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Organizational Strategy Formulation and Flexibility: An Introduction to Special Issue

The formulation and implementation of organizational strategy are recognized as key aspects of the management of all modern successful organizations. However, it has become a daunting task to cope up with changes in today's hyper competitive market place. With increasingly more global competition and the infusion of the internet in the business world, flexibility in the strategy formulation and strategy's implementation process has become a requirement to survive and develop new business. Many researchers over time have stressed the importance of incorporating flexibility in the formulation of business strategy, as it may help achieve better business performance. In such an environment, traditional strategic planning methods do not suffice. To keep organizations competitive, policy makers will have to overhaul the process of formulating and implementing strategic initiatives to explicitly consider flexibility at various levels in the organization. Many challenges await companies as they formulate their organizational strategy and create flexibility in business processes. Thus, organizations are obliged to continuously explore new and innovative strategies, and to seek powerful methodologies that will confer competitive advantage.

The purpose of this special issue is to group together high-quality papers that lie at the intersection of flexibility and organizational strategy issues. The call for papers for this special issue emphasized that the flexibility is adapted in its most generic sense and includes both the service and manufacturing environments. The five papers finally included in this special issue reiterate this viewpoint.

In the first paper of this issue, entitled, 'e-strategy Model for Creating Flexible Organizations', Sharma and Gupta argue that the creation of an e-strategy requires comprehensive knowledge of every aspect of business, from core operational needs to competitive forces to technology priorities. While the research thus far has emphasized only the operations management perspective, they suggest that the strategy perspectives are also important. Utilizing existing knowledge from various areas, they present a conceptual framework of an e-strategy model that suggests considering flexibility at all levels including external stakeholders, such as customers, partners, competitors and suppliers, as well as at internal resources like people, processes and technology.

While Sharma and Gupta were concerned with a framework and a model of e-strategy for organizational flexibility, Bhandari, Bliemel, Harold, and Hassanein in their paper 'Flexibility in e-Business Strategies: A Requirement for Success' suggest that the complex and transient nature of the environment faced by e-Business ventures poses a challenge to organizations trying to formulate and implement strategies that are flexible enough to anticipate and react to the rapidly unfolding changes in this environment. After reviewing the traditional and more recent approaches to strategy in terms of their characteristics and flexibility, they outline flexibility requirements for organizations in the emerging e-economy at different stages of maturity. Creative exercises, such as experimentation and scenario planning are proposed as essential tools for expanding the knowledge base of firms yielding them more strategic options leading to more flexibility.

The issue of strategy development is further taken up in the third paper of this special issue entitled, 'Flexibility in Operations and Business Innovation' by Halemane and Janszen. They argue that firms need to consider various drivers of change within and from the environment in developing new vision and products for dynamic markets. They suggest that the resource based view falls short, in that it does not explicitly address competencies in organizational capabilities and market orientation. In this process, constraints at operations and business level have been identified for meeting the drivers of change. The resulting operations performance with environmental constraints demands suitable business enablers, or drivers of strategic flexibility, for achieving business excellence. In this paper, estimates of the potential performances are shown to assist the learning process at business level, and as evidenced by within-case analysis also at operations level.

Once the issues related to flexibility have been handled, from the strategy and operational perspective, a firm starts to function as a flexible organization. However, as time passes, the needs for flexibility increase. Therefore, models and processes are required to improve flexibility. The fourth paper entitled, 'Improving Flexibility in Strategy Formulation by Adopting a New Technology: Four Internet-Based Business Models' by Igal Karin explores how a firm's flexibility in the formulation of organizational strategy might be improved by adoption of internet technology. At the basis of this work are four case studies of firms, acting in either local or global markets, which adopted Internet technology and whose managers preferred an





Jatinder N. D. Gupta and Sushil K. Sharma

evolutionary rather than a revolutionary change from traditional business models to more innovative internet-based ones. This preference for an evolutionary transition seems to be related to the organizations' continuous exploration of new strategies, their wish to maintain strategic flexibility, and the prudence generally required with innovation.

The effectiveness of planning and control processes depends on the performance measurements and the models used in their assessment. The last paper of this special issue entitled, 'Manufacturing Performance Modeling and Measurement to Assess Varying Business Strategies' by Gül E. Okudan and Gülsen Akman, discusses the need for integrating several performance measures in an index to give an overall measure of manufacturing performance. It addresses the importance of an adjustment mechanism that aligns the overall performance index with the corporate strategy in a volatile environment. Analytic hierarchy process is used to model and to measure the manufacturing performance of a company in a dynamic manner. The resulting index can be used to directly evaluate overall manufacturing performance with respect to achieving various business strategies.

We believe that this special issue establishes a foundation for the understanding of various issues involved in Organizational Strategy Formulation for creating and sustaining flexibility. The presentations in this special issue illustrate the concepts with a variety of situations. Hopefully, this special issue will stimulate new research about modeling and assessment of various approaches used in the creation and sustaining of flexible organizations through time.

This special issue would not have been possible without the cooperation and assistance of many people: the authors, and reviewers. We would like to thank Professor Sushil, the Editor-in-chief of this journal for inviting us to edit this special issue. In addition, we acknowledge our respective universities for affording us the time to work on this project and our colleagues and students for many stimulating discussions. Finally, the guest editors wish to acknowledge their families for providing time and support for this project.

Jatinder N. D. Gupta
Sushil K. Sharma
Editors





Global Journal of Flexible Systems Management

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Guidelines for Authors

Aim

The journal is intended to share concepts, researches and practical experiences to enable the organizations to become more flexible (adaptive, responsive, and agile) at the level of strategy, structure, systems, people, and culture. Flexibility relates to providing more options, quicker change mechanisms, and enhanced freedom of choice so as to respond to the changing situation with minimum time and efforts.

It is aimed to make the contributions in this direction to both the world of work and the world of knowledge so as to continuously evolve and enrich the flexible systems management paradigm at a generic level as well as specifically testing and innovating the use of SAP-LAP (Situation- Actor - Process-Learning-Action-Performance) framework in varied managerial situations to cope with the challenges of the new business models and frameworks. It is a General Management Journal with a focus on flexibility.

Scope

The Journal includes the papers relating to: conceptual frameworks, empirical studies, case experiences, insights, strategies, organizational frameworks, applications and systems, methodologies and models, tools and techniques, innovations, comparative practices, scenarios, and reviews.

The papers may be covering one or many of the following areas: Dimensions of enterprise flexibility, Connotations of flexibility, and Emerging managerial issues/approaches generating and demanding flexibility.

Coverage

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papers are reviewed for relevance, focus on flexibility, innovation, practical considerations, quality of evidence, contribution, methodology, readability, and organization. Based on the recommendations of the referees, the editor then decides whether the paper should be accepted as it is, to be revised or rejected. The reviewing time will normally be 10-12 weeks.

Manuscript Requirements

Length: No maximum length for a paper is prescribed, however, authors should write concisely.

Title: The title should be brief and typed on a separate sheet.

Format: The paper should have a cover page giving title, author's name, complete address, telephone number, fax number, and email of the author. In case of co-authors, these details should also be provided for each co-author. Correspondence will be sent to the first named author unless otherwise indicated.

The second page should contain the title and an abstract of 100-150

words. It should also include upto eight keywords about the paper. The authors may attach the category sheet to define the relevant categories to which the paper belongs (available on the website-www.giftsociety.org). The second page should not include the authors name. The paper should begin from the third page.

Headings: should be short clearly defined, and numbered.

Footnotes: should be used only when absolutely necessary and must be identified in the text by consecutive numbers placed as superscript.

Text: The main text should be more readable and mathematical models, if any, should be provided in Appendix. The ideas proposed should preferably be supported by real life case examples from business situations.

Tables and Figures: All tables and figures should be kept to a minimum and numbered consecutively using arabic numerals. Each table should have a brief title written on the top of the table, and each figure should have a brief caption written on the bottom of the figure.

Photos and Illustrations: must be supplied as good quality black and white original with captions. Their position should be shown in the text by typing on a separate line the words "take in Plate n"

References: to other publications must be in standard style. That is shown within the text as the author's name followed by a comma and year of publication, all in round brackets, e.g. (Volberda, 1997). At the end of the paper a reference list in alphabetical order must be given as follows:

For books: Surname, initials, (year) *title*, publisher, place of publication. e.g. Mckenzie J. (1996) *Paradox: The New Strategic Dimension*, McGraw -Hill, Berkshire.

For journals: surname, initials, (year) *title*, *journal*, volume (number), pages. e.g. Volberda H.W. (1997) Building Flexible Organization for Fast Moving Markets, *Long Range Planning*, 30 (2), 169-183.

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Checklist

- * The paper is original, not submitted anywhere else.
- * The length of the paper is commensurate with content.
- * The title and headings are brief and catchy.
- * The author(s) name and affiliation are given only on cover page.
- * Abstract and keywords are provided.
- * Focus on flexibility in management is kept.
- * The paper incorporates innovative ideas/models in a practical framework.
- * Mathematical models, if any, are given in Appendix.
- * Tables/Figures are properly placed and numbered with brief titles/captions.
- * References are in standard style.
- * Few highlights (8-10) of two-three lines are provided to put in boxes.
- * Few key variables (3-5) are identified for flexibility mapping on a continuum.
- * Some key questions (2-3) are provided to reflect the applicability in real life.
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e-Strategy Model for Creating Flexible Organizations

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Abstract

Management literature argues that flexibility in organizations can enhance corporate responsiveness and can create competitive advantages. In the new internet-driven economy, flexibility and rapid response are the keys to business success. The challenge is to structure a leaner, more customer focused and flexible organization to remain competitive in the global economy, especially in e-business. Creating an e-strategy requires comprehensive knowledge of every aspect of business, from core operational needs to competitive forces to technology priorities. So far, research on flexible organizations has emphasized only the operations management perspective and not the strategy perspective. This paper presents a conceptual framework of an e-strategy model that suggests considering flexibility at all levels. The model proposes that flexibility has to be considered at external stakeholders levels such as customers, partners, competitors and suppliers, as well as at internal organizational levels that include people, processes and technology.

Keywords : e-business strategy, e-commerce, e-strategy, flexibility, IS/IT strategy

Introduction

The major driver in many business domains today is the use of internet-based technologies to open new market opportunities, deliver improved services to customers, and streamline internal business processes. The internet has profoundly altered today's business environment by redefining business processes and changing the dynamics of relationships with customers, partners, and suppliers (Wargin and Dobbye, 2001). E-business is defined as the 'use of electronic networks and associated technologies to enable, improve, enhance, transform or invent a business process or business system to create superior value for current or potential customers (Sawhney and Zabin, 2001). E-business is really all about new business models, strategies, and tactics that are made possible with the capabilities of the internet and related technologies. E-business is changing the competitive landscape of virtually every industry (Sharma and Gupta 2001, Sharma and Gupta 2003a, Sharma and Gupta 2003b).

In the present phase of e-business, companies and organizations are moving beyond integrating their various processes to sense and respond to fluctuating market conditions in real time (Boulton, Libert and Samek, 2000). To cope with those changes, business firms have to be responsive, focused, flexible and resilient. E-business technologies are a collection of technologies, such as web sites, browsers, electronic procurement software, desk-top video conferencing tools, intelligent database search engines, computer supported co-operative working packages,

and many other technologies, as well as the web-enabling of more traditional and familiar software such as Enterprise Resource Planning (ERP) Systems. E-business affects all aspects of the enterprise: the way new products are developed; methods of working with suppliers and distributors; delivery of goods and services to customers; and so on. However, this makes the choice of a developing e-business strategy more difficult (Angehrn 1997, Anonymous 2001, Khoong 2001).

As organizations adapt their business processes and models to compete in the e-business environment, e-business strategy is recognized as a critical imperative for success. Companies like Amazon.com., Dell.com, and Cisco.com have adopted the right kinds of e-business strategies and have been dominant players in the e-business market. But many others who either tried to emulate these companies or planned their own strategies could not survive. For example, Compaq didn't become Dell even when it announced it was selling direct like Dell. Although every company that offers e-commerce solutions claims that it has adopted e-business strategy, recent surveys indicate that many companies do not have an e-business strategy at all or if they do, it is not well integrated with business strategy (Anonymous, 2001).

The key objectives of 21st century organizations are conducting much of their business online, innovating, ensuring low cost production, and striving for customer excellence. Although many organizations have begun offering products and services online, many of them suffer



from several typical technology pitfalls: failure to integrate technology with business strategy, technology not linked with customer offerings, and services and systems remaining as fragmented systems, to name a few. To keep organizations competitive, policy makers will have to overhaul the process of formulating and implementing strategic initiatives to explicitly consider *flexibility* at various levels in the organization. Many challenges confront companies as they formulate their organizational strategy to create flexibility in business processes. Thus, organizations are obliged to continuously explore new and innovative strategies, and to seek powerful methodologies that will confer competitive advantage.

Management literature argues that flexibility in organizations can enhance corporate responsiveness and can create competitive advantages. Creating an effective e-strategy requires a comprehensive knowledge of everything from core operational needs to competitive forces to technology priorities. So far, research on organizational flexibility has been conducted mainly from the perspective of operations management only and not from a strategy perspective (Gupta and Goyal, 1989). This paper presents a conceptual framework of an e-strategy model that suggests considering flexibility at all levels. The model proposes that flexibility has to be considered at external stakeholders levels, such as customers, partners, competitors and suppliers, as well as at internal organizational levels that include people, processes and technology.

Flexibility and e-Business

In Webster's Dictionary, "flexible" is defined as "a ready capability to adapt to new, different or changing requirements." In a manufacturing context, it can apply to either production growth and volume increases or to physical changes in an existing product.

Because of the multitude of choices available to customers, today, flexibility is a key factor in business success. Flexible companies are able to respond rapidly to changes in their markets, and can play an active role in shaping these changes. Versatility is having the agility and resilience throughout and beyond the enterprise to create or maximize market opportunities. Not surprisingly then, it is suggested that the organizations should offer solutions for isolating, extending and modifying the business rules that drive the processes within digital value chain (Porter 2001, D'souza and Williams 2000). Flexibility is an effective means by which an e-business can hedge against uncertainty in a swiftly changing environment. Systems, applications, and business processes—in short, the entire environment supporting e-business—must seamlessly adapt to changes without costly and time-consuming infrastructure overhauls (Shi and Daniels, 2003).

Becoming flexible is becoming imperative for survival. There are several dimensions to becoming a flexible organization including the following: creating a responsive internal environment that can quickly react to any change in the marketplace, planned or unforeseen, a threat or an opportunity. Second, an organization should have variable cost structures to manage costs in proportion to growth of the organization or change in demand. Third, an organization needs to be focused on what is profitable and core to the enterprise's success. Finally, the organization needs to have a resilient infrastructure that is available around the world and around the clock (Phan, 2001).

The development of multi-capability organizations requires the rethinking of many underlying assumptions. Flexibility must be built into facilities, equipment, systems, people and organizations. Flexibility is the ability to respond appropriately to a wide variety of business conditions. Financial viability, human capital and technical infrastructure are just a few examples of factors that will affect the flexibility

Today, flexibility is a key factor in business success. One possible response to the new business environment is development of a fluid and flexible conceptual framework (internal structure – People, processes and Technology) that can respond quickly to changed circumstances.

of an organization. Flexible organizations mandate that business processes are integrated end-to-end, enabling it to respond with flexibility and speed to any customer demand, market opportunity or external threat (Shi and Daniels 2003, Sethi and Sethi 1990).

As organizations use real-time information to accelerate an increasing number of business processes, flexibility and adaptability become fundamental requirements for supporting today's—and tomorrow's—business imperatives (Davidson, 1999). Agile, cost-effective responses to business and technology changes differentiate successful companies from their competition. The ability of organizations to use, adjust, or redeploy not only technology but also human resources and capital assets is a cornerstone of business agility. The flexibility of an organization also comes from its ability to create custom-quality products in short production runs, on-demand, inter-spliced with production of other products on the same production line, at low cost, with high reliability, and low cycle time. In a flexible business, the production flexibility itself may be located at any global location internal or external to the knowledge-source of the organization. Flexibility is also the ability of an organization to sense environmental change and respond efficiently and effectively to that change. By developing an e-strategy framework, it is possible to measure the state of flexibility within an organization and identify weaknesses so that the organization can implement solutions to improve its agility.

e-Business flexibility determines an organization's ability to adapt to changes and uncertainties in its business environment, both internal and external. In addition to general business flexibility, e-Business flexibility reflects an organization's ability to react to those environmental variables that are particularly associated with information

technologies and new ways of doing business which are enabled by these technologies. The dramatic and continuing decrease in the cost of a broad range of technologies (e.g., Internet, wireless, and broadband) and the wide use of standards have created numerous opportunities for increasing e-business flexibility, thereby changing the basis of competition. Flexibility is particularly important in an increasingly volatile business environment characterized by intense, global competition, short product life cycles, increased technological innovation, and time-sensitive customer demand. The focus of competition in global marketplaces is increasingly shifting from cost, quality, and service to delivery, flexibility, and innovation (Shi and Daniels 2003, Gupta and Goyal 1989).

Organizations need an appropriate e-strategy framework to gain competitive advantage (Sabherwal and Chan, 2001). The increasing pace of change in market conditions places a premium on building flexible organizations in the business world. Organizations have to respond by creating fluid and flexible internal structure that can respond quickly to changed circumstances (Kumar, 1987). Old strategies will no longer work in changed circumstances. Organizations need an e-strategy framework to counter new competition and help create a business strategy that can create flexibility. Criteria for an e-strategy should flow directly from the shared vision (organization's business and strategic plans) and should be linked to entire value chain (Galliers 1999, Haapaniemi 2001).

e-Strategy Model

A comprehensive e-strategy is central to the success of an e-transformation of the enterprise. e-Business takes into consideration the entire set of transactions occurring in a business including strategic and operational decisions. Hence, thinking about the enterprise from the e-business perspective requires radical thinking of how business is conducted at present and in the future across the enterprise and beyond. e-Business strategy is not an extension of an internet strategy or an IT strategy in an enterprise. In fact, it should flow from the company's overall business strategy and should be necessarily linked to company's vision, objectives and goals. No matter the size of the organization and the scope of its business, an e-business plan should be all-inclusive taking into consideration all stakeholders, core competencies and core entities of the enterprise. Development of such a strategy necessitates a framework that integrates customers, suppliers, enterprise and trading partners (Dutta 1996, Dutta, Kwan and Segev 1998).

The key to e-strategy is finding the balance between flexibility (how easily and quickly people can change to meet the business need) and speed to market (how quickly

business practices and technology solutions can change). Also, when considering an e-business strategy, one must consider the entire supply chain of business – from interaction with customers and end users, production and fulfillment, through to interaction with suppliers (Lapierre, Filtrault and Chebat 1999, Leidner 1999). The e-strategy model is derived from the work of IBM's Process-Technology-People (P-T-P) Model (Sharpe, 1989) and the Kanungo (2003) e-strategy framework. An e-strategy of an organization is essentially the organizational strategy to strengthen operation in digital space. It is different from an e-commerce strategy in the sense that while an e-commerce strategy encompasses suppliers, channel partners and customers, an e-strategy includes employees as well besides the other components of an e-commerce strategy. e-Strategy can also be termed as e-organization strategy, which encompasses e-business and e-employee. An e-business Strategy is "electronic" in the sense that it is based on the exploitation of information available in electronic form and the corresponding technology (Kanungo, 2003). Kanungo's

This paper presents a conceptual framework of e-strategy model that suggests considering flexibility at all levels. The model proposes that flexibility has to be considered for external stakeholders, such as customers, partners, competitors and suppliers, and internal structure – People, processes and Technology level.

model (2003) emphasizes that e-strategy model must consider both the external and internal environment of an organization. While the external environment consists of suppliers, channel partners, customers and competitors, the internal environment consists of internal processes, organizational culture, beliefs and values, norms and its employees.

The P-T-P model of IBM consists of employees (people), activities that those employees perform (processes), and tools that help them perform those activities (technology). It further suggests that an effective e-strategy model for an organization requires flexibility to be built in the enterprise architecture at the people, processes, and technology level (Sharpe, 1989). People need to be knowledgeable about the technologies they operate and operational procedures. It is very important to have people who are ready to learn on a continuous basis and adapt to the changing environment. Processes build on the notion that all organizations have some form of operational practices and procedures. The new e-business environment depends upon organizations' ability to adapt to a new, more collaborative, competition model. To become flexible, organizations have to shift from being product-centric to customer-centric, making customers a part of the organization. Companies cannot continue to compete in today's frenetic environment with disparate, disconnected IT infrastructures and disintegrated processes or applications. The organization's management must understand that new technologies and business models that change industry dynamics and redefine what both shareholders value and customers desire will also change their business processes. To prepare for that, an organization should work on an operating philosophy that includes changing business processes and business models. Technology; e-business

enabling technologies infrastructure should be flexible, reliable, scalable and quickly deployed to keep up with the ever-changing, unpredictable advances in technology (Hackbarth and Kettinger, 2000). Customers will expect businesses to serve them via the internet, anytime, anywhere in the world, on any device, at any time. Therefore, it becomes mandatory to create web-based infrastructure that can integrate back-office management systems, customers and business partners to respond to any situation. Properly designed web portals can provide trusted business partners with a secure, flexible environment for activities ranging from self-service to collaborative commerce (Budhwani, 2001).

The proposed e-strategy model is shown in Figure 1. The model indicates that at the bottom most layer, creating flexibility requires enabling e-business technologies. Once the enabling technologies are flexible enough to quickly adapt to a changing market environment, it is important to create flexibility in core processes. The second level of flexibility has to be at the core processes. e-Strategy for creating flexible organization would also demand the workforce to be flexible. Researchers have argued in favor of integrated strategies for digital space (Jarvenpaa and Tiller, 2000). They argue that an e-business strategy model should be integrating various strategies, such as marketing, manufacturing, supply chain and financial strategy. Therefore, all strategies that need to be integrated should flow from shared vision (or view of the firm). Kanungo (2003) contends that e-strategy must link with the four components of business (customers, suppliers, partners and competitors) because these components influence

Many challenges await companies as they formulate their organizational strategy and create flexibility in business processes.

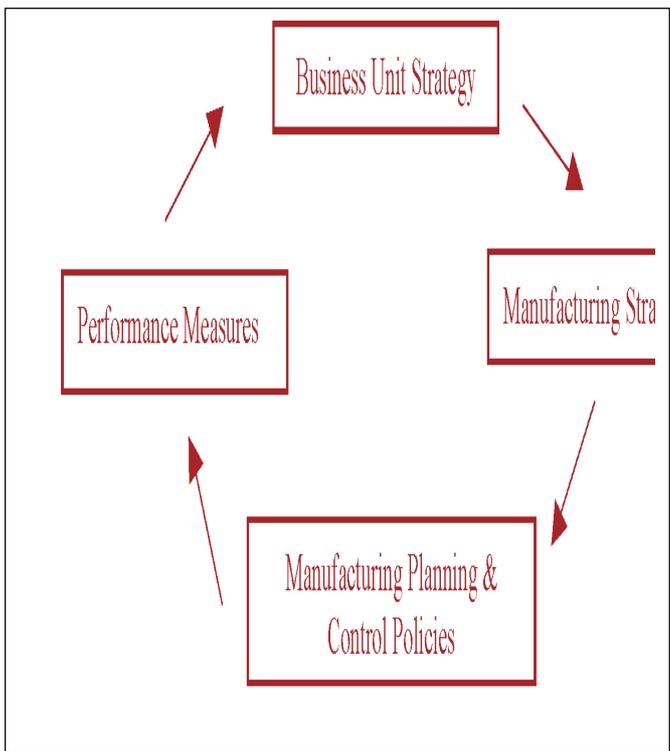


Figure 1 : An e-strategy Model for Flexibility

business strategy. Issues related to suppliers, channel partners and customers are less technological issues than business. For example, issues like how the purchase process would be managed, what level of integration with suppliers and distributors would be achieved or which products or services would be offered to customers and how, appear to be business oriented than technology oriented. Technology is only a medium or at best serves as a link to maintain these relationships in virtual space (Kanungo 2003, Hackbarth and Kettinger 2000). The details of each layer are described below.

Flexible Technology Infrastructure

In order to provide the flexibility, scalability and reliability required of e-business, companies need to create a flexible e-business infrastructure. This infrastructure should consist of open interfaces that allow new applications and services to easily connect. The flexible e-business infrastructure should include; universal connectivity through the use of open standards, and integration with internal and external services. Universal connectivity through the use of open standards implies that companies must allow customers, business partners, suppliers, and influencers to have access to systems and applications with a variety of access devices available. Having interoperability to allow sharing or communicating with mixed technologies across and beyond the enterprise is an important success factor in e-business. e-Business infrastructure should have capability to integrate internal and external services seamlessly. By integrating business applications and data among customers, suppliers, partners and employees, companies can achieve a more effective and efficient e-business model. Enabling integration is accomplished by using open standards-based infrastructure elements in conjunction with an integration, which allows existing application functionality to be integrated with the new application logic (Shi and Daniels, 2003). In today's e-business on demand environment, integrating information across and beyond the enterprise is a competitive mandate. Initiatives such as customer relationship management, supply chain management and business intelligence are based on successfully integrating information from multiple data sources, both structured and unstructured. Information integration technology enables integrated, real-time access to traditional and emerging data sources, transforms information to meet the needs of business analysts and manages data placement for performance, currency and availability. This, in turn, leads to fast, constant and easy access for customer facing e-business solutions.

Capability to collaborate in the value network resource reconfiguration – sharing data with suppliers, customers, and partners in a value network through XML standards is merely a first step. For the foreseeable future, businesses will have to support multiple points of integration and multiple points of interaction. The organizations must integrate

applications with multiple points of interaction, such as Web browsers, interactive voice response units (IVRs), personal digital assistants (PDAs), and mobile phones, so that data is appropriately synchronized and so that various points of interaction represent the brand faithfully. Early e-business initiatives focused on the front-end—with applications such as online stock trading, online auctioning, and industry portals. Now, companies are moving beyond e-business and apply these concepts across the front- and back-ends of enterprise processes. Companies have to move beyond electronic document interchange (EDI) and adopting solutions based on extensible markup language (XML) to facilitate the flow of transactions between business processes and across organizations. Organizations will realize the benefits of a fully adaptive approach when they can easily change business partners or processes without undue cost or conversion time. A strong backbone of systems on which organization will build e-business solutions is an essential component of an e-business strategy. One must evaluate factors such as data integrity, openness of technologies, readiness for integration, and real-time accuracy of data.

Flexible Core Processes

Worldwide, organizations are trying to achieve flexibility in all processes and at all levels. This capacity—often called agility—is a prime enabler of success. However, until agility is achieved, aggressive productivity objectives are not being realized. Agility and the productivity will mainly depend on the drivers; the organization's ability to use its full capacities, build output-oriented teams, implement efficient process orientation, and reach the optimum in performing supply chain management. The inability to rapidly achieve agility reflects the demands imposed by the complexity of process management, highlighting three major roadblocks: the lack of competency of personnel, the failure to adequately document and make transparent the relationship among process elements and the availability of technological support.

Today, being flexible is more important than ever. Agile assembly systems allow manufacturers to react quickly to shifting customer demands and shorter product life cycles. They can produce a wider variety of products; alter the mix of options or features; add new processes or assembly stations easily; and change volumes with minimal investment and changeover loss. Successful business growth depends heavily on the ability to update, integrate, customize and deploy applications rapidly and provide fast, reliable, interactive data access to end users, from employees to suppliers, customers and partners. To be effective, organizations must standardize the management of business processes that span multiple applications, corporate departments, and external entities. Comprehensive business integration is required to manage these increasingly complex information resources in a cost-effective manner. Applications and data stores must be combined using an

approach that not only provides access to the information and business processes within the systems, but also compounds their value as an integrated unit.

It is imperative in today's business environment for organizations to have a consolidated view of information stored in multiple systems and databases, and a concerted execution of business processes. More organizations are recognizing that the solution lies in finding a way to better integrate existing systems and processes into the organization. Application integration and business process management provide a scalable mechanism for consistently upgrading business processes and integrating existing and future systems to enable efficient information retrieval and performance analysis.

The impact of technologies on business processes, relationships and organization can have much larger ramifications than the technology implementation itself.

Businesses today are facing many pressures—pressure to compete in a fast-paced ever-changing climate, pressure to constantly reduce costs to remain competitive. Becoming flexible is becoming imperative for survival.

Inadequately addressing these process, relationship, and organizational impacts can greatly impede the success of e-business strategy. For e-business to succeed, the technology and processes must work

well together. Entirely new processes and roles may be required, for instance to create and manage content delivered over the web, such as product technical information, pricing and other content. It is more important to understand that how various e-business initiatives will impact on processes, business relationships, organization. Collaborative e-business applications are emerging to solve multi-enterprise integration challenges. New designs, supported by the latest web architectures and B2B standards will usher in a new era of business collaboration in the years ahead (Craig and Jutla, 2000).

Achieving this flexibility will require a new architectural model for applications. Conventional applications are defined by a combination of business logic and a particular set of appropriately structured data. A traditional transaction processing system that uses a relational database cannot easily be merged with a workflow management system based on documents, whether as text or images. Process-based business models promise greater flexibility and extended visibility. Web-services technology and interfaces are becoming a standard part of application integration. Therefore, companies should migrate from screen-based legacy data integration to more complex, object-like frameworks that enable integration of legacy data into web-services architectures.

Flexible Workforce

The organization chart of a traditional enterprise had long been defined as a shrinking pyramid with the CEO at the top. The 21st century organization will look like the web; horizontal, a mesh that connects partners, employees, external contractors, suppliers, and customers in various

forms of collaborations. The players will grow more and more independent. Tomorrow's corporations will be virtual, defined not by their location but by their ability to acquire knowledge, organize information, and organize independent contractors and suppliers worldwide. To keep ahead of the steep new-product curve, it will be crucial for organizations to attract and retain the best thinkers. Companies will need to build a deep reservoir of talent-employees and free agents to succeed in this new era (Amor 1999, Aalst 2000).

e-Business requires more creative thinking and less bureaucracy. This philosophy must filter into a number of areas, including site design, usability, performance and general capabilities. But it also means thinking up new ways to communicate and developing new business models. e-Business demands that a team or task force is created that is empowered to make quick decisions. Because e-business overlaps among multiple departments and domains, it is essential to develop teams that can communicate issues and understand the needs and concerns of others. It's important to eliminate barriers (Cross and Baird 2000, Adeyam 2000).

Organizational changes are considered an important factor for the successful application of e-business technologies. Such developments should be designed to promote a culture change, team working, more open communications, and so on. These will bring benefits such as improved cross-functional understanding, shorter lead times and lower costs (Levasseur, 2001).

The biggest challenge businesses face in the implementation of e-business strategies is a strong resistance to change. Many companies are finding it difficult to change employee and customer mind-sets on business-process and customer-service issues. Implementing an e-business program would also mean a change in the way the organization conducts its business. Organizations should not only focus on the distribution and supply chain management aspects of e-business, but also other components such as customer relationship management and channels management. As discussed earlier, e-business strategy typically touches on many different processes, organizational elements, and technologies within a company. It is important to actively involve people from across the affected areas of the business. Having the right mix of personnel involved in the strategy will help contribute ideas on possible e-business opportunities, will help ensure that the e-business vision is grounded in the reality of day-to-day operations, and will help the strategy team understand the organization's readiness and capacity for the change. In addition, such participation will help foster a broad sense of ownership. At the same time, input from your customers, suppliers, and partners must be solicited to have their concerns addressed. The organization must understand all aspects of e-business, to make strategy a well-rounded success (Swanson, 2001).

Flexibility Through Integration

Customers, partners and suppliers expect ready access to the information they need to do business. These expectations translate into real challenges for e-business infrastructure, including application and data integration, personalization, security and scalability. Focusing on external value-chain partners is a major aspect of transformation. Internal sign-offs are being replaced by external relationships, and more of what was done internally is now done externally. An e-business recognizes that power is shifting to the consumer. In the one-to-many hierarchical information flow that characterized the Industrial Age, information flowed one way, from the producer to the consumers. The Internet has changed this and it has enabled the information flow to be reversed so customer-centric companies can pull information from consumers to improve and customize products.

e-Business creates a collaborative community. The concept of a collaborative community enables collaborative interactions between an enterprise, its suppliers, trading partners, employees and customers. Data and processes once seen as internal to an organization are now shared by the trading community. This structural shift is no small leap and

Flexibility needed to be built in to facilities, equipment, systems, people and organizations.

requires a change in mindset to the extent of changing the work culture. Not only the people within an enterprise have to be trained to adapt to this new culture, other members of the community should be convinced to embrace the change. Customer-centric business processes increasingly rely on multiple channels. Thus, for consistent customer service, applications, customer data must be integrated with different databases and applications (Oliver, 2001). The integration of applications, processes and data creates a single view of the customer, prevents discrepancies in customer data, and ensures consistent service of the customer, no matter the channel. In addition, any employee who interacts with customers, no matter where they are in the organization, can access any customer information necessary in order to provide superior service (Papazoglou, Ribbers and Tsalgatidou, 2000).

E-business relationships with customers and suppliers are driven by the exchange of accurate, timely information. Customers decide to do business with companies based on how quickly they can access their account information from a Web site, or how easily they can choose from a range of service offerings online. Similarly, suppliers are selected based on information they provide about inventory, on time delivery, and so on. Face-to-face interaction is less and less a part of the business equation. To keep business running smoothly, it's imperative that companies learn to manage these new information-driven relationships. E-business strategy would require an organization to change the organizational culture to incorporate e-business as a key medium or mode of integrated service delivery (Sharma, Krishnan and Grewal 2001). Self-service capabilities (such as account and order inquiry) and the ability to solve



customer problems and improve customer processes will be core to e-business strategy (Noy, 1998).

Conclusions

Successful business growth depends heavily on the ability to update, integrate, customize and deploy applications rapidly and provide fast, reliable, interactive data access to end users, from employees to suppliers, customers and partners. e-Business strategies or e-strategies must address how partner, employee, governance, community, and customer facing processes can be e-business enabled. e-Business enabled means business processes are improved via technological advances, new knowledge management capabilities including content management and relationship management, and online trust capabilities (Jutla et al, 2001). To be successful with e-business strategies, companies need more than technologically sound information systems. An organization's processes, people and systems must function symbiotically to meet and exceed stakeholders' (customer, suppliers, and partners) needs and wants. Companies need to employ customer- focused people at every level of the organization and build processes that are simple to execute and flexible enough to change with changing times.

Integrating customer-focused people, processes and information systems to form a symbiotic relationship will help to create an effective e-business strategy for e-business success. Therefore, in order to develop e-strategy for being flexible, organizations must focus on three interrelated components—people, process, and technology. The e-strategy framework presented in this paper would certainly help organizations to become more responsive and adaptive to its overall business environment and would help to create the flexibility and resiliency. The main theme of this paper is that flexibility need not be considered only in processes but throughout the enterprise in people, processes and technology. Based on the e-strategy model presented in this paper, we contend that e-strategy has to integrate various other strategies (like the information technology and organizational strategies) for creating agility and flexibility. Therefore, e- strategy is an essential and important part of information technology strategy. While developing an e-strategy, due diligence must be given to people, processes and technology rather than focusing on only one of the components. Therefore, further research is required to develop systems and procedures that facilitate the implementation of the e-strategy framework proposed in this paper.

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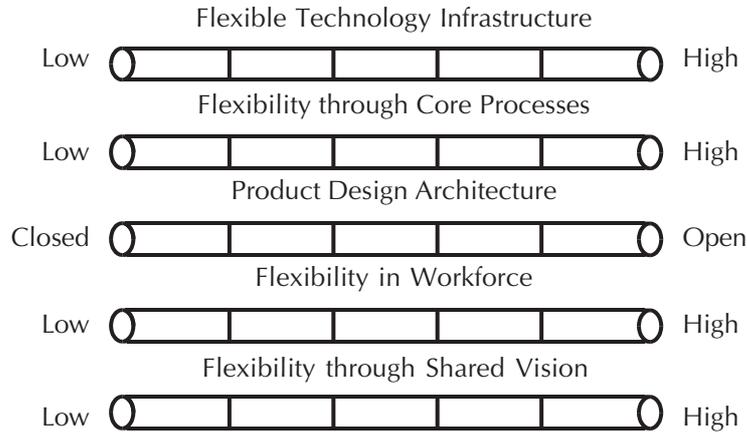
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Flexibility Mapping : Practitioner's Perspective

1. What types of flexibilities do you see in the practical situation "e-strategy" on the following points:
 - Flexibility in terms of "options"
 - Flexibility in terms of "change mechanisms"
 - Flexibility in terms of "freedom of choice" to participating actors.
2. Identify and describe the types of flexibilities that are relevant for your own organizational context? On which dimensions, flexibility should be enhanced?
3. Try to map your own organization on the following continua (Please tick mark in the appropriate boxes)



4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of "e-strategy" relevant to your organization.

Reflecting Applicability in Real Life

1. In your organization, what type of flexibility exists? On the basis of the framework presented in this paper, what areas of flexibility require work? How will you go about achieving it?
2. In your organization, what strategic decisions require explicit consideration of various types of flexibility? How would you organize to accomplish this?



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Flexibility in e-Business Strategies : A Requirement for Success

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Abstract

The complex and transient nature of the environment faced by e-Business ventures poses a challenge to organizations trying to formulate and implement strategies that are flexible enough to anticipate and react to the rapidly unfolding changes in this environment. In this paper, we outline the main areas of flexibility requirements for organizations in the emerging economy. Traditional and more recent approaches to strategy are reviewed in terms of their characteristics and flexibility. Strategic imperatives and flexibility requirements are then derived for e-Business firms at different stages of maturity and linked to appropriate approaches to strategy setting. Creative exercises, such as experimentation and scenario planning, are then presented as being essential tools for expanding the knowledge base of firms yielding them more strategic options leading to more flexibility.

Keywords : e-business , flexible strategy, strategic attributes, scenario planning

Introduction

Firms operating in today's economy are experiencing increased pressures due to several factors including a rapidly changing business environment, shorter product life cycles, increasingly demanding and less loyal customers with rapidly evolving preferences, and fiercer competition (Bucki and Pesqueux 2000, Dryer and Gronhaug 2004). These trends are motivated by an increasingly global economy, deregulation in many industries, and fast developments in information technologies that enable new business models and novel forms of collaboration and competition. This is especially the case for firms that operate within an online environment which is characterized by lower switching costs, lower barriers to entry, more substitution threats, quickly changing regulations and increased competition due to lower differentiation and increased geographic reach (Porter, 2001).

The dilemma facing managers of e-business organizations operating in such an unstable environment is that there seems to be little value in coming up with a comprehensive business strategy if it is almost certain that it will become obsolete in the near future. However, the danger inherent in not having a business strategy is that success will most likely be achieved only by accident (Porter, 2001). The negative impact of such an approach has been demonstrated in the recent failure of many dot-com startups.

The traditional approaches to strategic planning by looking to industry structure for opportunities and threats, and internally to the firm for strengths and weaknesses have been called into question because of their lack of flexibility to respond to radical changes in the external environment (Salmela and Spil, 2002). Consequently, much research has demonstrated the importance of flexibility for firms to prosper in turbulent environments (e.g. Yeo and Qui 2003, Knot Van den Ende and Vergragt 2001 and Dryer and Gronhaug 2004).

Flexibility within a business context is a rather complex concept to define as it incorporates several dimensions (Shi and Daniels 2003, Dryer and Gronhaug 2004). Traditionally, flexibility tends to focus on the ability of firms to adjust their manufacturing volumes to varying market demand. However, more recently, the concept of flexibility has been extended to incorporate the ability of firms to develop new products, enter new markets and industries (Dryer and Gronhaug, 2004). Bucki and Pesqueux (2000), define flexibility as "the ability to adapt in a reversible manner to an existing situation". Shi and Daniels (2003) review various definitions of flexibility from the literature and define flexibility within an e-business context as "an effective means by which an e-business can hedge against uncertainty in a swiftly changing environment".

This paper will explore the characteristics of the emerging economy and outline their implications to the need for



flexibility in various areas of e-business strategy. The three predominant traditional approaches to strategy (Industry Structure, Resource-based, and Dynamic Capabilities) will then be reviewed and contrasted to the strategy as simple rules approach. The paper presents an analysis of the characteristics of e-business firms at various levels of maturity and outline the corresponding strategic imperatives and flexibility requirements. It also explore various means for realizing flexibility in strategy formulation and implementation. The paper ends with some conclusions.

The Emerging Economy and the Need for Flexible Strategies

While the Internet has the potential to bring about the fundamental technological, social and economic changes that support innovation, efficiency, opportunity, and a level-playing field, it also poses several challenges for corporations. These challenges include hyper-competition from all corners of the world, uncertainty in the nature of product and service offerings, and the absolute necessity to perceive and respond quickly to changing environments (Whinston, Stahl and Choi, 1997).

As such, the new market dynamics in the emerging economy stipulates that a corporation must define its industry, competition, customers, and boundaries in ways different from those governed by traditional industry rules. For example, in traditional strategic analysis approaches, an industry is assumed to be vendor-defined where players are faced with direct competition, whereas new rules for the emerging economy require that it be thought of as customer-focused where payers are prepared for collaboration and competition. In such an environment, competition becomes based on rapidly reconfigurable value chains as opposed to being between individual companies (Rayport and Jaworski, 2001). While very few industries could be considered global previously, almost all industries now have the potential for global reach and while the extent of vertical integration determined the limits previously, networks determine the boundaries in the emerging economy. One implication of this paradigm shift is that companies must incorporate into their strategy such measures of local adaptation as languages, demographics, currencies, attitudes toward pricing and quality, payment systems, local consumer tastes and habits, differences in national regulations (Guillen, 2002), and policy issues such as consumer privacy, taxation, fraud, intellectual property protection, and conflicts of international law (Jarvenpaa and Tiller, 1999). According to Forrester Research (2000), e-business companies in the U.S. cannot fulfill about 46% of orders placed by foreign customers due to these reasons. Recent localization efforts made by Yahoo!, eBay, Amazon, Google etc. are a testimony of this necessity.

In order to meet the above challenges, companies must be flexible in three main dimensions that relate to their product/service offerings or the value proposition they offer

to their different customer segments, their technology infrastructure and their collaboration strategies both of which are required for the effective delivery of this value proposition to those customer segments. Below, we explore the flexibility requirements in each of these areas in more detail.

Flexibility in Product Offerings

Products, hereafter, refer to both goods and services offered by companies to their customers. Companies must be flexible in their product offerings because one standard cannot meet the different needs, tastes, and expectations of an increasingly segmented and global customer base. Flexibility, in this context refers to the ability of a company to meet this challenge within the overall framework of its business strategy. The capacity and speed of product innovation is an attribute of such flexibility.

The ability to meet the rapidly changing and evolving customer needs comes from sustained innovation efforts. One source for innovation is the individual and collective expertise of employees. The tacit dimension of such expertise is also a source of competitive advantage as it cannot be easily imitated (Leonard and Sensiper, 1998). The internet channel has allowed e-businesses an unprecedented opportunity to capture all aspects of the consumer experience on their websites. Hence, another source of innovation comes from the knowledge regarding customers' experiences, responses, needs and expectations. Companies must make a deliberate and formal effort to capture, manage, and disseminate this knowledge so that innovation can actually be realized and translated into compelling product offerings. Companies must see such knowledge as the key strategic resource and align its corporate strategy with its knowledge acquisition and management strategies (Winter, 1987).

Flexibility in Technology

Many studies in the past have shown that organizations can use technology as a resource to gain competitive advantage (Clemons 1991, Clemons and Row 1991, Parsons 1983). Technology, which is the primary force behind the emergence of the new economy, has become not only a means of production but also a main component of service, relationship building, collaboration, and co-existence. In this context, the importance of flexibility in technology cannot be overemphasized. Byrd and Turner (2001) identify several dimensions of technological flexibility, such as data transparency, compatibility, application functionality, connectivity, technical skills, boundary skills, functional skills, and technology management. They also observe that the flexibility in technology as measured by integration, modularity, and IT personnel, flexibility is positively correlated to an organization's innovativeness, mass customization, market position, and difficulty to duplicate. Malhotra (2001) identifies technology flexibility as the

In the same way that there is no one single strategy that is appropriate for all organizations, there is not a single approach to strategy formulation, or level of flexibility required for all organizations.

ability to cope with the integration of new e-business applications with the existing brick-and-mortar infrastructures. Such integration entails flawless fusion of enterprise resource planning, supply chain management, and customer relationship management, which is not possible without having integration standards, network capacity, data storage capacity, and processing power. Gronhaug (1999) links technological flexibility with product and services flexibility by using the open-system metaphor (Katz and Kahn, 1966) in which organizations are viewed as input-throughput-output systems. Flexibility in formulating and executing a technology strategy, which is critical to achieving a sustained competitive advantage for firms in the new market environment, must address such issues as:

- **Impact of technological change within the organization**–The drastic technological change can convert yesterday's core competence into a core burden today, which makes it necessary to examine how a company's core competence is related to technology and to determine the company's acceptable level of reliance on technology. While technology (e.g. e-mail, Groupware, etc.) can play an important role in building a positive and learning corporate culture, it can also pose challenges related to human factors associated with the effective adoption and use of technology to enhance productivity.
- **Impact of technological change on the market**–Technological changes can exert a huge impact on the market by directly affecting the size and nature of customers, partners/suppliers, competitors, and products. Companies must examine different dimensions of potential technological changes and their implications, while formulating its technology strategy.

The ability to exploit technology both inside and outside the company to gain a sustained competitive advantage is possible only when companies have flexible strategies in terms of acquiring and exploiting technology infrastructure.

Flexibility in Collaboration

Collaboration and alliances are necessary because e-business companies cannot do everything themselves (Hagel and Singer, 1999). Potential collaboration in e-business generally includes content providers, IT vendors and software developers, suppliers, and intermediaries (Sculley, Woods and Woods, 2002). The right collaboration can help gain the trust of other players in the market as well as early liquidity in the e-business (Brunn, Jensen and Skogaard, 2002). Based on the survey conducted in the grocery industry, researchers found collaboration in B2B commerce to be the real source of performance improvement (Lee, Pak, and Lee, 2003).

Alliances, which refer to several governance modalities that range from relational contracting to licensing, to logistical supply-chain relationships, to equity joint ventures (Gulati and Singh, 1998) are also becoming important due to the complexity and global reach of e-businesses. In the period 1987-1997, the number of alliances grew at 25% per year (Harbison and Pekar, 1997) as alliances are viewed as a means of adding value to firms and a central element to strategy (Lorange and Roos, 1992). Strategic alliances are more likely to involve competitors (Duysters, Kok and Vaandrager, 2000). Contractor and Lorange (2002) suggest that the role of inter-organizational cooperation grows in the future due to three broad reasons: regulatory factors, changes in the business and economic environment, and changes in industry practice and strategy. Companies must have flexibility in their alliance strategies to allow them to form quickly and effectively virtual supply chains that may transcend industry and national boundaries overcoming regulatory hurdles.

Another difficulty in the electronic marketplace is that there may be uncertainty about the quality of products since customers cannot see and touch the product to the extent they can in a physical store. This information asymmetry, which is known as the problem of Lemon markets (Akerlof, 1970), suggests that incorporating quality alone is not sufficient and

companies must find ways to guarantee the quality of their products and services through intermediaries. According to Sarkar et al. (1995), intermediaries in electronic commerce provide consumers such services as independent product evaluation, needs assessment, product matching and aggregation. However, an intermediary's privileged position may introduce biases and inhibit the smooth flow of information between vendor and consumer (Ehrlich and Cash, 1999) and as such, consumers may not trust them. Also, intermediaries need to renew organizational skills, resources and functional competencies to sustain the advantages that they build (Teece, Pisano and Shuen, 1997).

Flexibility in forming strategic alliances must address issues such as:

- **The nature of collaboration**–As the nature of competition becomes increasingly based on rapidly reconfigurable value chains (Rayport and Jaworski 2001), e-businesses must decide on the nature of the collaboration with different partners (e.g. whether it is short-term or long-term), and the organizational structures that will govern such collaborations. They also must examine how such collaborations will affect the company's brand image.
- **Mechanisms of quality assurance**–Digital intermediaries, who assure quality for the company's products and services, should be considered strategic partners because

In order to determine the appropriate approach to strategy formulation and level of flexibility, an organization requires a deep understanding of:

- ***The volatility of the environment in which they are operating.***
- ***The level of maturity of their organization***
- ***The resources and capabilities of their organization.***

they can play a critical role in building brand image and enhancing customer satisfaction and loyalty.

The capacity of forming collaboration and alliances maintaining a strong brand image is possible only when companies can afford to be flexible in strategies related to the above issues.

Approaches to Strategy

Literature on business strategy provides three predominant approaches or views on how competitive advantages can be achieved and sustained (Teece, Pisano and Shuen, 1997). These approaches to strategy are the industry structure based view, the resource-based view, and the dynamic capabilities based view. They each have different strengths and various limitations to their applicability in unstable environments. This section will review each in turn, before introducing the strategy as simple rules approach that is derived from the need for flexibility and the realizing that in practice, strategies grow and adapt to changing unstable environments. This section will conclude with an illustration of the key attributes of each of these four approaches and their implications to flexibility in formulating and implementing strategies in organizations.

The Industry Structure Approach

While fluctuations in economic conditions can affect the profitability of a firm in the short run, it is industry structure that determines limits to profitability, and the extent to which a firm can find a position within that industry to best cope with the competitive forces. This determines the profitability of a firm over the longer term (Porter, 1980). It follows then that the starting point for strategic analysis is industry structure, which elucidates the opportunities and threats. Competitive strategy is the position a firm takes relative to the five competitive forces (Threat of substitutes to the products/services offered by the firm, power of suppliers, power of customers, degree of rivalry within industry, and the threat of new entrants). In this framework, a defensive strategy would be formulated by positioning the firm within the existing forces, and an offensive strategy would seek to influence the balance of the competitive forces.

Porter (1996) seeks to differentiate between operational effectiveness and strategy by asserting that higher than average prices can be charged by competitive positioning and delivering higher value, but that greater operational efficiency can only generate lower average costs. Similarly, a definition is offered that positioning is doing different activities in different ways, but operational effectiveness is doing similar activities better than competitors. "... Strategic positions should have a life time of a decade or more, not of a single planning cycle" (Porter, 1996). Therefore, by this definition, operational effectiveness is reduced in ranking towards tactics, and is necessary but not sufficient for superior overall performance.

Organization can choose an appropriate approach to strategy formulation from those that are highly structured to those that are highly decentralized.

More recently and specifically addressing the formulation of e-business strategy, Porter (2001) reasserts that the old rules still apply, and that the internet did not change everything. The business's experience with the internet to date has shown that we are in a period of transition, creating the artificial situations that dissipate the visibility of the old rules. If the old rules are still in effect, then Porter's thinking on strategic positioning should still be relevant. The internet will not normally confer a competitive advantage, and in most cases will increase competition, and therefore reduce profitability within an industry. This is the case where the internet is used within an existing industry. The argument is made that the internet for the most part enhances operational effectiveness, which is not sufficient to provide competitive advantage. Where entirely new industries or markets have been created, such as online auctions, then in that instance it can be used to achieve a competitive advantage.

Common criticisms of the industry structure approach are that it down plays or ignores the firm's contribution to profitability, and that the focus on industry misses competitors emerging from other unrelated industries. The industry structure view also has low flexibility in both the strategy and decision-making dimensions. The long-term planning horizon of five to ten years, hierarchical decision-making, and an assumption of relatively slow changes in the environment are key elements of this approach. The expectation is that by achieving a competitive advantage by industry positioning, the organization can expect relatively stable revenues, and therefore has a reduced need for flexibility. In other words, rather than design the organization for flexibility, design the organization to have a reduced need for flexibility.

The Resource-based Approach

The resource-based view asserts that a firm's resources are what drive its performance in a dynamic competitive environment (Collis and Montgomery, 1995). The industry structure approach may give average profitability to firms in an industry, but the resources of a firm give it its competitive advantage. For a resource to qualify as the basis for an effective strategy, five tests are made: inimitability, durability, appropriability, substitutability, and competitive superiority. Resources can be physical, or intangible.

The resource-based view moves the focus away from industry structure to the firm as the basis for profitability. That profitability is derived from scarce firm specific resources (Teece, Pisano and Shuen, 1997). The approach to a new venture from the resource-based view, would be to first identify the firm's unique resources, then to look for markets where these resources would yield the highest returns.

The underlying assumption is that the acquisition or development of capabilities and resources is difficult, and must be built and cannot be bought, and therefore strategies that cannot easily be duplicated are possible (Eisenhardt and Martin, 2000). An older study by Porter of large U.S. firms showed that most companies that attempted to diversify by acquisition divested more acquisitions than they kept, and dissipated shareholder value (Porter, 1987). Additionally, a commonly held belief in equity markets is that there is a discount for conglomerates. Both arguments support the statement that capabilities cannot be bought. If acquiring resources is difficult, then forming partnerships may be a more attractive option, and is suggested as one of the capabilities that is facilitated by the internet economy.

The acquisition of resources is a centralized decision in the resource-based view, and therefore indicates that strategic planning and decision-making are still relatively low in flexibility, but higher than that of the industry structure view. This view assumes that the environment is more dynamic, and that the organization can also move between markets.

The Dynamic Capabilities Approach

This approach extends the resource-based view to address environments of rapid change by introducing dynamic capabilities (Teece, Pisano and Shuen, 1997). This approach continues the concept that enduring advantage is through a firm's efficiency and effectiveness. This concept can be seen working in areas, such as research and development, product development, technology transfer or rapid technological change. In order for a firm to take advantage of a new opportunity, it must consider its current processes, the current state of its capabilities and resources, and the paths or options available to it, from that position. Dynamic capabilities are frequently used to build new resource configurations to take temporary advantage of an opportunity, and is most appropriate in moderately dynamic to high velocity markets.

To further explore the difference between resources and dynamic capabilities, Makadok (2001) developed a theoretical treatment of the two concepts. A key concept that emerged, in this work, is that capabilities can only be developed after the acquisition of the underlying resource. This reinforces the view that capabilities are the deployment of resources, and gives credence to the view that capabilities are internal to the firm and cannot be bought, short of buying the firm. The implication for the dynamic capabilities view is that for the rapid exploitation of an opportunity, the needed resources can be bought, but the capabilities (in the form of processes and systems) must already be in place in order to utilize the resource.

The dynamic capabilities approach requires the organization to design their processes and systems, for rapidly changing environments. This results in greater

flexibility in the implementation of the resulting strategy, but maintains a centralized decision-making process. This approach increases the overall flexibility of a firm over the resource-based view.

The end position in the development of this concept is reached in high velocity markets where strategy is based on simple rules (Eisenhardt and Sull, 2001), with the rules being based on a thorough understanding of a firm's resources and capabilities. In the next subsection, we will examine this simple rules approach to strategy and show how it is an emergent strategy with the ability to accommodate uncertainty.

The Strategy as Simple Rules Approach

Another way to view dynamic capabilities is that strategy differs in its plans and implementation, as was explored by Mintzberg and Waters (1985).

The level of flexibility required for an organization can then be determined along the dimensions of the organization's product offerings, technology infrastructure and collaborative strategies.

In their research they defined strategy as a pattern in a stream of decisions, and identified two different poles of the strategy continuum: the

first being the perfectly deliberate strategy, where the realized strategy came about exactly as intended, and the second pole is the perfectly emergent strategy, where the realized strategy came about out of a complete lack of intentions. Neither of these poles is likely to exist in organizations, because the first assumes that everything is controllable and predictable, and the second pole assumes that a consistent pattern in a stream of decisions can come about from a total lack of intentions. Mintzberg and Waters recognized that strategies lie within these poles, and identified eight different categories of strategies.

Of the strategies identified by Mintzberg and Waters (1985), umbrella strategies seem to be the best suited for organizations competing in turbulent environments. This is because umbrella strategies are 'deliberately emergent'. These umbrella strategies acknowledge that because of the complexities and variations in the environments, centralized control of all decisions is impossible. This does not mean that organizations give up on planning altogether; instead their strategies are guided by the constraints that their leaders impose on the actors making the decisions. Hence, realized umbrella strategies are partly emergent from the decisions made by individual actors, and partly deliberate through the constraints imposed on the actors by the organization's leaders.

Interestingly, Mintzberg and Waters (1985) recognized that deliberately emergent strategy being best suited for organizations in turbulent environments. A recent version of deliberately emergent strategy is "Strategy as Simple Rules" (Eisenhardt and Sull, 2001). Here the constraints guiding the strategy of the organization are formulated as simple rules intended to give functional managers flexibility and focus in decision-making. These rules facilitate rapid response to changing and uncertain environments through decentralized decision-making.

Eisenhardt and Sull (2001) categorize these rules as: how-to-rules, boundary rules, priority rules, timing rules and exit rules. The purpose of these rules is to enable processes that determine which opportunities should be seized, how it should be done, how to synchronize efforts within the organization, and when to abandon opportunities. Since these rules provide functional managers a higher degree of autonomy within the organization, the desired effect of the “strategy as simple rules” is for better, more creative decision-making. As the changes in industry structure or the competitive landscape become apparent, managers can act quickly to seize business opportunities because they are not bound by traditional strategic planning cycles.

The strategy as simple rules approach moves a large part of the decision-making process to operational levels of the organization, and removes a large part of the strategic planning process, resulting in a highly flexible organization. Of the four approaches to strategy reviewed, this is the most flexible. This does not necessarily mean that it is the best approach for e-business strategy, as it is obvious that different firms have different needs and priorities. In next section this issue is investigated in more detail.

A Comparative Summary of Strategic Approaches

The preceding review of approaches to strategy formulation and implementation has shown the development of thinking over the past few decades in this area, and how early work has been continuously updated to remain relevant. We have summarized the key attributes of each approach to strategy in Table 1.

Table 1 : Approaches to Strategy Formulation and Implementation

Attributes	Industry Structure	Resource Based	Dynamic Capabilities	Simple Rules
Competitive Advantage	Industry Positioning	Difficult to replicate resources	Difficult to replicate capabilities	First to exploit opportunity
Source of Profits	Monopoly Rents	Efficiencies within the firm	Efficiencies within the firm	Exploit short term market anomalies
Time Frame for Strategy	5-10 years	5-10 years	2-5 years	0-2 years
Flexibility in Strategy Formulation	Low	Low	Medium	High
Flexibility in Strategy Implementation	Low-Hierarchal	Medium-Centralized	High-Centralized	High-Decentralized
Issue(s) Addressed	Focus on source of profits and competitive forces	Contribution of internal resources	Contribution of internal processes	New Markets, New Products, New Business Models
Weakness(es)	Low emphasis on internal capabilities of firm	Low ability to compete in volatile markets	Slow response time to new opportunities and threats	Risk of too much experimentation

Competitive advantage and the source of profits are the signature attributes of each approach. It is critical that organizations ensure that they are internally consistent on these two attributes; for example, seeking to exploit short-

term market anomalies is antithetical to industry positioning.

The time frame for strategy and the flexibility in strategy formulation are the inverse of each other. The industry structure approach expects that a strategy should be good for five to ten years, and therefore the requirement for flexibility is low. At the other end of the spectrum, where high flexibility in strategy formulation is required, the expectation is that the strategy’s life span is short.

The industry structure approach tends to be a top down process for the development of strategy, which complements a hierarchical organizational structure, typically resulting in low flexibility in strategy implementation. Likewise, the resource-based approach allows little flexibility at the strategy formulation stage as it is based on the long-term development and optimized deployment of resources. The dynamic capabilities approach recognizes the changing nature of capabilities, yet tries to plan in the long-term; therefore, it allows a medium amount of flexibility in strategy formulation. The simple rules approach places the least amount of emphasis on year to year planning, resulting in the highest degree of flexibility in strategy formulation compared to the other approaches.

It is important to bear in mind that these different approaches all utilize the tools that are typical to business plan development at the strategy formulation stage, even though the tools were originally developed from one approach or another. For example, the widely used SWOT analysis examines the strengths and weaknesses of a firm (derived from the resource-based approach), and opportunities and threats (derived from the industry structure approach). Strategy formulation requires the structured knowledge gained from applying these business planning tools in order to assess the current state of the business and create the educated predictions about the future which are essential in developing a strategic plan, according to the methodology of each approach. So, for instance, when formulating a business strategy using the simple rules approach, management will examine the structure of the industry it is in, its resources, and capabilities before formulating their strategy in the shape of simple rules.

The industry structure approach allows little flexibility in strategy implementation because of its hierarchal decision-making structure. The resource-based approach allows a medium degree of flexibility in strategy implementation because of the centralized control mechanisms utilized to foster operational efficiency and acceptance of the fact that the firm will sometimes move between markets if it can do so efficiently. Although the dynamic capabilities approach still maintains a centralized decision-making mechanism, it has a high degree of flexibility in strategy implementation because it is more outwardly focused, recognizing that it has unique capabilities in an unstable environment that continuously presents new challenges and opportunities. Similarly, the simple rules approach enables a high degree of flexibility in strategy implementation through its

persistent environmental scanning and decentralized management structure.

The approaches to strategy formulation and implementation have been developed to meet existing issues, weaknesses in existing approaches, changing needs, and advances in strategic thinking. To reflect this, the attribute rows for issues addressed and weaknesses should be read from left to right, with the understanding that an approach has dealt with the issues and weaknesses to its left. This should not be taken to imply that the farthest right approach is necessarily the most highly developed, since if simple rules are taken to excess they result in no strategy at all. In the same way that there is not one right approach, there is not a requirement that an organization use only one approach, either at the same time or over time. For example a mature firm may establish a stand alone e-business with its own strategic approach that may well be simple rules, maintaining a resource-based approach at the parent firm. As the e-business, and its market mature, you may see the e-business move towards the parent firms approach over time.

Flexibility in e-Business Strategy

The complex and transient nature of the environments faced by e-business ventures, poses a constant challenge to organizations trying to formulate and implement an e-business strategy that is flexible enough to anticipate and react to external changes as well as provide the strategic direction needed for success (Smith, 2000). In this section, we start by examining the combined strategic attributes of e-business firms at different stages of maturity to see what their strategic imperatives are. We then proceed to link those imperatives to specific flexibility requirements and outline which strategy approaches are best for firms at different stages of their development. We also show how creative approaches, such as experimentation and scenario planning, can increase flexibility and suggest what additional actions must be taken to refine e-business strategy implementation through increasing knowledge in organizations about the dynamics of their environment.

Flexibility Requirements for Different e-Business Firms

When considering the different approaches to business strategy available to e-business firms, it is important to take into account that every firm has a unique combination of business model, capabilities and resources. The flexibility and creativity enabled by the dynamic capabilities and simple rules approaches to strategic planning is beneficial to firms, as it allows them to cope with the uncertainty of changing environments. It must be said that not every kind of firm is best off using the strategy as simple rules or the dynamic capabilities approach to strategy formulation and implementation. The trade-offs that come with these approaches to strategy are that the utilization of resources is not as efficient as with some of the more ‘traditional’ approaches to strategy, and that the higher degree of flexibility leads to less focused strategic planning.

To bring this into perspective it is useful to examine the different strategic imperatives for e-businesses at different stages of maturity as shown by Rayport and Jaworski (2001). Table 2 illustrates the differences between e-businesses at different stages of their lifecycle in terms of their growth patterns, products and knowledge of their markets, and competitive positions. The combination of these attributes determines what the strategic imperatives for each of the different types of business are. These strategic imperatives have different flexibility requirements for which some approaches to strategy are more suitable. Note that the use of the term ‘products’ refers to tangible products, digital products and also services in the following discussion.

Table 2 : Requirements for Flexibility and Choice of Strategic Approach

Lifecycle Stage	Startup/Beta 6 Months-1 Year	Customer Acquisition 1 Years-2 Years	Monetization 2 Years-5 Years	Maturity > 5 Years
Typical Growth Pattern	Exploiting niche opportunities in new markets/products	Extending product offerings and expanding markets	Increasing market share through complementary products and new markets	Defending market share growth by acquisition introduction of complementary products
Products/ Information Gap	High Market/ technical uncertainty, few products	Good knowledge of existing business, less known about new areas	Existing product lines, good knowledge of markets and technology	High knowledge of markets, wide range of products
Competitive Position	Low industry power, susceptible to changes in the environment, relying on limited product offering	Low power in industry, vulnerable to drastic changes in environment	Medium degree of power, susceptible to juggernauts, specialists and sudden shifts in the environment	Substantial presence in industry, price maker, vulnerable to specialists
Strategic Imperatives	Develop a platform for rapid growth by building a strong team and creating a flexible site	Build market share as quickly as possible by aggressively spending on partnerships and promotion	Increase revenues and customer lock-in by developing new revenue streams	Control costs and optimize marketing expenditures to achieve profitable growth
Flexibility Requirements	High Product High Technology High Collaborative	Medium Product Medium Technology High Collaborative	Medium Product Lower Technology Medium Collaborative	Lower Product Lower Technology Lower Collaborative
Strategic Approach	Simple Rules	Simple Rules/ Dynamic Capabilities	Dynamic Capabilities	Industry Structure/ Resource Based

← Increasing Stability and Expectations for Consistent ROI →
 ← Increasing Uncertainty and need for Flexibility →

e-Businesses at the **Startup/Beta** phase typically grow by exploiting opportunities in changing environments with new products that fulfill previously unmet needs. They face the challenge of high degrees of product and technological uncertainty, which combined with the limited size of their product offering, exposes them to high risk. They have very little power to influence the industry or environment that they operate in due to their small size. They are highly

vulnerable to unforeseen changes in their environment, whether from new consumer preferences, new products competing with their own, or changes in the value chain. Thus, the strategic imperatives for new ventures are to launch their products quickly to exploit their business opportunity before someone else does or the opportunity fades. Since they face high uncertainty about their markets and the potential of their products, they must be highly flexible to make adjustments to their business models as they gain further insights about their markets, products, environments, and competition. For these reasons, the strategy as simple rules approach is the most suitable approach for startups in order to cope with uncertainty, yet have the strategic direction they need to succeed.

Once e-business ventures have already successfully launched their first products, they enter the **customer acquisition** phase of their life-cycle, and typically grow by expanding their market and by extending their product offering. They have already gained a fair degree of knowledge about their existing market space and technology, but usually face new uncertainties around the areas they

plan to grow into. These young firms have little power to change the rules in their industry, and must be wary of how they use it. e-Businesses at this stage often pursue a low-cost negative profit margin business model in order to 'get big fast'. They need to be certain that their business model in fact has scale economics or they will fail (Oliva, 2003). Typically, their past success has drawn the attention of larger firms operating in the same or a tangential industry, who may enter the same market as the young firm. For the young firm the arrival of such a new entrant can bring about devastating changes to its business environment. Changes in technology and consumer preferences can also prompt the young venture to reconsider the validity of its business strategy. Flexibility in business strategy is crucial to young e-commerce firms as they focus on growth through new products and markets, while refining their operations to improve profitability. Their planning horizon is still short-term, as the uncertainties of their business environments make it difficult at best to predict the outcome of their endeavors. They require a medium degree of flexibility when it comes to making strategic decisions regarding their products and choice of technologies. Although their recent successes have let them establish a competitive position for themselves, they still need to be wary of changes in their industry and, thus, require a high degree of collaborative flexibility. The strategic approaches suitable for this kind of firm are dynamic capabilities or simple rules, as these allow high degrees of flexibility.

Once e-businesses further mature, they enter a phase of **monetization**, where they typically grow by increasing market share through marketing efforts, offering complementary products, and expanding into new markets.

These kinds of businesses have a good understanding of their markets, technology and industry through their history of operations. Although they have a medium degree of power to influence their industry, they still face threats from niche serving competitors and from the giants in their industry (Lumpkin, Droege and Dess, 2002). Sudden changes in business environment are also threats that these kinds of firms must anticipate and be ready to adapt to. Their strategic imperatives are to lock in their customers and increase their market share, while keeping abreast with new developments in their industries and remaining prepared to adjust their business models to take advantage of them. These strategic imperatives require medium degrees of

Organization can increase flexibility with techniques such as:

- *Strategy as simple rules*
- *Scenario planning*
- *Strategic experimentation*
- *Technological forecasting*
- *Active environmental scanning*
- *Use of cross-functional teams*
- *Keep a focus on the customer.*

product and collaborative flexibility, and lower technological flexibility, since they are already established in terms of their business model. For these kinds of firms, the dynamic capabilities approach to strategic planning is the most suitable as it provides them with flexibility to cope with changes and the centralized control needed to focus decision-making towards the longer term business strategy.

Mature e-businesses typically grow by defending their market share, and introducing complementary products, while making strategic acquisitions of smaller businesses that fit their portfolio. These firms have a wide range of products and a high degree of knowledge about their customers, markets, and products which allows them the ability to manage their operational efficiency in minute detail (Tung-lung, Chang and Ping Li, 2003). Through their size they have a substantial presence in their industry that allows them to be a price maker. These large businesses can still be vulnerable to rival specialist businesses that focus on the more profitable market segments. Their strategic imperatives are to their stakeholders who expect them to produce consistent returns on investments by protecting their market share and improving their operational efficiencies. These kinds of businesses have the luxury of being less vulnerable to changes in their environments than younger e-businesses because of their considerable power in shaping their industry structure. These mature organizations require far less flexibility along all aspects, since they have significant power within the industry, and can utilize it to force suppliers and distributors to adopt their ways of doing things. For them, long-term strategic planning is possible and, therefore, the traditional industry structure or resource-based approaches to strategy are the most suitable to help mature e-businesses focus on operational efficiency and profitability.

Throughout this analysis it becomes evident that the uncertainties decrease for more mature firms, as they have longer operating histories and more knowledge and influence in their industries. The younger ventures face a much higher degree of uncertainty for their business and

therefore require more flexibility in their strategy. The expectations of the stakeholders for consistency in the financial results become higher with larger and more mature firms as they are seen as less vulnerable to environmental influences.

Flexibility through Creativity, Experimentation and Knowledge

Decentralized decision-making in a strategy approach, such as simple rules, increases flexibility by enabling management to increase the scope of their solution sets of acceptable decisions that fulfill the criteria embodied within the guidelines provided by upper management. Since these criteria are defined through simple rules instead of complex analysis and planning methods, it allows for timelier problem solving by easing away from long-term planning and the need for accurate forecasting. Hence, this could be viewed as a creative approach to formulating and implementing strategy.

According to empirical research by Ogilvie (1998), creativity is beneficial to the overall quality of strategic decisions in fast-changing and ambiguous environments. She argues that this creative action approach to strategy focuses on creating new industry dynamics and a new competitive space as opposed to concentrating on incremental improvements. Rather than concentrating on the fit between existing opportunities and available resources, it seeks to expand on the opportunity horizon and competence base of firms.

Scenario planning is an example of a creative approach to planning strategy. Scenario planning, when done properly, is an imaginative process, which tries to explore future possible outcomes of actions, and in the process, develops assumptions about the dynamics of competitive environments. Scenarios involving disruptive technologies are of particular importance to e-businesses, as they can often enable or destroy firms' chances of survival (Phaal, Farrukh and Probert, 2004). Scenarios are often the basis for experiments with new business models and the development of new opportunities.

Venkatraman (2000) further supports the importance of scenario planning and strategic experimentation. He states that "Past success is no guarantee of future success, and calendar-driven strategic planning is giving way to strategic experimentation and rapid adaptation. The challenge is to pursue experiments that not only augment current business models but also create new ones and rules of competition" Furthermore, Venkatraman stresses that organizations should not focus all their efforts on experimenting with predictable opportunities but should also explore probable ones.

The fact that e-Business firms today are already performing countless experiments has two main consequences on the competitive environment. They increase the rate and magnitude of change in the industry and competitive rules in the near future, and according to

Malone (2001) these experiments will enable companies to eventually determine the details required to build more stable and profitable business models. This will not happen for several years though; in the mean time e-business companies must continue to learn from their experiments and those of others to keep abreast with environmental changes.

Activities such as experimentation, scenario planning and technological forecasting increase the knowledge base of firms allowing them more flexibility in setting and updating their strategies on a regular basis to remain competitive especially in turbulent environments (Knot, Van and Vergragt, 2001). Zack (1999) takes a comprehensive approach to analyzing the link between knowledge and strategy in organizations. In his work, he identifies that a firm's strategy is closely linked to the level of knowledge that it possesses. Hence, a firm's strategy and actions in its market or what it "can do" is dependant on what "it knows". Consequently, Zack identifies what he terms as the "strategic gap" which is defined as the difference between what a firm "must do" to compete in the market place and that which it "can do". What a firm "must do" in turn dictates what a firm "must know". The strategic gap, as such, is highly related to a "knowledge gap". Zack argues that the strategic gap could only be bridged by bridging the knowledge gap.

When firms are operating within turbulent environments, as is the case for many e-business firms, bridging the knowledge and strategic gaps becomes a necessity for survival (Oliveria, Roth and Gilland, 2002). Since both e-business and RandD management face similar challenges coping with uncertainty and rapidly changing environments, we suggest knowledge can also be gained through the RandD strategic management mechanisms proposed by Menke (1997):

- **Active environmental scanning** : managers must dedicate time for monitoring developments by competitors, suppliers, and distributors.
- **Using cross-functional teams** : projects should promote cooperation and mutual learning by members from technology, marketing, and financial backgrounds.
- **Constantly focusing on customers** : from an e-business perspective this poses opportunities as well as challenges, such as the ease of online data collection, online personalization, privacy issues, lack of face-to-face contact, rapidly changing customer preferences, and low switching costs for customers.

The knowledge gained from these activities needs to be disseminated throughout the organization in such a way that managers receive it and can act on it on a timely fashion. The concept of the adaptive enterprise (Evgeniou, 2002) epitomizes this, as it strives for high information visibility and high flexibility. Evgeniou (2002) describes the adaptive enterprise as having the capability using information systems to "view company, product, and customer information in 'as was', 'as is' and 'as if' scenarios so that the past and potential

success of strategic decisions can be accessed and new strategic operations analyzed.”

As an e-business matures, it can refine its strategy by reducing uncertainties through increasing knowledge about its environment, customers, and technologies. The limit of how much uncertainty can be reduced is governed by the pace of disruptive change faced by the firm. Since it is not likely that disruptive changes for e-business will disappear anytime in the near future, there will always be requirements for flexibility in e-business strategy.

Conclusions

Flexibility is the key to dealing with industry volatility and complexity faced by e-businesses today, by hedging against the uncertainties inherent in a swiftly changing environment (Shi and Daniels, 2003). We have identified the different kinds of flexibility required for survival in the emerging economy, and shown that e-businesses at different stages of maturity require varying degrees of flexibility to cope with and exploit changes in their environment. Creative exercises such as experimentation and scenario planning were presented as being essential tools for expanding the knowledge base of firms yielding them more strategic options leading to more flexibility. In the turbulent environment of e-business, maintaining flexibility becomes a key success factor to cope with uncertainty and continuous change. Such flexibility could only be maintained through continuous learning and knowledge management processes.

Companies trying to cope with the unsettled e-business environments today must balance the need for flexibility with the need for focus when they develop and implement strategy (Malhotra, 2001). This requires the managerial ability to recognize when to apply classic strategy paradigms to drive business focus and when to embrace creativity and innovation by fostering a ‘trial and error’ environment (Loebbecke and Wareham, 2003). It is crucial to continuously expand the knowledge the company possesses and to foster creativity and innovation when confronted with new situations.

It is important for companies engaged in e-business to continuously scan their environment to anticipate and react to any threats and rapidly cash in on opportunities as they arise. This could only be achieved by maintaining flexibility in their business strategy. The paradigm of strategic flexibility in e-business can be summed up in the words of the boxer Muhammad Ali: “Float like a butterfly, sting like a bee”.

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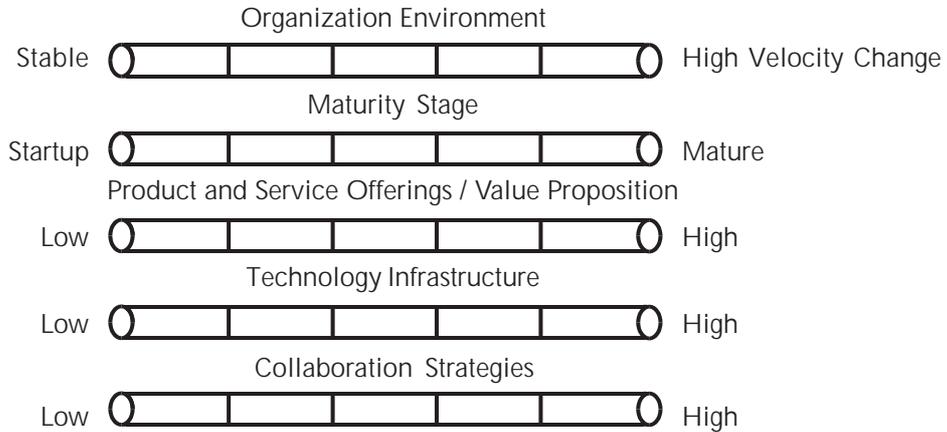
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Flexibility Mapping : Practitioner's Perspective

1. What types of flexibilities do you see in the practical situation "e-Business Strategies" on the following points:
 - Flexibility in terms of "options"
 - Flexibility in terms of "change mechanisms"
 - Flexibility in terms of "freedom of choice" to participating actors.

2. Try to map your own organization on the following continua (Please tick mark in the appropriate boxes)



3. Given the above assessment, what level of flexibility is required of your organization in each of the dimensions?

Reflecting Applicability in Real Life

1. As a result of the mapping of the strategic flexibility of your organization, what is the strategic gap that you have identified in terms of what you know and can do (resources, capabilities) and what you must do?
2. What are the appropriate techniques needed for your organization to reach its optimal level of flexibility?



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Flexibility in Operations and Business Innovation

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Abstract

In order to develop new vision and innovate products and businesses for dynamic markets, firms need to consider various drivers of change within and from the environment, and the way in which they interact with each other. The resource based view falls short, in that it does not explicitly address competencies in organizational capabilities and market orientation. In this study, starting with a proposal to bring stratification to the resource based view, whereby internal resources and the external orientation can be separated, constraints at operations and business level have been identified for meeting the drivers of change. The stratification facilitates prescribing operations enablers, which function as drivers of operations flexibility for innovation. The resulting operations performance, when added with environmental constraints, demands suitable business enablers, or drivers of strategic flexibility, for achieving business excellence. Estimates of the potential performances are shown to assist the learning process at business level, and as evidenced by a within-case analysis also at operations level.

Keywords : business flexibility, operations flexibility, product innovation, resource based view

Introduction

In a world where everything changes, doing the same thing as yesterday is the surest way to fail and loose market position. Now-a-days many drivers of change can be recognized. Some drivers of change originate from within firms and they are caused by driving forces that are attributed to the creativity, skill and knowledge of the employees. Mobilizing these forces towards a common strategy is termed differently by different researchers: resource base such as idiosyncratic modes of technology (Conner and Prahalad 1996, Schroeder, Bates and Junttila 2002), competence base (Prahalad and Hamel, 1990) or capability base (Amit and Schoemaker 1993, Stalk, Evans and Schulman 1992). Some drivers of change originate from the forces of the external environment (Day, 1994) which are attributed to suppliers and customers (such as in the most of manufacturing industries), deregulation of markets (such as the telecom and electricity markets), globalization of markets catering to demographic variations, internationalization of competition, and increasingly more critical consumers. Other drivers of change are influential at the intermediary linking level and refer to emergence of new technologies (such as ICT, biotechnology and nanotechnology), and emergence of new infrastructure (such as internet) that facilitates organizational process routines.

The drivers of change are not independent, but influence each other mutually making the business process complex. The drivers of change thus complicate the dynamics of a company's business and make prediction of the future by extrapolation from the past nearly impossible. In order to develop a new vision and strategy regarding innovation of new products or explore new markets, firms need to take

into account the various drivers of change and the ways in which they affect each other. This can be facilitated by considering the origin of the drivers of change, namely the driving forces, and their level and trend.

Innovative firms often succeed in meeting the challenges associated with the drivers of change. They are capable of identifying the appropriate moment to initiate a change to meet the competitive forces in the market. They would do this by introducing new products in the market and creating competitive advantage. A firm starting with this externally oriented strategy can compete well in the product markets by developing new products and manufacturing capabilities (Hayes and Jaikumar 1988, Hayes and Pisano 1994). The external change would be achieved by these innovative firms through effecting a change within, namely in the resource base, in regard to their operations. The resource base usually includes main assets, such as technology and plant, key-processes of manufacturing and core competencies. In the environment of dynamic markets and improving technologies, setting strategic goals as to where the firm excels now and wants to outperform the competition in the future becomes difficult. Equally difficult will be the task of developing and coordinating a suitable resource base. In other words, the choice of competitive priorities on the performance of the resources within is prerequisite for building sustainable competitive advantage. The resource base view considering dynamic markets has been termed by researchers as dynamic capabilities by which firms integrate, build and reconfigure internal and external competencies (Teece, Pisano and Shuen 1997, Eisenhardt and Martin 2000). Since the competitive priorities change in accordance with internal and external driving forces, flexibility will be required at both fronts: the resource base and the external



orientation. Flexibility on the resource base concerns the choices, also called design choices, comprising of techniques, methods and criteria (Sanchez, 1995). It also refers to various dimensions, which properly monitored and controlled, may broaden the scope of manufacturing processes (Gerwin, 1993). Flexibility on the part of the externally oriented strategy concerns organizational and managerial choices (Carlsson, 1992) to meet market requirements. Thus, flexibility is a need for closing the gap between what the market needs and what the firm can accomplish.

The vast literature on the 'resource based view', though exposing the effects of the external environment, does not explicitly distinguish the strategy at the resource base from that at the external orientation (Verona 1999, Coates and McDermott 2002). Due to its valuable breadth and depth, the resource based view will be used as the starting point in our conceptual analysis. We will, however, split this into two levels for focusing on the drivers of change explicitly and separately: operations level representing the strategy at the resource base and business level representing the strategy for the external orientation. On the basis of certain chosen organizational goals formulated in response to the drivers of change, corresponding performance goals are set at operations and business levels. These performance goals exemplify the corresponding strategies. Since the strategies corresponding to the separate goals need to be integrated for achieving a unified organizational performance, the competencies of the resource base and those of the external orientation are linked. Finally, the achieved performance can be taken as guideline for feedback to support learning at the resource base and the external orientation separately as proposed in the model in Figure 1.

The drivers of change are not independent, but they mutually influence each other making the business process complex.

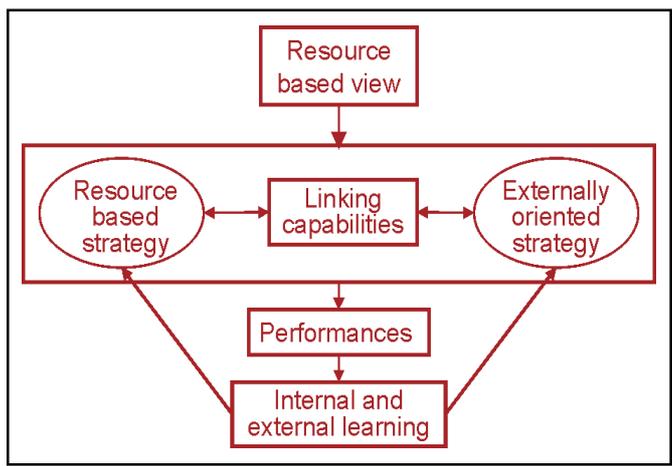


Figure 1 : Linking of Capabilities and Learning Process

We will subsequently work out this model as to how the focus at operations level can differentiate the strategic goals of operations performance in accordance with the specific decisions made at the business level. We will discuss how the internal constraints forming bottlenecks can be removed through enablers. It is the object of this paper to demonstrate

which enablers of change, or drivers of flexibility, are needed for improving the performance separately at the operations and business levels. The conceptual model will be substantiated with the help of a case study involving computer simulation. The case study is intended to show how an innovative firm operating in a dynamic market chooses its competitive priorities and makes choice of flexibility measures in order to achieve higher operations and business performances.

Literature Survey

In order to be competitive, firms build their resources for not only confining to a static market share, but also for positioning on the 'war of movement'. The positioning involves reacting to the dynamics of the market by choosing and dropping products and even businesses rapidly. This is done with the help of developing and organizing superior capabilities, which are used for making the firm flexible in order even to change the rules of the competitive game. With this view some researchers (Stalk, Evans and Shulman, 1992)

believe that the market importance is becoming increasingly unimportant. This view, however, directly contradicts the long held

notion of the PIMS group (Profit Impact of the Market Strategy) (Buzzel and Gale, 1987). The latter authors estimate that the resources and quality products are preferred, but not essential for achieving high profits. They advocate gaining and maintaining a favourable market position is essential for continued profitability.

Research as to which of the organizational capabilities or market competition has most influence on forming firms' actions and business strategies has been inconclusive. Equally inconclusive have been the studies on the outcomes of the corresponding business or firms' performance criteria. It is, however, far too evident that both organizational capabilities and market environment shape business strategy and performance, and vice versa (Henderson and Mitchell, 1997). It is made evident by these scholars that the competition shapes organizational capabilities, which in turn shape the competition within which business strategy and performance form inputs and outputs. Organizational capabilities and market competition thus are interactive and they are difficult to separate. However, without separating these, strategy formulation might put too much focus on one and too little on the other. In the section to follow, we will attempt to distinguish contents of the organizational capabilities, which often are termed as the resource base, from those of the market environment. Following this, various types of flexibilities will be drawn up and described.

Resource Based View

Resource based view has evolved over last two decades from identifying what is resource base and what this base means to improving capabilities and finally to achieving and sustaining competitive advantage. This view focuses on



firm's ability in product innovations and process improvements through accumulation and effective use of internal resources, such as assets, technologies, skills and knowledge. The strategy from this view emphasizes what firms are capable of doing, rather than by the need they seek to satisfy.

A wide spectrum of research and discussions on this topic can be found in literature. A thorough review may be found in the context of management of product development (Verona, 1999) and production and operations strategy (Coates and McDermott, 2002). Resource based view has been enhanced in the recent years to include the market dynamism and the path dependent evolution of competencies, or dynamic capabilities, which are unstable and drive the competitive advantage (Teece, Pisano and Shuen 1997, Eisenhardt and Martin 2000). Starting with these reviews as basis, advancement on the resource based view will be forwarded in this section.

The strength of dynamic capabilities lies with their availability for reconfiguring, and thereby creating new competitive advantage.

Traditional categorization of resources concerns tangible and intangible form within the firm. Tangible resources are assets that can be acquired in factor markets and they tend to contribute little to economic rent generation if the environment is excluded (Amit and Schoemaker, 1993) unlike it is conceived in industrial economics. Intangible resources often are internally developed technologies, skills, attitudes and knowledge. They also refer to relational resources derived from the firm's interaction with the environment (Lowendahl, 1997). Tangible and intangible resources are supplementary to each other, and they form together a robust resource base.

Resources can be deployed and coordinated, thus they can be bundled to form capabilities (Amit and Schoemaker 1993, Prahalad and Hamel 1990, Teece, Pisano and Shuen 1997). Capabilities in a narrow definition refer to the combination of a number of skills or abilities to carry out functional tasks or activities. In a broad definition, capabilities are considered combinative when the existing skills can be recombined for creating platforms for the future (Kogut and Zander, 1992). According to these researchers, supported by knowledge, capabilities reside in routines that are intrinsically intangible; they accumulate over time and they are idiosyncratic and, thus, firm specific (Dierickx and Cool, 1989). Resources and capabilities are dynamic because they may change due to innovations caused by managerial behaviour that is either internally or externally driven (Teece, Pisano and Shuen 1997, Eisenhardt and Martin 2000).

Capabilities are composed of knowledge that is enhanced by learning within the organization (Teece, Pisano and Shuen 1997, Leonard-Barton 1995). According to the former researchers, learning is consistent with the properties of rent generation from firm specificity of accumulated skills and capabilities. Learning is triggered by problem-solving

strategies when the potentials exist for improving on performance. This form of internal learning also takes place through the training of multifunctional employees (Gerwin and Kolodny, 1992) and even in an unpredictable way that is difficult to codify. Internal learning of manufacturing plants could be of the sort that is learning-before-doing (Pisano, 1994) involving a new technology, whether it is new to the world or new to the industry, that is yet to be put to practice in a particular industry or group of firms. In contrast, external learning is mainly attributed to building and expanding capabilities through acquisition of knowledge and developing skills. This is often referred to as inter-organizational learning through the creation of tacit knowledge that is not easy to duplicate (Madhok and Tallman, 1998). With external learning can firms gain access to the distribution channel, develop goodwill with customers, or develop a positive reputation before other competing firms get to this stage (Lowendahl 1997, Gerwin 1993). By combining external learning with

exploiting internal resources and their characteristics, achieve firms competitive advantage (Rumelt 1984, Hamel and Prahalad 1994). Some firms excel from availing the so-called 'first mover advantage' thereby obtaining sustainable competitive advantage.

Competitive advantage built solely on the resource based strategy has its base in operations area. Firms with these strategic abilities in operations have a strong objective of business performance, such as low cost and differentiation (Anderson, Cleveland and Schroeder, 1989). Manufacturing firms have different levels of abilities for ultimately achieving these business performances. The levels of abilities stretch strategically over quality, flexibility, and throughput time. Firms make use of the competitive advantage in these areas to reach idiosyncratic modes for manufacturing processes (Schroeder, Bates and Junttila, 2002).

Recent verifications on the rationale of the resource based view go beyond static markets to include dynamic markets as well. In the latter continuously shifting markets, the resource based view may have to address dynamic capabilities. Dynamic capabilities make managers able to integrate, build and reconfigure internal and external competencies for meeting the challenges of the rapidly changing environment (Teece, Pisano and Shuen 1997, Eisenhardt and Martin 2000). The activities would include specific strategic and organizational processes involving product development, and strategic decision-making with respect to technologies and markets. According to the above researchers, the functionality of dynamic capabilities can be duplicated across firms, though the duplication is path dependent. Dynamic capabilities, however, are experiential since they rely on quickly created new knowledge. They are unstable because of the continuously changing markets. Lastly, the strength of dynamic capabilities lies with their



availability for reconfiguring, and thereby creating new competitive advantage.

Types of Flexibility

Flexibility concerns absorbing external uncertainty of product markets, on the one hand. On the other, flexibility concerns the capability of adaptation of manufacturing processes and their inputs. In combination, flexibility is usually referred to as adaptive response to environmental uncertainty, or within a particular industry (von Hippel, 1988) and to specific customers' expectations. A review of the literature reveals that flexibility is classified by different researchers in different dimensions (De Toni and Tochia, 1998). The dimensions correspond to considering flexibility on the basis of different uses, aims or functions.

In order to bring clarity on these dimensions, we will broadly divide flexibility into strategic and manufacturing, or operations. The flexibility with which the externally oriented strategy is modified and updated is termed as strategic flexibility and it makes organizations reposition themselves in the market they intend to serve and gain new customers. Strategic flexibility will emphasise the capability to change the firm's strategy with the help of the competencies selected, developed or exploited (Hayes and Pisano, 1994). It may refer to the coordination capability of identifying critical interdependencies among different flexibilities (Sanchez, 1995) concerning design choices, and their dependence on techniques, methods and criteria. Strategic flexibility may be looked from the view point of effecting a change: proactive or offensive, and reactive or defensive (Gerwin, 1993). The strategic flexibility will address performances that are aimed at and those achieved (Swamidass and Newell, 1987).

The latter, manufacturing strategy has been treated in vast literature and thoroughly reviewed (De Toni and Tochia, 1998). The reviewers have classified manufacturing flexibility on different dimensions. In essence, these dimensions are mainly aimed at dealing with uncertainty at machine and plant levels to meet uncertainty of demand in different time intervals (Slack, 1987). The dimensions refer to processes with little penalty in the performance consideration of efficiency, cost, quality and speed. The scope for flexibility at the resource level to meet the changing environment, thus, is a primary requirement for manufacturing firms. This strategic view on manufacturing flexibility has been widely discussed (Gerwin, 1993).

Referring to the review of vast and articulated literature by De Toni and Tochia (1998) it may be concluded that the classification of flexibility or flexibility dimension is broad, measurement of flexibility is difficult, the need and choice of flexibility is varied, and the interpretation differs

among different people within the organization. Out of the wide approaches specified there, we make a choice in the section to follow for bringing a fit between their classification and our study.

Strategy Linkage and Flexibility Need

It is evident that the competencies have strong relevance to external driving forces of competition and their rate of change. Since competencies, or dynamic capabilities, need to be reconfigured to meet these changes, we propose, to start with, to segregate these with internal and external focus. With this segregation, it will be possible to address the internal and external capabilities separately. Then linking and reconfiguring of the capabilities will be sought for in order to define valuable performance objectives of the organization.

Stratification to the Resource Based View

Starting from the considerations of industrial economics, the resource based view has evolved to include intangible resources as well. In the recent literature, it is considered to account also for environmental inputs. These inputs in the form of both internal and external learning are essential for the enhancement of competencies. Thereby the scope of the resource based view has widened so much that a distinction between the internal and external

The classification of flexibility or flexibility dimension is broad, measurement of flexibility is difficult, the need and choice of flexibility is varied, and the interpretation differs among different people within the organization; the present study makes a choice for bringing a fit between some of these and innovation.

focus has become blurred. In consideration of this aspect, researchers have addressed the question whether organizational capabilities or market considerations are responsible for shaping firms' actions and performance (Henderson and Mitchell, 1997). They confine their findings to comment on the interactions that take place between the organizational capabilities and market competition, and those between strategy and performance. Their reference to reciprocal interactions at multiple levels has prompted us to bring stratification to the resource based view in internal resource base and external orientation. In addition to bringing a distinction, the stratification also demonstrates how the stratified elements can be separately addressed for feedback and learning. Without such stratification, it would be hard to effectively address relatively independent internal and external focus. In succession to this, we will combine the stratified elements through linking of capabilities for formulating sound and unified objectives of the operations and the business.

Resource Based Strategy

Competencies reside in the resource base, thus they are internal to the firm. They are improved during transactions due to exposure to other functional areas within the firm and also to the environment, specially for meeting commitments to suppliers and customers. Though competencies are activated by market requirements,

competitive challenges and external opportunities, the resource base is mainly responsible to operations, such as technology, product development and production processes. It may then be considered that the competencies relate to internal emphasis on the resource base, and thus they are managed from the view point of a resource based strategy.

Resource based strategy, which is put forward here, focuses on an inside-out perspective built around company's internal strength. Markets are identified, explored, stabilized, or expanded starting from the firm's strength in its tangible and intangible resources. The resources thus developed could be difficult to imitate by competing firms and, thus, the leading firm continues to benefit from its position (Barney, 1991). The same could work adversely as well, in that it may become too difficult for a firm to switch to other competences to meet the changing market demands (Leonard-Barton, 1995) making the firm lethargic. This strategy concentrates on attaining a distinctive resource base that is superior in its form and strong in imitation barriers, through its inimitable and idiosyncratic capabilities.

The resource based strategy alone is not sufficient, through focusing on the internal resources and competencies, for effectively meeting the demanding and changing environment. Monitoring of the environment and its forces of change requires a separate focus in the form of externally oriented strategy. The monitoring would reveal the drivers of change that have to be accounted for in setting new competitive priorities. Ability of connecting the input from this monitoring with the resource base concerns linking, recombining or reconfiguring of capabilities.

Externally Oriented Strategy

At the other end of the resource base, there are competencies that are directed to the external environment for anticipating drivers of change, such as market trend and competitors' strength. They also aim at customer satisfaction and durable relationships with channel members and suppliers. These competencies support the resource based strategy for anticipating and meeting the market requirements. In view of this, we stratify these competencies and associate them with externally oriented strategy.

Firms taking their environment as the starting point for determining their strategic cues from their customers and competitors are termed as *market-driven* or *externally-oriented* (Day, 1994) and their approach as *positioning approach*. Originating from the marketing side, this outside-in perspective is still used, though not as much as the inside-out perspective that dominates the field of strategic management. The customers of concern, those that are prepared to pay more for the products and services, readily satisfied with the supplies and deliveries, and remain loyal, are named as key customers. The requirements of key customers are kept focussed and any shifts in them are

positively met. No chances are left in this process for the competing firms to intrude in the business with the key customers. Thus, understanding and responding to external developments remain crucial. Therefore, the strategy is differentiated as an outside-in perspective and it is often the starting point for building competitive advantage on the basis of product differentiation or cost (Porter, 1980). According to Porter, this strategy profits firms with their strong position in the market through economy of scale, added advantages of large bargaining power with their customers and suppliers, and strength to avert new entrants and rivals. Firms with this perspective continuously monitor signals from their suppliers, competitors and customers to define their own plan. In order to achieve this, firms use as tools, market sensing, customer linking, channel bonding and technology monitoring (Day, 1994). Others opt for information assimilation and knowledge expansion through external learning (Kogut and Zander, 1992). With the help of careful monitoring of market signals would firms be able to create markets for new products, bring in industry changes and remain ahead of the competitors. Thus, the strategy concentrates on attaining an advantageous position that is superior in its bargaining power and strong in mobility, and on positioning in the market and industry. The choice as

Linking of the stratified competencies at the resource level and the business level also means combining or configuring the competencies belonging to the two separate strategies.

to which capabilities to nurture and which investments to make, must be guided by the results of the externally oriented monitoring, or the outside-

in perspective. In view of this, the resource base cannot be left unchanged, thereby limiting the firm's ability to implement the best market strategy, but it needs to be continuously updated.

Linking of Capabilities

It is clear from the foregoing discussion that any one of the strategies is not sufficient in order to utilize different competencies embedded separately in different levels of the organization. Linking of the two stratified competencies is an essential management activity that brings synergy. The linking also means combining or configuring the competencies belonging to the above mentioned two separate strategies. The linking leaves the identity of the separate strategies preserved for addressing the focus of each strategy separately. The separation of the focus would independently facilitate monitoring of the competencies and the learning process related to each strategy. Failure to link the capabilities, or the lack of integration, would result in uncoordinated strategies each aiming at its own performance. Concentrating on individual strategy separately would firms be aiming at excelling either in internal performance or in external performance. The vast literature in strategic management focuses on either inside-out view of the resource based strategy, or outside-in view of the external orientation that is mainly market driven. A combined approach can be found in the recent literature on the resource based view, though it does not focus on the

competencies related to the resource based strategy and the external orientation separately. Based on the resource based view, the combined approach refers simultaneously to the resource base and the external orientation. Basing on this combined approach, researchers term the abilities of firms differently: spanning capabilities (Day, 1994) combinative capabilities (Kogut and Zander, 1992) and dynamic capabilities (Teece, Pisano and Shuen 1997, Eisenhardt and Martin 2000).

Spanning capabilities refer to purchasing, customer service delivery, new product development and strategy development. These capabilities are the result of market requirements, competitive challenges and external opportunities that activate the resource base or the inside-out capability.

Combinative capabilities focus on the integration of capabilities for technological and organizational opportunities (Kogut and Zander, 1992). Acquisition of knowledge and external learning play a crucial role in improving the knowledge base that is needed for combinative capabilities.

The output from operations and business due to the linking of capabilities, which can be termed as performance, can facilitate the learning process as shown in Figure 1. Internal process performance helps monitor the process of internal learning and, thus, enables strengthening of the resource base and its strategy forming. On similar lines, external learning is improved from the business performance and the impact of the product performance in the market. External learning would help organizations sharpen their externally oriented strategy. Competitive advantage derived from the learning process enables firms to protect existing markets, enter new markets by reapplying competencies, and even give ability to firms reach monopoly position in chosen markets (Rumelt, 1984).

The Need for Flexibility

It is evident from the foregoing discussion concerning the resource based strategy and the externally oriented strategy that they are mutually dependent. External and internal driving forces influence these strategies differently. In order to meet external driving forces and internal constraints, the resource base needs to be reequipped; in order to meet various limitations inherent of the resource base and the environmental constraints, the external orientation needs to be updated. In either situation, the corresponding strategy requires continuous monitoring and revising of strategic decisions at the appropriate moments. This requirement can be met by flexibility, not only in the decision-making process, but also in efforts that have to be put in. Thus, flexibility is diverse in nature and it has relevance over the whole organization. It stretches from the organizational level for defining the organizational strategy and managerial choices that span over a relatively longer periods of time.

Flexibility stretches also up to work and activities level for the implementation of the strategy, though usually over a relatively shorter span of time.

The resource based strategy concentrates on building strong tangible and intangible resources for fulfilling product innovation and the manufacturing needs. The resources need to be improved and expanded in accordance with internal forces of technological changes and learning curves. This requires variability of products and processes, or in the case of manufacturing, performing activities that can be planned and controlled.

Intriguing interactions between environment conditions and business performance become visible when markets tend to grow or contract. The growth provides a slack environment to undertake new activities that may not prove useful during the contracting period that might follow. The request for flexibility thus originates from the market and customers (Buzacott, 1982). Environmental uncertainty, created specially by market competition, has profound impact on manufacturing strategy, which in turn has strong consequence on business performance (Swamidass and Newell, 1987). Manufacturing flexibility is a means of coping with environmental uncertainty, and it is important to manufacturing strategy content.

Changing environmental conditions or market competition may not tend to reach a steady state, but may continue to fluctuate with time, and even become turbulent. This dynamic nature makes any prediction of the competitive forces difficult. It is this dynamic nature that makes the managerial task of making the best estimates of different phases of the fluctuation hard, and developing any needed new capability complex.

In the context of our research, flexibility relates to establishing competitive priority and arriving at key success factors at the time of turbulence in the demand (Nakane and Hall, 1991). The division we choose within flexibility refers to the distinction on the basis of operations and business considerations. The former considerations are internal to a firm and they refer mainly to product and production or manufacturing flexibility covering the abilities to meet the variability of random or seasonal demand, product life cycles, range of products, customization and delivery times. The latter considerations referring to business or strategic flexibility consist of the ability to successfully vary the mix of competitive priorities in the market. With this division of flexibility, we will proceed to consider different ingredients that may contribute to forming operational and business objectives.

Innovation of Operational and Business Processes

The concept that the resource base and the environment together can be made use of for formulating a business strategy aimed at a definite performance (Henderson and Mitchell, 1997) applies to the product markets affected by

In the context of our research, flexibility relates to establishing competitive priority at operations and business levels, and arriving at key success factors at the time of turbulence in the market demand.

product life cycle as well. The consideration of a link between the resource base and the environment, however, proposes the need for defining their mutual relationship also corresponding to innovation of products and businesses. In the context of the complexity of formulating a business strategy and uncertainty of the resulting performance in the market, can the innovation process be analyzed through extending the broad lines described by Janszen (2000) in his book. The author shows that the complexity calls for suitable iterative methods to arrive at reasonably acceptable estimates. Similar complexity calling for 'mid-course corrections' to businesses, and the needed iterations to resolve this, has been dealt recently (Lynch, Diezemann and Dowling, 2003).

The iteration suggested by Janszen lies on the fact that the innovation of a product is not complete when it is designed and developed; the innovation follows a trajectory. Only after the new product is introduced, can customers express well which product attributes they like most and which they like less. As the market develops, will the marketers find increasingly easier to predict from their market data how the next product variation and generation must look like. In other words, the emerging market drives the development of the next variation and generation of products and vice versa. Similar mutual interactions exist between the development of new products and the development of key technologies. A simplified form of these interactions will be analyzed in what follows.

A focused analysis of the resource base in view of the operations provides insight to the strengths and weaknesses of the internal resources related to innovation. It reveals also potential constraints, which, if not resolved, would create bottlenecks for working towards the goals. In order to resolve these, can enabling methods be employed. Many of them are commonly used tools and methods in operations management, and they are treated here as potential enhancers of capabilities for enabling the firm achieve its innovation and operations goals. Since these enablers also function as key elements in accelerating, decelerating or modifying the course of activities, we like to name these as drivers of operations flexibility.

As shown in Figure 2, enhanced operations are realized following the operations model. Similarly, enhancement of the entire business process can be achieved using the business model. During the latter enhancement, in addition to making use of the outcome of the operations performance as input, also environmental constraints are accounted for. Similar to the operations enablers in the previous stage, at this stage, business enablers are taken in to consideration: correspondingly termed here as drivers of strategic flexibility. In view of the long periods of time involved before the outcome of the business performance would be available, and the involved possible risks, one may rely on the

Potential constraints to operations can be resolved using enabling methods, or potential enhancers of capabilities, which also function as key elements in accelerating, decelerating or modifying the course of activities, and thus as drivers of operations flexibility.

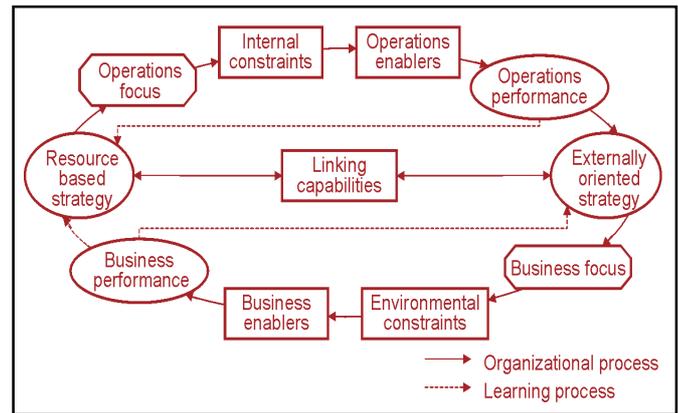


Figure 2: Linking of Capabilities for Enabling Organizational Process and Learning Process

estimate of the expected business performance. The business enablers, when critically scrutinized along with the business strategy, would yield reasonably accurate estimates of the potential, and thus the effectiveness of the previously chosen strategy. The estimation of the business performance would be realistic, however, only after the results of the modified business are fully available.

Similarly, feedback from the operations performance may involve long periods of time, such as during product development activities. In such cases, one can depend on the estimates of potential operations performance. These estimates serve as guidelines to re-examine the resource based strategy, externally oriented strategy and the linkage between the two. They represent the measure of the success of the enablers in regard to realizing product innovation, and thus they would help in

approving a product generation and supportive guidelines for the next variation of the new product. The estimates would be useful also for scrutinizing the production process and the knowledge management.

With these two-stage estimates of the potential operations and the business performance as input, one can redesign the enablers and re-estimate the performances both at the operations level and the business level. The process can, thus, be iterated for arriving at improved and more realistic estimates before carrying out the organizational implementation. The above mentioned estimates can be applied also to on-going businesses to effect mid-course corrections. The iterated values can be the best estimates of the mid-course correction to operations or business strategy for bringing timely changes in product attributes and product positioning in the market.

The iterations are necessary steps for arriving at the most realistic expected performance before any decisions on drivers of flexibility of operations and business can be implemented. The iterations may have to be continued, specially when the internal and external drivers of change

are not static but vary with time, and product life cycles (Janszen, 2000). The iterations can be repeated with the performance data or their expected estimates corresponding to the previous period.

Our conceptual model is somewhat similar to the holistic model of Gerwin (1993) for manufacturing activities, which has been recently enhanced (Narasimhan, Talluri and Das, 2004). The researchers distinguish between flexibility competence and execution competence, which is similar to our approach to distinguish flexibility between the expected and the actual. Our model differs, however, in that it focuses on product innovation and business enhancement.

The elaboration of the conceptual model presented in Figure 2 is worked out in this section for providing areas of importance within the previously identified operations and business focus of the resource based and externally oriented strategies. Some representative elements within each area will then be discussed for their competence level and their constraints. Subsequently enablers or drivers of flexibility will be shown, which are used for overcoming the constraints. Finally, estimates of the expected or achieved performance levels, their indicators, and their importance as input for internal and external learning will be discussed.

Operations Focus

With the chosen business strategic considerations as input, the operations focus will be directed on segmented areas in products, production and knowledge. The segmented areas will be treated for their competencies, constraints, flexibility and performance. Performance as output from the operations focus, or its estimate, serves as input to the subsequent consideration of the business focus. Some illustrative elements of each of these focused areas have been listed in Table 1. Though self-explanatory, the elements have been worked out below for clarity.

Product Focus

Product focus identifies the need of new product development or improvements on an existing product. In a turbulent environment where the drivers of change are strong, does the need for frequent renewal of products and their features become essential. The turbulent environment may be driven by technology change or competitors' attempts to modify products with improved features to satisfy the needs of the market and costumers.

The product focus for meeting these external drivers of change demands developing or acquiring new technologies and developing suitable competencies on situational basis, or dynamic capabilities. The externally oriented strategy will place emphasis on the choice of technologies. In the presence of internal constraints for developing within the organization, these may have to be procured. For acquisition of new technologies, organizations usually follow any of the

established methods: procuring through paying for patents, joint ventures, mergers and take-overs. Organizations with strong technology development programs, attempt to combine these programs with product development.

This process, also called product-technology road mapping, seems to show much benefit for bringing integration of product and technology, thereby bringing the needed integration between business and technology (Groenvelde, 1997). Road mapping plays a role in distinguishing the needed change in technologies for facilitating product creation when market opportunities change over both short and long terms. In essence, these roadmaps build a bridge between technologies and products, and also clarify the options that are available for product-technology combinations. Roadmaps, on similar ground also platform technologies, serve as enablers of the product development process. Since these roadmaps open up the possibility of developing a wide range of new generation of products, and each generation with wide range of product attributes, we term these as drivers of flexibility. The output of the product development process supported by enablers yields product related benefits, and thus it is also an indicator of the operations performance. An organization

with critically developed product-technology roadmaps will already be in a position to estimate the technology position of the product, thus an estimate of the operations performance. This estimate will be a valuable input to the resource base for positioning

the product-technology characteristics and updating its value for other products and their generations. The estimate will also bring additional insight to the product development activity in view of the new product-technology mix, and thus will be eye-opener providing benefits of internal learning.

The above sequence of management activities starting from the externally oriented product focus, identifying the internal constraints, overcoming these constraints, arriving at estimates of the expected performance, or the actual performance, and providing the feedback to the resource base have been shown before in Figure 2. Various activities of this process have been listed in different columns of Table 1.

Product design is more or less a routine activity succeeding the description of the strategic imperatives concerning the product development program. When complexity and innovation dimensions of the design activity are high, however, the existing design technologies may have to be enhanced (Fitzsimmons, Kouvelis and Mallick, 1991). Organizations carry out the enhancement by employing design and development tools that facilitate versatility of design, and interface compatibility. Additional product attributes and also speed can be added benefits as

Enhancement of the entire business process can be achieved using business enablers, which, in addition to making use of the outcome of the operations performance as input, also account for environmental constraints, and thus as drivers of business flexibility.

Table 1: Effects of Operations Flexibility on Resource based Strategy and Operations Performance

Resource based Strategy/ Operations Focus	Internal Constraints	Operations Enablers or Drivers of Operations Flexibility	Operations Performance Indicators
Product focus Technologies/competencies Design choice and infrastructure Standard designs Product changeover times	Product focus Product-technology synergy, product development competencies Technology adoption, product design technologies Non-modular designs Slack decision-making for product changeovers/ improvements	Product focus Platform technologies and roadmaps Design and development tools for speed and product attributes (CE, QFD) Reuse of standard designs Quick changeovers (multi-skilled workforce not dedicated to older machines and technology)	Product focus Wide product attributes, broad product range Interface compatibility, robust designs Short throughput times Early pre-production ramp, actual introduction versus schedule
Production focus Process positioning Inventory policy, capacity planning, lead times	Production focus Traditional manufacturing systems Long production runs, sales under manufacturing clutches	Production focus Technology competence for designing needed production attributes (JIT, TQM) Manufacturability, value engineering Advanced manufacturing systems, ability to ramp production volume up or down	Production focus Mobility: fast delivery (delivery speed) Cost price (economies of scale)
Knowledge focus Knowledge of job content Tacit knowledge level Development learning Job enlargement, job empowerment Established work practices	Knowledge focus Lack of training programs Isolated learning Too many projects related to new products Culture with no responsiveness to customers, lack of suitable measures	Knowledge focus Training programs for achieving operations goals Structured lessons learned Experienced workforce, networking with suppliers and customers Measures focused on process performance	Knowledge focus High level of competence, quality and productivity Process time to knowledge maturity Job flexibility Customer and market orientation

well. Reuse of standard designs is one of the methods for bringing additional speed for the design process. The resulting short throughput times of the product development activity, which can be accounted as operations output, facilitate the possibility of achieving early pre-production ramp. These advantages of reusing standard designs have been worked out in detail under the case study of this article.

Production Focus

Similar to the product focus, also production focus can be scrutinized for constraints. Relevant enablers can be identified and the production performance can be improved. In this context, the environmental uncertainty has to be looked into not only from the perspective of the product in the market, but also manufacturing flexibility. The role of the manufacturing managers is crucial in achieving this type of flexibility (Swamidass and Newell, 1987). The flexibility concerned is relevant for putting up the production ramp, reaching the market with high response and satisfying the customer requirements most. Traditional production planning methods such as MRP, with its own advantages of more disciplined production planning, would overcome the disadvantages of long production runs. For providing a direct coupling with the customers and the market, however, one may have to go for the adoption of a pull system such as JIT. Though this is seen as a good start, its prerequisites are short setup times and low defect rates, which might be costly for a firm to achieve, if it has not already done so.

Product-technology roadmaps open up the possibility of developing a wide range of new generation of products, and each generation with a wide range of product attributes, and thus the roadmaps function as drivers of flexibility.

A firm successfully operating with JIT system will have skilled workforce and the quality improvement programs such as TQM already in place. Similar to product-technology roadmaps, JIT and TQM programs can be seen as drivers of flexibility, and they would work as eye-openers benefiting the organization with internal learning for elevating the competence level and the operations flexibility.

Knowledge Focus

Creation, assimilation and distribution of knowledge are crucial to high-technology firms. In relation to these knowledge related activities, researchers distinguish between information, and know-how, or *how* to do something (Kogut and Zander, 1992). According to them, know-how is an incomplete description of ingredients, or information, as compared to the knowledge. Transferring and imitating is more difficult with knowledge than with know-how, and on the basis of this reason there persists difference in the outcome or the firm performance using the newly developed or acquired knowledge. Knowledge lies in building new and related skills, which are embedded in the organization of technologies for further exploitation.

The method of organizing, such as creation, replication and imitation of technology, creates new capabilities. During triggering the 'inert' capabilities, and thus opening up the possibilities to put the knowledge to use, does the skill development, or learning, take place. For innovative firms, this learning is essential for exploiting the inert

capabilities that are difficult to imitate and re-deploy by competitors. When intending to incorporate new technologies in new products, or when dealing with product-technology roadmaps, does the enhancement of the above mentioned skills in the form of capabilities becomes a need.

Various trainings are meant in this regard to accelerate the process of knowledge creation and capability enhancement (Gerwin and Kolodny, 1992). Training programs will include multidisciplinary teams, which would satisfy the requirement of organizing social relationships (Kogut and Zander, 1992). These training programs for improving the knowledge base in product development and production concern a number of objectives. Some are directed towards the knowledge of job content and improving tacit knowledge level for dealing with the requirements of product-technology roadmaps, the latter also known as development learning. Similar programs can be formulated with the production focus for the improvement of capability level in production attributes through methods, such as JIT and TQM.

Thus, knowledge focus brings attention on the resource base for reducing process time to maturity, such as with product-technology roadmaps, or achieving higher delivery speeds, such as with the help of JIT and TQM. Training programs are meant to enhance the capabilities on job content and job flexibilities specially when many diversified projects may have to be initiated in product development and optimization is needed in the case of production processes. These training programs will, thus, bring higher flexibility to the workforce while maintaining capability improvement. At the end of the training programs, reasonably accurate estimates of the expected process performance can already be done. A feedback of such estimates will support the internal learning and also help reconfigure the resource base for eventual implementation of focused strategies on new products, or production processes.

Business Focus

It has been evident from the discussion earlier in this article, that the external orientation puts emphasis on the business process of the organization. The strategic elements of the business process are unique, or difficult to replicate, and concern user’s needs. With this in view of the business focus, we will look into the role of product positioning, and customer reach. These dimensions of product positioning and customer reach are far too crucial specially for innovative firms operating in competitive markets. A success in these aspects is based on the success of the operations focus through its resource base; the success also supports some of the ‘first-mover’ advantages of the competitive edge in the market. One of the basic considerations of setting a business performance goal is that the operations focus has been properly integrated with the external orientation of the business. This also means the internal support to the

business goal is coherent, thus the next sequence of activities concerning the business focus can start.

Product Positioning

As we have elaborated before, turbulent markets often are accompanied with high competition. Also market slump and lower overall demand for products may result from several external elements: aged technologies and products, demographic changes, reduction in the buying power of the consumers due to economical reasons, and over capacity of the industry sector. Some of these factors may contribute to high competition as well. In addition, substitute products and imports from outside may set a higher competition in the market. In order to meet these constraints arising mainly due to external environment, organizations choose to renew their products and the product range by switching over to new products, or bringing uniformity to their range of products for establishing strong brand image, and thereby differentiating from competitors. Brand image building and product promotion are far too commonly used business enablers, and thus can be treated as drivers of strategic flexibility. The output of the product positioning can be measured as the success of the business as listed in Table 2. Indicators of the success of innovative firms are innovative products and product differentiation. Uniqueness of the products

Internal learning from the feedback of the estimated or achieved operations performance is crucial for timely reconfiguration of the resource base and competencies.

assures that the products can be priced independent of the competitors’ prices.

Table 2 : Effects of Strategic Flexibility on Externally Oriented Strategy and Business Performance

Environmental Constraints	Business Enablers or Drivers of Strategic Flexibility	Business Performance Indicators
Product positioning Market slump/ low overall demand High competition	Product positioning Promotion, brand image building Differentiate from competitors Product switchovers, uniformity across range	Product positioning Innovative products Product differentiation
Customer reach Product market fragility Customer preferences Responsiveness to customers Product quality problems Price erosion	Customer reach Reputation Customization Quick response Effective communication from sales and marketing, SCM Price elasticity	Customer reach Order winning Customer satisfaction Customer retention Market share Revenues and profits

Customer Reach

Product positioning in the market is important, but not essential. Since the drivers of change deprive the markets of stable environment, positioning turns out to be only fragile. In addition, drivers of change in technology would bring more fragility. In order to meet these drivers of change, the strategy may have to be developed at more fundamental level

from which organizations can exercise adaptive customer reach. Firm performance in this context amounts to reaching more effectively the customers than the collective markets. In this context, firm reputation turns out to be a measure of external firm performance for order winning. It is an intangible asset that not only keeps the customer satisfied, but triggers the customer to return as well. Thus, reputation works as a business enabler and driver of flexibility at business strategic level. Reputation also influences firm performance towards suppliers and competitors, which we do not delve into in this study.

In arriving at higher business performance as to customer reach, the constraints may lie with demographic changes and product proliferation in the market. Excessive product offer in the market tends to drive customers apt multiple preferences and demand quick response. These requirements call for firms to offer wider product attributes and customization. Quick response can be met by combining operations focus on internal processes, such as shorter throughput times, with suitable supply chain management. Also effective communication from sales and marketing adds to meeting the quick response. These customers' requirements, when met successfully, bring higher customer satisfaction and retention.

Order winning status of the firm, along with customer retention accompanied by difficulty of replication by competitors, assure that the profits will not be filtered away. The profits will be a source of revenue also for meeting the needs of building internal resources, and external image against the competition. The need for limited price elasticity would ensure lower fluctuations due to price erosion, which would not considerably influence the revenues and profits.

Internal and External Learning

As stated before, learning can be seen to take place due to various activities within the organization. Internal learning is a consequence of internal problem solving, training, pre-production activity, such as learning-before-doing, or the estimated or achieved operations performance. The internal learning from the feedback of the estimated or achieved operations performance is crucial for timely reconfiguration of the resource base and competencies. Effective internal learning, if stimulated by cross-functional teams that stand responsible for monitoring and integration, reduces times needed for the reconfiguration. It is also triggered by social and informal relationships among members of different functional areas.

In contrast, external learning can be distinguished to take place in two forms. In the first form, it takes place due to explicit linkage with the knowledge sources outside the firm. A few individuals within the firm take an active role in establishing contacts with scientists in research laboratories or universities, and alliance relationships. Thus, external

linkage is a crucial source of external learning specially in high-technology industries for attaining superior RandD performance (Eisenhardt and Martin, 2000). In the second form, the external learning takes place in information flow from the business focus, mainly regarding product positioning and customer reach, or the market. It is the feedback of the expected or achieved business performance, thus the impact of the operations focus, in turn brings the need to modify the operations focus in view of new drivers of change in the market.

Though the second form of external learning can be seen as internal to the organization, its features are different in that its focus extends beyond the operations close to the customer and the market. This form of external learning is paramount to serving the dynamic market effectively by improved rates of transfer of knowledge within. Externally oriented strategy can, thus, be improved for rapidly capturing the changed requirements of the customers and the market. Through linking of capabilities, distinctive abilities can then be generated from recombining the knowledge, the resource base and the competencies.

Methodology

Case study approach confined to a single firm is used in this research. The study is exploratory both for scrutinizing the proposed conceptual model and for assisting a firm in its decision-making process. This approach has proven characteristics of qualitative interview in marketing research and it is suitable for new product development, advertising development and image studies (Moran, 1986).

The approach has been recently applied by Coates and McDermott (2002) in their exploratory analysis of new competencies of companies.

The study incorporated representative activities in marketing, business process and operational process within the firm. A range of choices was developed for optimising the organizational activities, through rigorous interaction with a focus group of the firm. Interviews with the focus group were conducted in the way common to this approach: non-structured and in natural manner. These early stage interviews were substantiated subsequently with brainstorming sessions. One of the authors of this article was positioned as moderator for conducting interviews and conducting brainstorming sessions. The main objective of choosing a focus group was to form a forum of members with varied expertise, and to create relaxed and informal setting for them to express their views. Due to difficulty in coordinating over a number of sessions, the focus group was confined to two senior managers from the functional area of product development. Though both managers belonged to a single functional area, their background and expertise stretched over marketing in the case of one manager and technology development in the case of the other.

The approach used by us consisted of choosing a specific situational activity within a firm and analyzing its impact on the entire organizational process stretching from the creation of new products to the market performance.

The members of the focus group were versatile also with other functional areas of the organization, and thus they were able to represent those areas with integrative view. In regard to detailed information of the functional areas, the focus group was able to direct the moderator to other preferred sources of information. These included team leaders of product development projects within the functional area of product development, and managers of different other functional areas. The case study started with an orientating session with the focus group and ended with a plenary session involving the focus group and some of the previously interviewed managers. The study was progressed between these two phases through a number of interactive brainstorming sessions with the focus group, and the abovementioned interviews.

Case Method

During this study, case study research was chosen for a number of reasons that fit with those in the literature (Eisenhardt 1989, McCutcheon and Meredith 1993, Yin 1994). These reasons can be listed as follows. (1) Verify the suitability of the conceptual model in the organizational context, (2) Overcome lack of a prior theory for measuring events and their effects, (3) Describe events and outcomes, and their logical sequence within the business process, (4) Effectively integrate information from multiple sources, and (5) Develop scenarios for decision-making by the organization.

Information collection was done in two stages. The first stage consisted of an orientation session in which semi-structured questions were put to the focus group concerning the market nature and the type of demand for competencies of different functional areas. The questions concerned whether the new product strategy of the firm was technology or market driven. In consideration of the dynamic nature of the market, the emphasis was put on the inventory of the efforts that go into competence management for the creation, production and marketing of new products. The following questions were, thus, directed to identifying the competencies of the firm against those of the competitors in the market.

1. Was there synergy in technology development, RandD and product development?
2. Was there time-lag between technology development and successive product development?
3. Were there methods used to monitor the moment and the extent a new technology could be implemented in new products?
4. What was the level of synergy between product development and production process?
5. What was the impact of the market for deciding on product price and product attributes?

In the second stage, the data collection was extended to fill in details from various team leaders of product development projects, and the managers of marketing and technology development. At this stage also relevant

documents and publications of the organization were reviewed concerning the production attributes, technology and product portfolio. Also included were the documents concerning the market position of the competitors and fragmented information on the competitors' competencies.

Subsequent to the information collection, several interactive brainstorming sessions were held with the focus group. In the first interactive session, a computer simulation modeling developed by the moderator was described with its features depicting various critical activities in product and business development. The possible output of the simulation was shown to consist of valuable predictions of the business performance. During this session, salient features of the previously collected information were presented and the needed additional input in the form of alternative proposals was called for.

Interactive sessions were devoted to taking up a proposal from the focus group and discussing its consequences on the business process and the market impact. During this process, various options were identified in which the group members would find acceptable compromise of their objectives.

The collected data was subsequently analyzed with the computer simulation for ranking valid proposals and their options. Supported by data and simulated scenarios, subsequent interactive sessions were dedicated to analyze options and their consequences critically, and to arrive at refined options. The previously interviewed project leaders and managers of other functional areas were then asked to validate these options along with their scenario details. During the last plenary session, only selected definite proposals, their options and scenarios were concluded for decision-making by the organization.

Being plenary, the interactive sessions were meant to confirm the observations of the moderator and opinions of each participant. With this feature, the data assures reliability (Eisenhardt 1989, Yin 1994). The data thus collected is considered superior to that collected independently from individual managers, and hence it derives higher validity.

Data Analysis Using Dynamic Business Modeling

For confirming the key elements of the model and the main themes of the data, a method based on computer simulation was used. The simulation method used for this study had been successfully tested previously with a number of organizations by one of the authors of this article. With this rapport, the method was considered suitable for ratifying the key elements of the conceptual model, and substantiating them with the exploratory and descriptive data. In the end, the method was intended to yield outputs that could be validated by various managers within the organization.

Prior to applying the simulation in our study, suitable information was collected in accordance with the methods previously described by various researchers. One of such methods is within-case analysis, which has been recently applied for exploration of the organizational process of



developing and leveraging capabilities in regard to a new technology by Coates and McDermott (2002). These researchers ascribe the method to McClutcheon and Meredith (1993) and Eisenhardt (1989). The description of the suitability of the within-case analysis in the case study approach described by the former researchers fits reasonably well with that of ours. However, our method can be called a situational study approach in which the objective is to make predictions of the success of certain organizational processes. The approach used by us consisted of choosing a specific situational activity within the firm and analyzing its impact on the entire organizational process stretching from the creation of new products to the market performance. Performance predictions were then made using the data that was collected from different sources and analyzing this data using the above mentioned simulation method.

A broad description of the computer simulation method used in our study can be found in the book by Janszen (2000). The author names it as Dynamic Business Modeling (DBM) and its origin lies with the computer modelling method of Morecroft and Sterman (1994). It is similar to systems dynamics approaches used for describing and understanding the non-linear behaviour of systems. It is a knowledge management instrument that is suitable to stimulate outward look and openness of the organization, thereby facilitating organizational learning. In our research, we have initially exploited the main feature of the DBM consisting of validating relational behaviour and consequence of different organizational processes. The established relational behaviour could then be used for analyzing the data collected from different functional areas. The data was filtered and streamlined output of views and opinions originating from different functional areas. During the data analysis by the moderator with the help of the simulation, the impact of a single strategic proposal from a specific functional area was studied on strategic perspectives of other functional areas. Critical capabilities of individual functional area were then scrutinized and their shortcomings were identified. Any change that needs to be brought in for improving any of the shortcomings was then taken as an option, and the consequences of each option were studied. Complete sets of options and their consequences were taken for scrutiny by all concerned functional areas. These sets were used for generating new sets that represent compromises to various options of different functional areas, and thus for facilitating the decision-making process.

Case Analysis

The conceptual model explained previously is far too descriptive in that it refers to product development, production processes and knowledge. In turbulent markets of high-technology products, development and improvement

of products are crucial. These product related innovation activities lay emphasis on knowledge creation, assimilation and distribution, thereby facilitating enhancement of the resource base and competencies for recombinative abilities. On the basis of these considerations, we have selected a case wherein product creation, renewal, production, product positioning and market size stand central.

The ability to introduce a new product to the market follows the ability of successful product innovation. At business performance level, new products can be used for improved product positioning and product differentiation in the market. The introduction of a new generation of products adds to product differentiation even further. Such an introduction requires improvements of products in accordance with new technologies, and product-technology roadmaps. The introduction may also require incorporating diversified customer and market requirements in the form of product attributes and delivery speed. Targeting customer reach at the business performance level relies on quicker product changeovers through shorter throughput times. Product design technologies, design infrastructure and the ability to recombine various competencies related to product technologies contribute to throughput time

reductions. In this regard, organizations use platform technologies for minimizing the efforts needed for developing and recombining the competencies. Also modules, subsystems and standard designs are commonly used for minimizing the efforts that go in to product

Standard designs relieve organizations of the pressure on the capacity requirement of the infrastructure and help to consider product characteristics in generic or platform level, and thus facilitate generating new standard designs of broad base.

With too many standard designs in stock, a firm may slip into the practice of working with traditional technologies, and may even use aged-roadmaps.

development. We will concentrate on the last, standard designs, for carrying out in accordance with the within-case analysis described under the methodology of this study. We will consider the reuse of standard designs as the enabler or driver of operations flexibility for reducing product development times or throughput times. We will show how throughput time reductions can be made use of in improving product positioning and the market size.

Case Description and Application of DBM

The case originates from a leading European firm that produces and markets high-technology products of relatively short product life cycles. As a representative case, one of firm's home appliance products has been taken for this study. The product market is characterized by high competition and volatility due to rapid renewal of products and their technologies. It is season driven and the estimates of the market size are shown in Figure 3 over a period of nearly three years covering four successive product variants. The first variant is considered for introduction nearly a year after the proposed completion of this analysis. In order to meet the seasonal demand, it is found essential to introduce each new product variation at the appropriate moment and subsequently supply the product according to the demand.



Thus, the moment of introduction succeeds a number of product development activities and pre-production ramp for approving the product on quality and the rate of production. It is estimated from the previous generations of similar products that the market is sharply influenced by the selling price of the product that erodes uniformly at approximately 9% during the product life cycle.

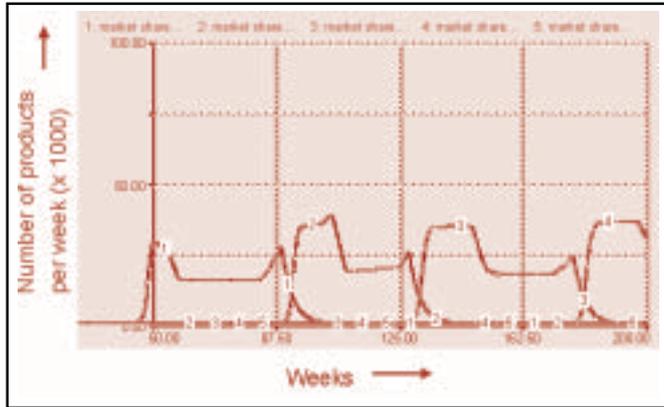


Figure 3 : Market Size for Products

Using the above input from the interactive sessions with the focus group and the information collected from team leaders of different product development projects, managers of other functional areas and firm's documents, an analysis of the effects of reuse of standard designs in one of the product variants has been carried out. For convenience of monitoring the introduction of a new variant, the second successive variant of the product has been chosen for this study. It is on this product variant, previously described Dynamic Business Modeling (DBM) has been used for generating various options focused specially on product introduction as explained below.

As a start, on the basis of the above mentioned data, a simulation model was setup and its dynamic validation over the recent past was carried out. The dynamic model consisted mainly of estimating the throughput times for product development on the basis of various activities undertaken and the competence level of the skilled personnel involved. In addition, information on product-technology roadmaps was incorporated in order to account for the familiarity and the learning curve effects on the involved workers. Other parameters included for the simulation were reuse of modules, or standard designs, and quality considerations on product design for assisting product development process. Finally, sensitivity analysis of the simulation model was made to correlate the effects of changes in parameter values on the outcomes of the simulation. The DBM was validated also on the business performance in the form of market size at different moments within a season and over the product life cycle.

Reuse of Standard Designs as Drivers of Operations Flexibility

Designs of parts, components and products usually get accumulated in a firm that develops new products. If the strategy of the firm is modular product development, then

the modules can conveniently be characterized on the basis of platform designs, thereby facilitating the reuse of these modules in product improvement, customization and even for developing new products. Modules or designs used in different product variants, termed here as standard designs, if used, facilitate new product development with two advantages. The first advantage lies with the reduced time for product development and pre-production ramp. The second relates to utilizing the surplus time of the design and development team for developing and maturing new technologies and new standard designs thereby creating idiosyncratic mode for competitive edge (Connor and Prahalad, 1996). Any direct coupling of technology development programs to product development process, though acceptable for maximizing the efficiency of the product development process, would not contribute positively to improving the development speed (Reinertsen, 1997). Technology development programs usually are planned over a longer duration and coupling these programs to product development process, which is short termed, would bring higher uncertainty for the schedule of product development projects. Thus these technology programs are usually uncoupled from project development projects.

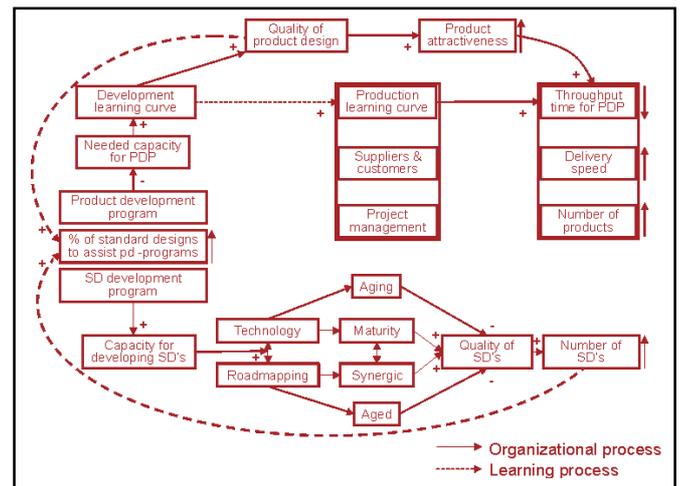


Figure 4 : Organizational and Learning Processes during the Reuse of Standard Designs in Product Development

Product development programs derive benefits from the use of standard designs in that the needed capacity and organizational activities get reduced. The quality of product design gets enhanced since the standard designs are already tested before and thus they can be directly integrated for developing or improving products. Also more product attributes can be built in the product with less input from the design capacity. Similarly, benefits on throughput times are positive in these times get reduced. Equally valuable benefits are the delivery speed and the number of new products, product generations or product variants. The above consequences of utilizing standard designs on various stages of product development, and ultimately on the operations performance, are schematically shown in the upper part of Figure 4. Considering the direction of the arrow representing inputs and outputs, the signs '+' and '-' indicate positive and negative effects of the inputs on the outputs

respectively. The figure also shows the internal learning due to achieving high design quality. In an efficient product development program, any feedback with respect to integrating and interfacing standard designs improves the versatility with which the existing standard designs can be used.

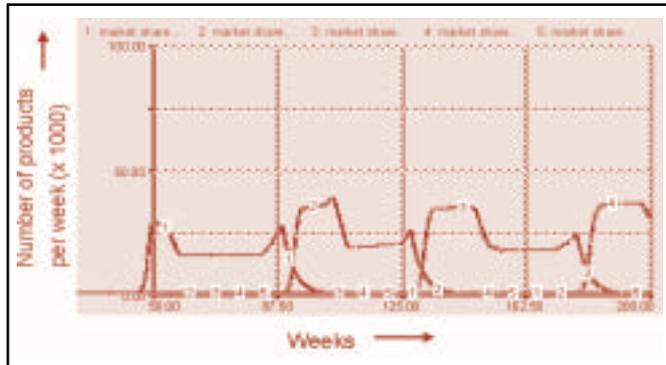


Figure 5 : Market Size for Products with 25% Reuse of Standard Designs (2) Versus no Standard Designs (1).

The simulation using the DBM shows that the reuse of standard designs by 25% of the total number of designs required for product innovation has a considerable effect on the share of the market size. Throughput time of 55 weeks for each variant becomes shortened by 10 weeks, and thus a product variant can be introduced earlier. This has been shown only for the second product variant for clarity in Figure 5. As the share of standard designs is varied, throughput times vary accordingly as shown in Figure 6. These times neither vary linearly nor can be reduced to lower than 20 weeks. There is little gain in throughput time reduction when the share of standard designs is increased beyond 70%. With such high share of standard designs, a product variant tends to become less of an innovation than a simple reproduction of an old product both in technologies and attributes. Thus, the share may not be taken too far in view of decreasing throughput times for product innovation and renewal.

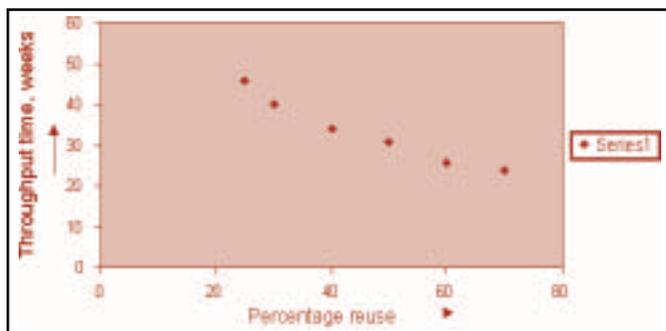


Figure 6: Effect of Reuse of Standard Designs on Throughput Time

Reduction of throughput times can be utilized also for creating benefits related to the market size. As evident from Figure 5, early product introduction improves the market size. If the product development process is started 10 weeks later, the product introduction can be realized at the original time frame. A comparison between the market size due to

such a later start shows a higher market size as shown in Figure 7. The gain may be attributed to the benefits to production planning for product changeover. In the transition periods of product changeover, the consequence of slackening market of the previous product variant can be utilized for optimizing the production line for the new product variant.

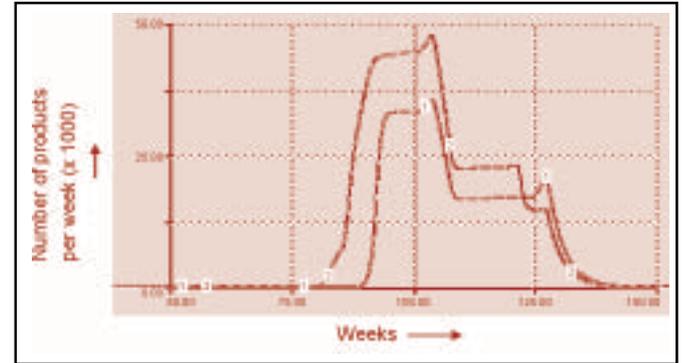


Figure 7 : Market Size for Products with 25% Reuse of Standard Designs, Production Planning Starts 10 Weeks Later (1) against no Adjustments of Planning (2).

The above mentioned pace could become adverse if the internal constraints are not properly taken care of. These constraints could lie with the lack of sufficient product development expertise of the workforce or team that is assigned to the project. Also slack decision-making could be a constraint for foregoing any gains on the delivery speed. Referring to Table 1, enablers of product focus can be seen as help in removing these constraints. If too many projects related to a new product development are in progress at a time, then the most suitable team members need not be available for the concerned project. Broadly experienced workforce with high job flexibility would be an enabler of knowledge focus.

Any potential for achieving gains of use of standard designs can be termed as an enabler. Effectivity of planning in relation to using standard designs is enhanced by team formation, and by assigning the most suitable designers to play the key role. This would free some of the experienced workforce for assigning on other activities. Other enablers are suppliers and customers who might already possess some suitable standard designs. Training of the new or existing workforce in the use of standard designs and proper communication of the strategic goal with respect to the new or improved product to the workforce would enable operations flexibility.

Using standard designs relieves organizations of the pressure on the capacity requirement of the infrastructure and on the team members. This relieved capacity can be utilized in developing new standard designs and even improving product-technology roadmaps. At this stage the product characteristics are usually considered in generic or platform level, and thus facilitating standard designs of broad base. The surplus capacity of the design and development teams can thus be channelled for integrating product roadmaps with technologies, and reducing the use of aging

technologies while increasing the utility of matured technologies. Similarly, aged product roadmaps can be discarded and new roadmaps can be chosen for use. Synergy of these new product roadmaps with matured technologies would make the teams produce high quality standard designs. This efficient process of monitoring product-technology roadmaps supported by the surplus capacity would also lead to developing larger number of standard designs, which would become additional asset for using in future product designs. The utility of the surplus capacity for generating superior product-technology roadmaps and large number of standard designs is shown in the lower part of Figure 4. Activities related to product-technology roadmaps stimulate organizational learning as well, if multidisciplinary team building and cross-functional cooperation are employed.

The reuse of standard designs improves the ability to recombine the competencies more effectively, thus elevating the resource base. The resulting learning curve effects of the product development process are also beneficial for building robust designs, as listed in Table 1, and supporting production activities with manufacturability and value engineering. The organization, thus, finds improvements in its production focus as well in the form of improved production learning curves, higher integration of suppliers and customers, and better project management for production ramp as shown in the middle part of Figure 4. Also external learning can be contributed to the consequences at the business performance level as explained before: customer retention achieved through higher delivery speeds and product positioning through wide number of innovative new products.

Some of the consequences of inefficient approach can be summarized as follows. With too many standard designs in stock, a firm may slip into the practice of working with traditional technologies, and may even use aged-roadmaps. The resulting new or improved products are likely to become outdated in the market. Also the contribution towards the learning curve effects with respect to product development will be poor. Accordingly, production experience of the workforce may become stagnant leading to the accumulation of internal constraints discussed before.

There are consequences of too many standard designs in stock also on the surplus of the design team capacity. If put to use properly, the surplus can benefit producing more, advanced, and newer standard designs, thus uplifting the resource base of the designs for use in new or improved products. Alternatively, there is also a danger that this surplus overcapacity is put to developing standard designs that are hardly used. The reason may lie with the changing market demand that has already surpassed the competencies that were required before. The reason may be attributed also to the strategic drift of following single or wrong trajectory learning. In either case, the surplus capacity is poorly utilized to meet the needs of the changing market, and improving the resource base of the firm.

The study has certain limitations concerning information collection and data analysis. As to information collection, the qualitative research was based mainly on the origin of the information at the focus group, which was rather narrow based. Difficulties in getting senior managers involved from other functional areas prompted us to confine to a small focus group. Detailed information was collected only from the sources that were directed by the small focus group. These reasons together restricted the information to rather narrow base and thus limited the scope of the analysis using the DBM. Considering the large size of the firm and the spread of innovation activities over many specialists and their interaction with the environment, our research can be treated to focus on relatively a few innovation activities. Within-case analysis employed for this study supports this view. This paper is directed toward validating both the conceptual model and the DBM for its analysis. It has been our objective to bring attention of the managers responsible for strategic decision-making within the firm to the need of stratification, and subsequently integrating internal and external focus, for achieving flexibility of operations and business. Other within-case analyses, if carried out, would reveal the impact of other flexibility measures on the firm.

Conclusions

In a dynamic technology and market environment, where drivers of change are many and they mutually influence each other, a thorough analysis of these drivers is an essential step for building and sustaining competitive edge in the market. Firms do this for innovation of products and even businesses. New products are developed, or existing products are renewed; similarly, new businesses are built, or existing businesses are enhanced. In order to realize the innovation, and to meet the needs of the drivers of change, it is essential for firms to be flexible with respect to their resources, capabilities and competencies.

A major question the firms encounter in this regard is whether to work with the resource base or the external orientation as a starting step for realizing successful innovation. The traditional resource based view puts emphasis on internal resources and capabilities or competencies, and what firms are capable of doing. The resource based view seeks benefits also in external learning and capability building. In the recent literature, the resource based view has been extended to account also for dynamic markets and the ability of firms to reach these markets through dynamic capabilities. Scope for flexibility at the resource level is a valid requirement, in order to function with strategic flexibility towards the market.

Where the mutual influence within the business system extends over a mix of market, product, technology and organization, the resource based view does not sufficiently differentiate between the focus on the resource base and the external orientation. The resource based view, correspondingly, does not support firms to develop explicit strategies for their operations and businesses separately. Explicit focus is needed, specially for those firms with their



businesses constituting of development and production of new products, and market orientation. The explicit focus can then be derived by stratifying the resource based view into the resource based strategy and the externally oriented strategy. With this stratification can the firms address their internal and external capabilities, reconfigure them, and bring the needed flexibility in each separately.

The stratified resource based strategy refers to managing competencies that are internal to the organization. The other, the externally oriented strategy consists of managing competencies that are essential for excelling in the market. Inventory of these competencies would reveal the level of competencies, constraints and monitoring these for future development. In order to develop a unified business goal, however, firms need to recombine and reconfigure their capabilities residing in stratified strategies. While bringing synergy, this linking of capabilities maintains the identity of each strategy intact, so that each can be separately addressed for monitoring, and internal and external learning, specially when the outputs, or their expected estimates, of a stipulated strategy are known.

In high technology industries, the drivers of change exercise impact on technologies related to products and production processes, and on the knowledge base. As a consequence, the resource base may turn out to be inadequate to meet these drivers unless suitable enablers are brought into action. These operations enablers enhance the competence level of the resource base and thus function as drivers of flexibility. The operations output can then be enhanced, which can be measured at the end of the implementation of the enablers, or at least it can be estimated on the basis of a critical scrutiny of the potentials. Such actual or expected performances will facilitate internal learning, thereby reconfiguring the resource base.

In dynamic markets, the drivers of change make the prediction of competitive forces in the market difficult. In addition, the expected and actual performances at operations level may turn out to be inadequate to meet the market requirements. In view of these considerations, it will be necessary to update the externally oriented business strategy related to customer reach and product positioning in the market with the help of suitable enablers. These business enablers function as drivers of strategic flexibility for achieving higher business performance. As in the case of operations performance, also business performance can be estimated for its potential prior to the implementation of the enablers.

Actual or expected performances in customer reach and product positioning will stimulate the internal learning and enhance the competencies of the external orientation. They will also be useful for enhancing the competencies of the resource base through external learning related to the business performance, or its estimates. Prior to the implementation of the enablers, estimates of the potentials of higher performance can be used as feedback for reconfiguring the resources and capabilities.

A case study carried out with a high technology firm substantiates the conceptual model. Data collected from managers of the firm through interactive sessions has been analyzed using a computer simulation of the 'Dynamic Business Modeling'. Using within-case analysis, competitive advantage of reusing standard designs is explored regarding product development at regular seasonal intervals. It may be concluded that using suitable drivers of operations flexibility can the competencies be enhanced for achieving successful design, development and production of new products. Similarly, product positioning in the market can be enhanced on the basis of higher product innovation performance, and with the use of drivers of strategic flexibility. The case also demonstrates the possibility of internal and external learning of the organization.

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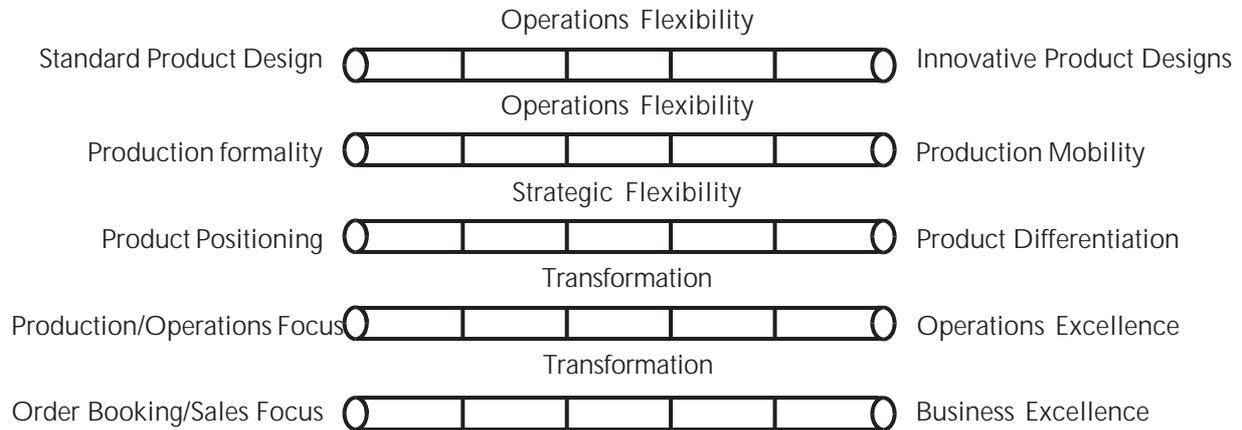


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Flexibility Mapping : Practitioner's Perspective

1. What types of flexibilities do you see in the practical situation of "Operations and Business Innovation" on the following points:
 - Flexibility in terms of "options"
 - Flexibility in terms of "change mechanisms"
 - Flexibility in terms of "freedom of choice" to participating actors.
2. Try to map your own organization on the following continua (Please tick mark in the appropriate boxes)



Reflecting Applicability in Real Life

1. What is the status of 'production/operations focus' and 'order booking/sales focus' in your organization? How will you utilize the findings of this study to enhance them?
2. Design a strategic transformation package for your organization that captures the strategic paradoxes mentioned in this paper.
3. Explore and innovate how customization, time to market, delivery speed, quality, and cost can be improved.



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Improving Flexibility in Strategy Formulation by Adopting a New Technology : Four Internet-based Business Models

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Abstract

The purpose of this paper is to explore how a firm's flexibility in formulation of organizational strategy might be improved by adoption of internet technology. At the basis of this work are four case studies of firms, acting in either local or global markets, which adopted internet technology and whose managers preferred an evolutionary rather than a revolutionary change from traditional business models to more innovative internet-based ones. This preference for an evolutionary transition seems related, the organizations' continuous exploration of new strategies, their wish to maintain strategic flexibility, and the prudence generally required with innovation.

Keywords : business model, competitive advantage, innovation, internet technology, strategic flexibility

Introduction

The dynamic character of the current business environment has forced firms to thrive for strategic flexibility, to examine their business model continuously, and to find ways to incorporate the internet into business processes (Bettis and Hitt 1995, D'Aveni and Gunther 1995, Simerly and Li 2000). Strategic flexibility pertains to both formulation and implementation. In the context of this paper, which deals mainly with flexibility in strategy formulation, it is defined as the ability of a firm to reformulate its strategy by modifying its business model in a revocable way, depending on environmental circumstances and market requirements. There are various types of flexibilities in an enterprise (Sushil, 2000) and a distinction has to be made between internal flexibility (manufacturing) and external flexibility (marketing); Success depends on balancing between these two types (Chatterjee, 2000).

The internet opens a new set of strategic opportunities for organizations (Evans and Wurster, 1997), including unprecedented opportunities to rethink and flexibly evolve their operations, marketing, and services strategies (Feeny, 2001).

The purpose of this paper is to study the adoption of internet technology in four firms and to identify the circumstances under which these firms were able to evolve toward a flexible and yet sustainable organizational strategy. After reviewing the literature and describing the methodology in the next two sections, we devote one section to each of the four cases. We then proceed to infer propositions and to conclude, in the last section, with the lessons learned from the four case studies. It is noted, in particular, that management, in all four cases, preferred an evolutionary change to revolutionary change.

Literature Review

It is generally agreed that competitive advantage is realized via a business model. However, there is no complete accord between researchers, practitioners, and consultants concerning the definition and the framework for a business model. Nevertheless, the term "business model" has yet to be defined precisely (Wetlaufer and Carr and Cliffe, 2001). Competitive advantage is predicated upon particular conditions, time, and reasons (Christensen, 2001). Since the determinants of competitive advantage are changing with the emerging technologies, it can be achieved in one of three ways. First, if a firm is efficient, as is Wal-Mart for example, its costs are low. In price-sensitive markets, a competitive advantage can be gained by transferring cost savings to customers. Second, a firm with certain uniqueness as Benetton for example, can gain competitive advantage by attracting customers that are ready to pay a premium for a product or a service perceived to be unique. The third origin for a competitive advantage is specialization of the firm. If we adopt the definition of Williams (1992) for strategy as "the search for advantage," these three ways of creating advantage can be designated strategies; Porter (1980) designates them, generic strategies. Through "one-to-one marketing" (Peppers and Rogers, 1993), which leads to mass customization and an internet-based business model, all three advantages can be combined. Mass customization has been adopted by various firms, including Mattel with Barbie doll, Custom foot with shoes, Levi's with women jeans, Cductive with music, Acumin with vitamin, ChmStation with cleaning materials, Ross/Flex with pneumatic valves, and Andersen Windows with windows. Although it is considered to be strongly linked to the internet technology, its future so far is unclear (Zipkin, 2001).

Internet technology can help diminish the limits of mass customization. For example, the high level of flexibility in



production technology required with mass customization can be achieved by creating virtual organizations that enable the firm to maintain competitiveness (Goldman, Nagle and Preiss, 1995). Industry structure and the competitive forces that shape strategies are, thus, changing (Porter, 2001) due to technological advances, with internet technology being a major subset with a potential breath of applications that might be difficult for competitors to imitate (Prahalad and Hamel, 1990). The internet enables firms to link activities and make real-time data created in one activity widely available to other activities, both within the company and with outside suppliers, channels, and customers (Porter, 2001). Therefore, firms have to be attuned to factors that may confer powerful advantages on the companies that possess them and adjust themselves strategically to changes in underlying conditions (Christensen, 2001). In other words, firms that operate in dynamic environments and are exposed to changes stemming from new technologies, including the internet, that occur almost continuously, must maintain flexibility in strategy formulation and implementation. The use of case studies, as outlined in the next section, will allow us to explore notions of flexibility in strategy formulation as well as to observe preference for evolutionary transition toward internet-based business models in four different organizations, which belong to different industries.

Methodology

Research Design

Yin (1994) has termed our research design “embedded multiple case” design, which denotes several units of analysis. We conducted our investigation at two levels:

- The level of firm (its strategy formulation, flexibility and performance)
- The level of the product or service (as being the most important controllable marketing variable).

Combining several case studies, according to Yin (1994), allows replication logic, i.e. the logic of treating a series of cases as a series of experiments with each case serving to confirm or disconfirm the inferences from previous ones. While a multiple case design increases design complexity and is more demanding than a single case study, it permits induction of more reliable models (Bourgeois and Eisenhardt, 1988).

The four firms included in the study - *Office Depot* (www.officedepot.co.il), *NTT* (www. NTTDoCoMo.com), *Sigma-Aldrich* (www.sigma-aldrich.com), and *Ostive* (www.ostive.co.il) – have been facing tough competition in a dynamic environment in Israel. The four were included in the research for theoretical rather than statistical reasons (Glaser and Strauss, 1967). They belong to separate industries, cover the business world from various aspects, fill different theoretical categories, and provide examples of polar types (Eisenhardt, 1989). Two companies, *Office Depot* and *NTTDoCoMo.com*, are active in the consumer market.

The other two, *Sigma-Aldrich* and *Ostive*, are in the industrial, or institutional market. Other points of view emphasize the following:

- *Sigma-Aldrich* and *Office Depot* are supplying mainly products, while *NTTDoCoMo.com* and *Ostive* are offering mainly services.
- *NTTDoCoMo.com* and *Sigma-Aldrich* are active in the high-tech industry, while *Office Depot* and *Ostive* are in the low / medium -tech level.
- *Ostive* and *NTTDoCoMo.com* are active only in one country, while *Sigma-Aldrich* and *Office Depot* are global companies.
- *Sigma-Aldrich* and *Office Depot* are exploiting the static internet, while *Ostive* and *NTTDoCoMo.com* are exploiting the mobile Internet.

Data Gathering

Adoption of internet technology in each firm and its effects on the firm’s business model, flexibility and strategy formulation were explored by principally adopting an experimental research approach (trying to capture cause-and-effect relationships) but using mainly observations, and questionnaire-based interviews.

Observations : Site functioning and sophistication were observed by the investigators before and after the interviews. Among attributes observed were

site stage, product offerings, search capabilities, online help, and options for community building and personalization.

Interviews : For each case study at least two interviews with application developers and web-site users were conducted with notes taken. In order to obtain both quantitative and qualitative data, a list of open questions was developed and presented to each interviewee. Questions posed to interviewees concentrated on facts and events rather than on respondents’ interpretations. In developing the questionnaire, the following items were chosen with regard to the company itself: target customers, benefit and value proposition, industry description, market size and trend, traditional selling methods, suitability for online marketing, online site evaluation, competition and benefits to customers and business operation. The remaining questions were aimed at tracing internet adoption in the interviewee’s company, his/her own activity in this regard, as well as internet-related problems stemming from competition. Several rules of Yin (1994) for within-case analysis were followed. According to the “24-hours rule”, detailed interview notes and impressions need to be collected within one day of the interview and, therefore, interviewers recorded and cross-checked immediately after each interview the various facts that were gathered. The second rule, to include all data, and the third rule, to add the investigators’ impressions separately from the respondents’ answers, were followed as well.

The purpose of this paper is to explore how a firm’s flexibility in formulation of organizational strategy might be improved by adoption of Internet technology.

Data Analysis and Presentation

Firms were treated as separate case studies. Having collected both qualitative and quantitative data from each firm, interviewers summarized and analyzed the data and developed preliminary hypothesis from respective data sets for discussion, including search of pattern across the various cases. It was assisted by (1) taking pairs of firms and listing similarities and differences between each pair, and (2) by categorizing the firms on a variety of dimensions (Bourgeois and Eisenhardt, 1988) product vs. service, consumer vs. industrial, local vs. global, and so forth. Based on discussions with the various respondents, we chose crude measures of performance as variables which sorted both the quantitative and qualitative data into consistent patterns: (1) revenue growth, (2) decrease in various costs, and (3) enhancing firm's reputation as perceived by respondents. Due to space limitations, the concise description of each case includes description of each of the four firms, including target customers, value proposition, strategies, industry, and impact of adoption of internet technology.

Case Studies

Office Depot : Establishing an Online Site in Israel

Target customers of *Office Depot* are both businesses and households, minded to price, convenience and service of office supply. *Office Depot* offers them three basic lines: non-electronic office equipment, electronic office equipment and office furniture. An order is delivered within one business day at no charge. *Office Depot* is a world's seller chain of office supply and an industry leader in e-distribution channel, including stores, direct mail, catalogue delivery, internet purchasing and business to business electronic commerce.

At the basis of this work are four case studies.

The market of office supply in Israel is, in general, diversified retailer type-wise *Office Depot* is considered to be a category killer, exploiting two facts: first-most of the products, are in their mature phase; second-a relatively high sensitivity to price. Its main focus is on turnover with bulk breaking, and low waiting time. Due to low entry barriers, competition is tough and price trend is downward. *Office Depot* is operating 23 stores and 2 warehouses. As in other western countries, there is an increase in blurring between professional and private life characterized with service improvement, price decline, and increase in number of SOHOs. The following features make a significant part of the offered lines ideal for online marketing. As a chain store, spatial convenience is low—in each city in Israel there is only one store – but delivery is simple. There is high value to weight and to volume and time-saving for customers under pressure. Personalization is enhanced by a personal purchasing list, which also contributes to privacy. This list is created by customers themselves and generally speaking, includes items that are bought routinely. Narrow variety and deep assortment enable customers to find detailed, exact,

clear and reliable information online, independent of non-professional manpower.

Customers can exploit marketing flexibility and order any time, anywhere, without waiting and losing time. They are presented with a full range of products, clearly and aesthetically, including updated information on various sales promotions.

The *business* side takes advantage of operational flexibility and obtains better advertising, at relatively lower costs, and profiling customers is possible. Continuous feedback from customers and business partners can be monitored online.

The internet based business model of *Office Depot* contributes both to the image of the firm and enhancement of sales. In other words, the firm can strengthen both its economic and operating drivers, by lowering its expenses and costs and increasing its turnover.

NTTDoCoMo.com : Mobile Internet as a Mean to Better Customers Service.

NTTDoCoMo.com is a spin-off of Japan's telecommunication giant NTT. As *Office Depot* it serves the consumer market. NTTDoCoMo.com uses mobile phone technology known as I-Mode phone and its target customers are households and "mobile consumers". Service is standard, based on professional people, sophisticated equipment and advanced technology offered in a flexible way independently of office hours.

The system enables customers' interaction with NTTDoCoMo.com to be seamless and uniform. I-Mode phone users have access to the Internet and the Web. They can send e-mail and text messages to others. They can also visit web sites. In addition, users can play videogames, reserve airline and concert tickets, find a restaurant, check their bank balance and transfer money. In addition, users can check train schedules and city maps, and even create albums that can be accessed from anywhere.

NTTDoCoMo.com had in 2002, 40 million users and the company had a market share of 62%. NTTDoCoMo.com has grown at a tremendous clip and retains a lion's share of the wireless internet market, it has a strong competition within Japan. Ezweb and J-Sky are the two other competitors. The reason for NTTDoCoMo.com success comes from "internet way of thinking" as opposed to the "telecom way of thinking". In details three reasons can be indicated. First technology, (HTML, MIDI or JAVA easy for Internet people as opposed to WAP technology offered in Europe). Second business model, (revenue is based on traffic as opposed to revenue based on transactions). Third marketing, (emphasizing neither technology nor wireless but the content-most important to users).

The following features make NTTDoCoMo.com successful. Strong connection with NTT. NTT owns an advanced packet-switched wireless networking in Japan that

was made available to NTTDoCoMo.com. While its competitors continued to offer circuit-switching systems NTTDoCoMo.com was able to offer consumers an always – on connection, leading to a key competitive advantage. The connection with NTT also led to strong brand positioning within Japan. The second major factor that contributed to I-Mode's success may have been the low PC penetration and high mobile phone penetration rate in Japan. The third reason for success is the fact that I-Mode instituted a system that benefits the official content providers immensely. NTTDoCoMo.com takes a commission for providing this service. The fourth factor for success is the easy-to-use handsets, friendliness to users and download speed are much faster. Billing is the fifth reason and is based on the number of packets that are sent-content not time.

NTTDoCoMo.com exploits its organizational flexibility. It has created a world wide industry. It has established that it is possible to successfully provide its users with access to the mobile internet.

Ostive : Mobile Internet, Exploiting Power of Real Time Information

Ostive and NTTDoCoMo.com are both exploiting mobile communication. They differ from each other by the fact that NTTDoCoMo.com is serving customer as a retailer, while *Ostive* is a wholesaler serving retailers. Internet and mobile communication are two technologies that redefine how and when people access information. *Ostive* is managing an intensive wholesaling distribution system, with a policy of selling through any retailer that wishes to handle its products. Products are perishable basic food items.. The mobile workers of *Ostive* need the ability to communicate with customers and fellow workers anywhere, anytime and to have access to relevant business information.

Target customers are dynamic food retailers that can benefit from online ordering, supplying, recording and information. Distribution management and follow up is based on a friendly technology easy to exploit. As most of the distributed products are in the mature phase of their life cycle, the marketing objective is to maximize profit while defending market share.

Ostive is a subsidiary of Osem, a strategic alliance with Nestle. The food distribution industry is characterized by intensive activity in which availability of food (especially fresh) is required almost every day and everywhere. Entry barriers stem from two sources: ability to offer high equity brands and having strong contacts with leading retailers. On the retailer level, the size of the market is 6.35 billion dollars per year (2000). Trends in the wholesale level are characterized by heavy investments in advanced logistic and IT systems. There is a significant improvement in the capabilities of information systems, enabling a better cost control and marketing decision-making. Small systems of food distribution are gradually disappearing and small and

medium size food manufacturers prefer to use existing large distribution systems.

The following features make food distribution business ideal for online marketing. Delivery is simple for most of the products and is characterized by routine purchasing and selling. Due to a 24 hour response of the system much time is saved and there is no need for retailers to plan their orders ahead of time. Customization for each retailer can be developed based on information capabilities of the system, despite the B2B type of the service, and the distribution during periodic picks in demands can better be dealt with.

Customers are enjoying innovation flexibility by being updated online, concerning new products, prices and promotion campaigns. Customers can easily follow up orders that were not fully met. Method of ordering is both efficient and effective, while follow up of the supply situation is easy and exact. The *business* side exploits operational flexibility since the system enables *Ostive* agents direct access to the company's central computer in order to execute orders out of five hundred products range. The system also significantly shortens the orders supplying cycle (max. 24 hours). Modification and updating of new products and prices are done online and immediately. Messages are easily communicated by SMS. The mobile internet based business

The paper investigates four firms acting in either local or global markets, and which have adopted Internet technology.

model of *Ostive* enables the firm to manage its distribution system in a more flexible way than its competitors. *Ostive* exploits real time information, a necessary condition in a market characterized by intensive distribution and wide-spread geographically.

Sigma-Aldrich : Establishing a Global Online Site

Sigma-Aldrich is facing professional customers. *Sigma-Aldrich's* customers are involved in generating new knowledge and creating innovative products. Market segment *Sigma-Aldrich* is serving is unique. Target customers are RandD community in life science. *Sigma-Aldrich* is supporting online this community advanced RandD activities, offering updated information with professional scientific consultation, as well as helping to find suitable materials.

Sigma-Aldrich is a global company developing, producing and marketing a wide range of bio-chemicals, organic chemicals, chromoto-graphic products as well as diagnostic reagents. *Sigma-Aldrich* is part of a global industry in which the strategic positions of competitors in major geographic or national markets are fundamentally affected by their overall global position. Economy of scale is very significant, need for localized marketing is low and advantages of standardized marketing are high. RandD are correlated with entry barriers, as there is a strong capital requirement.

The global market for RandD materials is increasing due to enhanced investment and activity in life sciences. Traditional selling methods are based on detailed catalogue of more than thousand pages, published in English and identical to the whole world.

The function of transforming final consumer requirements into a working prototype passes through many stages till it reaches the developing company and requires a good communication between marketers, engineers and manufacturing people. *Sigma-Aldrich* as a business involved in RandD activity has in its service some features that make it suitable for online marketing: High value to weight and volume with sophisticated requirements for packaging and preferred delivery from few centers. Though its B2B relationship personalization can be enhanced based on mutual discussion, industrial secrecy, while ordering, is better kept, and updated and exact information better found on online site.

Customers, exploiting the flexibility of the information system can access online site from any search engine.. With the use of the Internet, received service is of high quality. Belonging to a research community will create credibility among researchers. In other words, researchers will trust other researchers more than they will trust RandD materials salespeople. The *business* side exercises marketing flexibility and exploits the power of the internet to increase customer support and online quality. Online publishing saves many millions of dollars. The savings come from products manual and from electronic distribution which is the second largest savings for *Sigma-Aldrich*.

The internet based business model of *Sigma-Aldrich* contributes to a better customer online support, enhanced personalization and the building of a research community. Firm has the flexibility to update, add, delete, change and distribute general information and details online. Table 1 and Figure 1 summarize the four case studies.

Starting point is the fact that the dynamic character of the current business environment has forced firms to thrive for strategic flexibility.

Inferred Propositions

Establishing an online site in Israel (Office Depot), mobilizing the Internet as a mean to better serving customers (NTTDoCoMo.com), establishing a global online site (Sigma-Aldrich), and exploiting power of real time information (Ostive) are all strategic steps taken by these four different firms in order to move toward a more innovative business model. The forms we noticed within and across the cases enable to draw inferences regarding impact of internet adoption on firms’ creation of various flexibilities, that finally leads to competitive advantage, value creation and efficiency. We present three general propositions, each of them summarizes a set of inferences as a theme. We develop each proposition into specific hypotheses.

Proposition 1 : In dynamic environments firms adopt the internet technology to enhance their competitive advantage.

Obtaining a competitive advantage is different from market to market but is characterized by the fact that the firm can achieve sales and/or profit above the average. Adopting a new technology as the internet for example can lead to such a situation if done properly. A new technology is not a target but can be a mean to create a competitive advantage. A competitive advantage has to be customer advantage and it changes as the uniqueness of customers does. In our study, *Sigma-Aldrich* is facing professional and scientific customers expecting updated information while being not very sensitive to price. On the other hand, *Office Depot* is acting in the office supply market where low price is important but customers are interested in deep assortment. In more formal terms:

Table 1: Summary of Four Firms Adopting the Internet

Variable \ Firm	Office Depot	NTTDoCoMo.com	Ostive	Sigma-Aldrich
Market Type	Consumer / Business	Consumer	Industrial / Institutional	Industrial / Institutional
Product/Service	Product	Service	Service	Product
Level of Technology	Low/Medium	High	Low / Medium	High
Main Scope of Activity	Global	Local	Local	Global
Level of Competition	High	Medium	Medium	High
Level of Product/ Service Standardization	Low	High	High	Low
Level of Distribution Intensity	High	Low	High	Low
Target Customer	Convenience, price and service minded	Households in mobile market	Dynamic food retailers	RandD community in Life-Science
Benefit	Delivery speed good service and convenience	Advanced communication service	Advanced distribution management system	Supporting advanced RandD activities
Value Proposition	Any order is delivered to your office within 24 hours of ordering with a low price	An efficient and effective service offered in a flexible way and independent of office hours	Ordering, supplying and follow up of distributed products is based on a friendly technology that is easy to exploit and is not capital intensive	Offering updated information with professional on-line support for choosing and supplying suitable RandD materials

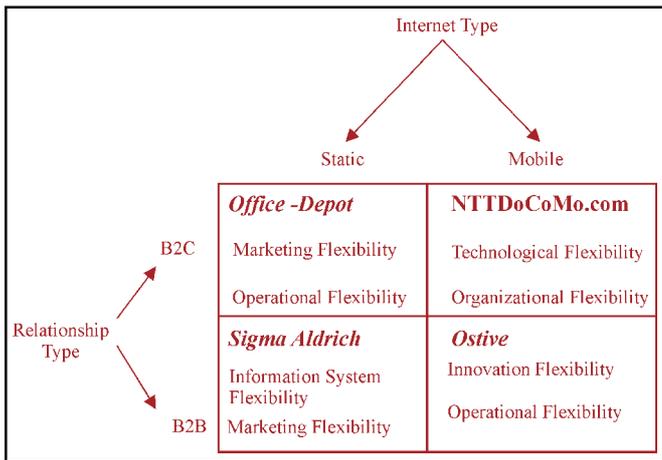


Figure 1 : Flexibility as Part of Strategy Formulation

H1.1 : In dynamic environments, the larger the product assortment the better the performance of the firm.

The assortment depth of products that can be provided by the internet is unlimited as physical constraints do not exist. Normally, customers prefer a greater and up dated assortment because more choices increase the chance of finding what they need. Professional and scientific customers of *Sigma-Aldrich* are looking constantly for cutting edge information relying on the firm’s staff to offer data, information, and knowledge concerning new materials, products, and other relevant issues. *Office Depot* is offering its products from various manufacturers with almost any possible brand. Lot sizes are planned and adapted to any customer, consumer or business. Variety of products in each line is large enabling the customer to find what he is looking for. A very large selection creates the need for suggestion. Thus,

Firms have also to examine their business model continuously.

Proposition 2 : In dynamic environments, firms adopt the internet technology to improve their efficiency.

Efficiency means doing things in the correct way with minimum possible waste. Almost any firm is looking to improve its efficiency. Marketing efficiency studies try to determine how various marketing activities could be carried out more efficiently. In other words, controlling efficiency of sales means (e.g sales forces), advertising, sales promotion, and distribution. For example, *Ostive* combined the use of the mobile internet in its distribution system. Global *Office Depot* established an online site in Israel to improve efficiency of sales promotion. In contrast, local *NTTDoCoMo.com* adopted the mobile internet technology to improve its distribution system flexibility, while *Sigma-Aldrich*, like other leading companies (e.g Cisco), is offering its customers an online catalogue. Thus,

H2.1 : In dynamic environments, the more marketing processes are digitized and implemented by the internet technology, the better the performance of the firm.

Digitizing various marketing processes takes advantage of Moore’s law. What addresses our sight and hearing senses

is feasible technologically. By adopting the mobile internet technology *Ostive* created a system that functions in a more harmonic way with significantly less costly mistakes. *Office Depot* with its online site saves times both to its customers and serving staff by adopting personalization approach based on exploiting information from the past purchases. By digitizing its various documents and search procedures backed by FAQ option *Sigma-Aldrich* improves efficiency of serving its customers by offering a better service in less time.

When taking together proposition 1 and 2, it seems that the value link to the customer is missing. Therefore:

Proposition 3 : In dynamic environments, firms adopt the internet technology to increase their value offer to customer.

One of the most useful powers of the internet technology is to take information as inputs, add value to it and produce more valuable information as output. Value is added because new kinds of information are produced that help customers and marketers to cope better with their problems and make correct decisions. Customers are interested to know what are the attributes included in the proposed offer and marketers

are trying to identify the major attributes that customers value. Adopting the internet technology enable firms to increase their value offer to customers. *Office Depot* and *Sigma-Aldrich* are offering a better personal and product value to their customers. Image value and service value are enhanced especially to customers of *Ostive* and *NTTDoCoMo.com* . Thus,

H3.1 : In dynamic environments, the higher the level of product and service personalization, the better the performance of the firm.

Personalization is a special form of product and service differentiation. It increases the value offered to the customer by assisting the customer in choosing wisely from a wide array of available products and services. When personalization exists marketers learn more about the tastes, needs, wants and demands of their customers. It leads to the creation of relationship marketing that has the aim of building long-term mutually satisfying relations with customers in order to earn and retain their long- term preference.

By creating relationship marketing with its customers *Office Depot* can enhance their satisfaction and cause them to feel they get a better value for their money. Customers of *Sigma-Aldrich* intensify their trust in the firm as a supporter of their RandD work. As the continuum of personalization develops it leads to a better mutual knowing of each other so that *Sigma-Aldrich’s* customers are supported in a proactive way especially in the research phase of their work when level of uncertainty is high. By adopting personalization and knowing every retailer very well the distribution system of *Ostive* functions in a more harmonized way, thus, diminishing possible mistakes and create a better

and more reliable service. Digital technology makes it possible for NTTDoCoMo.com to serve its customers on a personalized basis despite the fact the service is the same for every household. Given service is both efficient and effective and customers feel they are treated with the most advanced technology.

Concluding Discussion

This paper began with the implicit question: How does adopting internet technology enable a firm maintaining flexibilities and through evolution to change its business model to a more competitive one? Being more competitive is needed especially in dynamic environments. Those environments are characterized among others by technological changes, of which the internet is an eminent example.

It was found that firms adopting the Internet are able to improve one or more of the three necessary conditions for profit creation. The internet technology opens to firms that adopt it, a wide range of flexibilities with a noticeable significance for customers, consumers and other business partners. It was also revealed that availability of mentioned flexibilities exists for all four firms in the study that cover a wide range between various poles (consumer markets vs. institutional / industrial markets, product vs. service, medium technology vs. high technology, local firms vs. global firms). Firms are combining gradually the internet with their traditional activity, a phenomenon that stems from the fact that a limited experience with the internet exists for all firms and the required prudence accepted with innovations, as well as continuous exploration of new innovative strategies.

A lot was written about adopting technologies especially in stable environments. Adopting improperly a new technology, as the internet, in a dynamic environment can be very costly.

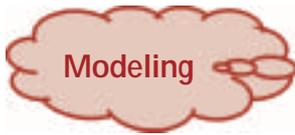
Therefore, adoption must be done very carefully, giving a special attention to the business model from which it has to be clear what are the benefits to the adopting firm. Our propositions focus on the conditions that lead to benefits to the firm in general and finally to profit creation. Achieved benefits are derived from generated flexibilities and are split to short and long run. Enhancement of revenue is expected relatively in the short run while improvement of firm's product, service, and image is anticipated in the long run. Proposition 1 deals with the formation of a competitive advantage, Proposition 2 deals with being efficient which means functioning correctly in the internal operations. Proposition 3 links proposition 1 and 2 and leads to the concept of value creation for customer. The three propositions cope with the three necessary conditions for profit creation and as it was shown are more easily achieved by adopting the internet technology.

The fast moving nature of the internet penetration to various aspects of our private and professional life, besides

blurring the line between them, presents firms adopting this technology with unique challenges. Given this uniqueness, flexibility in strategy formulation is compulsory, as it is possible that its impact will spread to almost any industry. Appendix 1 is a model of adopting the internet technology, which describes and summarizes the process that leads to better performance of firms adopting the internet technology.

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Manufacturing Performance Modeling and Measurement to Assess Varying Business Strategies

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Abstract

This paper discusses the need for integrating several performance measures in an index to give an overall measure of manufacturing performance. It also addresses the importance of an adjustment mechanism that aligns the overall performance index with the corporate strategy in a volatile environment. A methodology is presented that utilizes the strategic performance modeling and measurement index and the analytic hierarchy process to model and to measure the manufacturing performance of a company in a dynamic manner. The resulting index can be used to directly evaluate overall manufacturing performance with respect to achieving various business strategies.

Keywords : analytic hierarchy process, manufacturing performance modeling and measurement

Introduction

Business strategies are commonly considered at three different levels: (1) the corporate level, (2) the business unit level, and (3) the functional level. Manufacturing relates to this hierarchy of strategies as one of the functional areas. Manufacturing strategy can be defined as the effective use of manufacturing strengths as a competitive weapon to achieve the business unit or the corporate goals (Swamidass and Newell 1987, Cox and Blackstone 1998). The notion of employing manufacturing as a competitive weapon was not considered until the ground-breaking work of Skinner (1969), which highlighted that companies in general failed to tailor their manufacturing systems to perform in a way that supports their corporate strategy.

During the thirty five years since Skinner's work was published, considerable research in manufacturing strategy area has been done, with numerous papers published on the topic. However, it is still inappropriate to conclude that companies tailor their manufacturing systems to support their corporate strategies (Okudan and Kabadayi, 2001). Accordingly, after a comprehensive review of the manufacturing strategy research Dangayach and Deshmukh (2001) identified the need for research on quantification of the strategic fit between manufacturing strategy and business performance. Indeed, there are several potential reasons for the mismatch between manufacturing and the overall business strategy, one of the most significant is that performance measures do not match the business strategy and that the company operates based on those performance measures.

Performance measures can guide a company's efforts, monitor continuous improvement and establish feedback

systems for the success of decision-making in any functional area. Several performance measures have been proposed for manufacturing. These measures are classified based on their relevance to various competitive priorities. Wisner and Fawcett (1991) classified measures using five competitive advantages (quality, cost, flexibility, dependability and innovation). White's (1996) taxonomy of strategy-related performance measures is another in this area. It categorized more than hundred performance measures according to competitive priority, data source, type of measure, measure reference, and process orientation. With this taxonomy one can choose an appropriate measure for various manufacturing function decisions to support a particular competitive priority. However, if several competitive priorities are embedded in the manufacturing strategy, the questions: (1) how the performance measures should be integrated, (2) how the overall performance of the manufacturing function should be assessed, and (3) how the performance measures should be modified to ensure their consistency with the corporate strategy remain unanswered. This paper discusses these questions and points out their importance, particularly in a volatile environment. Then, a methodology for integrating multiple performance measures and assessing the overall manufacturing performance that uses the previously proposed strategic performance modeling and measuring index (SPMMI) and the analytic hierarchy process (AHP) is presented.

Corporate Strategy, Manufacturing Decisions and Performance Measurement

Manufacturing objectives are achieved through a pattern of actions in a set of decision areas. Although decision areas for manufacturing have been identified differently by various researchers (Skinner 1969, Platts and Gregory 1990,



Schroeder and Lahr 1990, Hill 1989, Hayes et al. 1988, Fine and Hax 1985) there is a consensus about the necessity of internal consistency between these areas. Some of these decision areas are given in Table 1.

Table 1 : Manufacturing Decision Areas

Decision Areas	Decisions
Structural	Capacity, Facilities, Plant location, Process and technology, Span of process, Vertical integration
Infrastructural	Quality management, assurance and control, Manufacturing planning and control policies, New product development, Human resources, Suppliers, Manufacturing organization, Information systems, Performance measurement

Because of the global availability of information and technology since the 1990s, manufacturers are faced with stiff competition due to a plethora of global manufacturers – all technologically well equipped to produce low cost, high quality products. This fact has shifted the decision-making emphasis from structural to infrastructural, including manufacturing performance measurement.

Manufacturing performance measurement is very critical for a company and, thus, received much attention in the literature. For example, Lockamy (1998) has suggested a normative model for development of a quality focused performance measurement system, which focused on the relationship between division and plant performance measurement systems to support the firm’s strategic objectives. Bititci et al. (1997) have developed a closed loop deployment and feedback model of performance measurement process. Neely et al. (1995) have given a framework for performance measurement system design. In addition, Bititci et al. (2000) described specifications for a framework for dynamics of a performance measurement system. Medori and Steeple (2000) have suggested a framework for auditing a performance measurement system. More importantly, the need to align the manufacturing performance measurement system with the company priorities was reiterated by Dangayach and Deshmukh (2001): “It is necessary to evolve a comprehensive performance measurement system matching the manufacturing mission of an organization. The performance measurement must be multidimensional based on cross-functional measures. Therefore, it is a potent area of interest for researchers.” However, this need is frequently overlooked. In fact, the inconsistency between performance measures and manufacturing strategy at the shop floor level has been reported after an extensive survey of thirty companies by Gelders, Mannaerts and Maes (1994). Thus, when establishing an effective performance measurement system, much emphasis should be put on its consistency with manufacturing strategy, and it is widely accepted that the manufacturing strategy should provide the necessary performance measures. To assure this consistency,

Models and manages the manufacturing performance as a competitive weapon under dynamic conditions.

manufacturing strategy is first set according to corporate strategy. Then, manufacturing planning and control policies are determined so that they support the manufacturing strategy and lead to a manufacturing system that is tailored to support corporate strategy. Finally, the company is maneuvered based on the measured performance. Figure 1 demonstrates these interdependencies.

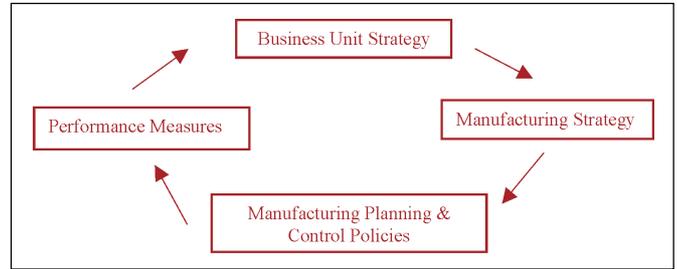


Figure 1: Manufacturing Function Control Cycle

Setting manufacturing strategy in today’s business climate is increasingly complex due to the changing relative importance of competitive priorities in manufacturing. Many authors explain this change in relevant importance of competitive priorities by relating them to post-World War II market conditions over the last four decades (Stalk and Hout 1990, Suri 1994, Goldman et al. 1995). During the 1960s, the U.S. dominated global manufacturing while Western Europe and Japan were still building their war-torn industrial capacities. During this time, production in the U.S. grew to supply the global market. In the 1970s, competition sharply increased and cost control became very important as European and Japanese companies entered into world markets. Mass production, characterized by the production of high volume, low cost and standardized products, became the dominant form of manufacturing. Overall, cost leadership strategy was being employed.

During the 1980s, Japanese companies led the way in satisfying customer needs through increased emphasis on quality and flexibility, without compromising product costs. Manufacturing flexibility became a requirement for global competitiveness. By the 1990s, competition in most industries increased further due to a plethora of global manufacturers. Now the challenge is to respond to changing customer needs more rapidly than competitors.

This evolution in competitive advantages has forced companies to follow multiple generic strategies, contrary to what Skinner (1974) and Porter (1985) recommended. For instance, Miller (1992) argued that there are a number of dangers associated with pursuing a single generic strategy. He claimed that strategic specialization might weaken products, ignore customer needs, and in the long run cause inflexibility. Wright et al. (1990) confirmed Miller’s supposition by demonstrating that companies, which adopt multiple strategies, outperform those that compete with a single strategy. Schroeder et al. (1991) showed that many companies, particularly Japanese companies, are capable of

producing extremely high quality products at low cost. Furthermore, Lockamy and Cox (1994) reported companies pursuing manufacturing strategies that include combinations of the objectives of improving quality, cost, delivery, and lead-time, simultaneously.

Despite this apparent need to embed various competitive priorities in the manufacturing strategy formulation in order to achieve competitiveness, it is not clear how performance measures should be integrated. In addition, today's volatile market environment makes it difficult to assure that performance measures are consistent with corporate goals because short-term necessities may conflict with the long-term objectives of the company. Volatility can emerge from unforeseen changes in government policies, international trade agreements, and sudden changes in the prices of major materials and components. Lockamy and Cox (1994) also discussed volatility and concluded that performance measures derived from corporate strategies must be consistent with dynamic, internal and external changes. However, mechanisms to adjust performance measures to meet the dynamic needs of the market environment remain unexplored.

Measures the manufacturing performance based on multiple competitive priorities.

The remainder of this paper demonstrates a methodology that integrates the strategic performance modeling and measuring index (SPMMI) proposed earlier by Okudan and Murray (1999) and the analytic hierarchy process (AHP) to address performance measures integration, and the adjustment problem. The SPMMI employs various performance measures related to four widely accepted competitive priorities (cost, quality, flexibility and delivery), assigns a weight to the overall class of each priority based on a company's strategic objectives, and adjusts the weights according to external and internal needs. Thus, manufacturing performance is modeled and measured when volatility is taken into account. The vehicle for this adjustment is the AHP. The steps of integrating the SPMMI and the AHP are:

1. structuring the complex manufacturing performance measurement problem into a hierarchy,
2. deciding on the relative importance of competitive priorities and hence, performance measures, and
3. synthesizing these decisions, and embedding them in the SPMMI. The SPMMI is a decimal number between 0 and 1 that indicates the overall manufacturing performance measured using the performance measurement model that is consistent with the manufacturing strategy.

Analytic Hierarchy Process

AHP is a decision-making tool to compare criteria or alternatives with respect to a criterion in a pairwise mode. Its foundation is a set of axioms that delimits the scope of the problem environment (Saaty, 1986). It is based on the mathematical structure of consistent matrices and their associated right-eigenvector's ability to generate true or

approximate weights (Saaty, 1994). For pairwise comparisons AHP uses a fundamental scale, which captures individual preferences with respect to qualitative or quantitative attributes. This scale converts individual preferences into ratio scale weights that can be combined into a linear additive weight for each alternative. Saaty (1988) provides four different methods for approximate calculations of these weights when a computer is not used. However, for exact solutions a software (Expert Choice™) is used, and that is the case for this application.

The resultant weights can be used to compare and rank alternatives and ultimately assist the decision maker in making a choice. AHP is also very powerful in structuring complexity despite the fact that it is generally known as a methodology for choice. Furthermore, it is still considered to be one of the most powerful tools of multicriteria decision-making, and its various aspects are improved and adopted to more complex situations [i.e., decision certainty is quantified by Scott (2002) and stochastic formulation of AHP is proposed by Hahn (2003)].

AHP begins by decomposing a complex, multicriteria problem into a hierarchy where each level consists of a few manageable elements, which are then decomposed into another set of elements. The least detailed level of the hierarchy is placed at the top of the hierarchy. The next level of the hierarchy contains attributes or variables, which contribute to the quality of decisions. Each attribute or variable may be decomposed into more details.

After the hierarchy is constructed, comparative judgment can be used to determine the weights of attributes at each level of the decision hierarchy, and then to synthesize the weights of attributes. First, a comparison matrix, which includes the top hierarchy elements, is constructed. Then, a ratio scale pairwise comparison of each pair of criteria with respect to the overall goal is performed. The relative importance of each criterion is estimated using an eigenvector approach. Next, the relative importance of each alternative with respect to each criterion is determined using a similar pairwise comparison. The pairwise comparisons between the criteria and between alternatives are made using the fundamental scale, which shows the relative importance. Table 2 presents this scale modified for the manufacturing performance modeling problem.

The final step of the process is to convert the comparison data to relative weights of decision variables and to obtain a composite weight for each variable at each level. AHP is applied to the manufacturing performance modeling problem in the following section.

Application

To illustrate the methodology an original example from Skinner's (1969) paper describing the missing link between manufacturing and corporate strategy is utilized (verbatim) as a case study.

Table 2 : Scale of Relative Importance (Saaty, 1986) Modified for Performance Modeling

Intensity of importance on an absolute scale	Definition	Explanation
1	Equal importance	Two measures contribute equally to the goal
3	Moderate importance of one over another	Experience and judgment slightly favor one measure over another
5	Essential or strong importance	Experience and judgment strongly favor one measure over another
7	Very strong importance	A measure is strongly favored and its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one measure over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between the two adjacent judgments	When compromise is needed
	Reciprocals	For inverse comparison

“Company C produced plastic molding resins. A new plant under construction was to come on stream in eight months doubling production. In the meantime, the company had much higher volume of orders than it could meet. In a strategic sense, manufacturing’s task was to maximize output to satisfy large, key customers. Yet the plant’s production control system was set up – as it had been for years – to minimize costs. As a result, long runs were emphasized. While costs were low, many customers had to wait, and many key buyers were lost. Consequently, when the new plant came on stream, it was forced to operate at a low volume.

Adjusts the model as the market conditions require it. Like many methodologies where human judgment is integral, the methodology presented will only produce favorable conditions for the company as the soundness of the human judgement integrated to it. Nevertheless, because it is very easy to apply it leaves room for iterations.

The mistake of considering low costs and high efficiencies as the key manufacturing objective in [this] example is typical of the oversimplified concept of “a good manufacturing operation.” Such criteria frequently get companies in trouble, or at least do not aid in development of manufacturing into a competitive weapon. Manufacturing affects corporate strategy, and corporate strategy affects manufacturing.”

For this case, the decision hierarchy that is structured for the manufacturing performance modeling and measurement problem is given in Figure 2. The goal is to model an overall measure to assess manufacturing performance that (1) integrates several performance measures that are relevant to competitive priorities, and (2) can be adjusted in a volatile environment to assure its consistency with the corporate

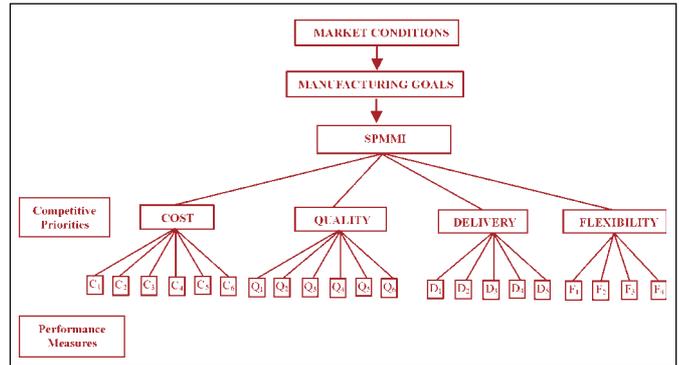


Figure 2 : The Hierarchical Structure

strategy. In Figure 2, this goal is indicated as the strategic performance modeling and measurement index (SPMMI). In the first hierarchy level, there are four primary competitive priorities that will be embedded in the index with relative weights varying based on their importance on achieving manufacturing goals.

SPMMI has been proposed earlier as an overall performance measure for manufacturing (Okudan and Murray 1999, Okudan 1999). This index integrates multiple performance measures that are relevant to widely accepted competitive priorities in manufacturing, namely cost, quality, delivery and flexibility. In fact, manufacturing was judged to be at least 50% responsible in achieving cost, quality, delivery and flexibility goals for a company (Vickery et al., 1993), and therefore, only cost, quality, delivery and flexibility were included in the SPMMI. These priorities are summarized by Spring and Boaden (1997) as:

Cost : Manufacturing and distribution of products at a low cost.

Quality : Manufacturing with high quality or performance standards.

Delivery : Reacting quickly to customer orders and meeting delivery schedules.

Flexibility : Reacting to changes in product designs, product mix, fluctuations in materials and changes in sequence.

It should be noted, however, developments in the marketplace may require consideration of other competitive priorities for inclusion in the SPMMI. For example, a recent survey showed “more innovative features/designs” to be an emerging, widely agreed upon competitive factor (Lau, 2002). However, because a comprehensive study on manufacturing’s relative responsibility on achieving more innovative features/designs is not available yet, SPMMI was used in its original format for this study.

Therefore, SPMMI is given with the following formula:

$$SPMMI = \left(\frac{w_1}{m}\right) \sum_{h=1}^m C_h + \left(\frac{w_2}{n}\right) \sum_{i=1}^n Q_i + \left(\frac{w_3}{o}\right) \sum_{j=1}^o D_j + \left(\frac{w_4}{p}\right) \sum_{k=1}^p F_k \quad (1)$$

where,

SPMMI is strategic performance modeling and measurement index for a product or a manufacturing system. It is a decimal number between 0 and 1.

C_h indicates cost related measures. $h=1,2,3,\dots,m$

Q_i indicates quality related measures. $i=1,2,3,\dots,n$

D_j indicates delivery related measures. $j=1,2,3,\dots,o$

F_k indicates flexibility related measures. $k=1,2,3,\dots,p$

$w_1, w_2, w_3,$ and w_4 indicate overall weights assigned to performance measure sets. They are decimal numbers between 0 and 1, where $w_1+w_2+w_3+w_4=1$.

In the index, it is assumed that all performance measures included can be indicated in a ratio format. For example, if during the first period of performance measurement the scrap rate is found to be 2%, and during the second period it is measured as 1.75%, the value indicating the scrap rate performance would be 1.125. This value is calculated as the ratio of the change in the value of the performance measure plus its original value to its original value.

In the second hierarchy level, there are performance measures. These performance measures are selected from White's (1996) taxonomy of manufacturing strategy related performance measures. In his taxonomy White included one hundred twenty five manufacturing performance measures, which were categorized into five competitive priorities as cost, quality, flexibility, delivery speed and delivery reliability. These five competitive priorities were found to be the only five (out of a set of thirty one), which were judged to be at least 50% affected by manufacturing decisions (Vickery et al., 1993). For this study, the delivery measures were counted as one category. In this illustration six measures for cost, six measures for quality, five measures for delivery and four measures for flexibility are used. These measures are listed in Table 3. The number of measures included at this level may be changed. The important point is that measures with high correlations with one another should be excluded. Ideally, a small number of important measures for the company should be used.

After its construction, each level of the hierarchy should be evaluated by means of pairwise comparisons. These pairwise comparisons are done using the fundamental scale given in Table 2. Pairwise comparisons start at the first level of the hierarchy. Competitive priorities are compared in a pairwise fashion for their importance toward achieving the manufacturing goals. Results of these comparisons are given in Table 4 for the case.

Assume that pairwise comparisons completed in Table 4 represent the plastic mold manufacturer's (Skinner, 1969) standing competitive priorities and that manufacturing

Table 3 : Performance Measures Included in the Hierarchy Competitive Priority

Competitive Priority	Symbol	Definition
Cost	C1	Manufacturing cost
	C2	Materials
	C3	Direct labor
	C4	Inventory
	C5	Repair and rework
	C6	Scrap
Quality	Q1	Quality relative to competitors
	Q2	Customer satisfaction
	Q3	Number of complaints
	Q4	Assembly line defects per 100 units
	Q5	Percentage reduction in time between defect detection and correction
	Q6	Cost of quality
Delivery	D1	Percentage on time delivery
	D2	Due date adherence
	D3	Percentage of orders with incorrect amount
	D4	Schedule attainment
	D5	Percentage reduction in purchasing lead time
Flexibility	F1	Flexibility relative to competitors
	F2	Process flexibility relative to competitors
	F3	How quickly plants respond to product mix change
	F4	Percentage increase in average number of set-ups per day

Table 4 : Pairwise Comparisons of Relative Importance of Competitive Priorities

	Quality	Flexibility	Delivery
Cost	2	5	6
Quality		5	6
Flexibility			3

Table 5 : Pairwise Comparisons for Cost Measures

COST	C2	C3	C4	C5	C6
C1	3	2	5	5	6
C2		½	4	5	7
C3			5	7	3
C4				7	4
C5					3

strategy and corporate strategy are aligned. According to Table 4, cost is favored strongly over delivery based on experience and judgment. In other words, cost is found to be more important for achieving the preset manufacturing goals, and the degree of importance is determined to be a 6 where a 1-9 scale is used, 9 being the highest degree.

Table 6 : Pairwise Comparisons for Quality Measures

Quality	Q2	Q3	Q4	Q5	Q6
Q1	2	2	3	4	1
Q2		1	3	2	2
Q3			3	3	1
Q4				2	1/2
Q5					2

Table 7 : Pairwise Comparisons for Flexibility Measures

Flexibility	F2	F3	F4
F1	2	1/3	1/4
F2		1/4	1/5
F3			2

Table 8 : Pairwise Comparisons for Delivery Measures

Delivery	D2	D3	D4	D5
D1	3	5	5	5
D2		2	5	5
D3			3	5
D4				3

Likewise, second level pairwise comparisons are also done based on experience and judgment relevant to the importance of various performance measures for each competitive priority. Results of these pairwise comparisons for cost, quality, delivery and flexibility are shown in Tables 5-8 respectively.

These pairwise comparison data are then converted to an overall weight of a competitive priority in the SPMMI, and to weights of performance measures for each competitive priority. These calculations were completed using the Expert Choice 2000 2nd Edition for Groups software, a decision-support system that leverages the comprehensive expertise of an organization to enhance decision-making. The software provides exact calculations of the weights by raising the pairwise comparison matrix to arbitrarily large powers and dividing the sum of each matrix row by the sum of the elements of the matrix (Saaty, 1980). Figure 3 shows



Figure 3 : Relative Importances Calculated in Expert Choice Using Pairwise Comparisons

the calculated weights for the set of pairwise comparison judgments given in Table 4. Overall synthesized weights of each decision variable are calculated based on the AHP. The calculated overall weights for the example are given in Table 9.

When these weights are integrated to SPMMI for the first level of the hierarchy, the following result is achieved:

$$SPMMI = \left(\frac{0.491}{6}\right) \sum_{h=1}^6 C_h + \left(\frac{0.348}{6}\right) \sum_{i=1}^6 Q_i + \left(\frac{0.055}{5}\right) \sum_{j=1}^5 D_j + \left(\frac{0.105}{4}\right) \sum_{k=1}^4 F_k$$

For the second level, when local relative importances of six cost related performance measures are taken into account and linked to the overall weight of the cost, the competitive priority, the following is achieved:

$$\sum_{h=1}^6 C_h = \left(\frac{0.179}{0.491}\right) C_1 + \left(\frac{0.096}{0.491}\right) C_2 + \left(\frac{0.135}{0.491}\right) C_3 + \left(\frac{0.041}{0.491}\right) C_4 + \left(\frac{0.025}{0.491}\right) C_5 + \left(\frac{0.016}{0.491}\right) C_6$$

It should be also noted that the assumption of having equal weights for a set of measures in any competitive priority class (in the original SPMMI index) has been replaced with the inclusion of synthesized weights that were calculated from second level pairwise comparisons.

Assume that C_{1-6} values were found to be 0.90, 0.70, 1.10, 1.20, 0.75, and 0.50, respectively. Then,

$$\sum_{h=1}^6 C_h = 0.92$$

Likewise, ...” computations for the quality, delivery and flexibility measures can be completed. Assume that relevant values are 1.20, 0.65, and 0.80, respectively. Then, the overall index (SPMMI) can be calculated to be: $SPMMI = 0.99$. This means that an overall 1% decrease in the manufacturing performance was realized as compared to previous period’s performance. However, SPMMI, (as it is defined with the current relative importance of competitive priorities) does not reflect the true performance measure of

Table 9 : Overall Synthesized Weights

Level	Variables	Weights
1	Cost Quality Delivery Flexibility	0.491 0.348 0.055 0.105
2	Cost Measures	C1= 0.179, C2=0.096, C3=0.135, C4=0.041, C5=0.025, C6=0.016
	Quality Measures	Q1=0.106, Q2=0.072, Q3=0.065, Q4=0.031, Q5=0.032, Q6=0.043
	Delivery Measures	D1=0.027, D2=0.014, D3=0.008, D4=0.004, D5=0.003
	Flexibility Measures	F1=0.013, F2=0.008, F3=0.047, F4=0.037

the manufacturing system. Because it fails to take into account the internal and external developments (i.e., the increase in demand while the second plant was still in construction and the loss of customers due to the missed delivery dates, then the low demand when the second plant was operational due to lost customers). Recalling the case from Skinner’s (1969) work, imagine that for the transitional time until the second plant was operational, competitive

priorities should have been rejudged to have different weights, yet the overall process was overlooked. However, a more accurate overall performance of the manufacturing is required.

To achieve a more accurate measurement of performance, further imagine that relative importance of competitive priorities are judged and then judgments are converted into weights using the Expert Choice software as seen in Figure 4. As seen, overall delivery is judged to be more important than cost, rather than the opposite to better reflect the strategy of the company. Imagine that the performance measures and their values for each competitive priority category are unchanged. In this case, SPMMI index would be recalculated to yield a SPMMI index value of 0.77, which provides an overall measurement of manufacturing performance. This means that only 77% of the previous period's performance was captured. In other words, a 23% decrease in manufacturing performance was realized.

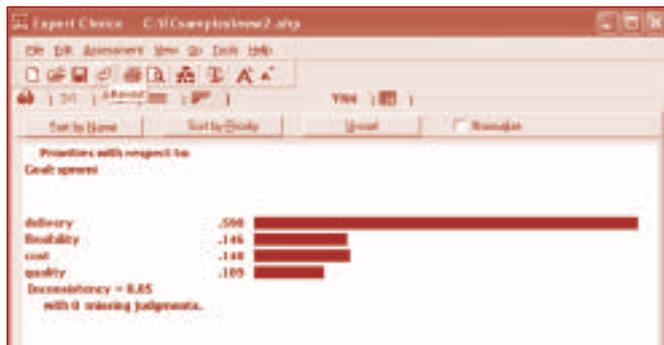


Figure 4 : Rejudged Pairwise Comparison Assessment of Competitive Priorities

Overall, as explained above using a case study, representation of the overall manufacturing performance using an index (SPMMI), which can be tailored to a company's strategy fairly easily, can be a powerful tool in converting manufacturing capabilities into a competitive weapon. In this fashion, rather than periodically reviewing and revising the complete set of measures, their contributions to the manufacturing strategy can be revised to coincide with the changes in the competitive environment and strategic direction. Therefore, manufacturing performance levels over time can be traced despite changes in adopted competitive priorities and hence the manufacturing strategy.

Conclusion

This paper presented a methodology that utilizes the strategic performance modeling and measurement index (SPMMI) and the analytic hierarchy process (AHP) to model and to measure a company's manufacturing performance. The final index value, achieved using this methodology, shows the overall manufacturing performance toward achieving manufacturing goals. The steps of the methodology presented can be summarized as the following:

1. Model the overall manufacturing performance as an index using SPMMI, which utilizes competitive priorities.

2. For each competitive priority category select performance measures and define them in ratio format.
3. Using pairwise comparisons assess the relative importance of competitive priorities and related performance measures.
4. Convert pairwise comparisons into weights (relative importance).
5. Collect performance measurement data for predetermined intervals (i.e., for three months).
6. Synthesize weights and performance measurement ratios into a SPMMI index value.
7. Plot the SPMMI index value over time to trace the overall performance of manufacturing.
8. Evaluate the fit of the competitive priority weights to the changes in the competitive environment. If change is needed go to step 3, if not go to step 5.

Steps 1 and 2 structure the complex manufacturing performance measurement problem of a company into a hierarchy. Steps 3 and 4 enable decisions on the relative importance of competitive priorities and hence, performance measures. Steps 5 and 6 embed performance measures and weights into an index. Finally, steps 7 and 8 provide traceability and adjustability to the overall manufacturing performance measurement. The methodology, given in steps above, revisits and revises competitive priorities' contributions to the manufacturing strategy to coincide with the changes in the competitive environment and strategic direction. Therefore, manufacturing performance levels over time can be traced despite changes in adopted competitive priorities and, hence, the manufacturing strategy.

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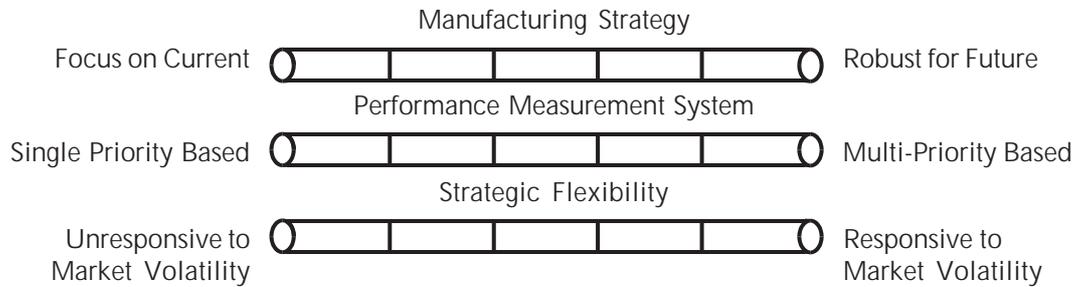
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Flexibility Mapping : Practitioner's Perspective

1. What types of flexibilities do you see in the practical situation of "Manufacturing Performance Measurement" on the following points:
 - Flexibility in terms of "options"
 - Flexibility in terms of "change mechanisms"
 - Flexibility in terms of "freedom of choice" to participating actors.
2. Try to map your own organization on the following continua (Please tick mark in the appropriate boxes)



Reflecting Applicability in Real Life

1. Does the manufacturing performance measurement system of your company reflect the strategic needs (i.e., the company aims being the low cost provider as well as offering customized products)?
2. Given the continuous potential for volatility in the market, how does your company align manufacturing strategy and performance measures to market needs?



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