations, for example, the subjectivity in decision making and its dependence over judgment of experts. In spite of this, it provides an opportunity to fully understand the potential consequences of specific change and to identify various causes associated with it that they might otherwise fail to anticipate. In this chapter, we have discussed the impact of environmental pressures on flexible GSC. Moreover, the shaded elements shown in Fig. 21.2 have been described above.

The construction of this diagram is discussed as follows: The diagram starts with writing the name of the change/event or decision to be made in a circle in the center of the paper, i.e., flexible GSC, as shown in Fig. 21.2 and then the opinions of expert team members taking part in the session are collected. The major concerned focuses are:

1. Illations—it shows the “impacts” of the specific event or decision to be made (can be illustrated as the spokes of a wheel drawn as shown in Fig. 21.2).
2. Probabilities—finding the chance of occurrence of event/change or the likelihood for each impact.
3. Implications—examination of certain crucial factors associated with each impact, i.e., cost and other resultant benefits by specific event or decision.

After considering all these above-mentioned concerns, a well-represented impact diagram for the problem has been generated, but still we are not able to rank major and crucial illations associated with specific change or decision. Therefore, the process cannot be stopped and further there is a need for a decision making process for the final ranking of various criteria/parameters associated with flexible GSC driven by environmental pressures. This process needs to be well executed in a manner which facilitates flexibility and green perspective in supply chains. At this practice, it requires some degree of quantitative aspect to solve the stated problem and further a decision making model was proposed using AHP method, and to enrich it interpretive ranking process (IRP) is also being used, and it is explained as follows.

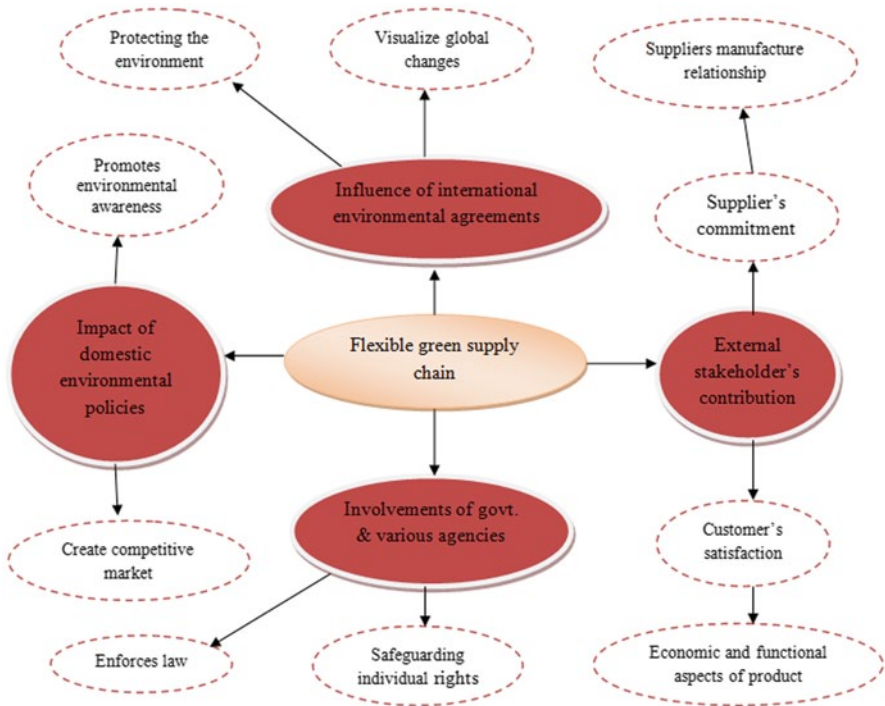
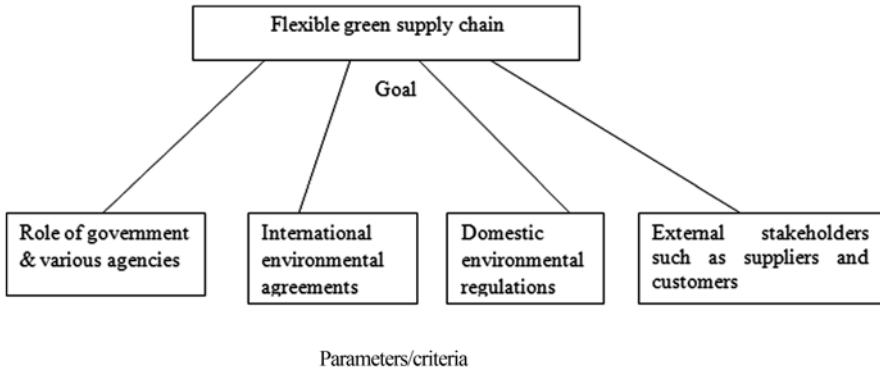


Fig. 21.2 Environmental pressure impact diagram for flexible GSC

### 21.3.2 Analytic Hierarchy Process

In this section, we provide a brief introduction to AHP along with general methodology. This methodology has been proposed by Saaty (1980) to support multicriteria decisions, where “analytic” states that the problem is broken down into its constitutive components and “hierarchy” states that a hierarchy of the constitutive components is drawn in relation to the main objective. AHP has proved very promising results and found its applications in the selection of alternatives, planning of decision or particular process, optimization and allocations of resources, and the sectors such as the manufacturing, education, industry, engineering, government, and many others (Saaty 1990; Vaidya and Kumar 2006). Moreover, this method has been used to solve many complex decision making problems and can be characterized as an MCDM technique that can combine both quantitative and qualitative aspects effectively during ranking/evaluation of alternatives. During application, initially, it starts with the determination of relations between the elements of the problem, followed by the building of a hierarchy, and finally consistency check whether a feasible solution has been obtained or not. An advantage of the AHP over other MCDM techniques is that it is designed to incorporate both tangible and intangible criteria of the decision process.



**Fig. 21.3** Decision hierarchy

The AHP steps described below can be best understood through a discussion of an example application. Consider an example as shown in Fig. 21.3. In this example, the decision problem is to rank various parameters/criteria associated with flexible GSC considering environmental pressures. Various qualitative criterions are listed in Fig. 21.3. AHP will be utilized to determine the highest ranking parameters for flexible GSC based on these qualitative considerations. This method also has some limitations like decision making is based on the subjective judgment/experience of the decision maker(s). Further, the steps in the AHP method for decision making are grouped into three categories:

### 1. Constructing the Hierarchy

Step 1. It involves the definition of decision to be made and ultimate desired goals. Here, the decision problem is to achieve a flexible GSC.

Step 2. It starts with the creation of hierarchy from top that proceeds toward lowest level considering the intermediate as well. After a clear idea about criteria and the alternatives, the expert developed a decision hierarchy. It is recommended that the hierarchy is composed of at least three levels: a goal, criteria, and alternatives. But, if the problem is simple and can be solved easily, then the number of levels may be lessened. Further, in this study, there are only two levels represented by some elements as ultimate objective and various selected parameters/criterions required to achieve goal further these elements are shown in a decision hierarchy (see Fig. 21.3).

### 2. Setting Priorities

Step 3. It involves the construction of matrices after analyzing pair-wise comparisons for various criterion/parameters listed in the study. The decision maker chose nine-point scale for expressing his or her intensity of preference between listed criterions. Further, a value of 1 is given in the comparison, if two criteria are of equal importance, a value of 9 is given in the comparison when one criterion has absolute importance over the other. The AHP uses a scale given by Saaty (1980) to measure the different weights as shown in Table 21.2.

**Table 21.2** Measurement scale for preferences between elements

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Weak importance of one over the other	The judgment is to favor one activity over the another
5	Essential or strong importance	The judgment is strongly in favor of one activity over the another
7	Demonstration importance	The judgment as to the importance of one activity over the another
9	Absolute importance	The judgment in favor of one activity over the another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values between the two adjacent judgments	When compromise is needed

Step 4. Here, in this step, we make pair-wise comparisons among all elements, may be “n” in each level which can be written in an (n × n) evaluation matrix A in which every element  $a_{ij} = w_i/w_j$  is the quotient of weights of the criteria. Let  $C = \{C_j | j = 1, 2, \dots, n\}$ , be the set of criteria. Moreover, the relative priorities may be described as the right eigenvector (w) relative to the largest eigenvector (maximum),

$$AW = \max * W - (1)$$

$$A = a_{ij} = \begin{pmatrix} 1 & w_1 / w_2 & w_1 / w_n \\ w_2 / w_1 & 1 & w_2 / w_n \\ \dots & \dots & \dots \\ w_n / w_1 & w_n / w_2 & 1 \end{pmatrix}$$

Further, it is stated that the matrix A has rank = 1 and  $\max = n$  when the pair-wise comparisons are completely consistent. In these cases, weights can be obtained by normalizing any of the rows or columns of matrix A. The procedure stated above is repeated for all the levels in the hierarchy.

**3. Consistency Check**

Step 5. After writing all the pair-wise comparisons, next step is to check the consistency of matrix. Saaty (1980) described that the maximum value of eigenvalue,  $\lambda$ , of a reciprocal matrix A is always greater than or equal to n (number of criteria/parameters selected). Further, if  $\lambda = n$ , then the pair-wise comparisons are said to be consistent. The closer the value of computed  $\lambda$  to n, the more consistent the written maximum pair-wise comparisons. Now, the consistency index (CI), which indicates the inconsistencies of pair-wise comparisons, is computed as:

$$CI = \frac{(\lambda_{\max} - n)}{(n - 1) - (2)}$$

**Table 21.3** Consistency index

Matrix rank	1	2	3	4	5	6	7	8
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41

The final consistency ratio (CR), an index to conclude whether the evaluations are sufficiently consistent, may be defined as the ratio of the CI and the random CI (RI), which is shown in Table 21.3. Moreover, if the ratio  $CI/RI < 0.10$ , the system is consistent enough, but if  $CI/RI > 0.10$ , serious inconsistencies might exist. It means that applied AHP method is unable to generate meaningful results and then whole procedure has to be repeated to improve the consistency of the system. Further, it can be drawn that the measurement of consistency is directly linked with the effectiveness of decision makers as well as the consistency of all the hierarchy.

### 21.3.3 Interpretive Ranking Process

Using the strengths of both the intuitive process and the rational choice process of decision making and complementing the limitations of each one by the other, the IRP is evolved. The IRP takes the advantage of the analytical logic of the rational choice process and couples it with the strengths of the intuitive process at the elemental level. In AHP, an expert gives the judgment about the importance of one element over the other in the pair along with its intensity, but the interpretation of the same is left in a tacit manner with the expert, thereby making the interpretive logic of the decision opaque to the implementer. In IRP, the expert is supposed to spell out the interpretive logic for dominance of one element over the other for each paired comparison (Sushil 2009). The application of IRP along with AHP can make the process more logical and understandable to the reader. Therefore, taking an IRP as the base methodology, we are formulating an interpretive matrix for the concerned four criteria.

Let us represent, A = role of government and various agencies, B = domestic environmental regulations, C = international environmental agreements, and D = external stakeholders such as suppliers and customers.

## 21.4 Results and Analysis

This section involves mathematical calculations and computations as per the steps listed in the AHP method. Further, decision makers began to compare the parameters/criterion considered with the assistance of interpretive matrix (Table 21.4) and measurement scale (Table 21.2) and resulted square matrix is written as follows.

- Let us represent, A = role of government and various agencies, B = domestic environmental regulations, C = international environmental agreements, and D = external stakeholders such as suppliers and customers

**Table 21.4** Interpretive logic

Paired comparison	Interpretive logic
A dominates B	Government plays an important role in formulating regulations
A dominates C	Government takes the decision regarding environmental agreements
A dominates D	Government agencies have the ability to influence the external stakeholders
B dominates A	Not applicable
B dominates C	Regulations can affect the agreements
B dominates D	Environmental regulations need to be followed by all stakeholders
C dominates A	Not applicable
C dominates B	Not applicable
C dominates D	Environmental agreements influence the decisions of stakeholders
D dominates A	Not applicable
D dominates B	Not applicable
D dominates C	Not applicable

$$\begin{matrix} & \begin{matrix} A & B & C & D \end{matrix} \\ \begin{matrix} A \\ B \\ C \\ D \end{matrix} & \begin{pmatrix} 1 & 5 & 6 & 8 \\ \frac{1}{5} & 1 & 2 & 4 \\ \frac{1}{6} & \frac{1}{2} & 1 & 2 \\ \frac{1}{8} & \frac{1}{4} & \frac{1}{2} & 1 \end{pmatrix} \end{matrix}$$
  

$$\begin{matrix} & \begin{matrix} A & B & C & D \end{matrix} \\ \begin{matrix} A \\ B \\ C \\ D \end{matrix} & \begin{pmatrix} 1 & 5 & 6 & 8 \\ 0.2 & 1 & 2 & 4 \\ 0.16 & 0.50 & 1 & 2 \\ 0.125 & 0.25 & 0.5 & 1 \end{pmatrix} \\ & \hline & \begin{matrix} 1.491 & 6.75 & 9.50 & 15 \end{matrix} \end{matrix}$$

The sum of column A=1.491, sum of column B=6.75, sum of column C=9.50, and sum of column D=15.

- After dividing each element of above written matrix by their respective column sum,

$$\begin{matrix} & \begin{matrix} A & B & C & D \end{matrix} \\ \begin{matrix} A \\ B \\ C \\ D \end{matrix} & \begin{pmatrix} 0.67 & 0.74 & 0.631 & 0.533 \\ 0.1341 & 0.148 & 0.21 & 0.266 \\ 0.143 & 0.074 & 0.105 & 0.133 \\ 0.083 & 0.037 & 0.052 & 0.066 \end{pmatrix} \end{matrix} = \begin{pmatrix} 0.6435 \\ 0.1895 \\ 0.1058 \\ 0.0597 \end{pmatrix}$$

0.9985



The average of row A=0.6435, average of row B=0.1895, average of row C=0.1058, and average of row D=0.0597.

Weight vector,  $w=[0.6435, 0.1895, 0.1058, 0.0597]$ .

- Multiply the matrices: initially developed and above written matrix

$$\begin{matrix} & \text{A} & \text{B} & \text{C} & \text{D} \\ \text{A} & \left( \begin{matrix} 1 & 5 & 6 & 8 \end{matrix} \right) \\ \text{B} & \left( \begin{matrix} 0.2 & 1 & 2 & 4 \end{matrix} \right) \\ \text{C} & \left( \begin{matrix} 0.16 & 0.50 & 1 & 2 \end{matrix} \right) \\ \text{D} & \left( \begin{matrix} 0.125 & 0.25 & 0.5 & 1 \end{matrix} \right) \end{matrix} \times \begin{pmatrix} 0.6435 \\ 0.1895 \\ 0.1058 \\ 0.0597 \end{pmatrix} = \begin{pmatrix} 2.7034 \\ 0.7686 \\ 0.4267 \\ 0.2404 \end{pmatrix}$$

- Now, divide the resultant matrix as given above by computed weight vector matrix:

$$\begin{pmatrix} 2.7034 \\ 0.7686 \\ 0.4267 \\ 0.2404 \end{pmatrix} \div \begin{pmatrix} 0.6435 \\ 0.1895 \\ 0.1058 \\ 0.0597 \end{pmatrix} = \begin{pmatrix} 4.2010 \\ 4.0559 \\ 4.0330 \\ 4.0268 \end{pmatrix}$$

- Finally to check the consistency,

$CI=(4.1391-4)/4=0.03$  from Table 21.2, for  $n=4$ , value of  $RI=0.90$ .

Now  $CI/RI=0.03 \div 0.90=0.0333 < 0.10$ , we conclude that the matrix is consistent enough.

The ranking of various process parameters/criteria is associated with flexible GSC. The role of government and various agencies (A), domestic environmental regulations (B), international environmental agreement (C), and external stakeholders such as suppliers and customers (D) are found by the AHP method. AHP shows that the role of government and various agencies has overcalled the rank followed by domestic environmental regulations for the flexible GSC driven by environmental pressures. International environmental agreements and the effect of external stakeholders such as suppliers and customers have relatively low ranking. Thus, the AHP gives a qualitative way of achieving flexibility and green perspective in supply chains considering various environmental pressures.

Weight vector,  $w=[0.6435, 0.1895, 0.1058, 0.0597]$

Figure 21.4 shows that the ranking of parameters/criterion involved in the critical assessment of flexible GSC driven by environmental pressures is as follows:

- Rank 1. The role of government and various agencies.
- Rank 2. Domestic environmental regulations.

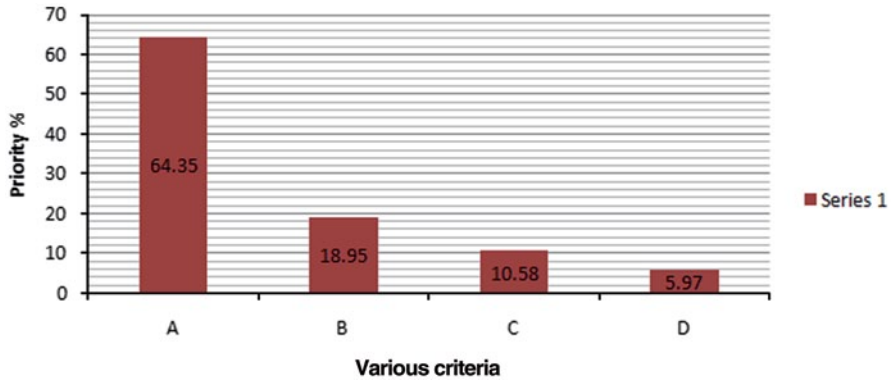


Fig. 21.4 Priority-wise effect of various criteria

Rank 3. International environmental agreements.

Rank 4. External stakeholders such as suppliers and customers.

## 21.5 Conclusion

The research shows that the incorporation of flexibility in GSC may yield tremendous results. The term “flexibility” in the literature is not new in general; it is in its application to GSCs but still required a lot to do. Supply chain managers also have understood the importance of effective flexible GSCs to compete in global market and economy. In the twenty-first century, due to rapid developments in technology and science, changes are not new. Therefore, to handle these creations in business environment, there should be an equivalent development in supply chain networks. But still, certain aspects in supply chain need to be improved and developed by looking it from a sustainable flexible green standpoint. It is also found out that the kind of market and particular product are the major indicators for accounting the need of flexibility in supply chains. Further, it is recommended that a better understanding of using remanufactured/recycled/reusable materials in supply chains will definitely yield sustainable production and operations. This study proves to be very beneficial for the learners to understand the need of flexibility and environmental consideration in GSCs. Briefly, this work may pave a way for GSC interaction with various driving environmental pressures and provide a great opportunity for researchers toward its flexibility point of view. Finally, the various managerial implications arising from this study are presented.

Supply chains are known to be a solid production process, in which raw materials are changed to final product and then are presented to customers to fulfill their customer demand, detailing with the resources available through the chain. But, now, due to recent developments by applying the concept of flexibility in GSC, management is able to adjust strategically in volatile markets, as well as fluctuation from within the chain while considering environmental pressures regulated by

various domestic and international agencies. Certain benefits raised from flexible GSCs can be categorized as short- and long-term benefits. Further, the ability of a chain to compensate the changes in demand and manage the external disturbances equally comes under the short-run benefits, whereas handling structural shifts in products development, market behavior, and supply channel strategies generates long-run achievements. In summary, by knowing the fundamentals of flexibility, operation managers can excellently work within desired objectives to achieve customer satisfaction, market edge, and environmental issue and set up a sustainable GSC, without changing it structurally.

This chapter shows the possibilities for more flexibility and its implication benefits in GSCs. Further work has to provide detailed description about the specific factors that determine and regulate flexibility in GSC driven by environmental pressures. We can talk a lot about the terms “market volatility” and “external disruptions,” but still investigation is required on how a specific market affects flexibility, what are the various external disturbances, and how they affect flexible perspective in GSCs. Moreover, proposed impact wheel diagram to study the problem and used multicriterion decision making (AHP method) to rank the associated criteria need to be structurally validated and have major limitations of highly dependence on the judgments of experts. Therefore, the developed model could be studied and validated by using other advanced decision making tools and this may result in some interesting findings while overcoming the difficulties in the development of flexible GSC.

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**Part V**  
**Financial Flexibility and**  
**Mergers and Acquisitions**

# Chapter 22

## Innovative Mode of Financing and Abnormal Returns to Shareholders of Indian Acquiring Firms

Neelam Rani, Surendra S. Yadav and P. K. Jain

### 22.1 Introduction

Performance of acquiring firms has been extensively studied empirically in finance as well as in the strategy literature. Most empirical studies agree that the method of payment plays an important role in explaining acquiring firms' stock return. The stock market reacts differently to the announcement of acquisitions on the basis of mode of financing being used. In an acquisition, the acquirer can pay the claims of the target firm shareholders either by paying cash or by issuing stock or by a combination of both cash and stock or entering into a payment contract known as earn-out<sup>1</sup> offer. This chapter is an attempt to explore the influence of these innovative methods of payment employed in financing the acquisitions. The aim of this chapter is to investigate the returns to acquirer shareholders in the case when a combination of cash and stock or earn-out offers is used as a mode of payment. The chapter also looks into whether the short-run performance of domestic and cross-border acquisitions is impacted differently when such an innovative mode of payment is used.

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<sup>1</sup> Earn-out refers to two-part contractual financing structure in mergers and acquisitions where the target firm must "earn" part of the valuation based on the performance of the business following the acquisition. In an earn-out, part of the acquisition price is paid after closing based on the target firm's ability to attain certain predefined financial goals.

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For better exposition, the chapter is organized into six sections including this section. Section 22.2 reviews the previous empirical research Work related to the impact of method of payment on acquirer returns. Data-collection and sample-selection-related issues have been delineated in Sect. 22.3. Section 22.4 explains the objective of the present work and methodology used. The major findings are given in Sect. 22.5. Section 22.6 presents concluding observations, limitations and directions for future research.

## 22.2 Literature Review

The stock market reacts differently to the announcement of acquisitions on the basis of mode of financing being used. In an acquisition, the acquirer can pay the claims of the target firm shareholders either by paying cash or by issuing stock or by employing some innovative mode of financing such as a combination of cash and stock or earn-out offers. Asquith et al. (1987), Huang and Walkling (1987), Travlos (1987), Yook (2003) and Heron and Lie (2002) found that acquisitions financed with stock generate negative returns to the acquirer shareholders on acquisition announcement, whereas the returns for acquisitions financed with cash generated are zero or slightly positive.

Many hypotheses have been put forward to explain the theoretical rationale as to why the share prices are influenced by the choice of the payment method:

The “*free cash flow*” hypothesis opines that acquisitions being paid for in cash reduce the agency costs and convey positive signal to market (Jensen 1986; Masse et al. 1990). *Free cash flow* hypothesis proposes that cash transactions result in positive abnormal returns.

*Asymmetric information hypothesis* (also known as *the information content hypothesis*) states that an offer to pay in shares for an acquisition will be seen by market participants as a signal that the stocks are overvalued (Myers and Majluf 1984).

A few studies have investigated the impact of asymmetric information on the choice of mode of payment (cash or stock) by the acquiring firms (Fishman 1989; Eckbo et al. 1990). The acquiring firm may experience the risk of overpaying the target firm under high information asymmetry tested as *asymmetric information hypothesis* (Myers and Majluf 1984; Jensen 1986), and “contingent-pricing effect” tested as a different view point of information asymmetry (Hansen 1987). Contrary to this, Martin argues that stock transactions are no longer observed as a negative signal by the market participants. He suggested the *risk-sharing and investment opportunity hypotheses*.

*The risk-sharing hypothesis* proposes that it could be beneficial to pay in stock especially in high-risk transactions, because in this case, the target firm will have an incentive to make a success of the takeover transaction (Rappaport and Sirower 1999; Jung et al. 1996; Martin 1996). *The investment opportunity hypothesis* proposes that firms with excellent future investment opportunities should not pay in cash for acquisitions.



The investment opportunity and risk-sharing hypotheses conclude that stock transactions are no longer observed as a negative signal by the market participants.

Extant literature establishes that internationally cash offers are accompanied with higher returns to the acquirer firm shareholders than the stock offers. The rationale suggested is that the cash is usually employed in financing an acquisition when the acquirer has less information asymmetry about the true value of the target company's assets.

In context of cross-border and domestic acquisitions, Conn et al. (2005) suggest that the signalling effect of cash transactions may not have the same force in the case of cross-border mergers and acquisitions. They suggest that other factors may have influence on the means of payment. For example, they argue that the use of equity by cross-border acquirers may be due to the problems associated with acquiring information about foreign firms. Rani et al. (2013) observed positive abnormal returns for cash payments in domestic acquisitions.

Gaughan (2002) suggested that the use of cash may be due to the reluctance of foreign target firms to accept overseas stocks and this might neutralise the signalling impact of cash acquisition. *Asymmetric information hypothesis* has been viewed as liability of foreignness in context of cross-border acquisitions (Zaheer 1995). Further, the risk associated with information asymmetry is higher in the case of cross-border acquisitions (Datar et al. 2001; Reuer et al. 2004; Donohoe 2006; Contractor et al. 2007; Mantecon 2009; Chang and Tsai 2013). Kohers and Ang (2000) proposed two-part payment contract comprising a front-end payment at the time of the merger, and a deferred payment, or earn-out, which is dependent on the target's ability to attain certain prespecified financial goals.

In the light of these arguments, it remains unclear whether acquisitions financed with cash or stock performs similarly in the case of cross-border and domestic mergers and acquisitions. The apparent controversy in the empirical literature regarding the profitability of cash- and stock-financed acquisitions in the context of cross-border and domestic acquisitions emphasize the need for further research. Moreover, previous literature has not focused on the possibility of innovative financing like combination of cash and stock or earn-out offers as mode of payment.

Extant literature has also focused on the implications of domestic versus cross-border acquisitions for acquirers. Empirical work documents variation in returns for acquirers in domestic and cross-border acquisitions (Cakici et al. 1996; Aw and Chatterjee 2004; Conn et al. 2005; Lowinski et al. 2004; Campa and Hernando 2004; Goergen and Renneboog 2004; Moeller and Schlingemann 2005; Francis et al. 2008). Recent works (Barai and Mohanty 2010; Gubbi et al. 2010; Karels et al. 2011; Zhu and Malhotra 2008) observe positive returns for cross-border acquisitions by acquirer in emerging market firms. Rani et al. (2011) also document positive market reaction to the announcement of foreign acquisitions in pharmaceutical industry in India.

In the light of the above discussion, this chapter investigates the returns to acquirer shareholders in the case when a combination of cash and stock is used as a mode of payment. The study also looks into whether the short-run performance of domestic and cross-border acquisitions is impacted differently when a combination of cash and stock is used as a mode of payment.

## 22.3 Data Collection and Sample Selection

This chapter is based on acquisitions that were announced by Indian corporates listed on Bombay Stock Exchange during the period January 2003 to December 2008. For collecting data, Thomson SDC Platinum Mergers and Acquisitions Database have been used. The announcement dates have been verified from the archives of corporate announcements on Bombay Stock Exchange.

### 22.3.1 Sample Selection Procedure

All transactions that fulfil the following conditions have been included in the study:

- Public limited companies listed on Bombay Stock Exchange.
- Mergers and acquisitions announced between January 2003 and December 2008.
- Acquisitions of minor stakes (that is less than 51 c) have been excluded from the sample.
- Mergers and acquisitions in the financial sector are excluded from the sample. This is because of the different nature of assets and liabilities of financial firms, and the different financial reporting of these companies.
- There is no announcement of issuance of new shares by the way of domestic or international offering in the form of Public Offer, follow-up of public offer preferential issue, foreign currency convertible bonds (FCCB), American depository receipts (ADR) and global depository receipts (GDR), announcement of another merger or acquisition during the event window.
- There is no announcement of capital investment in a new project, credit rating and financial results during the event window.
- To avoid possible information contamination or the confounding effect, the firms that undertake any significant event, such as announcements of bonus shares, dividends or ex-dates on any type of dividend (cash/stock dividend), within 20 days prior and after the acquisition are excluded from the sample.
- The firms must have daily price information available on the Bombay Stock Exchange or Capitaline database. The firms having non-synchronous trading have been eliminated from the sample.

These filters reduce the data set to a very small sample of 14 announcements comprising ten cross-border and four domestic acquisitions using innovative financing as a mode of payment (Table 22.1).

## 22.4 Objective, Hypotheses and Methodology

The objective of this chapter is to examine short-term abnormal returns to the shareholders of acquiring companies using a combination of cash and stock; the disaggregate analysis for such returns has also been attempted for domestic acquisitions and cross-border acquisitions. The period of the study is 2003–2008.

**Table 22.1** Sample selection. (Source: Thompson SDC platinum database for mergers and acquisitions)

Total number of announcements	44
<i>Less acquisitions excluded</i>	
Rumours and news of acquisitions withdrawn subsequently	9
Minor acquisitions	2
Acquisition by financial companies	1
Acquisition by unlisted companies and investor groups	6
Trading data not available	2
Confounding events	5
Multiple acquisitions in one announcement	4
Date could not be verified	1
Selected in sample (44–30)	14

The following hypotheses have been tested to investigate the average effect of the announcements of acquisitions on the acquirers’ shareholders wealth.

**H<sub>01</sub>** There is no average abnormal return on the announcement day due to the announcements of acquisitions to the acquirers’ shareholders.

**H<sub>02</sub>** There is no cumulative average abnormal return for the event window period due to announcements of acquisitions to the acquirers’ shareholders.

The event study methodology is used to examine short-term stock price reaction to mergers and acquisitions announcements. The traditional market model with value-weighted market index (BSE SENSEX) has been used to estimate abnormal return. The traditional market model to estimate abnormal returns as per Eq. (22.1) is

$$R_{i,t} = \hat{\alpha}_i + \hat{\beta}_i R_{m,t} + \varepsilon_{i,t}, \tag{22.1}$$

where

- $R_{i,t}$  is its return for firm  $i$  on day  $t$ ;
- $R_{m,t}$  is the corresponding return on the Bombay Stock Exchange (BSE) index SENSEX,
- $\varepsilon_{i,t}$  is the error term and
- $t = -280, \dots, -26$ .

The abnormal return (AR) for each day for each firm is then obtained as per Eq. (22.2)

$$AR_{i,t} = R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i R_{m,t}) \text{ where } t = -20 \dots +20, \tag{22.2}$$

where  $\hat{\alpha}_i$  and  $\hat{\beta}_i$  are estimated from (22.1) using data from the appropriate estimation window. Abnormal returns are averaged for each event day across firms (where  $t=0$  is the announcement day when it is first time announced in the public newspaper) and cumulative abnormal returns (CARs) are computed by summing average abnormal returns for the window of interest.

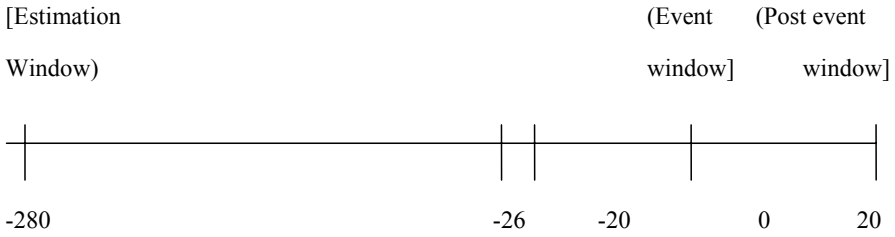


Fig. 22.1 Timeline for an event study

The estimation period for the parameter estimation is constructed in the following manner. We start with an announcement date such as  $t=0$ . An estimation period window of 255 days is then constructed for a defined period such as the preacquisition period trading day  $-280$  to  $-26$ ; it implies 280 trading days prior to announcement date ending 25 trading days before announcement date as shown in Fig. 22.1

The average abnormal return ( $AAR_t$ ) for each day in the event window is calculated as follows:

$$AAR_t = \frac{1}{N} \sum_{j=1}^N AR_{jt} \tag{22.3}$$

where  $N$  is the number of firms.

In order to make inferences about the effect of the announcement, the abnormal returns have been cumulated across time for each security (if the event window covers more than one period) and across securities. The measure of abnormal returns in this chapter uses windows for varied sets of time period (in days), namely  $(-20, -2)$ ,  $(-1, 0)$ ,  $(-1, +1)$ ,  $(-2, +2)$ ,  $(-5, +5)$ ,  $(-10, +10)$ ,  $(-20, +20)$  and  $(+2, +20)$  period. The larger window of pre-event and post-event 18 days includes the effect of possible leakage of the information and also captures any adjustment to the share price (if any) following the announcement. The cumulative abnormal returns (CARs) are daily abnormal returns cumulated over part of the event period. Over an interval of two or more trading days beginning with day  $T_1$  and ending with day  $T_2$ , the cumulative average abnormal return (CAAR) is

$$CAAR_{T_1, T_2} = \frac{1}{N} \sum_{j=1}^N \sum_{t=T_1}^{T_2} AR_{jt} \tag{22.4}$$

### 22.4.1 Statistical Significance of Event Returns

There are numerous tests for evaluating the statistical significance of abnormal returns. Each tests the null hypothesis that abnormal returns are zero, but they differ

in the necessary assumptions about the statistical properties of (abnormal) returns. The parametric tests implicitly assume that the residuals follow normal distribution. When the assumption of normality of abnormal returns is violated, parametric tests are not well specified. In addition to parametric statistics, event studies typically report a non-parametric test. A non-parametric test is normally used in conjunction with parametric test in event study to verify that the results are not driven by outliers. Non-parametric statistics do not require stringent assumptions about return distributions as parametric tests. In order to obtain robust results, one parametric Crude dependence adjustment test (Brown and Warner 1980) and one non-parametric generalized sign (Cowan 1992) test have been applied.

*The Crude Dependence Adjustment Test (CDA)* The test incorporates the sample time-series standard deviation. Brown and Warner (1980) describe the test as featuring a “crude dependence adjustment”. That is, the test compensates for potential dependence of returns across security events by estimating the standard deviation using the time series of sample mean returns from the estimation period. CDA test uses a single variance estimate for the entire sample. Therefore, the time series standard test does not take account of the unequal return variances across securities. This test avoids the potential problem of cross-sectional correlation of security return. To account for the dependence across firms’ average residuals, in event time, Brown and Warner (1980) suggest that the standard deviation of average residuals should be estimated from the time series of the average abnormal returns over the estimation period. The estimated variance of AAR<sub>t</sub> is

$$\hat{\sigma}_{AAR}^2 = \frac{\sum_{t=-280}^{-26} (AAR_t - \overline{AAR})^2}{254}, \tag{22.5}$$

where the market model parameters are estimated over the estimation period of 255 days and

$$\overline{AAR} = \frac{\sum_{t=-280}^{-26} AAR_t}{255}. \tag{22.6}$$

The test statistics for day *t* in event time is

$$t = \frac{AAR_t}{\hat{\sigma}_{AAR}}. \tag{22.7}$$

*The CDA test for the null hypothesis that CAAR = 0 is*

$$t = \frac{CAAR_t}{(T_2 - T_1 + 1)^{\frac{1}{2}} \hat{\sigma}_{AAR}}. \tag{22.8}$$

*Generalized Sign Test (GSign Z)* The generalized sign test compares the proportion of positive abnormal returns around an event to the proportion from a period unaffected by the event. The generalized sign test adjusts for the fraction of positive abnormal returns in the estimation period instead of assuming 0.5.

The null and alternative hypotheses of interest are:

*The null hypothesis for generalized sign test is that the fraction of positive returns is the same as in the estimation period.* The actual test uses the normal approximation to the binomial distribution. To implement this test, we first need to determine the proportion of stocks in the sample that should have nonnegative abnormal returns under the null hypothesis of no abnormal performance. The value for the null is estimated as the average fraction of stocks with nonnegative abnormal returns in the estimation period. If abnormal returns are independent across securities, under the null hypothesis the number of nonnegative values of abnormal returns has a binomial distribution with parameter  $p$ .

The generalized sign test examines whether the number of stocks with positive cumulative abnormal returns in the event window exceeds the number expected in the absence of abnormal performance. The number expected is based on the fraction of positive abnormal returns in the 255-day estimation period,

$$\hat{p} = \frac{1}{n} \sum_{j=1}^n \frac{1}{255} \sum_{t=1}^{255} S_{jt}, \quad (22.9)$$

where

$$S_{jt} = \begin{cases} 1 & \text{if } AR_{jt} > 0 \\ 0 & \text{otherwise} \end{cases}$$

The following statistic has an approximate unit normal distribution with parameter  $\hat{p}$ :

$$Z_G = \frac{w - n\hat{p}}{\sqrt{n\hat{p}(1-\hat{p})}}, \quad (22.10)$$

where  $w$  is the number of stocks in the event window for which the cumulative abnormal return is positive.

The alternative hypothesis, for any level of abnormal performance, is *that fraction of positive returns is different from the fraction in the estimation period.*

## 22.5 Empirical Results

Average abnormal returns on the announcement day and CAARs for various event windows have been analysed for all acquisitions financed with a combination of cash and stock. In addition, the abnormal returns have been analysed for subsamples of cross-border acquisitions and domestic acquisitions.

**Table 22.2** Abnormal returns to the shareholders of acquiring firms on the announcement day, 2003–2008

N	Average abnormal return (%)	Median abnormal return (%)	Positive: negative	$T_{CDA}$	$T_G$
Panel A: Complete sample					
14	4.03	3.55	11:3	4.296**	2.521**
Panel B: Domestic acquisitions					
4	6.59	5.76	4:0	3.192**	2.197*
Panel C: Cross-border acquisitions					
10	3.01	2.83	7:3	3.013**	1.594

\* and \*\* denote significance at 5 and 1% levels, respectively

Table 22.2 reports the abnormal returns to the acquirer shareholders on the announcement day for complete sample as well as sub-samples. It contains average abnormal return and median abnormal return on the announcement day. Additionally, it presents proportion of positive and negative average abnormal return. Moreover, it provides the results of two tests conducted to measure statistical significance for average abnormal returns.

It is obvious from the data summarized in Table 22.2 that the acquirer shareholder earns substantial return of 4.03% on the announcement day. Median abnormal returns are 3.55%. Returns are positive for more than 78% stocks. Moreover, the results are statistically significant. It is also evident from Table 22.2 that returns are higher in the case of domestic acquisitions.

CAARs for multi-period event windows have been analysed for complete sample as well as for cross-border acquisitions and domestic acquisitions. Table 22.3 contains CAAR and median cumulative abnormal return for various event windows. Additionally, it presents proportion of positive and negative CAAR. Moreover, it provides the results of two tests conducted to measure statistical significance for CAARs.

The relevant data show that the acquirer experience 5.29% CAAR over the event window of 5 days (−2, 2). The notable finding is that the median cumulative abnormal return is 5.48%. More than 78% stocks have positive returns. Moreover, the results are statistically significant at 1%.

Another notable finding is that the returns are positive and impressive (15.66%) over the longer window of 41 days; the CAAR is statistically significant at 1% as per CDA test. However, the proportion of positive return is not significant.

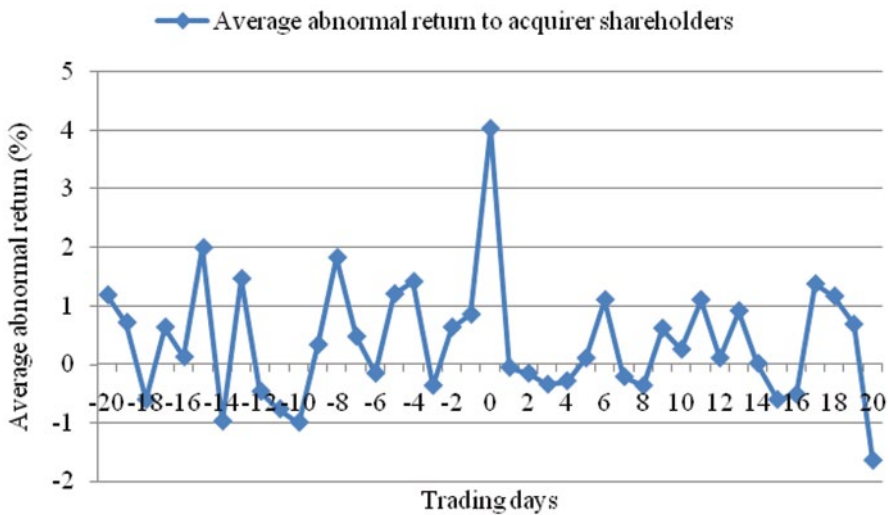
Figure 22.2 presents the average abnormal return for the entire event window. The graph portrayed in Fig. 22.3 supports the conclusion that acquirer shareholders experience substantial gain when acquisition is financed with some innovative method.

The data contained in Table 22.4 show the return for domestic acquisitions financed with a combination of cash and stock. It is evident from Table 22.4 that the returns are positive during all the event windows. The shareholders earn cumulative abnormal return of 10.28% during event window of 5 days (−2, 2). Moreover, the proportion of stocks having positive return is 100%. The results are statistically significant at 5%.

**Table 22.3** Cumulative abnormal returns to the shareholders of acquiring firms during multi-days event windows, 2003–2008

Event window	Cumulative average abnormal return (%)	Median cumulative abnormal return (%)	Positive: negative	$T_{CDA}$	$T_G$
(-20, -2)	7.61	3.82	8:6	1.861*	0.91
(-1, 0)	4.88	3.35	10:4	3.679**	1.984*
(-1, +1)	4.82	4.38	11:3	2.969**	2.521**
(-2, +2)	5.29	5.48	11:3	2.524**	2.521**
(-5, +5)	6.98	5.70	8:6	2.244*	0.91
(-10, +10)	9.83	7.78	9:5	2.288*	1.447
(-20, +20)	15.66	8.14	8:6	2.607**	0.91
(+2, +20)	3.23	-5.39	6:8	0.79	-0.165

\* and \*\* denote significance at 5 and 1% levels, respectively



**Fig. 22.2** AAR of acquisitions financed with a combination of cash and stock over event window (-20, +20)

The graph of average abnormal return during the event window of (-20, 20) portrayed in Fig. 22.4 also corroborates the above finding of positive return for most of the event days. The graph displayed in Fig. 22.5 also supports the conclusion that shareholders experience positive returns when domestic acquisitions are financed with innovative financing.

Table 22.5 contains return for the cross-border acquisitions financed with a combination of cash and stock. It is evident from the relevant data that the acquirer shareholders earn 3.86% CAAR over the 2-day event window (-1, 0). However, the median cumulative returns are 1.97%. Moreover, the proportion of stocks having



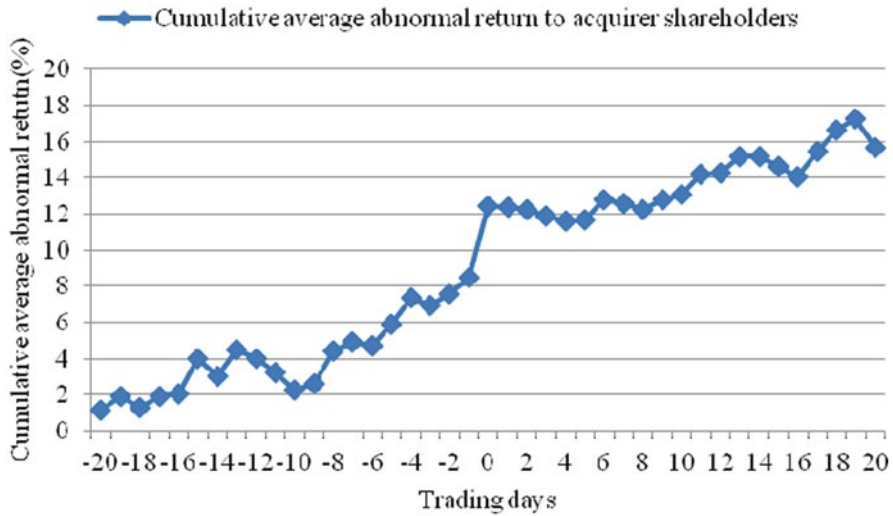


Fig. 22.3 CAAR of acquisitions financed with a combination of cash and stock over event window (-20, +20)

Table 22.4 Cumulative abnormal returns to the shareholders of acquiring firms (domestic acquisitions) during multi-days event windows, 2003–2008

Event window	Cumulative average abnormal return (%)	Median cumulative abnormal return (%)	Positive: Negative	$T_{CDA}$	$T_G$
(-20, -2)	15.73	10.90	3:1	1.749*	1.192
(-1, 0)	7.43	7.10	4:0	2.545**	2.197*
(-1, +1)	8.47	8.42	4:0	2.371**	2.197*
(-2, +2)	10.28	7.70	4:0	2.229*	2.197*
(-5, +5)	13.42	15.13	3:1	1.961*	1.192
(-10, +10)	21.03	20.19	3:1	2.224*	1.192
(-20, +20)	37.68	35.48	3:1	2.852**	1.192
(+2, +20)	13.48	17.24	3:1	1.499	1.192

\* and \*\* denote significance at 5 and 1% levels, respectively

positive return is not different from the proportion of stocks having positive return during the estimation period.

The graph of average abnormal return portrayed in Fig. 22.6 shows that the return are positive for most of the days during event window (-20, 20). The CAAR displayed in Fig. 22.7 also supports that the acquirer shareholder earns positive returns during the event window.

Independent *t*-test has been conducted to measure the difference between mean CAR of domestic acquisitions and cross-border acquisitions; the results are tabulated in Appendix I. Positive mean difference has been noted between the returns; however, the difference is not significant.

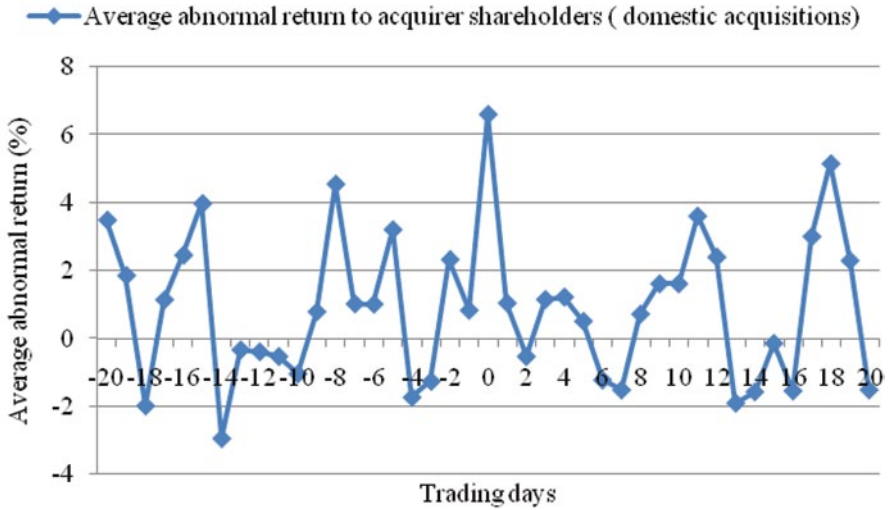


Fig. 22.4 AAR domestic acquisitions financed with a combination of cash and stock over event window (-20, +20)

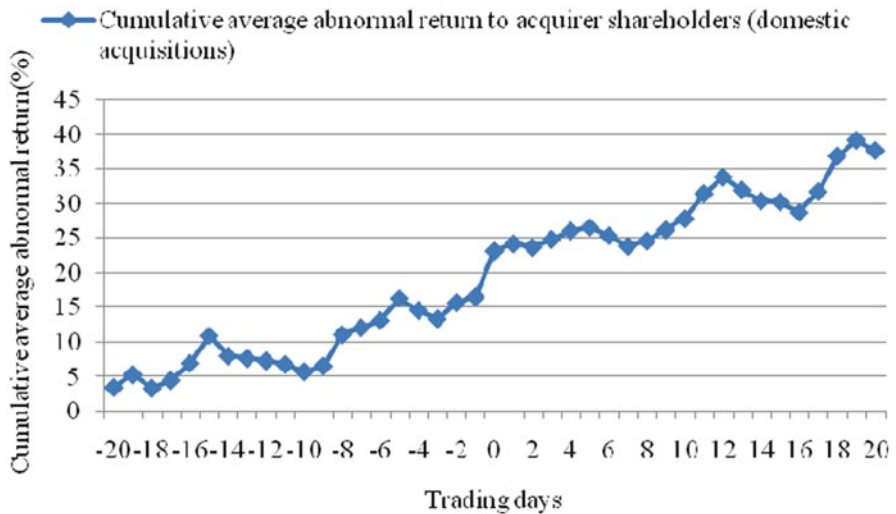
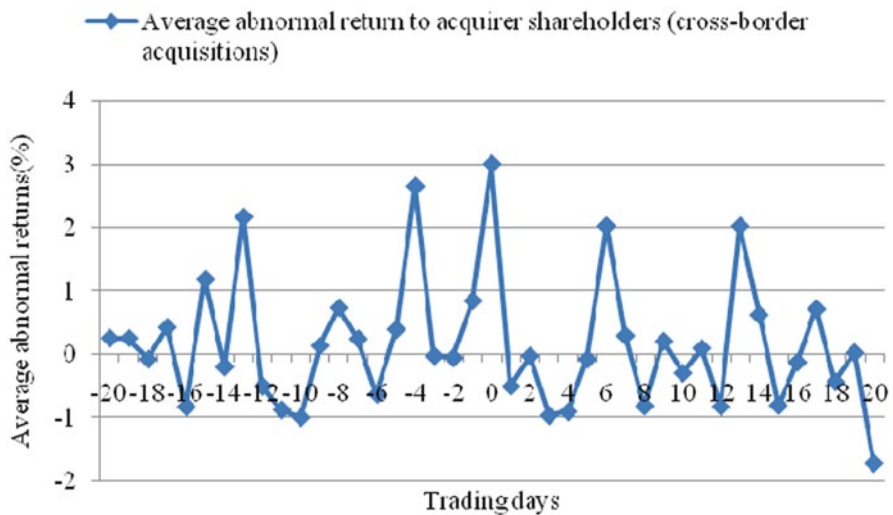


Fig. 22.5 CAAR domestic acquisitions financed with a combination of cash and stock over event window (-20, +20)

**Table 22.5** Cumulative abnormal returns to the shareholders of acquiring firms (cross-border acquisitions) during multi-days event windows, 2003–2008

Event window	Mean cumulative abnormal return (%)	Median cumulative abnormal return (%)	Positive: negative	$T_{CDA}$	$T_G$
(-20,-2)	4.36	0.43	5:5	1.002	0.322
(-1, 0)	3.86	1.97	6:4	2.736**	0.958
(-1, +1)	3.36	1.91	7:3	1.947*	1.594
(-2, +2)	3.30	3.52	7:3	1.477	1.594
(-5, +5)	4.40	0.18	5:5	1.331	0.322
(-10, +10)	5.36	3.83	6:4	1.171	0.958
(-20, +20)	6.85	-0.34	5:5	1.072	0.322
(+2, +20)	-0.87	-6.10	3:7	-0.201	-0.949

\* and \*\* denotes significance at 5 and 1% levels, respectively



**Fig. 22.6** AAR of cross-border acquisitions financed with a combination of cash and stock over event window (-20, +20)

## 22.6 Conclusion

This chapter examines the short-run stock price performance of 14 Indian acquirer companies employing an innovative method such as a combination of cash and stock or earn-out offers to finance acquisitions during the period 2003–2008. The results indicate acquisitions that generate statistically significant positive abnormal returns when earn-outs are used as a mode of acquisition.

The study documents that the shareholders of acquirer Indian corporates employing innovative financing experience positive abnormal return of 4.03% (statis-

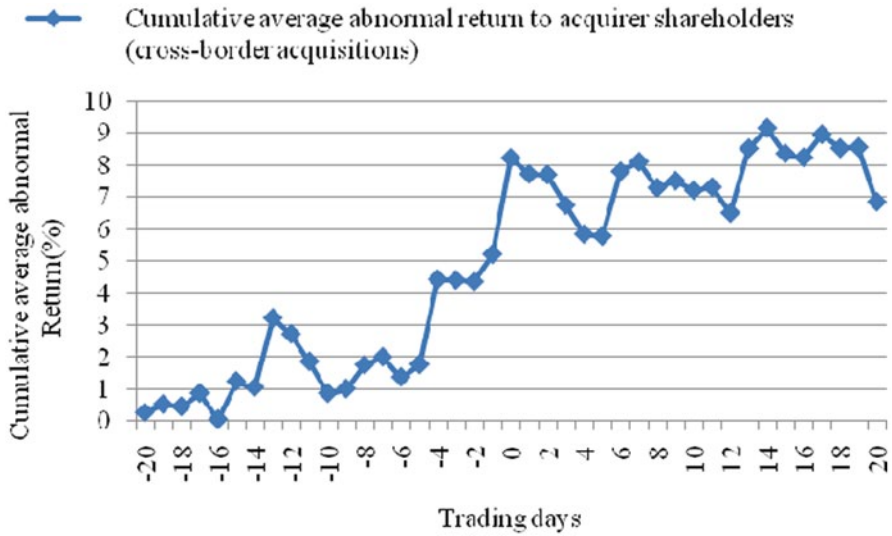


Fig. 22.7 CAAR of cross-border acquisitions financed with a combination of cash and stock over event window (-20, +20)

tically significant) on the announcement day. The CAARs are 5.29% (statistically significant at 1%) for 5 days window. The abnormal returns are also quite impressive of more than 4% during the pre-event window as well as multi-days event window of 2 days (-1, 0), 3 days (-1, +1); moreover, they are also statistically significant.

The CAARs are also positive for longer event windows of 11 days (-5, +5) days, 21 days (-10, +10) days and 41 days (-20, +20) days. The returns for domestic acquisitions is also positive during the pre-event window as well as multi-days event window of 2 days (-1, 0), 3 days (-1, +1), 5 days (-2, +2). The notable finding of disaggregative analysis is that the acquirer earns almost 10% CAAR (significant at 5%) for event window of 5 days (-5, +5) in case of domestic acquisitions. The abnormal returns are positive for cross-border acquisitions also, however, not statistically significant.

Another notable finding of the study is that the acquirers experience higher return for domestic acquisitions; however, the difference is statistically not significant. The study also has managerial application in indicating mergers and acquisition strategies to be the source of value creation in cross border as well as domestic acquisitions for an emerging economy like India when innovative method of financing is employed to mitigate the risk of valuation and adverse selection.

Above all, on a methodological level, the present study has demonstrated the use of the non-parametric significance tests to check the robustness of average abnormal returns and CAARs. The use of Generalized-sign test for assessing significance levels of average abnormal return and CAAR has proved useful to bring into notice the event-induced variance in the sample, as this test statistics take into account effects due to event-induced variance and offers, therefore, an alternative evaluation of significance.

The study is not free from potential limitations. One limitation of the study is the availability of relatively small sample size. For this reason, these findings cannot be generalized based on this study alone. But these initial findings merit consideration and suggest the need to conduct future research to explore the possibility of innovative financing as an option to enhance shareholders' wealth.

## Appendix I

### ***t*-test for difference of mean CAR of acquirers of domestic acquisitions and cross-border acquisitions using innovative mode of finance**

Event window	Mean CAR (%) of cross-border acquisitions ( $N=10$ )	Mean CAR (%) of domestic acquisitions ( $N=4$ )	Mean difference	<i>t</i> value	Significance value
AD	0.0659	0.0301	0.0358	1.27	0.2434
(-20, -2)	0.1573	0.0436	0.1137	0.86	0.4371
(-1, 0)	0.0743	0.0386	0.0357	1.08	0.3027
(-1, +1)	0.0847	0.0336	0.0511	2.17	0.0513
(-2, +2)	0.1028	0.033	0.0699	1.69	0.1467
(-5, +5)	0.1342	0.044	0.0902	1.43	0.1958
(-10, +10)	0.2103	0.0536	0.1567	1.36	0.2296
(-20, +20)	0.3768	0.0685	0.3083	1.34	0.2505
(+2, +20)	0.1348	-0.00873	0.14353	1.26	0.2487

*CAR* cumulative abnormal returns

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# Chapter 23

## Multiple Perspectives of Mergers and Acquisitions Performance

Anshu Agrawal, Sushil and P. K. Jain

### 23.1 Introduction

Profitability, fast growth, efficiency, agility, and industry leadership are the exigent requirements of corporate survival in present dynamic environment. Mergers and acquisitions (M&A) strategy has emerged as preferred mode for corporate firms for strengthening their position in market place and to meet the market challenges.

M&A performance has always been a keen interest area among researchers from financial as well as strategic management area. In spite of the vast amount of literature, focusing on value creation (Agrawal et al. 1992; King et al. 2004; Dutta and Jog 2009), accounting and economic measures, return on investments (Pautler 2003), synergies (Larsson and Finkelstein 1999), shareholders' wealth, etc., the performance outcome of M&A is still inconclusive. M&A, by and large, are considered as ineffective strategies, particularly from acquirer firms' perspective (Datta et al. 1992; King et al. 2004). "Empirical studies" (exclusively from financial field) reckoned higher failure rate in M&A; according to these studies, M&A are financial decisions and thus, are expected to entail higher returns, compared to any other investment or productive activity involving similar level of risk. On the contrary, strategic management literature suggests M&A as useful strategies for the attainment of corporate objectives, ranging from cost effectiveness to strategic expansion. These studies emphasize on assessing M&A success in terms of real benefits, rather than solely on financial basis (Lubatkin 1983; Brouthers et al. 1998).

Studies in recent decades have suggested methodological gap to be one of the major factors responsible for the high failure rate (Brouthers et al. 1998; King et al.

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2004; Angwin 2007; Barkema and Schjiven 2008; Halebian et al. 2009; Megilo and Risberg 2010). Majority of the performance studies focus on value-creation aspect of M&A (such as profitability, synergies, return on investment, share-price impact, etc.); the value-creation aspect, alone, seems inadequate for determining their success or failure. M&A are important strategic decisions driven by multiplicity of causes; therefore, comprehensive insight of M&A performance requisite adequate strategic mapping methods, capable of dealing with multiple perspectives (Brouthers et al. 1998).

Value-creating potential of M&A rests on the premise that synergistic combination of the firms is likely to supplement or complement the core skills and resources of the merging entities (Seth 1990a; Meyer 2008). Thus, for a precise view of M&A outcome, the examination of sources of value creation also seems essential (Mittal and Jain 2012).

In view of incongruence reflected in performance and strategic management literature on M&A performance and evaluation methods, the study proposes comprehensive analysis of M&A performance, considering multiple perspectives likely to be influenced by M&A decisions. The holistic analysis of M&A performance is suggested in terms of situations, actors, processes, and performance parameters (Sushil 2001; Mittal and Jain 2012). The study emphasizes on assessing the financial as well as strategic aspects of M&A; collective view of all possible parameters is expected to facilitate an enriched view of M&A possible outcomes. Integrated view of the M&A performance, in terms of multiple parameters, is likely to bestow an overview of strong and weak parameters in M&A performance; this could facilitate further decision-making and initiating appropriate actions.

## 23.2 Literature Review

M&A are considered vital corporate investments for rapid growth and development. The M&A performance outcomes and the key performance parameters are among the core research topics, and they aim to analyze value creation and its causes. The evidences from past studies signify that acquirer firms, by and large, fail to create value from M&A (Copeland et al. 2000; King et al. 2004). In view of high failure rate, the key success and failure parameters have emerged as recurrent theme in literature (Megilo and Risberg 2010); literature exhibits numerous antecedents for M&A failure, ranging from preplanning consideration (such as, selection of target, deal value, premium, objectives, etc.) to post-integration measures.

Value creation is an important objective for M&A decisions (Salama et al. 2003). Effectiveness of M&A decisions depends on as to how successfully the potential synergies are realized (Chatterjee 1986; Barney 1991); market power, economies of scale and scope resulting from operational decision-making, marketing, research and development, etc., lead to value creation in M&A (Seth 1990b); consolidated operations, elimination of redundant costs, resource sharing, access to specialized resources, and ease of availability of raw materials are expected sources for operational synergies from M&A (Herrick 2002); competitive advantage in terms

of access to specialized resources, possessing traits of enabling superior value to customers, etc., form the basis of marketing synergies (Barney 1991; Srivastav et al. 1998; Hooley et al. 2005).

Additionally, integration measures, human issues, managerial aspects, etc., are numerous strategic factors that are expected to influence value-creation process. Employees' satisfaction and firm performance are directly related; happy, satisfied, and well-motivated staff is always a significant contributor for organizational better performance (Huselid 1995; Hooley et al. 2005), enhancing marketing performance (Denison 1990). Human issues, such as, the skilled manpower quitting the jobs, cultural issue, etc., are considered important factors for M&A failure (Cartwright and Cooper 1996). M&A signify big corporate changes; these are expected to bring uncertainty and ambiguity regarding new working environment (Amiot et al. 2006; Chambers and Honeycutt 2009); they are likely to bring changes in the employees' behavior, may be good or bad for performance (Chambers and Honeycutt 2009). In present scenario of personal interactions, where staff interacts directly with the customers (especially, in service industry such as IT), more satisfied employees could better serve the customers and can enhance customer satisfaction (Bowen and Lawler 1992). M&A involves integration of the employees belonging to different histories, cultures, practices, experiences, etc. (Bruner 2004).

M&A, along with synergistic combinations, are also about who get to run the company (Brealey et al. 2010). Impact of human resources on M&A performance is largely governed by managerial abilities to successfully integrate them (Habeck et al. 2000). Compatibility with the manager and the culture is in fact considered panacea for employees' satisfaction, which is a crucial determinant of M&A success (Larsson 1993). Resource-based view emphasizes on managers as important source of value creation (Holcomb and Hitt 2007); value creation depends upon the successful transfer of the skills and capabilities and peoples' collaboration for the realization of the expected benefits and unpredicted opportunities (Chambers and Honeycutt 2009; Salama et al. 2003). The performance advantage of integration depends upon the managerial abilities to integrate, deploy, and synchronize them successfully (Barney 1991; Castanias and Helfat 2001; Lichtenstein and Brush 2001; Hansen et al. 2004; Kor and Mahoney 2005; Newbert 2007; Sirmon et al. 2007). Managers are essential actors who bring together the resources of two separate entities together; incompatibility in the management styles could negate the potential benefits associated with M&A (Davis 1968; Lubatkin 1983; Ivancevich et al. 1987; Datta 1991).

Further, in present era of technological advancement, acquisition of knowledge is among the important intents for M&A; high-tech sectors, particularly, pharmaceutical and IT, use M&A as preferred strategy for acquiring external knowledge, sources of new ideas, etc., rather than going for risky and costlier internal innovation (Kennedy et al. 2002).

Thus, there are multiple factors that affect M&A performance. Along with financial motivations, numerous real benefits persuade corporate firms for M&A decisions; these benefits are not adequately addressed in available studies (Lubatkin 1983). As per King et al. (2004), the performance models, used in available studies, are inconsistent in terms of parameters used; the literature since three decades is

revealing different definitions for M&A, in terms of operational definitions, indicators, temporal orientations, units of analysis, and so on (Meglio and Risberg 2009). For the precise and comprehensive view of M&A outcome, the existing models are needed to be reformed on the foundation of existing one (King et al. 2004). The study is an attempt to fill in the methodological gaps in existing literature; in this view the study proposes comprehensive analysis of M&A performance considering various possible perspectives likely to be influenced by M&A decisions.

### 23.3 M&A Performance: Multiple Perspectives

M&A are complex phenomena; they bring structural changes in the organization. As evidenced from literature, M&A are the source of opportunities and contingencies. Along with synergistic benefits—operational, marketing, or managerial, these decisions are likely to affect other perspectives also, such as technological, managerial, human perspective, knowledge perspective, and so on. They involve changes in management thinking and style, work culture, employees' perspective, customers' perspective, and so on. M&A decisions affect the various perspectives of merging entities, ranging from process to people. These decisions bring together assets, liabilities, cultures, peoples, policies, environments, managements, strengths, weaknesses, opportunities, threats, and so on. In this view, incorporating all possible aspects likely to have bearing on M&A performance is expected to facilitate better insight of M&A performance.

M&A success depends upon numerous factors; acquirer firms need to measure all possible factors likely to have bearing on M&A outcome. Apart from integration measures, due diligence, financial perspective, other internal and external perspectives need to be focused upon. For instance, employees' perspectives, customers' perspectives are among sensitive issues in M&A performance; ignorance of the same could create serious impediments; disenchanted employees and/or clients can jeopardize performance.

“M&A performance is actually an umbrella under which a number of performance dimensions exist, depending on the time horizon considered (short-term vs. long-term), and on the unit of analysis adopted”—*Giovanni Valentini, Department of Management, Institute of Strategy, Università Commerciale Luigi Bocconi, Milan, Italy*. Therefore, for holistic insight, it would be appropriate to assess the impact of M&A on financial, nonfinancial, internal, as well as external perspective. Considering distinct dimensions/perspectives of M&A performance is requisite as each dimension might be influenced by different factors; further, same factor might have a positive influence on one performance dimension and a negative effect on another. For instance, situation-actor-process-performance (S-A-A-P) framework (Sushil 2001) has been proposed for evaluation of M&A performance by Mittal and Jain (2012). As per the framework, M&A performance is a function of lead as well as lag parameters; framework reflects dual perspective of M&A performance, with enterprise and customers as two aspects. Apart from enterprise internal

**Fig. 23.1** Multiple perspectives in M&A performance



perspective and customer perspective, there are numerous perspectives that are expected to be influenced by M&A decisions. For the holistic understanding of M&A performance, all possible parameters of M&A performance, internal, external, lead, as well as lag, need to be identified. Figure 23.1 exhibits an overview of multiple perspectives of M&A performance; figure suggests the influence of internal as well as external perspectives on M&A performance.

Under the broad categorization of six perspectives (portrayed in Fig. 23.1), the study proposes a set of 48 parameters to facilitate all-inclusive view of M&A performance; select list is exhibited in Table 23.1. Table exhibits 48 performance parameters, under the broad categorization of lead- and lag-performance parameters and subcategorization of situation, actor (internal), actor (external), process, and performance.

The list could be more exhaustive; depending upon the changed circumstances (firms, industries, or environment) new parameters could be added or deleted.

### 23.4 Significance of Analyzing Multiple Perspectives of M&A Performance

Analyzing of M&A performance using multiple perspectives would likely facilitate better understanding of M&A impact. For instance, some facts relating to acquisition of Ahmednagar Forgings Limited (AFL) by Amtek Auto Limited (AAL) in the year 2002 are contained in Tables 23.2 and 23.3. Table 23.2 exhibits the post-acquisition impact of M&A from the perspective of AAL in terms of intents, situations, actors, processes, and performance factors; Table 23.3 contains information pertaining to

**Table 23.1** Mergers and acquisitions (M&A) key performance attributes

<b>Lead factors</b>
<i>Situation</i>
Opportunities
1. Globalization
2. New market entry
3. Rapid expansion (due to access to specific resources or favorable environment)
Threats
4. Regulatory threats (government opposition)
5. Competitive threats
6. Changed customers' demand
7. Economic threats
8. Employees' resistance
<i>Actor (internal)</i>
Managerial perspective
9. Managerial compatibility (Davis 1968; Ivancevich et al. 1987; Lubatkin 1983; Datta 1991)
Human resources (Koys 2001; Luecke 2003; Chambers and Honeycutt 2009)
10. Labor turnover rate
Learning perspective (Kennedy et al. 2002)
11. Research and development activity
<i>Actor (external)</i>
Customer perspective (Oberg 2008; Chand 2009)
Generic factors
12. New products
13. Improved products
Strategic factors
14. Better price
15. Quality improvement
16. Choice (product portfolio)
17. After sales service
Competitors' perspective
18. Impact on the competitors' strengths
Government perspective
19. Government's attitude towards M&A (favorable or unfavorable)
<i>Process</i>
Operating (Seth 1990b; Herrick 2002)
20. Operating cost (economies of scale and scope)
21. Operating efficiency
22. Better utilization of resources
23. Access to specialized resources
Marketing perspective (Barney 1991)

**Table 23.1** (continued)

24. Market share
25. Market resources (ability to control market) (Hooley et al. 2005)
26. Competitive strength
27. Reputational assets
28. New market and new market segments
29. Distribution network
30. Portfolio improvement (new products or better quality)
<b>Lag parameters</b>
<i>Performance</i>
Long-term performance
Profitability: from operations
31. Gross-profit margin
32. Operating profit margin
33. Net profit margin
Profitability from investments/rates of return
34. Return on investments
35. Return on capital employed
36. Return on shareholders' fund
Liquidity
37. Current ratio
38. Acid-test ratio
39. Defensive interval ratio
40. Debtors turnover ratio
41. Stock turnover ratio
42. Creditors' turnover ratio
Solvency
43. Debt-equity ratio
44. Interest coverage ratio
Growth
45. Net worth
46. Earning power (net profit margin $\times$ assets turnover ratio)
Short-term performance
47. Abnormal returns on M&A announcements
48. Cumulative abnormal returns on M&A announcements

financial impact. In view of relevant information, there seems no adverse impact of the deal on situations, actors, processes, or performance perspectives of the firms after M&A. The firm has successfully attained its desired objectives of expanded customers' base and manufacturing facilities; there seems a positive impact on the processes and indirectly on customers' perspective.

**Table 23.2** Key interpretation of impact of Amtek Auto Limited (AAL) and Ahmednagar Forgings Limited (AFL) in terms of Situation-actor-process-performance (S-A-P-P) framework

Factors	Impact
Intents	Enhanced production capacity and large customer base of AFL in western India
Situations	Enhancement of production capacity and market base
Actors	In terms of employees, knowledge, and managerial compatibility, no adverse impact has been observed; the benefits gained by both the firms after the deal also vouch/support the same
Customers' perspectives	Customers seem to have been benefited in terms of improved portfolio; further, they have gained easy accessibility to AAL product near their location
Process perspective	
Operating perspective	The findings indicate no significant cost economies; however, net profit margin ratio seems to have improved in the post-acquisition period
Marketing perspective	No significant market synergies have been observed in the post-acquisition years; yet, the improved assets turnover ratio indicates enhanced market base of the company
Technical perspective	Ahmednagar plant has successfully qualified for TS Certification from BVQI; in addition, the fastener division at Ahmednagar has also been accredited with ISO certification
Performance	Improved efficiency in terms of operations as well as assets utilization

Table 23.3 contains information pertaining to profit margins ratios of AAL pertaining to the pre-acquisition year and post-acquisition years 1, 2, and 3. Relevant data suggest no significant operating synergies, normally expected in terms of enhanced gross-profit margin and operating profit margin, production, purchase, or cost economies. On the contrary, consistent decline in the profit margins suggest the failure of acquirer firms in realizing expected operating synergies of combination. It is important to be noted that deal has contributed in the realization of the underlying objectives of AAL (Table 23.2). In view of these findings, it is reasonable to conclude that success of M&A not necessarily means the financial improvement. Instead, constituting to strategic decisions driven with multiplicity of causes, performance of M&A decisions should be assessed in terms of realization of the underlying objectives set out by management. In other words, M&A success should be measured against the predetermined targets set by management as yardstick.

Additionally, collective view of lead as well as lag parameters (provided in Table 23.1) would likely facilitate a performance management and control mechanism for continuous monitoring of M&A performance in terms of identifying weak parameters and initiating corrective actions. Figure 23.2 exhibits lead and lag parameters' possible linkage map (based on the survey carried out by Jim Surguy, Managing Director—Results Business Consulting). In view of variation from the expected targets, in-depth analysis of the cause factors could be attempted and corrective strategy could be planned and initiated.

**Table 23.3** Operating Profitability and Expense Ratios of Amtek Auto Limited (AAL) for pre- and post-acquisition period (M&A Year 2002–2003; Figures are in percentage)

Operating Profitability and Expense Ratios	Pre-acquisition year	Post-acquisition years			Percentage change in post-acquisition years		
		Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Gross profit margin	35.56	33.09	30.68	31.59	6.96	13.73	11.18
Operating profit margin	18.00	16.55	16.04	17.95	8.04	10.89	0.28
EBIT ratio	18.88	16.79	16.32	20.32	11.08	13.56	7.64
Net profit ratio	7.76	10.28	10.28	14.19	32.56	32.45	82.92
Cost of goods sold ratio	64.89	66.91	69.32	68.41	3.11	6.83	5.42
Purchases to production cost ratio	97.29	97.21	97.36	97.54	0.08	0.07	0.26
Raw material to production cost ratio	97.29	97.21	97.36	97.54	0.08	0.07	0.26
Operating cost ratio	41.32	39.09	36.68	37.1	5.40	11.23	10.21
Administrative expenses to net sales	5.42	5.21	5.21	4.81	3.87	3.87	11.25
Personnel expenses to operating cost	7.37	6.91	6.76	6.38	6.24	8.28	13.43
Selling and distribution expenses to net sales	0.79	0.79	0.79	0.7	–	–	11.39
Selling and distribution expenses to operating cost	1.07	1.05	1.02	0.93	1.87	4.67	13.08
Advertisement expenses to net sales	0.01	0.01	0.01	0.01	–	–	–
Advertisement expenses to selling and distribution expenses	1.15	1.53	0.75	0.87	33.04	34.78	24.35

### 23.5 Performance Measurement and Management on the Basis of Multiple Perspectives

*Measurement of M&A Performance* The list of the select parameters providing in the preceding sectors comprises of quantitative as well as qualitative parameters. Depending upon the need and circumstances, parameters could be sorted in the order of preferences from most significant to least significant. To facilitate the uniformity in the measurement of both qualitative and quantitative parameters, scaling of parameters could be used; different grading scales, such as 1–3, 1–5, 1–7, 1–9, etc., could be used to scale the performance, ranging from below average to above average. The scale could be decided using experts' opinion, depending upon the performance of a particular attribute. Measurement of the performance on the select parameters against predetermined target would facilitate the identification of the variations from the proposed objectives (Table 23.4).



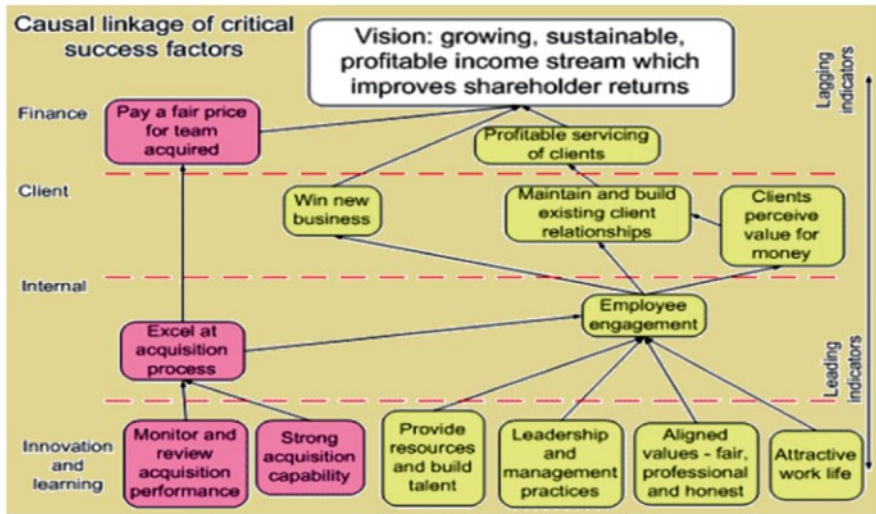


Fig. 23.2 Lead and lag parameters relationships and M&A performance. (Source: Results Business Consulting)

Table 23.4 Measurement of variations from expected targets

Parameters	Expected target	Actual performance	Variations
1			
2			
⋮			
N			

Identification of the variations would be helpful in initiating corrective actions for further improvement. In view of cause factors responsible and the magnitude of variations, an in-depth analysis of the cause factors could be facilitated and corrective actions could be initiated. On the basis of variations identified on the select parameters, strengths-weaknesses-opportunities-threats (SWOT) analysis could be carried out and strategy could be executed for further improvement (Fig. 23.3). Strategy could be implemented for overcoming the threats and weaknesses to exploit favorable growth opportunities offered by M&A, such as serving new market, new customer base, rapid expansion by leveraging large resources and assets base, etc.

Using select set of parameters, a strategy could be played as game-card (Sushil 2010; Mittal and Jain 2012; Yadav and Sushil 2014) for the identification of optimum M&A performance system. Literature also evidenced experience in deal-making as the success factor in M&A; lead and lag parameters’ linkage map (Fig. 23.2) also corroborate the same; it suggests significant influence of monitoring and review process of M&A performance on M&A success.

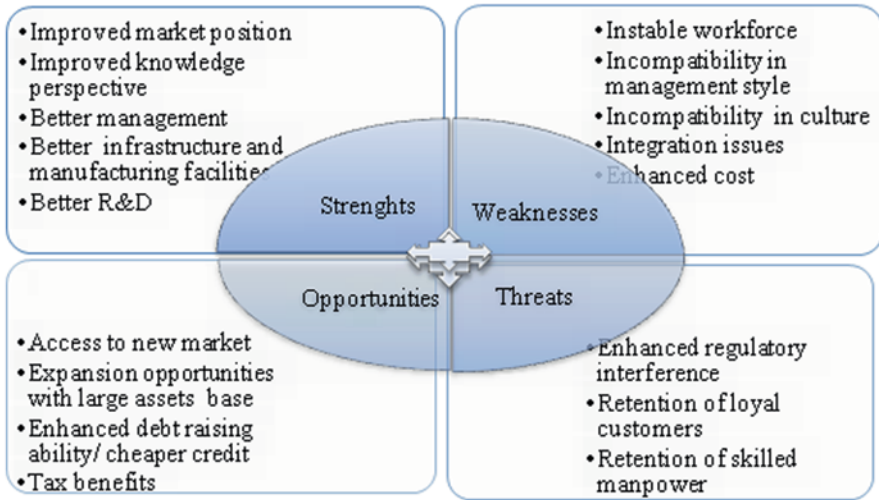


Fig. 23.3 SWOT diagram for M&A performance

In the words of Paul Johnnnstone, H R M&A and Benefits Manager, GE—“Each M&A deal has different flavor and more deals we do, the more knowledge we can bring to the next deal<sup>1</sup>.”

“We have the process, tools, and people to achieve successful integration; if we have done it before we will do it well this time. Those that do it for the first time will burn their fingers. We invest in our integration learning and capability because it brings value”—Andreas Denkmann, Head of M&A, Conegy<sup>1</sup>.

Above quoted views, prima facie, suggest the learning and experience to be significant contributor in M&A success. M&A provides an opportunity to leverage large assets base, knowledge and scare resources for rapid growth, expansion, and value creation. Optimum utilization of these opportunities requires to identify more perspectives of M&A performance, to analyze their impact of deal performance, and to articulate the experience in future deal making.

### 23.6 Conclusion

M&A decisions are driven by multiplicity of causes. Additionally, M&A are strategic-cum-financial decisions, likely to affect different aspects of the merging entities. This then constitutes rationale for analyzing these decisions in a holistic framework, encompassing all possible perspectives, financial or strategic, likely to be influenced by these decisions. Analyzing financial as well as nonfinancial aspects

<sup>1</sup> Quoted in—“M&A Integration—How to do it. Planning and delivering M&A integration for business success”—by Danny A. Davis. First edition 2012 published by John Wiley & Sons.

of M&A performance, is likely to provide a more robust view of M&A performance in terms of real benefits, along with the monetary benefits. Getting an insight into lead parameters, along with lag performance parameters, could be helpful in understanding the factors responsible for the outcome and initiating the required action, thereby enhancing longevity of M&A decisions, which perhaps seem requisite in the present scenario where M&A deals collapse within a short period of time.

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# Chapter 24

## A System Dynamics (SD) Model of Post-Merger Integration

Shyam Sethi

### 24.1 Introduction

A manager finds it difficult to cope with the complex problems with the ‘traditional management’ approach based on mental models, intuitions, experiences and judgements. To manage the complexities and contradictions, we need to substantiate a manager’s knowledge with tools of selecting and structuring available information, to generate formal models, so that the working of the system can be better understood and the policies improved. SD is a methodology that judiciously combines the traditional management with cybernetics and computer simulation so as to carry out a sound policy analysis (Forrester 1995). An approach that can capture the underlying dynamics of these systems will be highly suitable for the management. The dynamic behaviour of these systems is, to a great extent, governed by its structure, which is composed of various cause–effect relationships. There is information feedback which drives these systems.

The managerial and social systems are governed predominantly by ‘endogenous relationships’ rather than by the external influences. The internal policies affect a great deal in shaping their performance. Hence, the system that generates behaviour endogenously will be most suitable in dealing with managerial problems.

In the present study, the post-merger integration of Kelvinator and Whirlpool is discussed and a SD model is developed taking ‘market share’ and ‘profit before tax’ (PBT) as key variables. A causal loop diagram for the market share and PBT is developed along with stock and flow diagram. The simulation results using Powersim software have been derived for future predictions.

The objective of this study is to present the post facto validation of system dynamics simulation results with the actual results.

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## 24.2 Research Methodology

The principles and concepts of traditional management, cybernetics and computer simulation form the foundation of SD, overcoming their weaknesses and utilising their strengths synergistically. In the discipline of traditional management, the judgement and experience of managers are used to solve problem situations. Cybernetics or feedback theory provides principles that help a manager to filter out the real information useful in a problem situation and then relating various information elements to find out the causal relationships and feedback in the system. The computer simulation is used to generate the consequences for studying the dynamic behaviour of the system, as human mind is weak in generating and relating higher-order consequences. Thus, SD makes use of the strengths of the human mind for gathering information, generates a structure with the help of known principles and surmounts the shortcomings of the human mind by computers. The SD methodology with its causal philosophy is for gaining deep insight into a system.

The SD process starts from a problem to be solved—a situation that needs to be better understood, or an undesirable behaviour that is to be corrected or avoided. Presumably a SD model will organise, clarify and unify knowledge. SD models are built to determine and modify the processes that cause desirable and undesirable behaviour (Sushil 1994).

The approach to development of a SD model involves the following steps (Sushil 1993):

- Problem identification and definition
- System conceptualization
- Model formulation
- Simulation and validation
- Policy analysis and improvement
- Policy implementation

The SD process starts with the understanding of the system, through the problem definition, identification and formulation, followed by redefinition of the problem, repeated if required, till an acceptable system conceptualization is obtained. The model is then formulated in detail, in terms of mathematical equations, which further widen our understanding of the system, and the process is continued till a logical model in tune with the reality is achieved. Simulation and validation of the model comes next to formulation, leading to the refinement and reformulation of the model. The valid model is then subjected to policy analysis and improvement; the improved policies can be implemented on the basis of feedback, which will enhance the understanding of the system.

### 24.3 Problem Definition

Whirlpool India Limited (WIL) acquired Kelvinator of India Limited and TVS in 1995. Most of the mergers and acquisitions activities failed due to an array of reasons post-merger/acquisition integration being the most important (Sushil 2013).

Whirlpool went into the inorganic growth route by acquiring Kelvinator and TVS in order to realize the following goals. It formulated a 5-year strategic plan, set targets and actions required to be achieved (Whitwam 1994).

- To become a market leader and sustain market leadership in the segments they entered (i.e. refrigerator and washing machines). For this, Whirlpool had defined a target market share during the strategic plan period.
- To gain and maintain market share, Whirlpool had to build its brand name, since it had to surrender the Kelvinator brand to Electrolux within 1 and half-years of acquisition of Kelvinator. At the time of acquisition, the brand awareness of Whirlpool was only 20%.
- To sustain itself, WIL should earn a minimum profit (which would grow over the period of time). This would not only enable WIL to pay the agreed royalty to its parent company, but also expand its operations in the country to convert it into a manufacturing hub, which was an important part of the company's mission statement.

To achieve the twin objectives of market leadership and a reasonable profit (within the planned horizon 1995–2001), the following measures had to be taken:

- i. The brand awareness had to be increased from 20 (at 1996 level) to 90% by 2002 (Euromonitor Database 2001, 2002, 2003, 2004). This could be accomplished by increased spending in the following areas:
  - Advertisement (Media)
  - Sales promotion
- ii. To obtain the desired profit level, the following policy measures had to be initiated:
  - *Reduce material cost*, by means of global sourcing, volume leverage and value engineering
  - *Reduce manufacturing cost* by
    - a. Technological upgradation divesting the unprofitable manufacturing facilities and outsourcing some functions
    - b. Improving productivity by imparting training and development of employee skills and also by offering financial and non-financial incentives
  - *Reduce employee cost* by means of manpower reduction, which, in turn, can be accomplished by offering attractive voluntary retirement schemes (VRS).
  - *Reduce financial costs* by retiring high-interest debts by means of external commercial borrowings (ECB) and by infusion of more equity from the parent company.

The above points had to be accomplished taking into account the fact that there would be stiff competition offered by several multinational players like Electrolux,



GE-Godrej, LG and Samsung as well as domestic players like Videocon and BPL (Yoshino and Srinivasa 1995).

## 24.4 System Conceptualization

### 24.4.1 *Components and Interactions*

To form a basic framework for system conceptualization, the following components and their interactions have been considered below:

- Market share—this can be classified as:
  - Desired market share
  - Market share (actual)
  - Discrepancy MS (desired market share-actual market share) [for feedback purpose]
- Sales turnover
- Brand awareness
- Advertisement and sales promotion
- Competitors reaction (in terms of price reduction and promotional offerings)

This will form the ‘Market Share’ subsystem and will interact with the ‘Profit Before Tax’ subsystem, which consists of the following components:

- PBT will be classified as
  - Desired PBT
  - PBT (actual)
  - Discrepancy PBT (desired PBT-PBT) [for feedback purpose]
- Material cost will be affected by
  - Volume leverage
  - Value engineering
- Manufacturing cost will be affected by
  - Technological upgradation
  - Better trained personnel
- Employee cost will be affected by
  - Manpower reduction
  - Salary increase and financial incentives
- Financial cost will be affected by
  - Investments for technological upgradation
  - Investments for training and development
  - Retirement of debt
- Selling expenses will include advertisement and sales promotion expenses

### 24.4.2 Causal Loop Diagram

The system has been conceptualized with the help of an influence diagram (also called causal loop diagram) as shown in Fig. 24.1.

The causal loop diagram mainly consists of two loops, which have sub-loops attached to them.

- i. Market share feedback loop describes the interaction between the various components like sales turnover, brand awareness, etc. It is a stabilizing loop (or a  $-ve$  feedback loop) trying to achieve the market share target set and the discrepancy between the desired market share and the actual market share triggering the control mechanism. As an attachment we have the competitor’s reaction which is again a  $-ve$  feedback loop, being triggered when the market share of Whirlpool exceeds a particular market share (23 % has been defined here).
- ii. The PBT feedback loop consists of the following sub-loops
  - a. Manufacturing expenses sub-loop is again a stabilizing feedback loop, which sets a target of productivity to be achieved and is triggered by discrepancy in the PBT, and is acted upon by training and development of employees.
  - b. Material expenses sub-loop is also similar to manufacturing expenses sub-loop except that the action variables change volume leverage and value engineering.

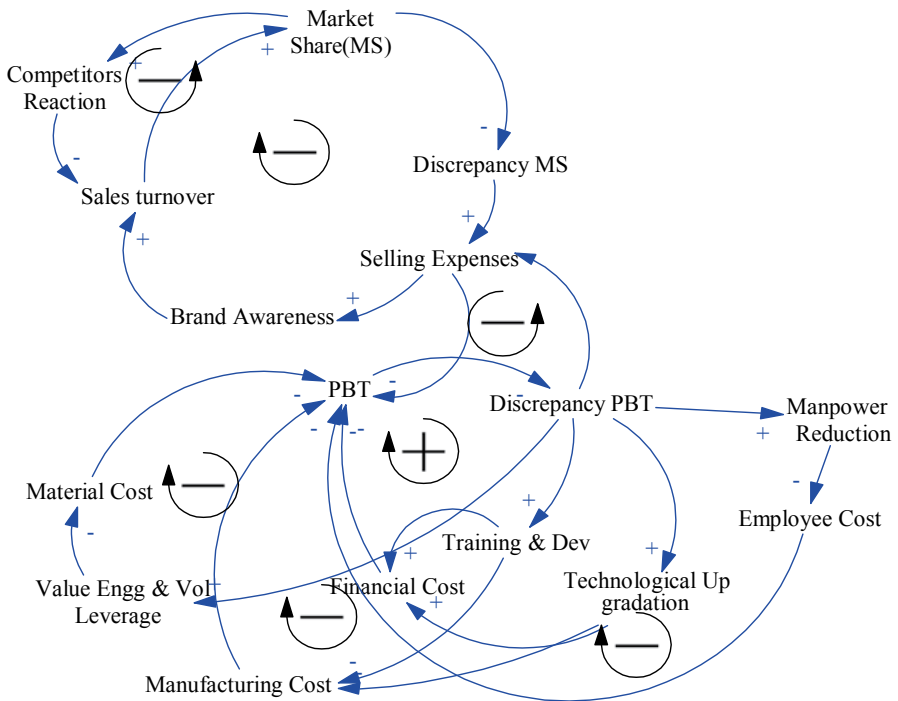


Fig. 24.1 Casual loop diagram for market share and PBT

- c. Employee cost sub-loop is also a stabilizing loop where employee reduction is the action variable.
- d. Financial expenses sub-loop is the only reinforcing loop (+ve feedback) since the discrepancy in PBT triggers upgradation of technology, which in isolation will shoot the discrepancies in PBT even further.

## 24.5 Model Development

After completing the causal loop diagram, the stock and flow diagram was prepared. For the clarity of development of stock and flow diagram, the system has been divided into the following sub-modules. Sub-models are developed in Powerism, here only market share sub-model is presented for illustration:

- Market share
- PBT
  - Material and manufacturing expenses
  - Employee expenses

### 24.5.1 Market Share Sub-model

The stock and flow diagram of market share sub-model is presented in Fig. 24.2.

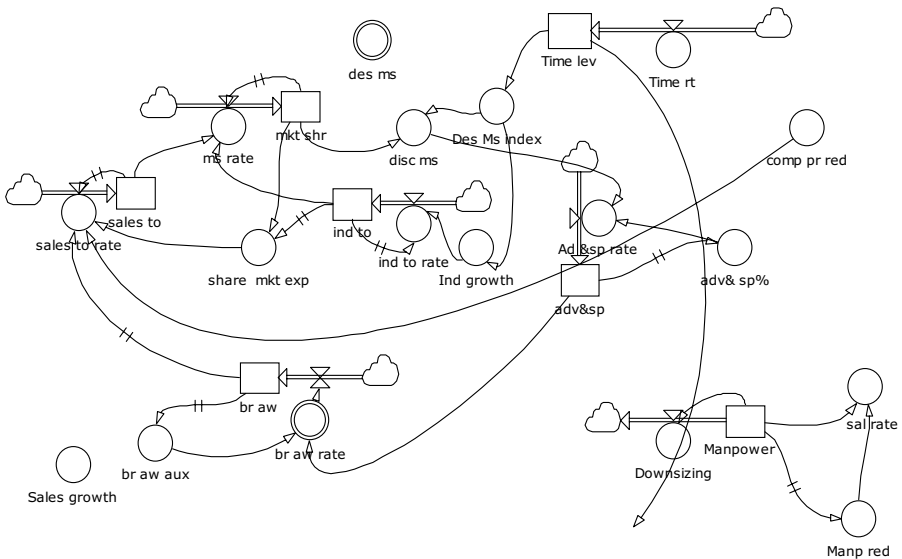


Fig. 24.2 Stock and flow diagram of market share sub-model

## 24.6 Validation of the Model

The validation of SD model is different from that of the conventional management science model. The validation is more about building confidence in terms of its suitability for model purposes, consistency with real system and utility and effectiveness. This research work was carried out in 2003 and simulation results were presented for year 2009. A post facto validation of the model was done by matching the simulation results with the actual results.

### 24.6.1 Comparison of Simulation Results with Actual Results

The simulation results obtained from the SD model are first compared with the real data obtained from the profit and loss account and the balance sheets of WIL. The results have been compared with the actual data. The behaviour of the model seems to follow the pattern of the real data, which verifies the model. For data on market share, business journal reports (Hindu, Business-line, Economic Times and ORG-Marg) have been referred.

It is observed from Fig. 24.3 that market share is following a sinusoidal pattern, though in later years there is a distinctive downward trend. Whirlpool with its dynamic strategies initiated in last years has reversed the trends.

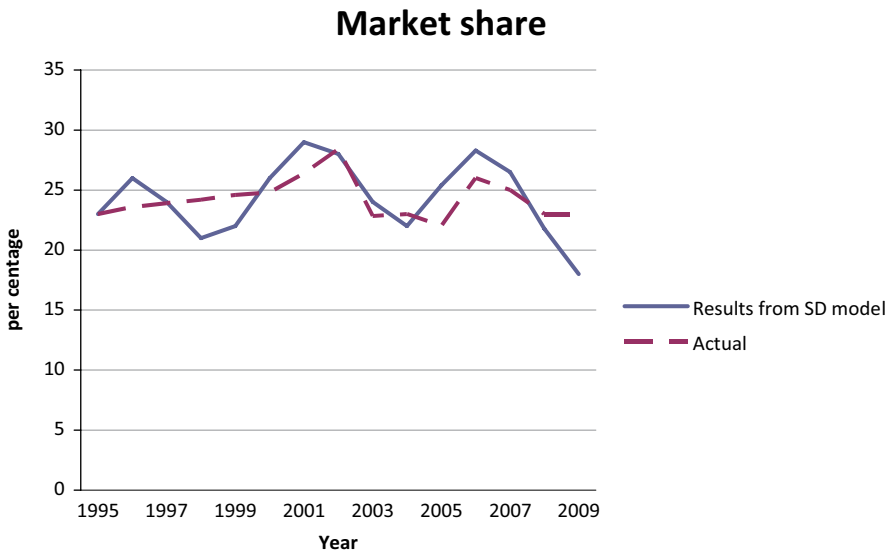


Fig. 24.3 Simulation results vs. actual data—market share

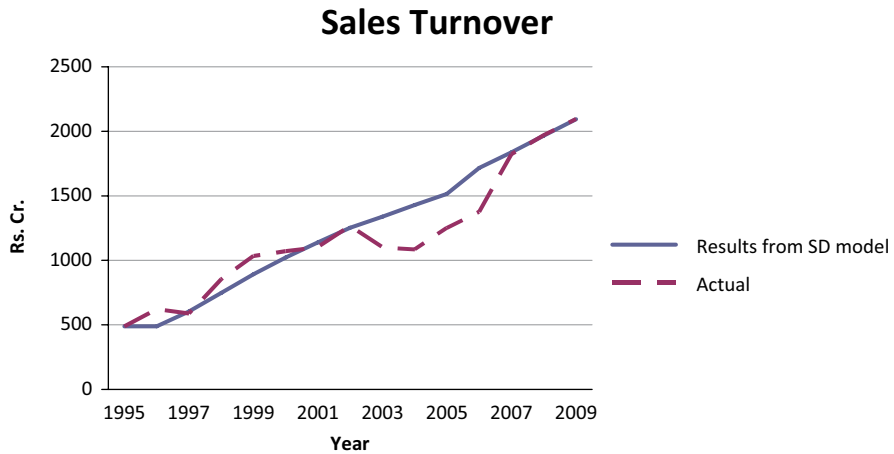


Fig. 24.4 Simulation results vs. actual data—sales turnover

Future prediction: Market share, 2003–2009

Year	2003	2004	2005	2006	2007	2008	2009
Market share (%)	26	22	25.4	28.3	26.5	21.8	18
Actual	26	23	22	26	25	23	23

For the other variables also, we have followed the same pattern of discussion with some brevity.

We observe from Fig. 24.4 that sales turnover is following a steady growth pattern, though in 2005 the growth has flattened a bit due to restructuring and reorganising the sales setup. Whirlpool improved sales considerably by introducing new models. Sales were ₹ 2095 crore as against the prediction of ₹ 2093 crore by SD model. This shows that the SD model describes the behaviour of system very well.

Future prediction and actual results: sales turnover, 2003–2009

Year	2003	2004	2005	2006	2007	2008	2009
Sales turnover (Rs. in crore)	1338	1429	1515	1717	1837	1966	2093
Actual (Rs. in crore)	–	1085	1250	1376	1623	1970	2095

The study was conducted in 2003 and simulation results were predicted till 2009. However, recently the data from 2009 to 2011 had been collected which shows the continuous growth pattern in sales after integration, which is shown in Fig. 24.5.

It is observed from Fig. 24.6 that PBT is following a sinusoidal pattern though in later years there is a distinctive trend of dampened oscillations. The upward trend from 2009 is continued in 2010 and 2011.

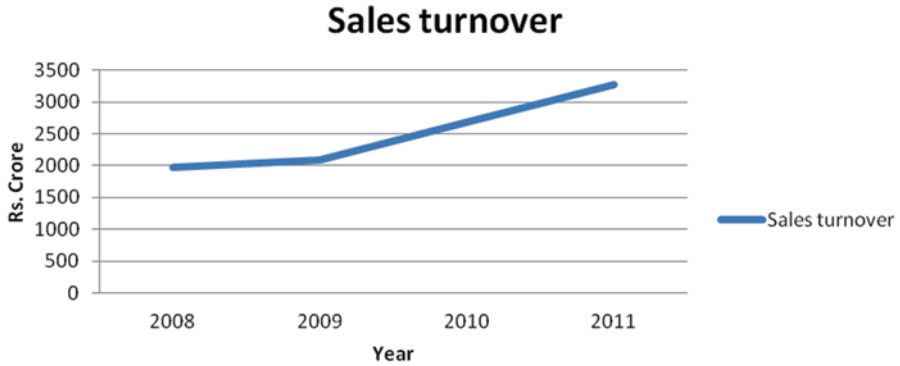


Fig. 24.5 Sales turnover (for year 2008–2011)



Fig. 24.6 Simulation results vs. actual data—PBT

Year	2003	2004	2005	2006	2007	2008	2009
PBT (%)	2	2	-2	4.24	1.35	0.5	3
Actual %	-	-3.2	-8.1	-2.76	-0.30	1.6	3.5

Figure 24.7 shows that material and manufacturing expenses are following a steady growth pattern and it followed the SD model. Though the material cost has actually increased considerably, Whirlpool has contracted it with outsourcing and improvement in technology and global procurement.

We can observe from Fig. 24.8 that employee expenses had fallen appreciably (this is because of the massive downsizing reducing manpower from 6000 people to 2951 by the year 2000, and then gradually settle at 2238 by the year 2005, which has been assumed as the ‘bare-minimum’ manpower to carry on activities. So employee expenses have steadied in the 6–7% range.

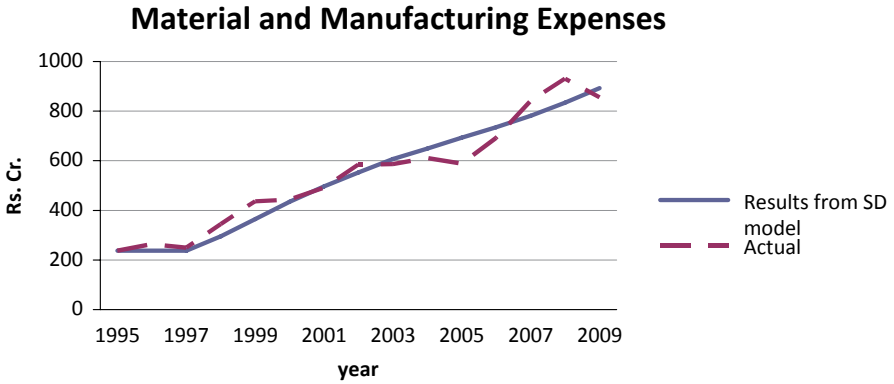


Fig. 24.7 Simulation results vs. actual data—material and manufacturing expenses

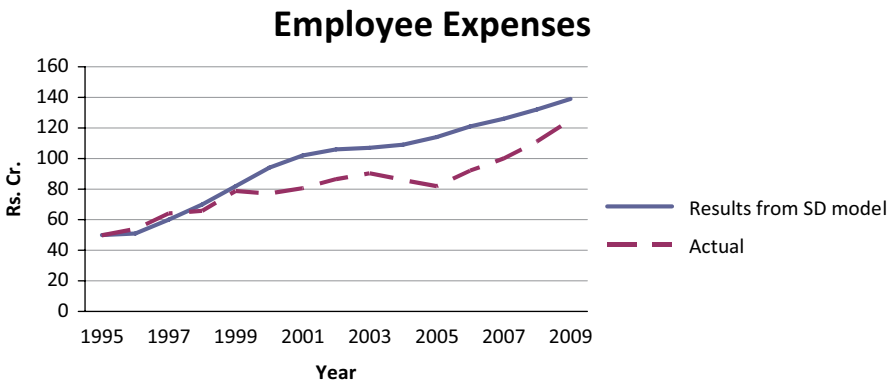


Fig. 24.8 Simulation results vs. actual data—employee expenses

## 24.7 Discussions

The discussion is elaborated under the following subheadings:

- Summary of major findings
- Major recommendations

### 24.7.1 Major Findings

From the closeness of simulation results with that of reality, we can infer that the policies assumed by us for formulating the SD model have been more or less corroborated by the actual results. The major policies and findings are:

For gaining market share, WILs policy (assumed for the SD model and corroborated by actual results) has been:

- WIL would spend heavily on advertising and sales promotion in order to build a strong brand awareness, which will, in turn, help WIL increase its market share to the desired level. If there is a discrepancy between the actual and desired market, the spending will be increased.
- If the market share of WIL goes on increasing, its competitors will react by either reducing prices and/or increasing promotional spending in order to retain the lost ground which will lead to a drop in the growth rate of WIL. That can have two implications:
  - a. WIL sales turnover will take a hit (which may not be in absolute terms but its sales growth will come down).
  - b. WIL will respond by offering a price-cut, which will further erode its margins and bring down PBT.
- It should be noted that WIL doesn't follow the path of increasing market share by proactively slashing prices.

Integrating the operations with Kelvinator necessitated the following steps:

- Technological upgradation of the manufacturing facilities (and starting a new facility) of Kelvinator was required in order to achieve better productivity and produce high quality products for the domestic market and for export.
- Productivity improvement could happen by shedding the excess workforce, inherited by taking over Kelvinator and consequently providing them with training for skill upgradation. Also in order to motivate the apprehensive employees, WIL need to increase salaries and offer other financial incentives.
- The burden of high interest paying debts had to be retired with softer loans available from the parent company. This can also be exploited for further investment required for technological upgradation.
- Better bargaining power with the suppliers including global procurement because of the volume leverage along with value engineering would help the company to increase material productivity and consequently the PBT.

To sum up, it can be said that WIL was able to manage the post-acquisition scenario considering its objective of building up brand awareness and consequently gaining market share. But its objective in terms of profit (we have taken PBT as the variable) has not been realized and as per the model predictions may be realized in the near future.

It can also be seen that of late, the market share has also been coming down, though WIL still remains the market leader in the overall refrigerator market and number two in washing machines. This can be attributed to the entry of new multinationals and to the market becoming fragmented. The saturation of urban markets and lack of significant presence of WIL in rural markets could also be a reason for the



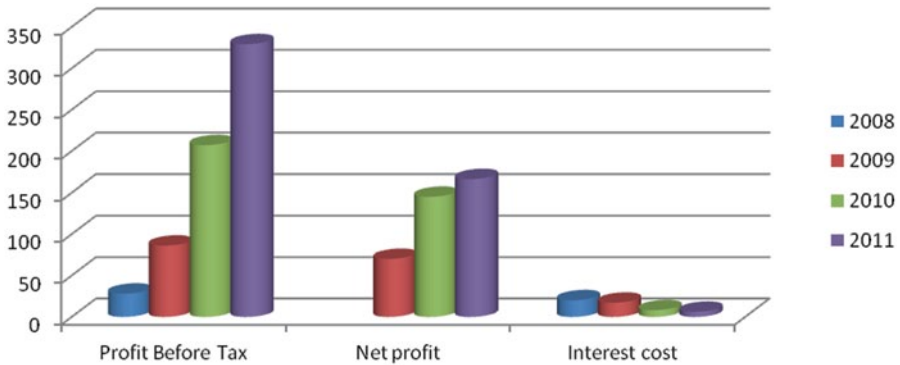


Fig. 24.9 PBT, net profit and interest cost for the year 2008–2011

decreasing market share. However, Whirlpool has made major strides in subsequent years and greatly improved its PBT, net profit and interest cost as shown in Fig. 24.9.

### 24.7.2 Major Recommendations

On the basis of the insight gained from the SD model, the major recommendations are:

- **Focus on Reduction in Material Expenses**

The material expenses has the maximum share of the expenses (around 50% of sales turnover). There had been limited gain in material productivity due to rising prices of steel sheets, copper and plastic in the international market. This has been reduced in the later years by outsourcing and global procurement especially during the years 2010 and 2011.

- **Focus on New Markets**

The market share is not increasing over a period of time despite substantial growth in the industry. To regain this market share, the company has to take necessary action. India's rural market is growing at a brisk pace because of the credit facility, growing purchasing power and low-market penetration. Whirlpool does not have a significant presence out there, which remains an unexplored potential. For rural markets, WIL will have to bring out a cheaper and innovative refrigerator.

## 24.8 Conclusion

It is observed that merger integration process helped Whirlpool attain global leverage in India. The integration process also helped in launching a well-conceived brand strategy to gain market share. It also aided the company in managing complex changes. It is facing severe challenges in the emerging competitive environments

with the entry of new players like LG, Samsung and Haier. It has improved the financials as shown in the figures previously.

This study presented the methodology of post facto validation of SD methodology and modelling. The results obtained by the simulation are very close to the results came out over the period of 2004–2009. This study can be considered to develop more confidence in SD methodology to predict the behaviour of a business system.

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