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Key Factors of Sustainable Firm Performance: A Strategic Approach

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The development of information technologies and their increased significance for business environments have forced businesses to rethink traditional methods of generating value and surviving the hyper-competitive conditions of our time. The uncertainty, dynamism, volatility, and impermanence of modern commercial environments have shifted the foundations of business success and survival.

Key factors that now affect firm performance and determine sustainability include knowledge creation, knowledge management, uncertainty management, organizational intelligence, and supply chain administration. The authors propose an analytical approach to identifying and enhancing these critical factors, and they describe ways for firms to exploit their strengths and minimize or compensate for their disadvantages.

Sustaining business success requires competitive strategies that are rational and analytical. Firms that isolate their overall goals have an advantage over their rivals; those that can innovate and incorporate the knowledge and intelligence they develop will prosper, even in the most competitive situations. Managers and business practitioners should learn from this book how to identify the key factors that make their firms effective and successful, and how to ensure they remain sustainable over time.

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Preface

The world is witnessing striking changes since the development of information technologies and their increased significance for business environments. These changes require firms to rethink the validity of their traditional methods for competing and for generating value. Traditional competition has already lost much of its effectiveness, and the uncertainty, dynamism, volatility, and impermanence of the new commercial environments are reconfiguring the foundations and premises of business competition. In this new environment, it is necessary to re-identify the factors that affect firm performance – to abandon classical perspectives and analyze those factors that play key roles in business performance from a new strategic viewpoint.

Performance is a multidimensional concept that defines the success of a business as well as its level of achieving business objectives. Traditionally firms consult measures of performance like annual sales and firm size. Factors such as efficiency and effectiveness may be added to these two dimensions later. More recently, new dimensions of performance (such as utilization of inputs, quality, innovation, and quality of work life) have been added to the performance criteria, and the idea of what constitutes successful, effective, or sustainable performance has been very much broadened. Today, dimensions like employee behavior, market share, product or market leadership, and public responsibility must all be included in an evaluation.

This book takes a strategic approach to explaining what key factors determine sustainable firm performance under the ruthlessly competitive conditions of our time. These key factors include creating knowledge, managing knowledge, managing environmental uncertainty, generating organizational intelligence, producing organizational knowledge, and strategically managing the supply chain.

The main objective of this book is to help firms develop new strategies for outperforming their rivals in a rapidly evolving competitive environment. This book differs from other studies in that it brings a strategic viewpoint to the concept of sustainable firm performance – it looks for ways firms can develop and exploit their advantages and achieve their overall goals. Managers who read this book will learn to identify and analyze the key factors that make their firms effective, successful, and sustainable over time.

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Contents

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Mustafa Emre Civelek is Head of the Ground Handling Services Management in Aviation Program at Istanbul Commerce University, where he teaches courses in e-commerce, foreign trade, and logistics. He is also a Ph.D. candidate in Management, specializing in the study of organization theory. He earned his undergraduate degree from Istanbul Technical University in 1994 and a master's degree from Yeditepe University in 2002. He is also a practitioner, working from 1994 until 2008 in the banking industry, mainly in international trade finance operations. His focus, therefore, concerns bridging the gap between theory and practice. His academic publications include books on e-commerce and academic papers on several issues regarding management.

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Introduction:
Excessive Competition in the New Business Environment

The science of economics tries to explain the issue of "meeting unlimited needs with scarce resources." Resource utilization is obviously very important in an environment where resources are being depleted and for this reason their value rapidly increases. Changing and diversifying consumer needs and, conversely, the difficulty in obtaining resources causes competition to reach quite serious levels. At the beginning of the 21st century, the real sector and people as a whole were forced to change due to many factors including the information revolution, the spreading of new technologies at an accelerating pace, technological developments, and growing globalization.

Various adjectives and terms have been used to define the new competitive age. The most prominent and frequently used ones include competitive landscape, excessively competitive environments, post-industrial society, and undiscovered new regions. The uncertainty, dynamism, volatility, and impermanence of the new competitive environment alter the natural foundations of competition. The world is going through striking changes with the development of information technologies and increased significance of technology. These changes cause firms to rethink the validity of traditional competition methods towards generating value. In other words, traditional competition has lost its effect in this changing world and changing conditions of competition. The uncertainty, dynamism, and impermanence of the new competitive environment produce a deterrent impact on many firms. At the same time, firms demonstrate innovative and active behaviors to benefit from product-market opportunities in today's competitive environment. For this reason, while firms create dynamic fundamental capabilities to benefit from the intensity of environmental opportunities in order to survive and succeed in this field, they also try

to learn how to minimize the negative effects of impermanence and uncertainty. To generate value, firms have to define, create, and continuously manage information (especially technological information). Strategically, information that is known to be correct and recognized is the most important resource to affect a competitive advantage.

Studies show that competition has started now to be information-based and competitive advantage results from physical assets rather than intellectual capabilities. Therefore, to be able to develop, survive, feed off resources and benefit from a competitive advantage depends on the ability of a firm to generate, distribute, and utilize information within its organization. The increased competitive importance of information has caused firms to improve their information-based viewpoints. This improved viewpoint, which predicates creation, usage, and implementation as the fundamental rationale of the existence of such firms, gives rise to resource-oriented perspectives in these firms.

The possession of technological information to enable firms to stand upright and have a say in this competitive environment virtually requires an intense learning process. Learning and possession of information are closely interrelated; information is a critical outcome of learning. If information is power, learning is the key to that power (Koh, 2000: 94). It is seen in many studies that information serves as the foundation for organizational learning and technology management. Information also influences the selection and realization of a firm's strategies.

The levels of learning achieved from the acquisition of information to the utilization of it in practice will affect the competitiveness of firms. In this sense, the concept of organizational learning and its impact becomes very important for firms. The creation and development of technological information by an organization and utilization of it in development of new products is crtically important for a firm to survive in these unmerciful competitive conditions. In an effort to explore and understand organizational learning in a more comprehensive way, the concepts of information management and the information generation process are considered. The management of technological information in technology-oriented firms will light the way, provide assistance, and convey ample benefits to a number of applications. Technology-generating firms engage in research and development activities to be able to produce and use such information. Both the basic research conducted by scientists and the applied development works carried out by engineers constitute the foundation for

firms to generate information and utilize it. The research and development teams in such firms assume the key role in generating information. The adequate performance of those working on these teams is very important in the process, extending from the acquisition of the information necessary for a perfect product to the launching of the product for customer use. In both R & D and new product development teams, the conduct, interactions, communication, and depth of knowledge of the team members, as well as many other factors, can influence their performance.

Introducing something distinguished compared to their rivals in a competitive environment is only possible if a business can acquire the information that is difficult for its rivals to imitate and that can be shared and spread, and assimilated through implementation. In these days of increasingly ruthless competition, firms that succeed in the information management process should also have merits such as innovating and being inimitable.

Modern managerial sciences such as information management, learning, technological knowledge, and innovation, as well as trendy concepts, are being valued more now by technology-oriented firms. As technology-oriented firms compete in an extremely changeable market, one of their most important activities is their research and development to develop new products.

The field of strategic management relates to the understanding of how to respond to the conditions that expose the differences in firm performance and the improvement of such performance. A considerable subgroup of the many studies made in this field is focused on the development of the "Dynamic Theory of Strategy." Teece and associates analyze competencies, skills and strategic resources and explain in detail the resource-based dispositions of firms to explore the probability of a "Dynamic Competencies Theory." The role of learning in development of new skills is at the center of this analysis. Teece and associates clearly linked learning to an improved firm performance by defining learning as "a process where repetition and experience make definable new production opportunities and better and faster performed tasks possible." Since the developments in organizational processes come down to the creation of new strategic skills, learning is understood as a personal and organizational process.

Adapting to a learning-based viewpoint for competitive advantage changes the bases for describing how various activities of firms are linked to high performance. Although top management still has an important

role in learning-based strategic management, a from-top-to-bottom approach is not valid in strategy anymore. The top management should do its best to create the conditions to enable its employees at every level who strive for continuous improvement at every stage of the overall transformation process of the firm to take responsibility, gain experience, and learn. To be able to define learning processes as a source of competitive advantage, these processes should have qualities such as being unique, inimitable, rare, and valuable.

Performance-improving learning should have the following aspects in the terminology of resource-based firm disposition:

- **Heterogeneity:** Processes are not the same on the basis of all firms
- **Durability:** Learning processes should be based on long-term work
- **Causal uncertainty:** The development and foundation of learning processes are not fully distinct
- **Low changeability:** The transfer of learning processes within the organizational boundaries is difficult
- **Inimitability:** Learning processes cannot be imitated easily
- **Convenience:** Firms can profit from learning

In order for the organizational learning concept to provide benefits to strategy management, it should be distributed to define various dimensions of organizational learning to be used in the future for assessment and anticipation of firm performance. Learning activities should have the following characteristics for researchers to explain how learning influences performance:

- **Being distinguishable:** Good learning should be distinguishable from bad learning
- **Being spreadable:** The manner of learning is present in the organization, therefore it is more appropriate to show organizational learning rather than personal or group learning
- **Being expressible:** Newly-hired workers can learn the new way of learning through open learning and other processes
- **Flexibility:** The way of learning should be changeable to meet new circumstances and needs (Carayannis and Alexander, 2002: 627-628)

Due to a constantly changing competitive landscape, the advantage is on the side of firms that have expertise particularly in technological learning. Both internal (firm size and structure, its administrative competence) and external (industry and sector status) factors affecting the organization may increase or diminish the ability of the firm to engage in effective technological learning processes. That is to say that effective management of these internal and external factors may result in competitive advantage through improving basic skills. If these factors are not managed effectively, the outdated skills may cause serious damage in the competitive landscape. Technological learning facilitates the firm's efforts of:

- Taking appropriate levels of risks
- Being especially active
- Making innovations
- Improving, maintaining, and utilizing constantly-changing (dynamic) basic skills
- Creating continuous competitive advantage
- Creating value (Hitt et al., 2000: 233)

Looking at it from a different viewpoint, the world is going through striking changes with the development of information technologies and increased reliance on technology. Therefore, technological learning also needs renovation. The concept of technological learning, which naturally focuses on technology and learning in developing countries, should be redefined under the conditions of today's high level of competition. Many scientists maintain that firms must keep up with integrated learning if they wish to survive and grow in today's turbulent environment. Lei and associates (1996) introduced the term "meta-learning," which consists of information transfer, experience, and dynamic routines, into the literature. They claim that meta-learning is necessary to maintain and improve effective dynamic basic skills. Firms need the speed, depth and breadth of organizational learning for effective technological information management.

It is argued that organizational experiences are effective means for firms to survive and grow in today's unpredictable and fast-changing environment. They claim that although the retained, saved organizational experiences are usually meant to improve the ability to comply, organizational experiences and personal ability to estimate are generally meant to increase

compliance. This idea resembles strategic and top level strategic learning. For individuals, the best way to learn tacit knowledge may be learning by practice. For this reason, the intern and orientation programs are the most effective way of gathering both tacit and explicit knowledge for the newcomers. Sharing information in a self-organized team or a field may be useful for individuals to increase their tacit and explicit knowledge.

Grant sees a firm as a place where information is put into practice. Thus, the major duty of organizational learning is to understand the processes of utilizing information, which is integrated into processes by its members and its coordination mechanism, and to establish compliance with such mechanisms and processes for more effective and powerful utilization of information (Grant, 1996: 109-127).

Environmental uncertainty is an external force that has an impact on firm performance. In today's competitive environment, markets have started to be more international, dynamic, and customer-oriented, and customer demands have become more changeable, while they seek better quality and require better reliance and faster delivery (Thomas and Griffin, 1996).

The product lifecycle becomes shorter and shorter and technological developments advance in a more speedy way. To respond to this uncertain environment, organizations need to increase their external resource utilization rates and customer-supplier partnerships (Krause et al., 1998).

The perceived environmental uncertainty originates from the following four factors:

- Increased global competition
- Development of new technologies that rapidly outdates existing products
- Changing customer demands and requirements that shorten the product lifecycle
- Increased need for participation of the people in the organization's task environment, such as suppliers and customers

Some studies state that the perceived environmental uncertainty stems from the unexpected changes in customers, suppliers, and technology (Li and Lin, 2006). Looked at the issue from this perspective, the sub-factors of environmental uncertainty as customer, supplier, and technological uncertainty are established. Customer uncertainty can be expressed as the

unpredictable changes in customer demands and preferences. The traditional market necessitates a fast-changing, complex, and customer-attracting competition environment. Customer demands for goods and services become more and more uncertain with respect to time, volume, and place. Customers today demand more choice, better service, higher quality, and faster delivery than in the past (Burgess, 1998; Hoek, 1999).

Supplier uncertainty is defined as the unpredictability and changeability in the product quality and delivery performance of suppliers. There are many sources of supplier uncertainty. These include a supplier's engineering level, a supplier's time management, and a supplier's reliability for delivery and quality of raw materials (Lee and Billington, 1992). The uncertainty arising from suppliers due to reasons such as delay and product damage may cause an organization to postpone its production process or even to discontinue the process. Moreover, such uncertainties may increase practices that can cause undesired outcomes such as inefficient use of resources in the supply chain, increased logistic costs, and stock storage costs (Yu et al., 2001). Even in calm and stable environmental conditions, it would be very difficult for a producer to provide high quality customer service if its main suppliers operate in low quality and delivery speed. If changeable environmental conditions prevail, this producer will be wiped out of this competitive environment (Prasad and Tata, 2000).

Technological uncertainty is defined as the unpredictability and changeability in the industry of an organization. The development in information technologies provides a wide range of opportunities to businesses. For example, the inventions in information technologies enhance a movement towards the integration of supply chain and business processes (Chizzo, 1998), provide many contributions to the firm, and enable correct supply chain integration (Thomas and Griffin, 1996). Advance information systems reduce the transaction costs related to product flow control and enable faster response to customer needs.

Today, the market spheres are concerned with richness of knowledge and high level of information circulation. In an environment where competition is experienced at an extremely high level, firms seek ways to attain competitive advantage and sustain such advantage. Day and Montgomery (1999) have developed five special concepts to contribute to market competitiveness, namely, significance of information; globalization, compliance, consolidation of businesses and sectors; market segmentation; authorization of customers; and harmony of organizations (Cheung, 2005).

While the developments in technology and globalization of services made markets become more dynamic, they also led to emergence of an increasing rate of uncertainty in consumer demands. Customers have now more knowledge, have the possibility of more options for products and services, and have a broader share in product development processes. Therefore, the competitive position of a firm depends on its understanding of the changes in customer demands and provision of appropriate returns to meet such demands (Butz and Goodstein, 1996; Flint et al., 2002).

More customer knowledge within a customer-supplier relationship enables suppliers to develop and offer more valuable products (Selnes and Sallis, 2003). For this reason, it is argued that the supply chain activities have more value-adding benefits for customers than other marketing functions (Fuller et al., 1993; Weitz and Jap, 1995).

Some studies have investigated how the strategic outcomes that need to materialize between the buyer and seller within the context of cooperation and learning should be. But some very important questions as to how the value-based strategies will be developed in the global supply chain are still unanswered (Selnes and Sallis, 2003; Jap, 1999).

Cooperation between firms has become an extremely important issue in recent years, but there is a high level of dissatisfaction with cooperation because the expected success was not achieved in terms of its outcomes and some firms even experienced failures (Dadgson, 1993; Hennart, 1988; Parkhe, 1993). Previous studies have mentioned a number of risks and dilemmas in relation to intercompany information sharing.

The first dilemma is how you should motivate self-interested members of the chain to share their expressly valuable information with the other members (Wood and Gray, 1991). The general tendency of individual firms is to protect their registered know-how against undesired damages. In conclusion, most firms (especially those that registered their knowledge) are unwilling to share information (Dyer and Nobeoka, 2000).

Another dilemma is the "free-rider" problem. This problem is more discussed within the theory of collective movement; qualified persons are sought who would try to achieve common objectives between individual firms and organizations that think of their own interests (Marwell and Oliver, 1993; Sandler, 1992). A successful cooperation develops collective and common knowledge and facilitates conveyance of such knowledge to the members of the chain. Development of useful information is important for free-riders because these members like to make use of such infor-

mation without making any contribution to the acquisition and creation of such information (Dyer and Nobeoka, 2000).

Despite conveniences in intercompany partnerships and advancements in implementations in recent years, there are still deficiencies. Intercompany sharing at all levels involves risks and dilemmas. Studies of supply chain management have recently reached large numbers. In an environment where competition between firms is experienced in such intensity and speed, there are many studies expressing that supply chain management is a determinant of performance for firms. Studies have attracted attention to the integration, agility, and even flexibility of a supply chain as a whole and added new dimensions to the supply chain. Nevertheless, supply chain management is still limited.

The effect of supply chain management on firm performance has been explored in a large number of studies (Aydın, 2005; Bayraktar et al., 2009; Day and Lichtenstein, 2006; Fawcett et al., 2007; Green et al., 2006; Koh et al., 2007; Li and Lin, 2006; Şen, 1992).

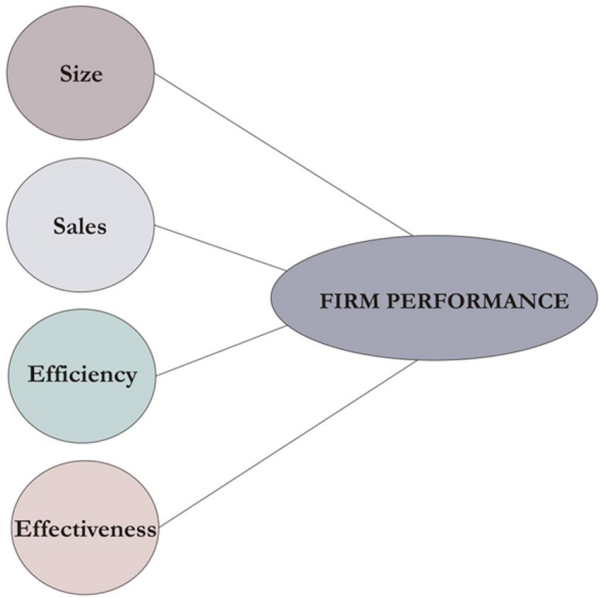

Figure 1.1. Dimensions of Firm Performance

In this book, where the key factors to achieve a sustainable firm performance are explained, the dimensions of firm performance were taken as size, sales, efficiency, and effectiveness as in Figure 1.1 and as mostly accepted in the literature. The five basic factors that businesses should focus on to improve their performance in a sustainable way in the presence of their rivals through these basic dimensions in a competitive environment in which they operate are creating knowledge in organizations, managing knowledge in a competitive environment, managing environmental uncertainty, generating organizational intelligence, producing organizational knowledge, and managing the supply chain as explained in the model seen in Figure 1.2. Each of these factors must be considered by firms in deciding their competitive strategies.

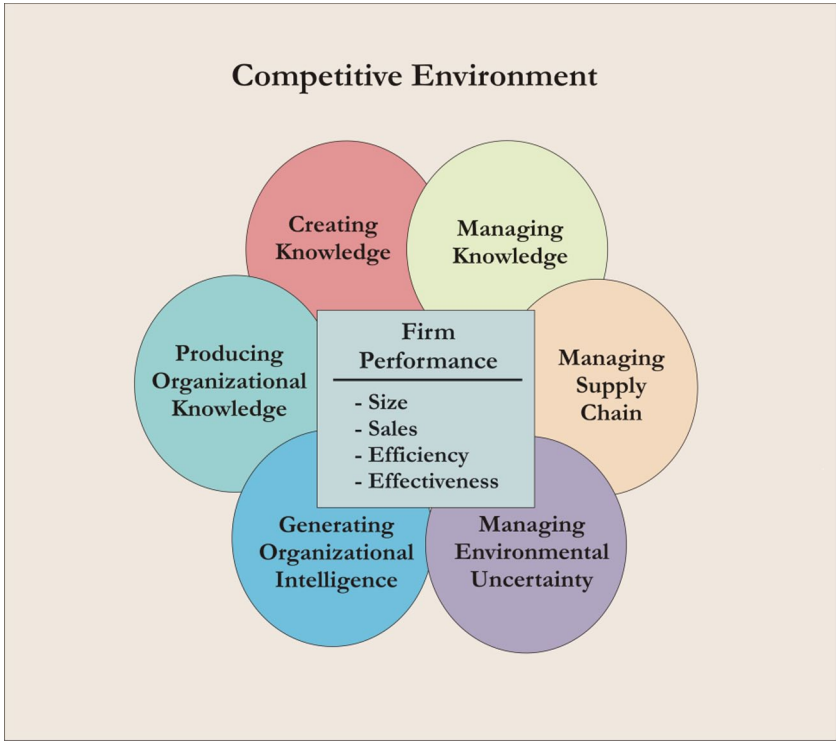

Figure 1.2. Integrated Success Model in a Competitive Environment

The success model in a competitive environment is an integrated model and offers solutions to guide the firm managers in achieving sustainable firm performance, which is the most important component of enabling firms to survive in a competitive environment.

Strategy is a long-term concept. It is the combination of the dynamic decisions made to achieve firm objectives in consideration of their rivals. What is meant by strategies being dynamic is that such strategies can be modified depending on the behaviors of the rivals and environmental factors. It is not possible to manage firms with static decisions in today's excessive competitive business environment. This model explains to companies how they can gain the dynamism to be able to implement their strategies. Integrating this model means that each factor needs to be improved and dealt with at the same level, simultaneously. For example, managing environmental uncertainty requires organizational wisdom and organizational wisdom requires creation and management of knowledge in the organization. While doing all these, the stakeholders in the close vicinities of the firms should not be disregarded. At this point, the supply chain management comes into the scene. To be able to point to efficient supply chain management, intercompany information sharing comes to the fore as a determinant factor. Uncertain customer behaviors, new purchasing trends, and technological developments make the results of shared quality information very high in added value. The quality of the shared information at this point will have a decreasing effect on the environmental uncertainty with which firms have to cope with. The loyalty and trust established by the firms in a supply chain is one of the dimensions that has at least as much impact as information sharing on firm performance. The fast reactions to be shown by firms against changing customer demands and unpredictable customer behaviors will help them come to a competitive position in the market. This requires firms to have agile structures. Thus, agility is a dimension that has an important effect in supply chain performance.

It is obvious in today's competitive environment that the competition between supply chains will be the determinant for firms' customer-oriented strategies from now on. It follows that in order to improve firm performance, supply chain performance should also be managed well. The firms that carry their supply chain performance to upper levels also obtain extremely successful results in the aspects of sales, firm size, efficiency, and effectiveness. Thus, supply chain management is a very important factor in improving firm performance.

This book explains through a strategic approach what key factors determine sustainable firm performance under the ruthless competitive conditions of our time. These factors that are of vital importance to firm performance include creating knowledge in organizations, managing knowledge in a competitive environment, managing environmental uncertainty, generating organizational intelligence, producing organizational knowledge, and managing the supply chain.

The main objective for preparing this book was to help firms develop new strategies taking into consideration their rivals in a changing competition environment. This book differs from other studies in that it brings a strategic viewpoint to the concept of sustainable firm performance. It is supposed that managers who read this book will consider, when assessing firm performance, the strategic significance of the factors of creating knowledge in organizations, managing knowledge in a competitive environment, managing environmental uncertainty, generating organizational intelligence, producing organizational knowledge, and managing the supply chain.

2

Sustainable Firm Performance:
Key Factors of Success

Performance is a multidimensional concept defining the success of a business, in other words, the level of achieving the objectives of a business. The short-term goals of firms are improving efficiency, reducing the level of inventories, and shortening the rate of turnover; their long-term objective is increasing their market share and profitability.

To be able to make a comparison between organizations and to assess their behaviors over time, financial measurements and market measurement criteria are used as instruments. When performance dimensions are mentioned in relation to operations, the first concepts that come to mind are sales and firm size. Then, the factors of effectiveness and efficiency are added to these two dimensions. In fact, Daft argues that performance is composed of two important dimensions in an effort to attract attention to effectiveness and efficiency. Effectiveness is the degree of achieving the set goals of a firm. Efficiency is the ability of a firm to produce the desired outputs with minimum resources (raw materials, money, human resources). Looking at it in terms of efficiency and effectiveness, firm performance can be defined as achieving firm goals in an efficient and effective way.

The definition of management is actually the attainment of organizational goals in an efficient and effective way. This overlaps the definition of performance. In industrialized countries dominated by complex technologies, organizations are social systems that bring together knowledge, people and raw materials to perform a task. If such social systems are structured for the purpose of profit, they are called firms. Looking from the viewpoint of this definition, the responsibility of a manager is to coordinate the resources owned by the company towards materializing company goals in an efficient and effective way (L. R. Daft, *Management*, 4th edition, Fort Worth: Dryden Press, 1997: 13-14).

To measure firm performance, return on investment (ROI), market share, profit margin of sales, growth rate of ROI, increase in sales, growth

in market share, and competitive position are used as measurement criteria in the literature. It can be said that in the 2000s new dimensions such as utilization of inputs, quality, innovation, and quality of working life have been added to these factors and the scope of concept of performance has broadened. Today, the dimensions of employee behavior, market share, product or market leadership, and public responsibility have been added to this classification (Koçoğlu, 2010).

Firm performance also represents the responsibilities of the organization towards its stakeholders. If a company achieves its profit target in an effective and efficient way, this, at the same time, will mean that it has fulfilled its duty to its stakeholders. However, measuring firm performance in terms of profit and cost is a very narrow perspective, because the most important components in having a competitive advantage against an organization's rivals are not only sales and firm size. When firm performance is evaluated considering sales, firm size, efficiency, and effectiveness, it is then expressed in full meaning. Thus, thinking of the dimensions of firm performance all together, they include sales, firm size, efficiency, and effectiveness.

Alongside these dimensions that are used to measure the numeric value of firm performance, there are also key factors that will influence the shape, direction, and size of the intended performance. Such key factors focus on knowledge and knowledge management, which are the most significant requirements of the current information age. Concentrating on these factors will enable firms to achieve their long-term sustainable performance rather than their short-term performance.

Considering the added value provided by factors such as labor, capital, and nature, which are among the classical production factors, to a firm in today's excessive competitive environment, the importance of these factors gradually decreases. While the role of labor in creating added value in the sectors where information technologies are used extensively diminish in time, surprisingly enough capital also remains insignificant compared to the value created. For example, the world famous social networking giant Facebook, which reached approximately 200 billion dollars of company worth, had a relatively low initial capital. The share of labor in this value also remains quite low when compared with other sectors. Given these examples, the classical production factors have lost their effect in time and totally new production factors have been introduced in the new eco-social system. These are entrepreneurship and knowledge. Today, knowledge is the production factor that creates the largest added value. Therefore, the

concept of knowledge management has become the most important component in determining firm performance.

Although the decreased importance of labor for firms in this new economic model will trigger unemployment globally and promise a gloomy future, since effective use of knowledge management systems in all sectors will increase efficiency at a global level, it will lower costs by invigorating global commerce and create a prosperity environment. Serious problems are being experienced in some countries in labor-intensive sectors with low added value such as agriculture. This then turns out to be a factor triggering inflation in those countries. Yet, when the knowledge of manufacturing technology (know-how) is introduced in the production processes in labor intensive sectors, efficient outcomes will be obtained and thus no loss of production will be experienced in those sectors. However, some problems arising from human resources may occur at this point. The executives of the new economic model have developed a different solution for this problem as well. It is a fact that 1,500 to 2,000 new lines of business are created every year in the developed countries that influence world economics. Given this reality, human resources are employed in the most appropriate fields in the countries having firms that target efficiency and

Figure 2.1. Key Factors in Sustainable Firm Performance

effectiveness in their production processes. Therefore, it is extremely important for firms to generate, acquire and manage knowledge to achieve sustainable performance in a competitive environment.

The key factors of sustainable firm performance can be enumerated as creating knowledge in organizations, managing knowledge in a competitive environment, managing environmental uncertainty, generating organizational intelligence, producing organizational knowledge, and managing the supply chain. The next section will include a discussion of the definitions of these factors and their vital significance for sustainable firm performance.

Sustainable firm performance is among the problems firms have to face most frequently in today's competitive environment. Factors such as daily changing consumer needs, geographic relocation of labor, and efforts to develop new products, and markets do not allow standardization of the world trade. In an environment of competition where a product that is marketed in Europe is managed from America and manufactured in Africa, it is very difficult to reconcile the rivals, customers, and markets. It can be seen how impossible it is to implement concepts such as estimation, foresight, and forecasting in such an environment. It is extremely difficult for firms keep long-term competition because knowing or understanding rivals and predicting customer demands change momentarily.

Creation of a competitive advantage in a business environment where competition is so ruthless can only be possible through the inclusion of a set of proprietary knowledge in the production process, which cannot be imitated nor easily put into practice. Firms that include inimitable knowledge in their production processes will be in a dominant position in the market with the unique products they offer to their customers as they will not be imitated by their rivals easily. The commercial relationships the companies called Asian Tigers established with developed countries and primarily with America and Japan at the beginning of the 2000s are extremely remarkable. These countries, which tried to survive in the market in those years by restructuring their production processes through imitating the technologies of developed countries, had foreign trade surplus against the developed countries whose technologies they imitated in a period as short as ten years as a result of their insistence on imitation and partly with the help of their ability to inspire. This example shows that firms can be easily imitated by their rivals in the market unless they employ their original and unique knowledge in their production processes.

Knowledge generation and management will be the leading determinants of sustainable firm performance in both managerial and production-related areas, from production processes to business conduct and from marketing strategies to human resources management.

The key factors of sustainable firm performance explained in this book are creating knowledge in organizations, managing knowledge in a competitive environment, managing environmental uncertainty, generating organizational intelligence, producing organizational knowledge, and managing the supply chain.

3

First Factor:
Creating Knowledge in Organizations

In recent years, managing knowledge has become a critical matter of debate in the business literature. Both businesses and academia believe that for an organization to maintain its competitive advantages in the long run, it can only be possible through effective use of knowledge. As mentioned by many authors, while soil, labor, and capital are the main factors of production in traditional economies, knowledge has become the primary factor of production and management providing advantage in competition in knowledge-based economies.

As knowledge has become a major weapon for competition in environments where increased market competition, the global economy, and fast technological transformation are being experienced, many theorists and practitioners have turned their attention to studying how organizational knowledge can be used in the most effective way (Akgün and Keskin, 2003: 175-188).

The process of creating knowledge is an extremely strategic process in firms. The selection of the sources from which knowledge will be derived, whether such knowledge will be useful for the firm, and the utilization of such knowledge in the firm are the major decisions to be made by the top management. The firms going through a knowledge creation

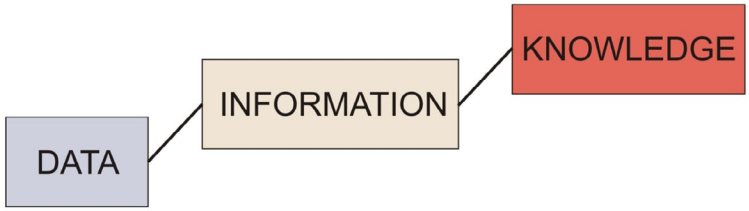

Figure 3.1. Relationship between Data, Information, and Knowledge (Akgün and Keskin, 2003: 175-188)

process should have their perception open in a competitive environment. The knowledge obtained from internal and external sources is expected to have a positive effect on the firm's competitiveness. In order to have a better understanding of the knowledge creation process in organizations, it will be useful to explain the definition and dimensions of knowledge.

3.1. Definition of Knowledge

The definition of knowledge dates centuries back, to the ancient Greek history. Knowledge can be defined as "a combination of organized ideas, rules, procedures and information." Knowledge was defined as "verified true beliefs" by classical epistemologists. Knowledge in a sense is "a meaning created by human brain." Knowledge and information certainly do not have the same meaning. In general terms, data is unprocessed (raw) bits of information, information is an organized set of data, and knowledge is an understandable grouping of information. While knowledge is organized, information is not organized. Data and information are the forms transferred or received from outside the brain and recorded within the brain. Knowledge, on the other hand, exists only in the brains of humans personally (Akgün and Keskin, 2003: 175-188).

Information reaches the human brain through sensors, transformed there into new information using previous information by information processors and then stored in the memory. By way of processing information, new and more information is obtained and processed, forming and generating further information to be used in the future.

In the competitive scene of the 21st century, the results of some studies have shown that maybe the most important of the factors affecting

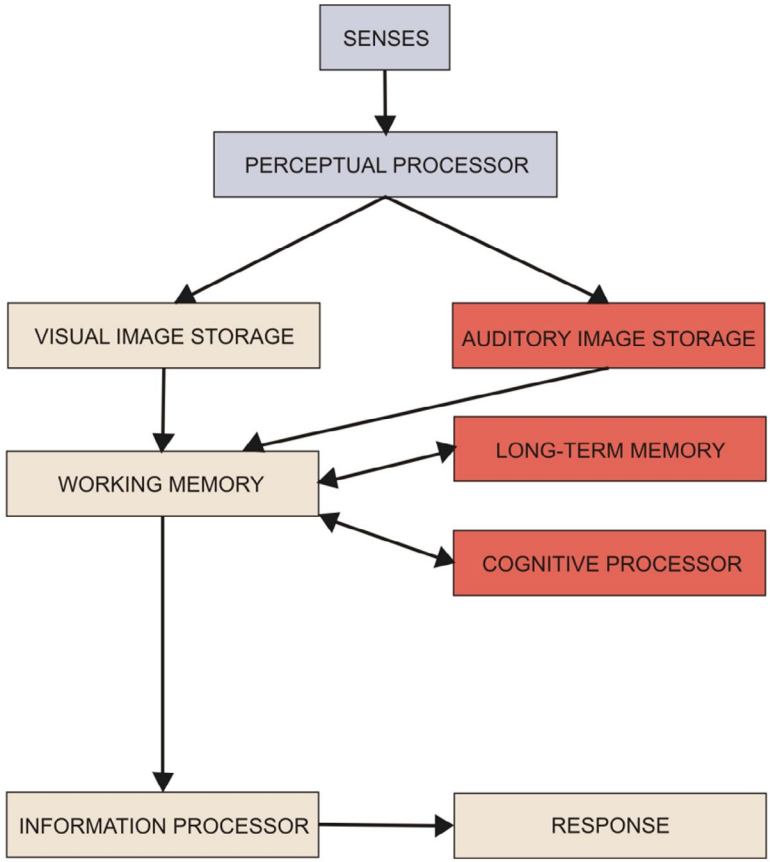

Figure 3.2. Process of Information Acquisition and Generation in the Human Brain

the performance of firms are globalization, technological superiority, and knowledge. These three factors both dependent and independent affects on the shape of the competitive scene. For example, it has been proven that knowledge and technology are highly interrelated with each other in the biotechnology industry.

No one can deny that knowledge is created by individuals in a business. However, it is also known that creation of knowledge is not limited to the efforts of an individual alone. Modern management science describes an organization as a knowledge network formed by individuals and groups.

In this context, individuals who interact with each other create organizational knowledge and at the same time such organizational knowledge enables individuals to acquire and create new knowledge. Therefore, management of organizational knowledge becomes a social issue rather than a focus on individuals, and knowledge becomes a sea of knoweldge of individuals or social knowledge. Social knowledge is the data and information obtained as a result of the interactions of humans in social and organizational spheres. Social knowledge includes the content of human cognition and the activities tying together human and environmental activities (Akgün and Keskin, 2003: 175-188).

3.2. Dimensions of Knowledge

There are various types of knowledge. The first distinction among them appears as tacit and explicit knowledge. Polanyi (1958-1967), who is known by management scientists, originally developed this important distinction among knowledge varieties. This distinction between tacit and explicit knowledge can be thought as the difference between experience-based knowledge (example for tacit) and openly known knowledge (example for explicit) (Polanyi, 1958: 120-121).

3.2.1. Tacit Knowledge

In tacit knowledge, learning, and experience are collected and it is generally known as "learning by practice." Being understood without being said refers to an individual's knowing more than what they say. Tacit knowledge requires loyalty, interest, and connection and has a "personal" quality. As stated by Polanyi (1958), "the goal of a skillful performance is the fulfillment of a set of unknown rules by an individual who is a member of an organization." For this reason, it is difficult to link tacit knowledge to a system, explain it, or describe it. When approaching the matter scientifically, the best definition of tacit knowledge would be "knowledge which has not been disclosed yet." Moreover, the terms used to explain the tacit aspect of knowledge include:

- "Know-How"
- "Subjective Knowledge"
- "Personal Knowledge"
- "Procedural Knowledge"

3.2.2. Explicit Knowledge

Contrary to tacit knowledge, explicit knowledge can be formulized, explained, and linked to a system. While explicit knowledge is explained by communication, tacit knowledge is explained by practice. The concepts related to explicit knowledge include:

- "Know-what"
- "Objective knowledge"
- "Educational knowledge"
- "Explanatory knowledge"

The dimensions of knowledge as classified here help understand the relationship between the technological knowledge, which is a special type of knowledge, and the value creating competencies of firms towards competition in an impermanent and dynamic competitive scenery (Hitt et al., 2000: 233-234).

3.2.3. Technological Knowledge

As a systematic body of knowledge, technological knowledge can be:

- Individual explicit (individual skills that belong to a special technology and can be linked to a system)
- Individual tacit (individual skills that belong to a special technology)
- Collective explicit (standard business procedures)
- Collective tacit (organizational culture and routines taking technology into consideration)

All of these technological knowledge dimensions can be a competitive advantage and source of value creation. However, the dimensions involving tacit knowledge are of the greatest potential for firm value and creation of competitive advantage. When looked at from a resource-based point of view, tacit technological knowledge may provide a continuous competitive advantage, because it is not only difficult to explain technological knowledge and link it to a system, it is also difficult to imitate it. Since tacit technological knowledge relates to special situations, those other than private firms may find this knowledge difficult to use and understand. Technolog-

ical knowledge, which is not only tacit but is also owned by collective organizations, may increase the difficulty for rivals to imitate it. For example, the success of Southeast Airlines is partly linked to its unique culture. This culture represents the knowledge that relates to the tacit experiences and collective acceptance inherent in the organization's social activities.

Spender (1996) mentioned the competitive importance of collective knowledge and argued that collective knowledge is the most secure and strategically significant type of organizational knowledge. For this reason, collective tacit technological knowledge is an important source of value creation and competitive advantage. As mentioned before, knowledge is a critical outcome of collective and personal learning. Bearing in mind the debates, learning and knowledge are the two intrinsic parts of competition (Spender, 1996: 45-62).

3.3. Creation of Knowledge in Organizations

Formatting the knowledge in a way to create a commercial value and implementing them towards organizational objectives is as important as generation of knowledge in organizations. In this context, generation of knowledge alone will not be sufficient; giving initiative and freedom to people in implementing such knowledge will play a key role for success. This is because in many business ideas that involve innovation there are considerable differences between the initial idea and the resulting product. For this reason, the teams that materialize the innovation should at the same time be held responsible for the implementation and commercialization of it and be allowed to act freely at all stages providing that they do not divert from the organizational objectives.

The cooperation between the teams and cooperation with the company's stakeholders are as important as the cooperation between the team members in generating new ideas in an organization. Particularly including the customers and suppliers in the new idea generation process is extremely important for the success and diffusion of that idea.

Since origination of innovations within the firm will create the value most suitable to the firm's structure, it will produce much more successful outcomes than innovations to be adapted to the firm from outside. Therefore, formation of an organizational culture supportive of innovation and change within the firm will result in much more efficient outcomes in the long run. An innovative value chain consists of three integrated phases:

1 Idea Generation
2 Idea Transformation
3 Idea Diffusion

3.3.1. Idea Generation

Idea generation in firms can be discussed under three headings. These are In-Company Idea Generation, Cross-Interaction, and External Interaction.

- **In-Company Idea Generation:** This means that company works to include supporting of new ideas and allocation of resources to these ideas.
- **Cross-Interaction:** This involves obtaining contributions of external stakeholders such as customers and suppliers to the ideas generated by the company employees and creating new ideas as a result of such collaboration.
- **External Interaction:** This relates to evaluation of company processes from an independent perspective and adaptation of totally external ideas to the company structure.

Each of these processes is important by itself and execution of only one of them is not adequate for forming an innovative organizational structure. For example, in-company idea generation alone will fall short of seeing the whole picture. Similarly, external interaction by itself will again be inadequate as it may not conform to the company structure. Hence, concurrent implementation of all these three processes will produce the most efficient results.

3.3.2. Transformation

The transformation process can be discussed under two headings. These are selection and development.

- **Selection:** Selection is deciding on which of the ideas developed in an organization will be executed. It can be said that this decision-making process is an extremely critical one, even the most important stage of an innovation process. It is not as easy as thought to decide in this decision making process on which of the innovative

ideas existing in the interest areas of the various policy structures in the company will be selected. Rejection of some radical innovative ideas that can be very beneficial to the company solely due to policy reasons is not so uncommon. Materialization of such ideas that can be really effective is only possible with the absolute support of the top management. So, formation of management teams from various departments during the selection processes will disrupt the implementation of ideas because each manager in such teams will evaluate the new ideas from his point of view. For this reason, selection processes are executed by the top management.

- **Development:** At the stage of idea development, the task of developing the idea should be assigned to the persons or groups who first suggested the idea. At this stage, the support from the top management and necessary resources should be made available to the team that will develop the idea. Considering that the original idea may go in very different directions during the development of the idea, the developing teams should be given the necessary freedom and supported by the top management at every stage because some policy areas within the company may be involved in the process.

3.3.3. Diffusion

This stage involves the implementation of the developed idea in the company. Since serious resistance may be experienced at this stage, commited support by top management is needed here as at the previous stage. Otherwise, the business ideas which arise and are developed as a result of extensive efforts will be lost in vain without materializing.

4

Second Factor:
Managing Knowledge in a Competitive Environment

Companies in search of sustainable competition have started to realize that technology alone is not sufficient. Today, what makes competition sustainable is knowledge. Knowledge has become one of the most significant production factors and managing knowledge has come to a point of vital importance for firms. Management of knowledge is the processing and managing knowledge in its simplest terms. The limits of the concept of management of knowledge can be broadened to cover the creation of business value and the management of organizational knowledge that will lead to a competitive advantage (Tiwana, 2003: 9-18).

4.1. Theoretical Origin of Managing Knowledge

The theoretical origin of managing knowledge has been linked to the emergence of knowledge-based organization theories and intellectual cap-

ital management. Rather than focusing on cause and effect, the organization theories have started to focus on situations defined as resources and "organizational advantage." As a result of this, researchers see it an organizational advantage to gain the characteristics of a knowledge creating and sharing organization. The possession of different qualifications by an organization from those of its competitors depends on its special resources, assets, and skills. The attention of organization managers is concentrated on the optimum utilization of the qualifications owned to acquire competitive advantage and economic wealth.

According to knowledge-based organization theory, one of the postmodern organization theories, knowledge is the only resource that provides a continuous competitive advantage. Therefore, all the attention of an organization should focus on knowledge and competitive qualification should be derived from knowledge. Organizations are approached as knowledge-based entities. The role of an organization is neither the acquisition of organizational knowledge nor the creation of it. This is the role and priority of individuals. Knowledge shapes in the brains of individuals. Organizations consolidate individual knowledge by providing structural regulation of the coordination and cooperation of their information workers.

Management of knowledge is seen as part of "intellectual capital," which is a very broad concept. Management of knowledge is the management of "intellectual capital" under the control of the organization. Intellectual capital is the knowledge, experience, organizational technology, customer relations, and professional qualification owned by organizations that enable them to have competitive advantage in the marketplace. Many organizations including Dow Chemicals have preferred to denominate their capital as individual, organizational and customer capital. Intellectual capital is a strategic concept. The focus is on generation and use of knowledge within a strategy and knowledge and success or value creation.

4.1.1. From Managing Knowledge to Supporting Knowledge

Since the 1990s, management of knowledge has been a matter that has always remained on the agenda. Researchers who have been working on organizations in recent years have advised today's companies to see generation of knowledge as a source of competitive advantage, to focus on the needs of information workers (the increasingly growing group of engineers, scientists, medical doctors, authors, computer programmers, and

other creative professionals) and to form a learning environment to meet the requirements of the post-industrial knowledge economy (Krogh et al., 2002: 13). The importance of knowledge and learning for both managers and employees has been recognized in all current management approaches. With the formation of organizational memory as a result of collection, distribution, storage, and diffusion of knowledge in organizations, the use of such knowledge in the generation of new knowledge and employment of it in decision mechanisms at a strategic level can take place in a much more efficient way owing to today's information systems.

The ability of an organization to learn is directly associated with its organizational culture. Creation of an organizational culture that supports learning requires top management to implement correct strategies, because it takes long to establish an organizational culture in firms.

4.1.2. Importance of Managing Knowledge

Organizations have to manage knowledge for various reasons. Effective management of knowledge enables providing better customer services by organizations. There are three major forces that make management of knowledge important for businesses and that come together to absorb management of knowledge. They are the increasing superiority of knowledge on the basis of organizational effectiveness, deficiencies of financial models in showing the dynamics of knowledge, and the deficiencies of information technology alone in achieving the real success in an organization.

According to the results of a case study, businesses that successfully established their management of knowledge (Andersen and Ernst & Young Consultancy Company) have attained a growth rate of 20% in recent years. The Ernst & Young Consultancy Company has increased its countrywide consultancy income from 1.5 trillion dollars in 1995 to 2.7 trillion dollars. As shown by the results obtained from that study, managing the asset of knowledge has generally resulted in considerable increases in the balance sheets of businesses as in the case of patents, trademarks, and licenses.

Organizations have become aware of an asset that occupied a large space and was rapidly spreading within them, namely, their "asset of knowledge." The success of organizations in the increasingly competitive market environment of the 1990s depended on the quality of their knowledge. Organizations use such knowledge in their important processes. When studies on this subject are reviewed, it can be seen that there are many views

agreeing that knowledge is a component businesses should focus on. For example, concepts such as soil, labor, and capital that were seen as the source of wealth previously are replaced today by concepts such as technology, innovation, science, know-how, and creativity, which collectively mean knowledge. Knowledge is certainly the best resource and a continuous competitive advantage.

4.1.3. Process of Managing Knowledge

Considering management of knowledge as a social concept is stressed more by the academicians who work on organizational culture and in-organization communication in the social psychology and management literature. Studies on the management of organizational knowledge have been presented more systematically by Berger and Luckmann (1967), Gurvitch (1971), and Holzner and Marx (1979). The sociology of knowledge, which is presented by these authors as an analysis at a social level involves five interdependent processes. These processes are:

- Acquisition
- Storage
- Dissemination
- Interpretation
- Implementation of Knowledge

These five processes are the most fundamental parts of an effective learning process in a social network and are like the rings of a chain. In case any of these rings is missing, effective management of knowledge cannot be considered. These five phases in the management of knowledge constitute the engine of organizational learning (Akgün and Keskin, 2003: 175-188).

4.1.3.1. Knowledge Acquisition

Knowledge acquisition is a critical element of organizational learning and knowledge management. Knowledge acquisition involves environmental (internal and external) studies and the transfer of information on environmental changes. Organizations learn more things by way of knowledge acquisition and this helps them implement successful strategies and develop technology.

Researchers divide knowledge acquisition into two groups as internal and external knowledge acquisition (Akgün and Keskin, 2003: 175-188). External knowledge acquisition includes participation in conferences, use of consultants, monitoring of economic, social and technological trends, systematic monitoring of customers and competitors, enabling new members and new organizations to join the organization and cooperation, and joint ventures with other firms. For example, examination of the new products developed by competitor firms and their advertisements for new products and technology may provide another business new ideas. The feedback obtained from customers helps the business acquire new knowledge. Organizations progress in internal knowledge acquisition through understanding of the existing technology and those who developed it, learning from experience, experiments, continuous process improvement, and a critical approach (Huber, 1991: 88-103).

Experience and learning involve the successes and failures experienced by an organization. Organizations acquire knowledge by evaluating their past successes and failures and use this knowledge to make future improvements. The experiments include research and development, pilot projects, and intrapreneurship activities. In this way, original innovations are launched and new processes are invented for the organization to better perform its tasks. Continuous improvement of processes is made possible through process improvement teams. Moreover, feedback on evolutionary changes plays an important role in applications that follow from continual improvement. For example, critical approach dialogs involve questioning of organizational assumptions and norms (Akgün and Keskin, 2003: 175-188). It is also very important for internal knowledge acquisition to encourage firm employees to generate new ideas showing a certain tolerance to their errors and, in this way, to leave a free zone for the employees where they can develop new ideas. Distribution of organizational resources in a way to support intrapreneur individuals and to allocate time for such individuals to use freely during working hours is important for supporting intrapreneurship. One of the major obstacles before intrapreneurship is the rule of fear culture in an organization, because intrapreneurship basically relates to sharing and implementation of free thoughts.

4.1.3.2. Knowledge Storage

The knowledge acquired as a result of knowledge generation processes should ultimately be stored. Without storage, there is no room for "mem-

ory" or "implementation." Organizational memory becomes a priority in this context. One of the most important factors in internal knowledge acquisition is organizational memory. The function of organizational memory is to demonstrate the conveyance of information stored throughout the development of an organization to the present time and future. If there is no organizational memory, learning does not occur in its full sense due to workforce turnover and passing time. Organizational memory is particularly significant in this age when businesses rely on restructuring and temporary or contracted workers. However, if organizational memory does not change with changing industrial conditions, it can limit productive learning or even promote ineffective learning (Akgün and Keskin, 2003: 175-188).

With the development of information technologies today, organizations are able to store very large amounts of knowledge. The operational information systems remain inadequate to process such large amounts of knowledge and to be able to use them when necessary. Advanced knowledge management systems are needed to process this huge knowledge and to render it useful. Such knowledge systems are high level software that can be used for supporting of decisions at a strategic level.

4.1.3.3. Knowledge Dissemination

Dissemination of knowledge is defined as a process of sharing information obtained from various sources. Knowledge dissemination is the delivery of knowledge where it must be when needed in organizations. Before knowledge is used at an organizational level, it needs to be distributed and shared within the organization. Knowledge dissemination is divided into two as formal and informal dissemination. Formal dissemination of knowledge involves individual written communication, training, internal conferences, briefings, and internal publications. Individual written communications include short notes, reports, letters, and publically open announcement boards. Training involves participation in courses and on-the-job trainings by utilizing internal consultants. Informal dissemination of knowledge includes job rotations, stories and myths, duty imposition, and informal networks.

Knowledge dissemination is one of the most important and critical processes within the process of managing knowledge. However, it is not easy to disseminate and share knowledge. The success of a firm in disseminating knowledge depends on the organizational culture and the amount of open knowledge available in the firm. An organization relying on tradi-

tional control and authorization relationships may find it difficult to disseminate knowledge. Because management which is based on inspections and orders does not usually allow formation of social units that are necessary to transform personal knowledge into organizational knowledge nor gathering of these groups together (Akgün and Keskin, 2003: 175-188).

4.1.3.4. Knowledge Interpretation

Knowledge interpretation is the processing of disseminated information. One or, more frequently, more than one interpretations are given to the disseminated information. Daft and Weick (1984) defined knowledge interpretation as a conversion to meaning from acquisition of information. It is also defined as the process of improving conceptual schemas and shared meanings as well as interpretation of events. These definitions stress that if all organizational units develop a common interpretation about a piece of information, more organizational learning occurs and knowledge is managed in an effective way (Akgün and Keskin, 2003: 175-188).

4.1.3.5. Knowledge Implementation

Knowledge implementation refers to the use of knowledge to solve the problems arising during new product development processes, transfer of technology, and marketing and management activities. Pentland (1995) stated that if knowledge is not implemented in practice, continuous improvement as a characteristic of learning would not be possible. For example, Low and Mohr (2001) pointed out that when knowledge relating to the market is gathered, one should be able to apply it to market strategy decisions directly. As an organization uses its own resources, the available knowledge is repackaged in a new context; the internal measurement standards can be raised, the creativity and motivation of employees can be increased, and the knowledge can be made more active and relevant for the firm.

Knowledge management process is an important part of the organizational learning that occurs as a result of social interactions in an organization. These social interactions combine individual and organizational knowledge, and take the organizational knowledge to an upper level. However, organizations can ensure an advanced level of learning and effective knowledge management only by using their knowledge processes in a complete and interactive way. As seen in Figure 4.1, the knowledge management process forms a closed cycle with each process affecting the others. Figure 4.1 shows only a simplified version of this process.

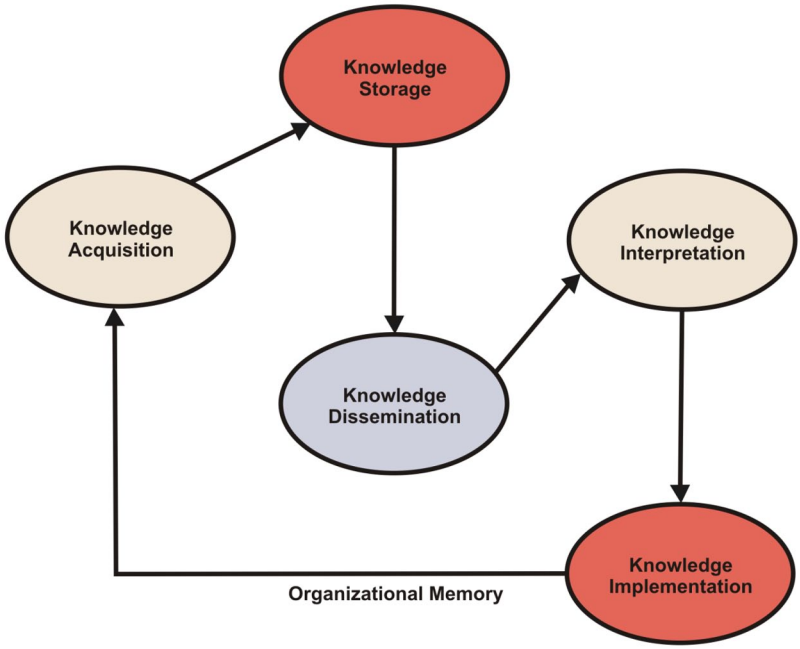

Figure 4.1. Organizational Knowledge Management Process (Akgün and Keskin, 2003)

As a result of knowledge implementation, the organization records in its memory what it has learned. These recorded results will affect knowledge acquisition and other activities of the organization at future stages. This memory is naturally distributed among both the structural and human resources of the organization. When the social aspect of knowledge is taken into consideration, the organizational memory distributed among people will be of vital importance for the management of organizational knowledge. The knowledge exchange among people creates such a memory in an organization or group that this transactive memory becomes like an adhesive binding the knowledge management processes to each other.

Having said all this about knowledge management, the effects of these processes on the ultimate objectives of companies necessitate a pragmatic discussion considered with respect to a manager. However, the positive effects of theoretical knowledge management on the company's performance are uncertain in practical terms. The main reasons for this are political and

personal interests in the organization, cultural structure, and deficient implementation of knowledge processes. The effect of effective knowledge management on company performance takes place more through various mediators. These are organizational learning, organizational change, organizational creativity, and organizational innovation (Akgün and Keskin, 2003: 175-188).

4.2. Benefits of Knowledge Management

In 1986, the Information Strategy Line published research on knowledge management in Europe. Seventy-eight percent of the businesses that participated in the research defined knowledge management as "a combination of processes to manage the use, dissemination, and creation of knowledge in order to achieve organizational objectives." For "why knowledge management? – a question asked in the research – the choice "gaining competitive advantage" was preferred from among all the options listed in the context of contribution to organizational objectives (Türk, 2003: 144-146). Therefore, knowledge management seems to be an extremely important factor in creating competitive advantage.

4.3. Increasing Returns of Knowledge Management

Knowledge has an economy enabling the management of the whole world. In Tiwana (2003), Peter Drucker explains this by giving an example of a book: "When you give or sell a book (a physical asset) to somebody, you lose it. You cannot sell it once more." By contrast, the same knowledge can be sold again and again. Thus, the economists define it as increasing returns. The more one uses it, the more it benefits the person and it creates for this reason a cycle building on itself. Knowledge is the only variable that explains the reason for the broadening gap between the market value and raison d'être of a successful company. The permanence and durability of a knowledge-based competitive advantage depends on the fact that a firm knows more than its competitors. The reason for this is that no matter how much investment competitors make in this area to catch up with other competitors, it prevents them from acquiring the same knowledge because it creates a time limitation. Besides knowledge, another source of competitive advantage is the effective use of time. Knowledge management enables organizations to create a unique collection of knowledge which they can integrate, so that the time-based advantage created results in an unrivaled economic

and market value in return for competition. Firms such as Microsoft, SAP, and Nintendo are examples in this category (Tiwana, 2003: 68-69).

4.4. Effects and Outcomes of Knowledge Management

Organizations have gained returns way beyond their expectations due to their knowledge management practices, that is, their attempts towards systematic and collective creation, sharing, and use of knowledge. There are many, various sources explaining the success stories of these organizations. To make a correct evaluation, though, alongside the knowledge management-related attempts of the organizations that succeeded beyond their expectations, their internal and external circumstances in that period should also be taken into consideration. Successful organizations and the nature of their successes that are linked to knowledge management are shown as a list in the brief Table 4.1, below.

Table 4.1. Examples of Knowledge Management in Successful Organizations

The leading large firms of the information technologies sector, Microsoft, Intel, Compaq, Dell, and Cisco, increased their 12 billion dollar market value to 588 billion dollars in a period of 10 years between 1987 and 1997. This means an approximately fifty-fold growth in a period of ten years.
General Electric (GE), which concluded its one billion dollar purchases through the internet in 1997, has increased this amount to five billion dollars through 2000. The savings gained in purchases in these three years are estimated to be close to 500 million dollars.
With the APS-Advance Planning System that IBM started to implement in 1996, it realized an increase of 40% in its inventory turnover and an increase of 30% in its sales volume within the first year. Improvement of its inventory management brought 500 million dollars of savings in its investment and operating expenses.
Chase Manhattan Bank succeeded to have an 11 million dollar increase in its revenues and considerable decreases in its costs in a period of 18 months.
Fireman's Fund Insurance has realized 33% growth in two years of time without hiring more personnel.
Shell Chemicals states that their return on investment in knowledge management is 10 to 1.
Unilever has dropped the 57-week period that is needed for their new soap plants to start production to seven weeks owing to the effective know-how applications they developed. The company gained considerable savings on its costs by, so to speak, re-learning and re-implementing the knowledge it already owned (Barutçugil, 2002: 51-52).

5

Third Factor:
Managing Global Environmental Uncertainty

by Okşan Kibritci Artar

The conditions of competition outside firms and countries constantly show variances for firms, countries, and people in the global ecosystem. There is great uncertainty as to how this variability will materialize. Uncertainty means risk for firms and countries. Today, firms and countries attempt to manage their risks and thereby their losses by managing uncertainty. In this context, the purpose of this study is to explore the sources of uncertainty for both businesses and countries and to set forth strategies to cope with uncertainty, which are necessary for decision makers to make healthier decisions.

Environmental uncertainty is an external force that has an impact on firm performance. In today's competitive environment, markets have started to be more international, dynamic, and customer-oriented, and customer demands have become more changeable, seeking better quality, and requiring higher reliance and faster delivery (Thomas and Griffin, 1996). Product lifecycles become shorter and shorter and technological developments advance in a more speedy way. To respond to this uncertain environment, organizations need to increase their external resource utilization

rates and customer-supplier partnerships (Krause et al., 1998). Gupta and Wilemon have stated that perceived environmental uncertainty originates from four factors, namely, increased global competition, development of new technologies that rapidly outdate the existing products, changing customer demand needs, and requirements that shorten the product lifecycle, and increased need for participation of external entities such as suppliers and customers. There are studies arguing that perceived environmental uncertainty arises from unexpected changes in suppliers and technology.

In this chapter, environmental uncertainty will be explained under six subdomains. These include the economic environment, technology and innovation, customers and the social environment, the political environment, competitors and market conditions, and changing competition conditions, as shown in Figure 5.1.

5.1. Uncertainty Originating from the Economic Environment

Increased economic opportunities due to the global integration of the world economy involve at the same time uncertainties and risks for businesses and consumers. Especially exchange rates and interests that show excessive volatility due to global financial and economic crises leave businesses and countries in an economically difficult situation so much so that businesses which cannot anticipate in time the risks arising from uncertainties are dragged to bankruptcies.

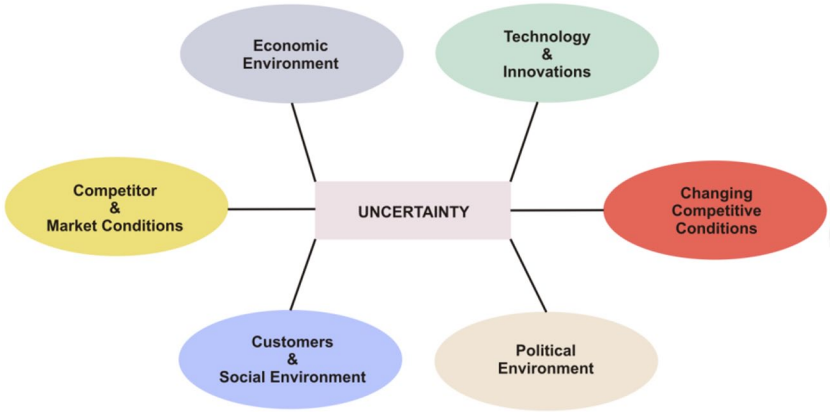

Figure 5.1. Dimensions of Environmental Uncertainty

It is known in economic theory that the uncertainties and risks in the real world as emphasized especially by Keynes after the Great Depression of 1929 impaired the economic expectations of economic entities and resulted in major economic problems (Knight, 1921; Kaminsky and Reinhart, 1996, 1999). It is also revealed in the classification of crises in international economics theory that uncertainty and impaired expectations feed crises. Today, global financial capital flows create great uncertainty and risk and move in a way to cause major problems in exchange rates, interest rates, and public and private sector domestic and foreign debt structures anytime in a country. For the above reasons, it is of utmost importance for businesses and countries to foresee the uncertainty and risks arising from the economic environment in time and take measures accordingly.

5.2. Uncertainty Arising from Technology and Innovations

In our time, the changes and developments in the areas of science-technology and innovation are very fast and multidimensional. Therefore, it is extremely important for businesses and countries to direct the changes in the areas of science-technology and innovation in order to increase and maintain their global competitive power. For businesses and countries to advance in the areas of science-technology and innovation, they need to conduct extensive and quality R & D and allocate resources to quality human capital. However, despite extensive R & D and resource allocation, there is always the uncertainty and risk of not gaining any added value. The effect of current environmental conditions on the process of developing new products has been investigated in depth particularly in the R & D literature (Drucker, 1994).

While some studies state that environmental and technological conditions are important, these variables are not accepted as effective factors of new product success (Brown and Eisenhardt, 1995: 343). Yet, it is meaningful that the degree of uncertainty and, particularly, technological impermanence and market uncertainty affect project success. For example, the telephone firms of our time are seriously challenged by the software revolution that enables telephone conversations through the internet, which eliminates high telephone fees. Such rapidly changing technology may cause a large-volume product to become outdated technologically overnight. Likewise, market uncertainty can be multidimensional. This may be

due to the degree of competition associated with a development project, changes in the market structure, or the unpredictable or variable nature of the market. Despite the risk and uncertainty related to new products, the rates of lack of success are surprisingly low when looking at the historical development of innovative firms. Product development is affected by uncertain and changeable conditions. Both market and technology factors moderate the relationship between process implementation and project performance. As a result of this, the management of a product development project may require different strategies (Bstieler and Gross, 2003: 147). According to Christensen (1997a), when innovative firms are interested in new products in highly uncertain markets, they should follow a different approach (Christensen, 1997a: 151). Researchers also focused on particularly three important R & D success elements in their studies on this matter:

- Quality of the preliminary development phase
- Degree of process reduction
- Management of the research process in the project team

They stated that each of these three elements may be affected by external project uncertainty and may require a flexible adaptation in organizing and planning of activities. It was found as a result of this study that process reduction under the conditions of high market and technology uncertainty can increase time efficiency and product profitability (Bstieler and Gross, 2003: 147). The extent of market uncertainty and technical impermanence affects the magnitude of project uncertainty. Accordingly, the environmental uncertainty that occurs in technologies and markets may impact project performance. For example, Rumelt (1991) and Powell (1996) explored the members and characteristics of the industry and found between 17% and 20% success as declared by the industry. Still, the moderating effects of environmental factors on success indicators have been rarely expressed due to the difference between the external environment and project success (Rumelt, 1991: 167; and Powell, 1996: 323). In another study, Cooper and Kleinschmidt (1993) found that there was no relationship between market competitiveness and product success (Cooper, 1993: 146). Montoya-Weiss and Calantone (1994) stated that a factor like market uncertainty cannot be a critical success indicator as other indicators. They argued that environmental factors would not have a strong impact on success and for this reason environmental

conditions were usually insignificant. Even so, they warned that further investigation of the effect of environmental factors on success could be more clarifying (Montoya-Weiss and Calantone, 1994: 397). By contrast, Brown and Eisenhardt (1995) pointed out that the effect of market reality on business success had generally been neglected and market reality did affect development process variables (Brown and Eisenhardt, 1995: 343). In addition to these, Terwiesch (1996) stated that R & D performance and market uncertainty were not independent of each other, but this relationship was affected from the nature of competition in every industry (Terwiesch, 1996: 3).

The environmental conditions surrounding new product projects may basically be different and thus different development approaches may be needed. For example, Calantone et al. (1994) stated that firms tended to adapt themselves to proactive strategies due to their risk taking behaviors under innovation and uncertain environmental conditions and to environmental battles due to their static organizational structures (Calantone et al., 1994: 134). Christensen (1997b) studied a sample case relating to the difficulties faced by firms with stable markets that were interested in the products in developing and unpredictable markets for innovative purposes. This researcher stated that, especially in initial markets where uncertainties prevail, the heuristic-motive learning processes might be more useful than a normal development process (Christensen, 1997b: 60).

As can be understood from the above literature review that R & D activities sit on a foundation of total "uncertainty" by their very nature. R & D is the blurry façade of a business. The reason for this is that the results, budget, and duration of R & D works are indeterminable. The statistics on this matter show that 63% of the new projects initiated have been cancelled without turning into a product, 12% of them have proved to be unsuccessful in the market, and only 25% of them have been able to remain in the market. The stars among these projects cannot even reach one percent. The same studies have concluded that 46% of corporate resources flow to unsuccessful new product projects.

Research and development is carried out in an environment of uncertainties. It is not known whether or not an idea brought up can be turned into a marketable product and, if it can be, how long it will take to realize it within what kind of a budget and, most importantly, how it will perform in the market. The most significant result of the above statistics is that it will not be right to expect success from all R & D works and top

management should approach the results of R & D works with tolerance even if they are unsuccessful.

Despite uncertainty, the beginnings and ends of processes are predictable and measureable and the results foreseeable; thus, efficiency can be achieved with these processes, but R & D projects cannot be managed. As its result is uncertain, unforeseen outcomes may ensue. For this reason, R & D projects can only be conducted with "knowledge management" (Altınay, 2000: 2-3). As in all business activities, the "research and development" function is also in the management and control process. The main difference between R & D and the other management functions is its uncertainty. The most important problem in the management of technological skills and R & D cycles is uncertainty. It affects all the activities of firms, their attempts to mobilize their main technological skills, their efforts to learn internally controlling the interactions between such skills, and the possibility of activating all their useful skills including their external skills (Quélin, 2000: 476-487).

Research and development activities are a great source of uncertainty for firms. Relevant aspects include:

- Opportunity costs to initiate a given research program
- Activation of instruments currently eligible for the task
- Termination calendar

Scientists traditionally classify uncertainty that affects the duration and nature of an R & D cycle under five different categories (Quélin, 2000: 476-487):

1. Market uncertainty
2. Competitive environment
3. Uncertainty on technological evolution
4. Internal R & D process
5. Human resources and culture

Most managers see market uncertainty as a combination of six basic characteristics:

1. Description of customer needs as uncertain and deficient
2. Nature and features of a product can only be understood vaguely
3. There is an inadequate familiarity with market employees

4. The sales force and their commercial capacities are not structured appropriately and not sufficiently comprehensive
5. The distribution network is not completed
6. The value chain is organized in a weak manner

The solution to these problems can sometimes be found through the data obtained by firms from the competitive environment. Yet, such external information does not usually reduce the uncertainty in R & D activities. Speaking in static terms, information does not reflect the real situation sufficiently and for this reason it hardly increases the firm's competency to acquire new markets, new technologies and new departments. The Smart Car (Daimler-Benz), which was intended to be a new concept for city cars, is an example of a new form or new distribution method of an efficient organization, but after all a sufferer of a weak disposition due to its sale price. Nevertheless, firms can improve their competency of predicting product and market trends using their experts, consultants, and even customer panels in this data compilation process and then integrate these into their technological research and development efforts. Moreover, cross-departmental or inter-functional groups may be mobilized within the firm to help define the possible use or function of a special technology, process or product (Quélin, 2000: 476-487).

The traditional analyses of competitive uncertainty show that firms are unaware of the expenses incurred by their competitors for technological development and the innovation policies of their competitors. Uncertainty is also related to the form and quantity of newcomers entering a certain market. Such firms may announce technology-based process changes and create new market segmentation. Establishing good contacts and developing long-term collaborative partnerships with state laboratories, universities, consultants, and research institutes may serve as a solution to this problem. This will enable a firm to closely follow the latest technological developments, research trends, and innovations that gain importance in time.

Firms can also add to their learning processes through their close and regular interactions with their large customers. For example, Air Liquid works closely with its major customers. This working relationship involves new systems, processes, and equipment, which means supporting management of convenience – cost reduction trial – and consumption of industrial gases (Quélin, 2000: 476-487).

The form of uncertainty in technological development is thought to be the major driver in managing R & D cycles and the technological capacities of firms. The main technical and technological uncertainties are suggested to be:

- Deficiency in knowledge as the future aspect of technological development
- Deficiency in quality and power efforts in this area
- Deficiency in required skills and competencies at personal or group level
- Insufficient contacts with firm customers
- Insufficient teams performing present duties (Quélin, 2000: 476-487)

The duration of R & D encounters many uncertainties that stem from the very nature of R & D activity. For example, an R & D project may be very unsuitable for its real position in any market or activity, or the priorities of groups may change during this technological development, or a large number of technical skills may be unnecessary. In Quélin's research, companies reacted to these type of events by focusing on the quality of the connection between their R & D laboratories and operational departments. Management of technological uncertainties and R & D projects: How to cope with basic queries is expressed in the following way (Quélin, 2000: 476-487):

- Not invented yet
- Examinations finished and scientific literature completed
- Competitors, suppliers, and universities studied on a regular basis
- Networks established with universities
- Brainstorming meetings organized together with technical teams
- Inadequate investment and energy in time
- Determining whether the current skills and resources are suitable for the present task
- Establishing teams based on the major skill on which the participants concentrate
- Establishing teams competent to evaluate R & D projects such as Total Quality Management
- Developing common relationships with universities and research

institutions when necessary; internalizing externally financed projects that are economically unnecessary when needed

- Level of skill very low
- Developing relationships with consultants and universities
- Developing partnership agreements and research contacts; externalizing such projects that are economically unnecessary
- Including members who can better perform special project strategies
- Weak firm–customer connection
- Developing relationships with the largest customers of the firm
- Teams not adapted themselves to the present task
- Establishing a performance assessment system; consolidating total quality processes
- Establishing a reward and premium system

They usually form horizontal work groups to share experiences and develop new ideas. Firms do in fact harmonize with this organizational form generally because they believe that this will facilitate the information transfer from the market to the technological research teams. In this way, they try to enable the relationship of R & D projects with potential users to be taken into consideration.

Other behavior types have also been examined frequently. For example, most firms are not happy with a static assessment of the present improvement of an R & D project by itself; they will check periodically whether the project follows its strategic directives and strategic plans (Quélin, 2000: 476-487). There are two dimensions to this type of uncertainty: the research and development activity and its ability to "listen to" the market on the one hand, and how the individual or collective skills of R & D teams are compared to the previously required things for the projects on the other. Creativity requires identification of the market and evaluation of customer needs. Firms still face the continuous problem of layering new technological skills on top of the existing ones. To overcome this difficulty, they can gain external skills in especially fast developing innovations and then they can internalize them or acquire other skills that are necessary to develop common relationships with other companies, research laboratories, and universities (Quélin, 2000: 476-487).

5.3. Uncertainty Arising from Customers and the Social Environment

The fast developments in information and communication technologies together with the global integration of the world economy has enabled the global society to interact with each other in an easy and fast way through the internet. In this context, increased social interaction across the world has left businesses facing more quickly changing and developing customer preferences and expectations. Therefore, businesses today should predict changing preferences and characteristics of their customers by monitoring them closely and arrange their product and service lines accordingly. Otherwise, firms that fail to understand customer preferences and expectations and to offer product-service lines accordingly may be exposed to the risk of losing their markets for not being able to manage the uncertainty arising from this.

5.4. Uncertainty Arising from the Political Environment

The disturbances, changes and conflicts at national and international levels may lead to emergence of important risks from the political arena. As the political uncertainty and risk increase in a country, economic uncertainty and risk also increase and businesses can incur damages from both their existing investments and planned investments in such an uncertain and risky economic environment. Thus, it is of the utmost importance for businesses to foresee the political uncertainties and risks in advance and take the necessary measures.

5.5. Uncertainty Arising from Competitors and Market Conditions

Today, all businesses have to outscore their competitors to increase or maintain their market share in a competitive ecosystem. Therefore, it is very important to monitor the competitors while at the same time to understand the changes in customer preferences and most importantly to generate innovations with high added value to outscore competitors and customers. Businesses must act by predicting in advance the uncertainties and risks to come from market conditions and their competitors; otherwise, they may fall behind and incur losses.

Supplier uncertainty is defined as the degree of unpredictability and changeability in the supplier's product quality and delivery performance.

There are many sources of supplier uncertainty. These can be enumerated as the supplier's engineering level, the supplier's time management, and the supplier's reliability for delivery and quality of raw materials (Lee and Billington, 1992).

The uncertainty arising from suppliers due to reasons such as delay and product damage may cause an organization to postpone its production processes or even to discontinue processes. Moreover, such uncertainties may increase practices that can cause undesired outcomes such as inefficient use of resources in the supply chain, increased logistic costs and stock storage costs (Yu et al., 2001). Even in calm and stable environmental conditions, it would be very difficult for a producer to provide high quality customer service if its main suppliers provide low quality and slow delivery. If changeable environmental conditions prevail, this producer will be wiped out of this competitive environment (Prasad and Tata, 2000).

Technological uncertainty is defined as the unpredictability and changeability in the industry of an organization. The development in information technologies provides a wide range of opportunities for businesses. For example, inventions in information technologies enhance a movement towards the integration of supply chain and business processes (Chizzo, 1998), provide many contributions to the firm, and enable correct supply chain integration (Thomas and Griffin, 1996). Advance information systems reduce the transaction costs related to product flow control and enable faster response to customer needs (Li and Lin, 2006).

5.6. Uncertainty Arising from Changing Conditions of Competition

Extensive competition in the global economy constantly changes competition instruments and parameters. The survival strategy through competition with cheap labor and low cost has come to an end. As the income and education levels of customers rise, they want high quality goods and services with novel features for reasonable prices. For this reason, it is extremely important for businesses to analyze the changing conditions of competition and adapt themselves to such changing conditions in order to become successful in competition. Otherwise, businesses that do not foresee the uncertainty and risk originating from changing and developing conditions of competition are bound to be wiped out of the market.

5.7. Analyzing and Managing Uncertainty

Throughout human history humans have been under threat from uncertainties and risks originating from the natural environment and other humans. This uncertainty and risk will continue in the future. Businesses cannot eradicate all threats, but by correctly analyzing the sources, causes, and timing of such threats, they can eliminate these threats or minimize the damages arising from such threats. By closely monitoring the critical macroeconomic indicators of countries with respect to economic uncertainty and risk, exchange rates, interests, inflation, and the course of economic growth can be predicted, and necessary measures can be taken when signals of a crisis are received. This uncertainty and risk can be applied to all other technological, political, social, and competitor- and customer-based threats.

The conditions of competition outside firms and countries constantly show variances for firms, countries, and people in the global ecosystem. It is greatly uncertain in what direction this variability will materialize. Uncertainty means risk for firms and countries. Today, firms and countries attempt to manage their risks and thereby their losses by managing uncertainty. Businesses cannot eradicate all threats, but by correctly analyzing the sources, causes and timing of such threats, they can eliminate these threats or minimize the damages arising from such threats.

In order for these uncertainties and risks to be analyzed and managed correctly, the environment should be closely monitored and the dynamics, manifestation, and causation of the sources of threat should be examined in a correct way. Success in predicting the timing of the next threat and the measures to be taken to eliminate it becomes an extremely important strategy in minimizing the damages to a business from the threats arising from uncertainty and risk.

6

Fourth Factor:

Generating Organizational Intelligence

Learning is the most important result of an innovation process. The measure of success in innovation is its commercial value. Looking at it from this point of view, acquisition of technological knowledge is valuable, because technological knowledge drags firms to further innovations. Although the publications on innovation-related learning and process attract very little attention from scientific spheres, scientists have studied some questions about innovation (Hitt et al., 2000: 235-236).

The organizational learning process is one of the main topics of debate in the management literature and a better understanding of it is important

for organizations. Organizational intelligence and organizational knowledge generation, both of which are included in the entirety of the organizational learning process, are related to organizational learning with respect to their initial and resulting roles. However, the literature concerning each of them is in relatively independent development. Developing an approach that evaluates organizational intelligence as an initial qualification and knowledge generation as a critical outcome at an organizational level within the entirety of organizational learning processes will contribute to a better understanding of the organizational learning process.

The studies on organizational learning process do not progress along a single line but are carried out from different starting points. Following this course of progress is useful for understanding the process better. Studies on the qualifications that enable realization of organizational learning and the outcomes of organizational learning are at least as important as the studies that focus on learning processes directly.

Organizational intelligence refers to not only a key component of the organizational learning process but is also a basic qualification required for the realization of organizational learning. Intelligence can be evaluated as a premise of organizational learning. Studies in this area have the potential to improve the works on organizational learning. On the other side, organizational learning clears the way for the generation of new organizational knowledge. Organizational knowledge generation is of vital importance for organizations to be able to adapt to the environment and sustain their competitive advantage. To put it another way, organizational knowledge generation is one of the main outcomes of organizational learning.

Organizational intelligence and knowledge generation are related to organizational learning with respect to their initial and resulting roles. Both of them are included in the entirety of the organizational learning process. However, the literature concerning each of them emanates from relatively independent channels. Developing an approach that evaluates organizational intelligence as an initial qualification and knowledge generation as a critical outcome at an organizational level within the entirety of organizational learning process will contribute to a better understanding of the organizational learning process (Kalkan, 2004: 401-402).

6.1. Organizational Intelligence

The developments in individual intelligence studies influence to a large ex-

tent the studies on organizational intelligence, which is a fairly new area. The definitions of organizational intelligence are generally based on the definitions and perceptions of individual intelligence. Although there are variations in the evaluations of secondary subjects and differences in the definitions, the literature usually agrees that individual intelligence is the ability to process information and to adapt to the environment. The concept named emotional intelligence is also considered within the entirety of intelligence. It is increasingly accepted that intelligence comprises different components and there are various factors affecting each component. The main components of consideration are the ability to process information, the ability to adapt, and emotional intelligence.

Organizational intelligence is thought of as the capacity of an organization to process information, generate knowledge, and use what is processed and generated for the purpose of better adapting to the environment. Organizational symbols, interaction patterns, organizational culture, and socialization processes all include and disseminate organizational intelligence. Studies point out that organizational intelligence refers to a social outcome arising from interaction between the individuals in an organization and the interaction of the organization with its environment. Therefore, organizational intelligence is seen to have a social structure. This social structure cannot be thought of having functioning independent of human emotions. Emotions are important not only for humans but also for organizations. The social well being of an organization cannot manifest without considering emotions. For this reason emotional intelligence should also be evaluated as a dimension of organizational intelligence.

A study containing comprehensive and empirical data for determining the components of organizational intelligence has not been conducted yet. However, other studies suggest that elements related to many different areas such as knowledge management, organizational structure, technology management, culture, and strategy can be thought of as the components of organizational intelligence. According to McMaster, knowledge management, technology management, organizational structure, and organizational processes represent the dimensions of organizational intelligence. Elements such as culture, memory, information systems, learning, communication, reasoning, perception, interpretation, and behavioral adaptation are proposed to be the components of organizational intelligence. Most of the elements proposed as components are seen to be related to the abilities of information processing and adaptation. Some of the components

proposed in the literature relate to emotional intelligence. Thus, the main components of organizational intelligence are information processing ability, adaptation ability, and emotional intelligence. This approach simplifies disparities in the literature and is functional in nature.

The increased number of studies regarding organizational intelligence has followed a course parallel to the development of the literature on organizational learning. Intelligence has been discussed in the literature explicitly or implicitly as a component of the organizational learning process. Without intelligence, it is not possible to have a sound learning process in organizations. Starting from the 1990s, many studies on organizational learning in the literature have started elucidating the importance of organizational intelligence although mostly in an implicit way. In more recent studies, intelligence has been dealt with more explicitly as a quality, framework, or process that also affects learning. Findings and data have been presented which would facilitate defining intelligence and identifying its components which would be useful in further studies.

Intelligence positively affects the acquisition, dissemination, and implementation of information, which are the main stages of the organizational learning process, as well as back-learning and interpretation. Organizational intelligence also makes its presence felt implicitly in the background of many other stages within the organizational learning process (Kalkan, 2004: 401-402).

6.2. The Literature on Organizational Learning

In the area of organizational learning and from the early stages of its development process, the efforts to combine different theoretical approaches into a useful unity and the efforts to make use of the plenitude of perspectives presented by different approaches have gone hand in hand. Although there is a deep interest in the concept of learning and a common acceptance of the positive impact of organizational learning on strategic performance, a consensus has not been reached among researchers on the definition of organizational learning. The difficulty of distinguishing between the outcomes of organizational learning and the process of learning itself makes it hard to come up with a useful and comprehensive definition.

In the early efforts of finding a definition, more attention was given to the contribution made by organizational learning to organizational effectiveness. Fiol et al. described organizational learning as "the improve-

ment of organizational effectiveness through having better knowledge and comprehension." They considered organizational learning as "broadening of the potential area of action of an organization by way of processing information." According to this approach, learning does not necessarily lead to an increase in the effectiveness of the learner. Learning does not necessarily occur consciously in any case, nor does it need to result in observable behavioral changes.

Huber (1991) supported his main theses on the nature of organizational learning with results obtained in different disciplines by making an extensive literature search. Organizational learning is an information processing procedure which can be divided into categories as the acquisition, dissemination, and interpretation of knowledge and storing it in the organizational memory to be reused and revalued. This approach, which rejects the inevitable positive relationship that is assumed to exist between learning and improving organizational effectiveness, which attributes importance to knowledge and organizational memory and which deals with organizational learning as a process, has served as a foundation for many studies to come.

In this context, a more developed and comprehensive definition came from Robey et al. They defined organizational learning as an organizational process to differentiate it from various other learning levels. When the literature is reviewed as a whole, it can be seen that a modification of this definition enhanced with the inclusion of the knowledge concept will make it possible to reach an improved and operational version of the definition. Organizational learning in this context should be evaluated as "an organizational process, which involves both conscious and unconscious spontaneous elements, which manifests through the activation of organizational memory using knowledge acquisition, access to knowledge, and assessment of knowledge and which affects organizational action" (Kalkan, 2004: 401-402).

Learning within an organization has a multi-stage structure. When persons who deal with learning encounter a knowledge gap, they analyze the problems and solve them. By its nature, organizational learning is neither micro nor macro in its full sense, but involves a complex interaction between the whole organization and its business units. According to Kim (1997), learning as a group and at the organizational level is "a process integrated with knowledge creation, dissemination within the organization, communication among organization staff, and organization management and strategy" (Kim, 1997: 53-60).

Learning has significant outcomes for an organization. Senge (1993) states that learning serves as a foundation for strategic competition structuring and organizational learning means in general "continuous testing of experience and transferring this experience to knowledge that is acceptable by the whole organization and that conforms with the actual objective of the organization" (Kazanjian et al., 2000: 273-274).

Within the general conditions of organization theory, previous studies made on organizational learning had focused, in a quite important way, on describing the learning processes in an organizational environment (Senge, 1993: 121-125).

As an organizational activity, learning is understood to be a "combination of in-group interaction and individual efforts." Therefore, organizational learning becomes a process embedded with the relationships among individuals. According to some scientists, organizational culture is an "output of shared learning experiences." Some scientists use the descriptive term "learning organizations" to define the ways of raising organizational performance, which suggests that firms that are good at organizational learning will show better performance in the market compared to others (Carayannis and Alexander, 2002: 626).

Knowledge and individuals have an important role in organizational learning. Organizational learning is expressed as "acquisition of new knowledge from actors who wish to implement the knowledge in the organization, which affects others and is used in decision making." Thus, learning requires acquisition of knowledge in addition to the knowledge that is used in some way. This intimates that there are two types of organizational learning, acquired and experimental (Miller, 1996: 484-505).

Acquired learning occurs through internalization and acquisition of knowledge from outside its boundaries. Experimental learning, on the other hand, mostly occurs within the firm and produces the new knowledge which distinguishes organizations from one another. In relative terms, individuals and groups play a more active role in experimental learning than in acquired learning. With effective experience and processes that support such experience, individuals and groups learn how to utilize organizational learning to create competitive advantage and value. There are also other types of learning:

- Learning at a lower level (unilateral learning and learning at the job level)

- Learning at an upper level (bilateral and strategic learning)
- Top level learning (a unified dynamic property)

Learning at a lower level involves improvement of undeveloped missing ties between behaviors and outcomes within the firm structure. It focuses on the learning effect present in some organizational services. Learning at a lower level is transitional and influences only one part of the organization. Known as the knowledge at job level in organizations (knowledge on the causal relationship in special problem areas), the job learning idea of Kuwada (1998) is similar to learning at a lower level or unilateral learning.

Learning at an upper level involves a heuristic use. Thus, learning at an upper level or bilateral learning occurs in complex and uncertain situations. The strategic learning idea of Kuwada (1998), which involves basic assumptions related to the exchange of knowledge at the job level. While learning at a lower level lasts short-term, learning at an upper level is generally long-lasting. Although both types of learning contribute to organizational success, learning at an upper level is comparatively more important for a firm to create a competitive advantage and value. For this reason, organizations must understand and accept a number of factors leading to learning at an upper level (Kuwada, 1998: 719-736).

Lei et al. (1996) argue that learning contributes to the dynamic fundamental skills of a firm. They allege that firms can succeed in learning at an upper level depending on three basic factors (Lei et al., 1996: 549-569).

- The knowledge transfer that shapes the rules of both universal and tacit knowledge base of a firm
- Experience which allows firms to be concerned with continual development and to define their heuristics
- Firms need to feed their dynamic routines to develop their specific skills and competencies

These learning processes should be interconnected to achieve top level learning in a systematic way. The ability to learn at the top level is important for a firm that wishes to define a new competition field especially in a dynamic, uncertain, and rapidly changing environment. Creation of a new competition field is usually a product of innovative and entrepreneurial behavior. Four conditions are necessary for an organization to achieve successful and top level learning:

1. A firm should acquire explicit knowledge as much as tacit knowledge from both internal and external sources.
2. A firm should constantly be occupied with experience that results in development.
3. Organizations should maintain the balance between examination and using for their own interests in order to survive and succeed. This means that organizations should innovate and get the benefits of that innovation.
4. Firms should develop routines to have an effective connection with technological knowledge within the whole organization. This association first emerges from the division of individuals and groups (Hitt et al., 2000: 236-237).

6.3. Interconnected Learning, Knowledge, and Organizational Creativity

What is expected worldwide is that organizational learning proposals are a variation of managing the change that allows important progress. Advancing developments show that each important progression involves an opportunity for learning and thus prepares for the next important progression.

Figure 6.1 shows a very close relationship between learning, knowledge, and organizational creativity. Going from left to right on the *X*-axis in the figure, there is a transition from simple to advanced learning. During this transition, the knowledge base grows concurrently with the creativity of new technology, thus, learning is positively correlated with organizational creativity. The transition from simple to advanced learning may result in sharp rises in organizational creativity. In other words, going to right along the F (E1) curve, an increase in organizational creativity is possible. In order to carry organizational creativity further ahead, the firm should go up to the F (E1) curve, a new creative-learning curve. Companies with advanced learning are likely to make more profit than companies with simple learning. Therefore, the jump on the F curve is broader at the advanced learning stage than at the simple learning stage. The distance between "CD" is wider than the difference between point "a" and the point on the F (E2) curve right above this point (Koh, 2000: 94).

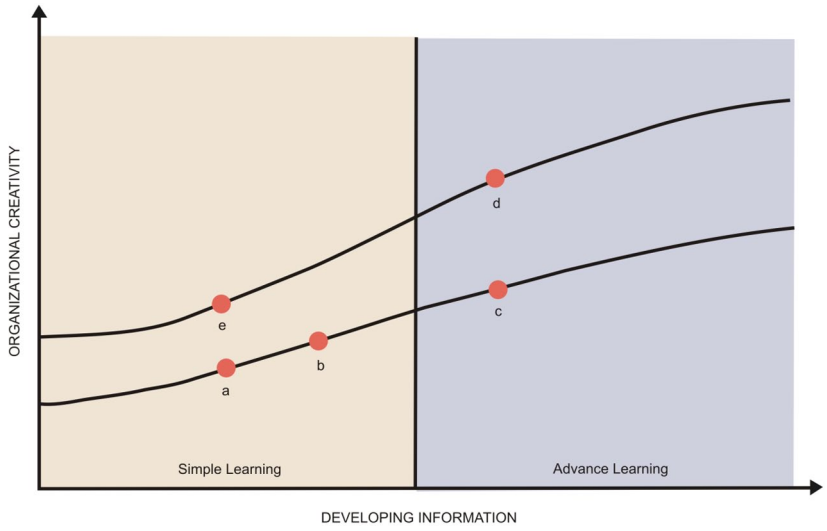

Figure 6.1. From Simple Learning to Advanced Learning (Koh, 2000: 94)

Dynamic routines are necessary to create new technological knowledge. At this point the role of the strategic leader of an organization is important. As stated by Ireland and Hitt, strategic leaders should cultivate intellectual capital and create an environment where innovative knowledge is developed owing to continuous learning. Therefore, the role of adjusting technological aspects is originated from the strategic peak of the organization.

BASF, a giant pharmaceutical company in Germany, encourages organizational learning. This firm has had to face strategic impermanence repeatedly during its 130-year history and has overcome these difficulties primarily through dynamic organizational learning and multidimensional endurance. The resulting technological knowledge was both tacit and collective. For this reason, other firms had difficulty understanding and imitating it and ended up allowing BASF to secure a competitive advantage and to create value as a result of using this competitive advantage. It should be pointed out at this point that when a firm uses organizational learning as a source of competitive advantage, this does not mean that the major skills of the firm will remain valuable. Rapid and unpredictable changes in the technological environment (Schumpeterian evolution and techno-

logical impermanence) may lead to changes in the value of a firm's existing technological knowledge. Thus firms must maintain the balance among their basic skills as part of their knowledge generation systems.

Organizational learning should be used to create dynamic fundamental skills. Dynamic fundamental skills may be set up on the foundations of both experience-related and acquired organizational learning (Hitt et al., 2000: 237-238).

Some researchers focus on the fact that learning may reduce organizational performance. Huber (1991) stated that people may learn incorrectly and learn something wrong as if it were right. If firms establish wrong ties between firm performance and administrative activities and reinforce such ties, ineffective or inappropriate learning processes may deteriorate the competitive advantage of the firm. Even effective learning processes may expire due to the changes in the market or environmental conditions. In this context, learning activities may change from basic skills to basic deteriorations. Skill depreciating organizational learning may limit a firm's performance in the short-run, but when it adapts itself to the market conditions and new technologies in the long-run, it can bring this performance to upper levels (Huber, 1991: 88-115).

6.4. The Organizational Learning Process

It is advisable to consider Huber's approach (1991), which stresses the organizational nature and process aspect of learning to be able to develop a functional model for the organizational learning process. The model proposed in this context consists of four stages.

Table 6.1. Proposed Model of the Organizational Learning Process

1	Knowledge Acquisition
2	Knowledge Dissemination
3	Knowledge Interpretation
4	Knowledge Storage and Revaluation

At the stage of knowledge acquisition, an organization internalizes the relevant information and knowledge through various means. Acquisition can be from both internal and external sources. Prior knowledge, direct

experiences, experiences of entities outside the business, and strategic actions are the major sources of knowledge acquisition. Different forms of acquisition can be useful under different conditions; there is no form of acquisition which is superior under all conditions.

Knowledge acquisition is followed by the knowledge dissemination stage. This stage, which can also be called knowledge distribution, refers to a process where modification and sharing of information and knowledge obtained from various sources are experienced. Knowledge can be disseminated through official and unofficial means. The dissemination of knowledge affects the coverage of the learning process. Modifying and sharing of knowledge in a sound manner depends on the extent of openness of the organizational culture to sharing and the development levels of the mechanisms supporting sharing.

The stage of knowledge interpretation is also referred to as the "stage of interpreting information." This process is more of a creative nature than inventive. Knowledge at different levels can be generated in the interpretation process. Since the emergence of different interpretations will broaden the organization's potential area of action, this stands for an increase in organizational learning.

The stage of knowledge storage and revaluation refers to a stage where the functions of organizational memory play an active role. The organization memory is structured towards knowledge storage and revaluation activities with views at individual and organizational levels. Stored knowledge influences also the form of perception and decision making processes in the future; thus, organizational memory structured to be open to development is quite important for an organization.

Although stages are mentioned in organizational learning for operational definition purposes, the presence of continuity and mutual interaction rather than succession predominate in the process. The organizational learning process has the perspective of developing organizational knowledge. Organizational knowledge consists of individual and common knowledge which the organization should use when realizing its mission. This knowledge has an ever-changing structure and such changes as a whole refer to organizational learning. Generation of new organizational knowledge is made possible as a result of the complex procedures carried out within the organizational learning process and the interactions in which actors outside the organization are also involved (Kalkan, 2004: 403-406).

6.5. Organizational Knowledge Generation

New organizational knowledge is generated as a result of the interaction of explicit and tacit knowledge of individuals within the organization. This process of interaction refers to the organizational learning process in which factors such as organizational culture, technology, structural aspects, and strategy are also effective. Organizational knowledge generation consists of six main stages. These stages are:

1. Development of individual knowledge
2. Sharing of tacit knowledge
3. Concept creation
4. Verification of concepts through testing
5. Building archetypes
6. Transmission and dissemination of knowledge in organizations (Kalkan, 2004: 403-406)

6.5.1. Development of Individual Knowledge

Individual knowledge, and particularly the tacit knowledge of individuals, is the basic element in the organizational knowledge generation process. Therefore, tacit individual knowledge should be developed, which is of critical importance in generating cumulative knowledge. The quality of the tacit knowledge of individuals depends on primarily two factors, diversity of the individual's experience and the knowledge being in the nature of holistic experience knowledge. Knowledge having a nature of being based on holistic experience depends on the nature of the experience through which the individual acquired the knowledge. Such experience should be the product of a concentration both intellectually and physically, nourished by a deep commitment; only this type of holistic acquisition will enable the development of knowledge through the utilization of tacit knowledge. On the other hand, for the tacit knowledge of individuals to develop, the obstacles before the explicit knowledge acquisition should be removed and technological means should be employed to facilitate this (Kalkan, 2004: 403-406).

6.5.2. Sharing of Tacit Knowledge

There are many people in an organization who have different pasts, knowledge accumulations, world views, intellectual structures, and motivations. Knowledge generation cannot take place unless the tacit knowledge of these people, which constitutes the most valuable treasure for an organization, is brought together. A common area is required to be able to share tacit knowledge. A common area refers to a conceptual combination of physical, virtual, and intellectual environments that enables experiencing the activities and sharing needed for a knowledge generation process. The cooperation in the common area should be efficient and as much inclusive as possible. Employees working at various levels can be helpful by making contributions to this area. Even the participation of actors from outside the organization in this contribution process may strengthen the generation of knowledge. The management should support the process by allowing autonomy of the employees (Kalkan, 2004: 403-406).

6.5.3. Concept Creation

To create concepts, it will be necessary first to establish mutual trust and a common intellectual model as a result of the interactions and sharing in the common area. In this way, individuals will come to the point of being able to generate knowledge in collaboration. Various reasoning methods are used in the concept creation process. Employees may advance from single cases to general concepts. They can also move from numerous general data to single inferences to form the infrastructure of the concepts to be created. The process of concept creation is a process that employees work together to realize. Thus, it requires cooperation. The diversity among the employees enriches the knowledge generation process by conveying different perspectives to the concept creation process. Presence of rich information accumulation in the organization also supports the concept creation stage (Kalkan, 2004: 403-406).

6.5.4. Verification of Concepts through Testing

Verification of concepts through testing is the testing of concepts to see whether or not they render any meaning and value to the organization and society. Setting forth standards to measure the meaning and value of con-

cepts is an important problem. Such standards may be qualitative as well as quantitative. For example, concepts and various outputs that stem from concepts such as a product can be valued by relating them to concrete criteria such as costs, profit margin, and growth rate. More subjective criteria may also be employed as standards. They usually relate to values, value systems, and organizational culture. The verification standards should be consistent within themselves. Such standards should also be in harmony with the objectives, vision, and strategy of the organization. Another important factor is compliance with social values, because an organization should also consider social interests while trying to achieve its own objectives (Kalkan, 2004: 403-406).

6.5.5. Building Archetypes

At this stage, a concept, which has been tested and confirmed, is shaped into a concrete form and converted into a pilot product, an initial example, or, so to speak, an archetype. An archetype refers to a prototype if a new product development process is in question or a model of the operational mechanism if it is an innovation in the services or organizational operation processes that is in question. In order to create a prototype in the new product development process in organizations, experts in the various departments of the organization such as production, quality control, marketing, and R & D come together and contribute to the formation of the initial example of the new product. In the efforts to create a new service or organizational structure, experts should again come together to build the model. In these efforts, the roles of the departments or units in charge of the functions such as human resources and strategic planning become more distinct as compared the product development efforts (Kalkan, 2004: 403-406).

6.5.6. Dissemination of Knowledge in Organizations

At this stage, the concept that has been created and tested, and whose initial example has been built during the knowledge generation process, is left free to circulate within and outside the organization. In this way, a new knowledge generation cycle is started on the ontological plane. Knowledge generation is handled as a process composed of successive stages. Although such staging is not incorrect in terms of conceptualization, in reality the stages

in the process may intersect with each other and returns or forward jumps omitting some stages may occur from time to time. Horizontal and vertical circulation of knowledge in an organization triggers a new organizational knowledge generation cycle. A better understanding of organizational learning will enable organizational behavior and various vital processes of organizations to be understood better and will create an effect with the potential to improve organizational performance. This is possible when the process as a whole is understood, not only the bare fact of learning. The premises that make learning possible and the critical organizational outcomes brought about by learning are present in the entirety of the organizational learning process. Figure 6.2 summarizes the organizational learning process by bringing together the basic elements and stages related to the concepts discussed throughout this study.

It should be noted that what is shown in the figure is only a simplified display of the process. In reality, there is the decisiveness of complex interactions rather than following a straight line in organizational processes. This fact represents human behavior resembling an aspect of the organizational processes. Specifically within the subject matter of this study, it is seen that the intersecting areas of intelligence, learning, and knowledge generation are considerably broad. This increases the complexity of inter-

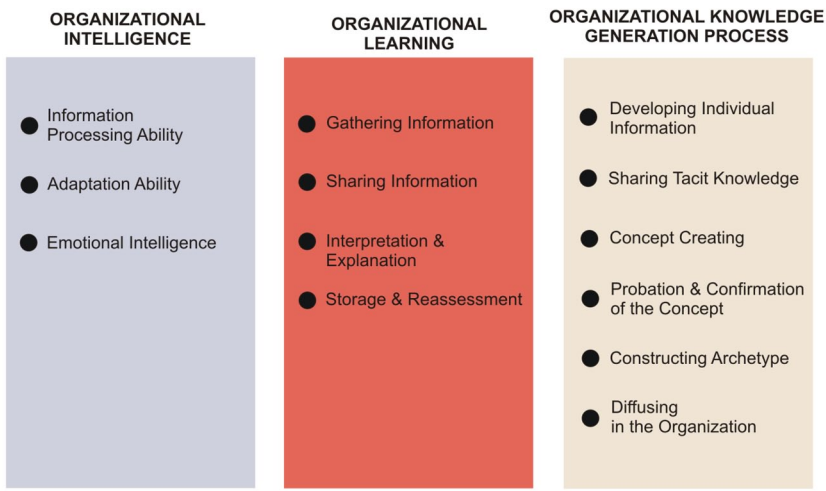

Figure 6.2. The Organizational Learning Process (Kalkan, 2004: 405)

actions. The subjects dealt with under each of these three headings intertwine with each other from time to time. There is a close relationship between the components of organizational intelligence and the cases dealt with by the learning process and organizational knowledge generation with learning process. Thus, the subject requires in depth exploration and clarification by further studies (Kalkan, 2004: 403-406).

Finally, this can be said: organizational intelligence is a prerequisite of organizational learning and organizational learning makes organizational knowledge generation possible.

6.6. Organizational Learning as a Source of Competitive Advantage

Although the concept of organizational learning is not very new in the literature of management sciences, it is not a process with definite outlines especially in the business spheres of our country. It is a process that is still developing and there are new works to contribute to its development all the time. The noteworthy studies in the modern literature of business administration do not separate the concept of organizational learning from the process of knowledge management, because it is very important to manage knowledge correctly and well for performing learning activities in businesses. Studies have shown that businesses that use the right knowledge at the right time and in the right place achieve more positive results than others as a result of their learning activities. Many studies in the literature mention a positive correlation between the extent to which businesses succeed in organizational learning and their financial performance. Therefore, the effect of these learning activities on the firm performance is unquestionably important.

The sectors and fields of operation of the firms engaged in organizational learning activities are also of utmost importance. The concepts that are popular in the literature of management sciences in recent years such as knowledge management, learning, technological learning, and innovation have started being used more extensively in technology-based firms. As is known, one of the most important activities of technology-based firms, or maybe *the* most important one, is research and development activities that lead to development of new products. It is evident that technology-based firms compete in an extremely volatile market.

The field of strategic management is meant to explain the differences in firm performance and to clarify how businesses should respond to the con-

ditions that will cause to improve this performance. As mentioned above, a fairly big subset of a large number of studies made in this area has focused on the development of the "dynamic theory of strategy." Teece et al. analyzed competencies, skills, and strategic resources, and explained in detail the resource-based outlooks of firms in an effort to explore the probability of the "dynamic competencies theory." The role of learning in developing new skills is at the center of this analysis. Teece et al. defined learning as "a process where repetition and experience make it possible to have definable new production opportunities and better and faster performed tasks" and linked learning to expressly developed firm performance. Since the developments in organizational processes result in the creation of new strategic skills, learning is understood as an individual and organizational process.

Adapting to the learning-based perspective of competitive advantage changes the grounds for defining how the various activities performed by firms are linked to high performance. As an activity of top management, improving performance under the old concepts of strategy had been based on the assumed "superior knowledge" of the administrators. Although top management still has an important role in the learning-based strategic management, the downward approach in strategy is no longer valid. The top management can do better by setting up the conditions for union loyalty, taking responsibility, gaining experience, and learning from mistakes for employees at every level who endeavor to develop continuously at every stage of the firm's total transformation process. To be able to define learning processes as a source of competitive advantage, these processes should have properties such as:

- Not substitutable
- Inimitable
- Not readily available
- Valuable

The performance enhancing learning in the terminology of resource-based firm view should have the following properties:

- *Heterogeneity:* Processes are not the same for all firms.
- *Endurance:* Learning processes should endure overtime.
- *Causal uncertainty:* The development and foundation of learning processes are not fully certain.

- *Deficient changeability:* The transfer of learning processes within the limits of the organization is difficult.
- *Inimitability:* Learning processes cannot be imitated easily.
- *Convenience:* Firms can earn profit from learning.

For organizational learning concepts to be useful for strategy management they should be distributed to define the various dimensions of organizational learning to be used in future assessments and predicting firm performance. In order for researchers to explain how learning affects performance, the learning activities should have the following properties:

- *Being distinguishable:* Good learning should be distinguishable from bad learning.
- *Spreadability:* The form of learning is present in the organization; thus, rather than individual or group learning, it is better to show organizational learning.
- *Being expressible:* New coming workers can learn the new form of learning through explicit learning, implicit publicity, and other processes.
- *Flexibility:* The form of learning should be capable of changing to meet new conditions and needs (Carayannis and Alexander, 2002: 627-628).

Due to the constantly changing competitive scene, firms that specialize in technological learning have the advantage. Both internal (firm's size, structure, administrative capability) and external (status of the industry and sector) factors may increase the ability of the firm to engage in effective technological learning processes or they can negatively affect this ability. In other words, effective management of such internal and external factors may provide competitive advantage through the development of basic capabilities.

However, in case these factors are not managed effectively, reduced capabilities may cause decimations in the competitive scene. Technological learning facilitates a firm's efforts in:

- Taking reasonable risks
- Making innovations
- Developing, maintaining, and using constantly changing (dynamic) basic capabilities

- Creating continuous competitive advantage
- Creating value (Hitt et al., 2000: 233)

Looking at it from a different point of view, the world is strikingly advancing towards the development of information technologies and the increasing importance of technology. For this reason, technological learning also needs refurbishment. The concept of technological learning in developing countries that naturally focus on technology and learning should be redefined in today's high level competition conditions (D'Aveni, 1994: 98-103).

Many scientists maintain that for firms to be able to grow and sustain their vitality they should catch up with consolidated, interconnected learning. Lei et al. (1996) introduced the term "meta-learning" (high level learning) in the literature, which comprises knowledge transfer, experience, and dynamic routines. They allege that high level learning is necessary for the maintenance and development of effective dynamic basic capabilities. Firms need the speed and depth of organizational learning for effective technological knowledge management.

Huber (1991) posits that organizational experiences are effective means for firms to survive and grow in today's unpredictable and rapidly changing environment. Although the retained, stored organizational experiences are usually meant to increase the ability to adapt. This idea resembles strategic and high level strategic learning (Huber, 1991: 88-115).

The best way to learn tacit knowledge for individuals may be learning by doing. For this reason, internship and orientation programs are the most effective way of increasing both tacit and explicit knowledge for newcomers. Sharing knowledge in self-organized teams or fields may be useful for individuals to increase their tacit and explicit knowledge.

Grant (1996) sees a firm as a place where knowledge is implemented. Thus, the major task of organizational learning is to understand the processes of utilizing knowledge which is fitted into a process by its members and the coordination mechanism and to adapt to these mechanisms and processes for more effective and powerful use of knowledge (Grant, 1996: 109-127).

6.7. Organizational Learning Indicators

The current literature relating to the firm specific technological skills and performance has defined a set of indications showing presence or absence of organizational learning. These potential indications are shown in Table 6.1.

Table 6.1. Potential Indications (Dimensions) of Organizational Learning

1. Carrying out R & D activities with respect to firm size	Firms making R & D Firms not making R & D
2. Rise or fall in R & D levels	Firms making high level R & D Firms making low level R & D
3. New product development and promotion	Firms developing new products at a high level Firms developing new products at a low level
4. Changes in new process technologies, efficiency and effectiveness	
5. Development of skills in new fields of technology	
6. Loyalty in strategic technological mergers	
7. Rates of premium and patent applications	Firms applying premium and patent at a high level Firms applying premium and patent at a low level
8. Technological licensing activity	
9. Opportunities in the importance of technology and administrative attitudes in firm strategies	
10. Organizational Intelligence	
11. Firm's technological capacity	Firms with low technology Firms with mature technology Firms with high technology
12. Firm's basic skills	Firms generating low technology Firms generating mature technology Firms generating high technology Firms generating future (developing) technologies
13. Firm's organizational structure	Rigid structure Semi-flexible structure Flexible structure
14. Firm's organizational culture	Importance attached to knowledge Openness to learning
15. Coordination and collaboration	
16. Employee profiles	Number of employees Their education statuses Their attitudes and behaviors towards learning Their interpersonal interaction abilities

Table 6.1. Potential Indications (Dimensions) of Organizational Learning (cont.)

17. Sector's status	Conditions of competition Rate of change Number of firms Technological skills and capacities of firms
18. Firm's position in the sector	Leader Follower Technology imitating firms Technology importing firms
19 Firm size	Number of employees Sales and revenue volume
20. Firm's project size	Small sized projects Medium sized projects Large sized projects
21. Firm's relationship with research institutes and universities	Firms not conducting their projects with any research institute or university Firms conducting their projects with a research institute or university Firms conducting their projects in coordination with both research institutes and universities

Apart from the ones enumerated above, there are another four variables as indicators of organizational learning. These variables will be discussed under the heading "Learning Orientation."

6.8. Learning Orientation

Learning orientation is interpreted as organization-wide knowledge creation and usage activity to secure competitive advantage. Such orientation involves acquisition and sharing of knowledge regarding customer needs, market changes, and rival behaviors. It also involves development of new technologies to create new products that are important for the rivals (Moorman and Miner, 1998: 698).

Learning orientation influences what kind of knowledge will be acquired and how such knowledge will be interpreted, developed, and shared. The four variables of organizational learning are as follows:

Table 6.2. Dimensions of Organizational Orientation

1	Commitment to Learning
2	Shared Vision
3	Open Mindedness
4	Knowledge Sharing in Organizations

6.8.1. Commitment to Learning

It is possible that commitment to learning or the extent to which an organization attributes value to learning is nourished in a learning climate. A committed organization sees learning as an important investment which is a prerequisite for survival. The more an organization attaches value to learning, the more learning will materialize. More importantly, commitment to learning relates to a long-term strategic tendency. Short-term investments will produce long-term gains. For example, committed organizations expect their employees to use company time to monitor, seek, or follow knowledge that is outside their current business space. If an organization fails to encourage or promote knowledge development, its employees will not be motivated to follow or monitor a learning activity (Calantone et al., 2002: 516).

6.8.2. Shared Vision

Shared vision is interpreted as focusing on organization-wide learning. Verona argued that without shared vision, what is learned by the members of an organization will have a very little meaning (Verona, 1999: 132). In other words, it is difficult for them to know what they will learn if they are motivated to learning. A common problem in organizations is to never implement most of the creative ideas to correct a general management deficiency. Great ideas result in failure when they are implemented due to various interests within the organization. Thus, a positive learning atmosphere requires an organizational concentration when new knowledge is implemented. Management open to learning would probably shape the organizational power or a basic skill.

Brown and Eisenhardt (1995) have stated that different departments have different ways of acquiring and implementing knowledge. For this reason, persons in different functional areas interpret innovation in differ-

ent ways. For example, while a marketer is interested more in marketing knowledge, a person working in R & D may focus on the technical aspects of innovation. This may even result in interpreting the same knowledge in different ways. A shared vision regulates the focal points of different departments and brings them quality in learning. The concept of shared vision in learning theory is similar to integration and internal communication in the R & D literature (Calantone et al., 2002: 517).

6.8.3. Open Mindedness

Open mindedness refers to be willing to critically evaluate the operational routines of an organization and to accept new ideas. Firms have to struggle with rapidly changing technology and disorderly markets. The rate at which knowledge becomes outdated is high in many sectors. Thus, the lessons learned from the past can only be instructive if the organization can respond to these (Verona, 1999: 132). Forgetting about the old methods may be important for renewing and improving the database (Calantone et al., 2002: 517).

6.8.4. Knowledge Sharing in Organizations

Knowledge sharing in organizations can be described as the behavioral routines or common beliefs regarding the dissemination of learning among various departments in an organization. It keeps operable the knowledge and information that are obtained from various sources as references for future actions. For example, experience gained by the marketing department from their customers may be useful for the R & D department to meet customer needs when developing new products and services.

Learning within an organization turns out as a collection of individual learning. Sharing of knowledge in organizations is necessary to prevent loss of information because of employee turnover and transfers (Moorman and Miner, 1998: 698).

Some researchers have argued that learning will not materialize in its real sense unless an organization has an effective system for sharing and reviewing knowledge. Sharing of knowledge in organizations is not simply acquisition of knowledge from various sources. It requires a systematic review and structuring of knowledge. Experiences and lessons learned should be shared among departments and stored as organizational memory (Calantone et al., 2002: 516-517).

7

Fifth Factor:

Producing Organizational Knowledge

Technological knowledge seems to be the most important and result-oriented production factor in today's environment where competition has reached such a magnitude. The works for creating technological knowledge aim at adaptation to the changing conditions of competition. Research and development can be defined at first sight as the name of these works in the literature. Although the term R & D is used as if research and development were the same terms, they are not the same. Therefore, before defining research and development itself, it should be specified what research and development mean separately and the distinct differences between them.

According to the viewpoint which explains research and development focusing on the activity and result sides of it, R & D can be defined as a project aiming at solving a technological or scientific uncertainty to make progress in science or technology. Advances involve new or developed products, processes, and services (http://www.innovation.gov.tr). R & D in the area of science and technology is a process based on science, technology, and creativity. There are research and development activities in the foundation of science and technology generation in the universal sense. Taken on the basis of business and work life, it is the art of systematically developing creativity to turn it into marketable products.

R & D is defined as commercializing an idea and converting it into a newly developed method to be used in the production of a new product, commodity, or service. R & D is an activity giving the full meanings of the words comprising it; it involves raising an idea, exploring whether it can be done technologically, developing it and then convert it into a product that can compete in the market and be sold. R & D can also be defined as a systematic questioning or research performed in a field of technology or science through analysis and experiment. R & D is defined as the regular works carried out for the purpose of obtaining new knowledge to enable develop-

ment of science and technology or producing new materials, products and instruments using the available knowledge, and creating new systems, processes and services including production of software or improving the existing ones. R & D is carried out systematically to increase the knowledge accumulation of the society and culture and to enable such accumulation to result in new applications (http://www.teknokent.itu.edu.tr).

From a human resources based viewpoint, the term "Research and Development" is used to explain the activities of a firm where scientists are employed to develop the technology and science as well as new products, processes and services that form the working ground of the firm (www.canfield.ac.uk). From the view point of meeting the demand, research and development is to discover new knowledge on products, processes and services and then use such knowledge to create new and advanced products, processes and services that will meet the demand of the market (www.advfn.com). As a social and cultural approach, research and experimental development can be defined as creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications (www.buildingipvalue.com).

As can be understood from the above R & D definitions, R & D is defined as a whole. However, some scientists mention about R & D separately as basic research and applied development. The definitions of basic research and applied development can be examined from this perspective.

7.1. Research and Development

Although "R & D" is used as if "research and development" were the same term, they are not the same. For example, some organizations perform these procedures separately in the same laboratory. Bell Laboratories can be shown as an example of this type of a structure. However, since research and development affect many separate laboratories at IBM, it is almost close to pure research. According to D. B. Miller (1986), these differences are listed as follows:

- Research is generally thought of being broader and more basic, that is, closer to pure science and less applied than development.
- When employees mention the behaviors of materials in a research, they tend to see themselves as scientists.

- The creativity in research can be thought as an invention.
- As a term "development" is generally used as a product or service, as an expected output, rather than a concept.
- The people in development are generally programmers or engineers.
- Development occurs when the idea takes commercial shape and, contrary to research, the activity is considered as an innovation.
- There are generally very few unknowns in development and the process is more predictable with respect to time, budget, and results (Miller, 1986: 5-7).

In their study measuring R & D efficiency, Karlsson et al. (2004) explained the difference between research and development by considering more than one aspect. In this study, the industrial research generally differs from organizational development. Mansfield et al. and Seiler encountered similar results in 58% of the firms they studied. According to these results, research was different from development. Mansfield discussed that where research did not differ from development, firm size would be a great explanation for these cases due to expenditures. For example, when both research and development are less than 26% or greater than 76%, firms do not tend to separate these two.

Roussel et al. have discussed that there is not a definite borderline between the terms research and development. If the purpose of research is to develop knowledge, the purpose of development is to implement or engineer that knowledge. The objective here is to diffuse knowledge and to establish communication between an area and another area. Development applies these principles to integrate them with commercial practices and establishes communication. According to the quotation made by Trygg from Asimov, research is defined as the activities carried out to find new technological components that would be useful for the firm in the future. Trygg states that product development is composed of product planning, design, engineering, and process planning. Thus, product development involves all the activities from technical skills to the disclosure of market needs. Mansfield et al. discusses that the difference between research and development depends on the type and extent of uncertainty, and business orientation. Given these definitions, it can be seen that there are some general aspects related to research and development. From one persepctive, the difference relates to five basic parameters:

- Time
- Originality
- Organization
- Depth of knowledge
- Objectives

7.1.1. Time Aspect

The objectives in research extend into the future. The results obtained from research may be useful not only with respect to market research but also for group knowledge and individual development that can be useful in future research. Rather than time, the degree of an innovation is prioritized by the managers of these stages. This does not deny the fact that research may drag the business down; a real research procedure cannot be limited only to a special product. As a definition, development aims at commercializing the products that would meet customer needs. As mentioned earlier, market timing has become more important since the time it was understood that the time of development has become shorter.

7.1.2. Originality Aspect

Research generally makes "jumps," which is not always the case for knowledge, and such jumps frequently result in solutions that can be called innovation. Innovations do not target a specific product but show only the possibilities in an area of technology. Development, on the other hand, is the continuous development of the ideas that are already present. The difference arises more from the different objectives of research and development. Research tries to find new areas of technology.

7.1.3. Organization Aspect

Development is usually carried out in the form of a project. The project process may be diffused in organizations or be co-located, but is mostly performed by one type of coordinator or project leader. The organization, in this respect, is a little or more structured and is controlled. On the other hand, research projects are governed by a semi-controlled chaos. The main factor is the discipline in which the research is being carried out. Some

researchers argue that research should be separate from the development organization to minimize complicated factors (e.g. day to day work and management) or to add some objectivity to the research.

7.1.4. Depth of Knowledge Aspect

Developing a product or process requires a cross-functional understanding and research requires high expertise in the field in which the research is being conducted. While the purpose of research is to develop knowledge towards new fields, the purpose of development is to apply a broader range of knowledge to commercial products. Knowledge requires a special area of interest and deepening in the subject matter of the research: General Skill and Special Skill. Gaining this type of skill takes years. Using this knowledge for commercial products requires knowledge in a broad area. One cannot deny the other, but while the knowledge that involves specialization comes more to the fore in research, it generally appears in the same way in development.

7.1.5. Objectives Aspect

The goal of research is to enable understanding cases at an advanced level or to search for new technology elements. It requires growing output uncertainty ahead and higher technological risks. The purpose of development is increased customer satisfaction or fulfillment of a customer need with respect to an existing product. Development involves both product development and process development (product development, product, and product service); research aims at either one of these within a certain period of time.

A large number of parameters separates research from development. These parameters are quite important to be able to measure the research work with respect to the expected output. The differences have a positive effect on the skill of performing the specific duties of each individual department. The general beliefs and main rules that facilitate the performance of duties increase the skill of the unit in fulfilling its tasks. However, since tasks are different, it is assumed that the structure and orientation should also be different. This sentence relates to the differences among research, sales and production, but our opinion is that the same can be said for the differences between research and development. It gives a small hint about the output expected from the commercial research that is dealt with

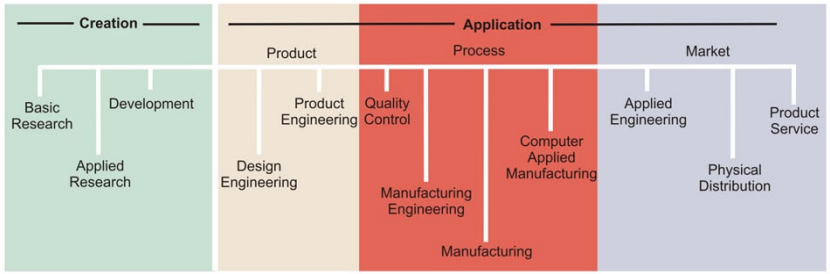

Figure 7.1. Creation-Application Spectrum

in the literature. The most obvious output for development is the "package" sold to customers. The contents of this package depend on the firm's business. On the other hand, it is difficult to describe an incidence of research. Research is generally defined as the stage before development.

7.2. Basic Research versus Applied Development

The goal of a firm's technical function is clearly described by Roberts in the preface of the book he wrote on making technological innovations:

- Creating new knowledge
- Constructing technical ideas that aim at new and developed products, manufacturing processes and services
- Developing functioning prototypes from these ideas
- Converting these ideas that have been shaped in new products and services into manufacturing, distribution and use

It is usually useful to describe this innovation creation process as fairly regular and manageable. For example, Steele has shown a creation-application spectrum beginning with basic research and ending with product service, which is reconstructed in Figure 7.1.

The difference between basic (new knowledge creation) and applied (problem solving) research is usually quite clear. Most basic research is carried out in universities in the United States, but the lines of this difference are ambiguous most of the time in practice. Moreover, if the customer voice is the only driving force behind innovation efforts, all the gains tend to be incremental, because incremental innovation takes place by making

additions to a product in line with the demands coming from customers. Deep-rooted innovations, innovations that create new markets and real growth for the future of an organization, do not follow normal company routines. The initial findings obtained from an ongoing IRI (International Research Institute) study show that great discoveries often come up as a result of complex projects and are usually obtained as a product of projects that have been repeatedly undermined and revitalized.

Organizations satisfy the conditions set by their customers, but there is often a need for a considerable lead-time to respond to customer problems in time and find solutions for them. This is why R & D and marketing work mostly on the same problems, in parallel not in series. The staging models of an innovation process are meant to show a reason as to what came up during the innovation in the best way. Not all customer problems can be solved and not all technology can be implemented always. However, the core idea is that incremental and deep-rooted innovations are different. At the end, only the unified powers of all the key functions of a firm, marketing, R & D, and procedures should be consolidated to satisfy customers. The National Science Foundation (NSF) divides research into three classes.

Basic research: According to NSF's definition, the purpose of basic research is to have broad knowledge and understanding about the subject being worked on, rather than its practical use. To take industrial goals into account, NSF modifies this definition to show that basic research causes scientific knowledge to advance "without a distinct commercial purpose, although such researches are within the current or potential interest areas of the company to which reporting is made."

Applied research: Applied research is directed towards understanding and gaining the knowledge that is necessary to identify the requirements of a special or known need that can be encountered. In industry, applied research involves the investments that manage the discovery of new scientific knowledge with special commercial goals for products and processes.

Development: It is the systematic use of the knowledge obtained from research towards the production of useful materials, instruments, systems, and methods including prototypes, process development and design (*Management of Technological Management*, 1999: 133-135).

Wheelwright and Clark define research and high-level development projects as acquisition of new know-how and invention of new science. Such projects are usually separated from the development organization.

The development projects are governed by more or less defined products that have different degrees of innovation. According to Mortino, R & D can be divided into four different stages.

Table 7.1. Four Stages of R & D

1	Basic Research
2	Basic Research-Development
3	Applied Research-Development (Prototype/Plot, Plant)
4	Experimental Research-Development (Commercial Development)

The goal of basic research is to enhance understanding of some incidences. The key point in this type of research is that it alone does not seek a product or process. Applied research relates to understanding of an incident, but there is more than innovation of a product or process in applied research. Manufacturability, reliability, and customer convenience are the most important issues at the prototype/plot (plant) stage. At this stage, the product is still not ready for large scale production; the stage only defines the possibilities of manufacturing in line with customer needs.

The remaining tasks at the commercial development stage are in designing. Technological uncertainties should have been resolved before this stage and they focus on costs/revenues (Karlsson et al., 2004: 179-180). A study on the technological innovations of industrial companies in Thailand defines classification of R & D. Research and experimental development in industries is defined as creative work performed on a systematic basis to create new or developed products, processes, and services or other applications. R & D can be differentiated from other activities for being an important asset of innovation and providing solutions to the uncertainties and problems used in technological and scientific methods.

7.2.1. Basic Research

Basic research is experimental or theoretical preliminary work to create new knowledge based on visible events without any special usage or application. Applied research is an original investigation to create new knowledge. It is governed by finding new ways of achieving some predetermined specific goals or certain possible uses for the basic research findings. It is a system-

Table 7.2. What R & D Is and What It Is Not

What R & D is	What R & D is not
Developing prototypes	Scientific, technical, and information services
Setting up pilot plants	Routine trials and standardizations
Trial production	Patent and license works not related to any R & D work
Drawings and designs directly related to R & D	Data collecting goal involving market research
Technical activities for materializing new products and processes after converting to the manufacturing unit	Works based on feasibility and plans
Material production and industrial engineering directly associated with developed products or processes, or developing new products	Education, training and after-sales services

atic work that uses the existing knowledge obtained from practical experience and research that is governed by the production of new materials, products, and devices that are supplied by new processes, systems, and services.

Another approach depicting basic research and applied development calls for evaluating them by dividing them into certain groups with respect to their scopes and objectives to facilitate application of R & D projects.

7.2.2. Basic Research and Development (R & D)

This is the R & D of ideas that have never been implemented before as a new product, material, and method. They are R & D activities where inventions and new concepts are created. They usually involve the strategic research and development activities of governments and are implemented by entities such as universities and scientific and technical research institutes. They are almost never implemented at the business level. The invention of Teflon material is an example.

7.2.3. Applied R & D

This is the R & D of the applications that will create a difference in its full sense and in its own right as a new product, material, or method. ABS brakes

in vehicles, mobile phones, and Walkmans are examples. Applied R & D is the activities performed by the firms that are leaders in the world market.

7.2.4. Experimental R & D

These are the most common R & D activities. Their purpose is to capture distinction by further developing the existing products, materials, and methods. According to the definition of the Scientific and Technological Research Council of Turkey (STRCT), it is the R & D of the products "that show technological differences in their essence in terms of their materials, parts and functions when compared to the previous generation of the product." The R & D activities to be conducted by subject matter experts (SMEs) should be of this class. The SMEs who have newly started their R & D should set up their structural R & D organizations in this way.

The plastic pedal groups and headlights close to daylight in cars and plastics used in household furniture are examples of these (Altınay, 2000: 2).

7.3. Environmental Uncertainty and R & D

The effects of prevailing environmental conditions on the process of new product development have been examined in detail particularly in the R & D literature. While some studies state that it relates to environmental and technological conditions, these variables have not been accepted as the effective factors of the success of a new product (Brown and Eisenhardt, 1995: 343). Even so, it seems reasonable that the extent of external uncertainty and especially technological impermanence and market uncertainty affect the success of a project. For example, today's telephone firms have to seriously face the software revolution that enables phone conversations on the internet, which has eliminated high phone bills. A technology that changes so rapidly may cause a product to become outdated technologically overnight. This may be due to the degree of competition related to the development project, changes in the market structure, or the unpredictable and changeable character of the market.

The risk and uncertainty with respect to a new product have caused surprisingly very little failure in the historical development of innovative firms. Product development weathers uncertain and volatile circumstances. Both the market and technology factors moderate the relationship between process implementation and project performance. As a consequence, man-

agement of a product development project may require different strategies (Bstieler and Gross, 2003: 147). Christensen (1997a) states that innovative firms should follow a rather different approach when they are interested in new products in highly uncertain markets (Christensen, 1997a: 151). Researchers also wish to deal with this issue.

Bstieler and Gross (2003) focused particularly on three important R & D elements in their study. These are:

- Quality of the preliminary development phase
- Degree of process reduction
- Management of research process in the project team

They stated that these three elements may be affected by project uncertainty and may require a flexible adaptation in organizing and planning of activities. It was found as a result of this study that process reduction under the conditions of high market and technological uncertainties may increase time efficiency and product profitability (Bstieler and Gross, 2003: 147).

The extent of market uncertainty and technical impermanence affects the magnitude of project uncertainty. Accordingly, the environmental uncertainty that occurs in technologies and markets may impact project performance.

For example, Rumelt (1991) and Powell (1996) explored the members and characteristics of the industry and found between 17% and 20% success as declared by the industry. Still, the moderator effects of environmental factors on success indicators have been rarely expressed due to the difference between the external environment and project success (Rumelt, 1991: 167; and Powell, 1996: 323).

In another study, Cooper and Kleinschmidt found that there was no relationship between market competitiveness and product success (Cooper, 1993: 146). Montoya-Weiss and Calantone (1994) stated that a factor like market uncertainty cannot be a critical success indicator like other indicators. They argued that environmental factors would not have a strong impact on success and for this reason environmental conditions were usually insignificant. Even so, they warned that further investigation of the effect of environmental factors on success could yield more clarity (Montoya-Weiss and Calantone, 1994: 397).

By contrast, Brown and Eisenhardt (1995) pointed out that the effect of market reality on business success had generally been neglected and market reality did affect development process variables (Brown and Eisenhardt,

1995: 343). In addition to these, Terwiesch (1996) stated that R & D performance and market uncertainty were not independent of each other, but this relationship was affected by the nature of competition in every industry (Terwiesch, 1996: 3).

The environmental conditions surrounding new product projects may basically be different and thus different development approaches may be needed. For example, Calantone et al. (1994) stated that firms tended to adapt themselves to proactive strategies due to their risk taking behaviors under innovation and uncertain environmental conditions, and to environmental battles due to their static organizational structures (Calantone et al., 1994: 134). Christensen (1997b) studied a sample case relating to the difficulties faced by firms with stable markets that were interested in the products in developing and unpredictable markets for innovative purposes. This researcher stated that especially in initial markets where uncertainties prevail, the heuristic-motive learning processes might be more useful than a normal development process (Christensen, 1997b: 60).

As can be understood from the above literature search, R & D activities sit on a foundation of total uncertainty by their very nature. R & D is the blurry façade of a business. The reason for this is that the results, budget, and duration of R & D works are indeterminable. The statistics on this matter show that 63% of new projects initiated have been cancelled without turning into a product, 12% of them have proved to be unsuccessful in the market, and only 25% of them have been able to remain in the market. The "stars" among these projects do not even reach one percent. The same studies have concluded that 46% of corporate resources flow to unsuccessful new product projects. R & D works are carried out in an environment of uncertainties. It is not known whether or not an idea brought up can be turned into a marketable product; if it can be, how long it will take to realize it within what kind of a budget and, most importantly, how it will perform in the market.

The most significant result of the above statistics is that it is not right to expect success from all R & D works and top management should approach the results of R & D works with tolerance even if they are unsuccessful. Despite uncertainty, the beginnings and ends of processes are predictable and measureable and the results foreseeable; thus, efficiency can be achieved with these processes but R & D projects cannot be managed. As its result is uncertain, unforeseeable outcomes may be encountered.

For this reason, R & D projects can only be conducted with "knowledge

management" (Altınay, 2000: 2-3). As in all business activities, the research and development function is also in the management and control process.

The main difference of R & D from other management functions is its uncertainty. The most important problem in the management of technological skills and R & D cycles is uncertainty. It affects all the activities of firms, their attempts to mobilize their main technological skills, their efforts to learn internally controlling the interactions between such skills and the possibility of activating all their useful skills including their external skills (Quélin, 2000: 476-487).

7.4. Shortening the R & D Cycle by Learning to Control Uncertainty

R & D activities are a great source of uncertainty for firms. The uncertainty covers:

- Opportunity costs to initiate a given research program
- Activation of instruments currently eligible for the task
- Termination calendar

Scientists traditionally classify uncertainty that affect the duration and nature of the R & D cycle under five different categories (Quélin, 2000: 476-487).

1. Market uncertainty
2. Competitive environment
3. Uncertainty on technological evolution
4. Internal R & D process
5. Human resources and culture

7.4.1. Market Uncertainty

Most of the managers see market uncertainty as a combination of six basic characteristics:

1. Description of customer needs is uncertain and deficient
2. Nature and features of a product can only be understood vaguely
3. There is an inadequate familiarity with market employees
4. Sales force and their commercial capacities are not structured appropriately and are not sufficiently comprehensive

Figure 7.2. Changing Paradigms in Industrial R & D (Quélin, 2000: 476-487)

5. Distribution network is not completed
6. Value chain is organized in a weak manner

The solution to these problems can sometimes be found through the data obtained by firms from the competitive environment or the market. Yet, such external information does not usually reduce the uncertainty in R & D activities. Speaking in static terms, information does not reflect the real situation sufficiently and for this reason it hardly increases the firm's competency to acquire new markets, new technologies and new departments. The Smart Car (Daimler-Benz), which was intended to be a new concept for city cars, is an example of a new form or new distribution method of an efficient organization but, after all, has suffered a weak disposition due to its sale price.

Nevertheless, firms can improve their competency of predicting product and market trends using their experts, consultants, and even customer panels in this data compilation process and then integrate these into their technological research and development efforts. Moreover, cross-departmental or inter-functional groups may be mobilized within the firm to help define the possible use or function of a special technology, process or product (Quélin, 2000: 476-487).

7.4.2. The Competitive Environment

The traditional analyses of competitive uncertainty show that firms are unaware of the expenses incurred by their rivals for technological develop-

ment and the innovation policies of their rivals. Uncertainty also relates to the form and number of newcomers entering a certain market; such firms may announce technology-based process changes and create new market segmentation. Establishing good contacts and developing long-term collaborative partnerships with state laboratories, universities, consultants, and research institutes may serve as a solution to this problem. This will enable a firm to closely follow the latest technological developments, research trends, and innovations that gain importance over time. Firms can also add to their learning processes through their close and regular interactions with their large customers. For example, Air Liquid conducts close work with its major customers. This working relationship involves new systems, processes, and equipment, which means supporting of convenience management, cost reduction trial, and consumption of industrial gases.

7.4.3. Uncertainty in Technological Development

This form of uncertainty is thought as having the major share in managing R & D cycles and the technological capacities of firms. The main technical and technological uncertainties are suggested to be:

- Deficiency in knowledge as the future aspect of technological development
- Deficiency in quality and power efforts in this area
- Deficiency in required skills and competencies at personal or group level
- Insufficient contacts with firm customers
- Insufficient teams performing the present duties (Quélin, 2000: 476-487)

7.4.4. Internal R & D Processes

The duration of R & D encounters many uncertainties that stem from the very nature of an R & D activity. For example, an R & D project may be essentially not suitable for its real position in any market or activity, or the priorities of groups may change during technological development, or a large number of technical skills may be unnecessary. Quélin (2000) found that companies reacted to these type of events by focusing on the quality of the connection between their R & D laboratories and operational

departments.

Horizontal work groups are usually formed to share experiences and develop new ideas. Firms do, in fact, harmonize with this organizational form generally, because they believe that this will facilitate information transfer from the market to the technological research teams and in this way they try to enable the relationship of R & D projects with potential users to be taken into consideration.

Other behavior types have also been examined frequently. For example, most firms are not happy with a static assessment of the present improvement of an R & D project by itself; they will check periodically whether the project follows its strategic directives and strategic plans (Quélin, 2000: 476-487).

7.4.5. Human Resources and Culture

There are two dimensions to this type of uncertainty: the research and development activity and its ability to "listen to" the market on one hand and how the individual or collective skills of R & D teams compare to the previously required things for the projects on the other. Creativity requires identification of the market and evaluation of customer needs. Firms still face the continuous problem of layering new technological skills upon the existing ones. To overcome this difficulty, they can gain external skills in especially fast developing innovations and then they can internalize them or acquire other skills that are necessary to develop common relationships with other companies, research laboratories and universities (Quélin, 2000: 476).

7.5. The Objectives of R & D

R & D basically aims at developing products and services in many areas for the benefit of humans. Although it involves extremely laborious and costly processes, it is very appealing for firms due to the high added value from its results. In addition to its basic objectives, the following objectives can be noted for R & D:

- Expanding production
- Improving product quality
- Lowering manufacturing costs
- Broadening product area

- Increasing market share
- Entering new markets
- Reducing energy consumption
- Replacing goods that are out of production
- Reducing environmental effects
- Developing business lines
- Fulfilling regulations and standards
- Increasing product flexibility
- Increasing cycle time

7.6. Limiting Factors of R & D

The main limiting factor of R & D is cost. Long-lasting basic research and applied development activities do not always result in a new product. Although the number of the projects resulting in new products has increased recently, only two out of 100 products of research find their way into the market. The other factors limiting R & D are given below:

- Inadequate R & D incentives from governments
- Inadequate support services
- Inadequate support personnel
- Corporate deficiencies of R & D personnel
- Deficient information on possibilities
- Deficient R & D infrastructure in firms
- Deficient R & D strategy at firm level
- Limited financial resources
- Failure to compete in international markets
- Management thinking that there is no need for R & D

7.7. Sources of R & D

The most important information source for R & D and other innovation activities is customers. This is monitored by the sources within the business and affiliates. The sources of R & D as follows:

- Customers

- Affiliates
- Sources within the company
- Suppliers owned by foreigners
- Rivals

7.8. Outputs of R & D

The point at which an R & D project meets the customers is the outputs of the project. Therefore, the outputs can be generalized as:

- Innovation
- Innovation in a product
- Innovation in a process

When looking at the definition, the outputs can be expressed as tools, equipment, materials, products, methods, systems, and production techniques that have a positive effect to the benefit of customers." Especially the outputs that will reach customers and create the difference should primarily render a benefit, because businesses actually sell the concept of "benefit" to their customers, not a product or service. Looking at it from this point of view, the outputs can be listed as:

- New or developed tools and equipment
- New or developed materials
- New or developed products or services
- New or developed methods or systems
- New or developed production techniques

Besides affecting customers in terms of technology and usefulness, each of these can also have striking outcomes such as:

- Lowering costs
- Influencing prices
- Providing a price advantage in the market

The main goal is to be able to offer customers the highest quality for the cheapest price. If this cannot be achieved, businesses should endeavor to offer the highest quality among the similarly priced products or the cheapest price among the products with similar quality. The only way out of this trap is to find different and unique products through creativity and innovation (Altınay, 2000: 2-3).

7.9. R & D Projects

R & D activities are performed on the basis of projects in businesses. Therefore, a new product with specified purpose, scope, budget and special conditions should be produced. In the research and development activities to be performed in line with scientific principles, each stage should be identified with respect to raising product quality or standard, developing new techniques to lower costs and raise standards, and developing a new technology for production. A plan should be followed when doing these. The results obtained should be transformed into useful tools, equipment, materials, products, services, methods, systems, and production techniques.

R & D works performed for improvements with the existing technology can be in the form of adaptation of the technology. The following will be a detailed examination of R & D projects from a customer-centered perspective.

7.10. Starting Point of R & D Projects

The starting point of a project is the manifestation of innovative and creative ideas. Innovation and creativity are present at every point of a system; the important thing is to create the environment in which innovative and creative ideas can manifest.

It is important in this case to activate the creativity region in the brains of people and to push the entire intellectual capital from top to bottom into the process of creativity. However, it bears noting that leaving brains free without any restrictions is the foundation of creativity. It should also be noted that especially those who are not encouraged to make mistakes remain weak in using initiative, which is extremely needed in an innovation work.

Many ideas will come up thanks to creativity. These ideas should be compiled and evaluated, and converted into an R & D project.

- An objective should be identified
- The scope should be set out in complete detail
- Project time should be scheduled by sketching the dates of milestones
- The project budget should be detailed
- Special conditions, if any (partnerships, consultancies, trainings, etc.), should be specified

Creativity is defined as establishing relationships between objects, thoughts, or ideas between which no relationships have been established previously. Creative thinking lies behind creativity. It is easier to interpret creative thinking when compared to analytical thinking.

- Analytical thinking produces solutions, creative thinking produces ideas
- Analytical thinking requires reasoning, creative thinking requires imagination
- Analytical thinking produces single or a few answers, creative thinking produces many possible answers
- Analytical thinking requires vertical thinking, creative thinking requires horizontal thinking

This last item determines the basic difference.

- There are selections in vertical thinking,
- Change is sought in horizontal thinking.
- Vertical thinking observes events in chains,
- Horizontal thinking consciously jumps.
- The links between events are important in vertical thinking,
- The results of change are important in horizontal thinking.
- Vertical thinking turns towards the highest possibility,
- Horizontal thinking searches the least possible aspects.

Stages of Creativity: Creativity appears in four different stages.

- Preparation
- Incubation
- Presentiment – Enlightenment
- Valuation

Creative Attitudes and Behaviors: Creative attitudes and behaviors are the indicators of the manifestation of creativity. Creative attitudes and behaviors include:

- Venturing to be different
- Delaying momentary decisions
- Thinking flexibly

- Thinking fast
- Creating concepts and linking them to each other
- Imagining and concentrating on a matter

Obstacles for Creativity: The main obstacle for creativity is the prevention of free thinking. Besides this:

- Lack of self-confidence
- Fear of making mistakes and being criticized
- Lack of concentration and ability to work on a subject
- Seeking perfection
- Fear of obstacles
- Resistance to cognitive conflicts and a self-defense mechanism due to one's sense of identity also seriously prevent creativity. Additionally, harmful tensions such as intellectual strains, malaises, insecurity, and inadequate ambition are among other important obstacles for creativity.

Development: Development is to implement the creative ideas that come up in an organization in a successful manner. Development relates more to an existing product or process.

Focus of R & D Works: The customer is at the focal point of R & D work. If customers are well heard, they can be used as a "third eye" in the business. That 80% of the products developed by creative companies come from customer proposals should not be overlooked. The target is to be the sole provider in a sufficiently sized market. Statistics show that successful firms obtain more than 50% of their revenues from the products they have developed within the last five years. This rate is much higher in very successful firms. However, the most important element in the product development process is the Competitive Development Period, which is the key phrase for competition and, more importantly, being profitable will totally depend on costs and efficiency because the price of the product intended to be launched will be determined by the market (Altınay, 2000: 3-6).

7.11. Stages of R & D Projects

As mentioned before, R & D works are those performed on the basis of a project. A project in this sense is also meant to develop a new product.

There is differing opinion and staging models regarding these stages. Each previous study refers to different R & D processes. Cooper proposed the stage-gate system. The key stages are:

- Discovery
- Scoping
- Building the business case
- Development
- Testing and validation
- Launch

Each stage involves multifunctional departments and there is a gate between every two stages. The gates work like quality checkers at implementation points. The qualities of three tasks are checked:

- Quality of implementation
- Business logic
- Quality of action plan

McGrath proposes five phases for concurrent engineering works. These are:

- Planning and specification
- Development
- Testing and evaluation
- Product release

Ulrich and Eppinger offered a five-phase development process. This process includes the following phases:

- Concept development
- System-level design
- Detail design
- Testing and refinement
- Production ramp-up

The R & D process is a stage-gate system and is divided into six stages (Lu and Yang, 2003: 594-599).

- Feasibility works
- Product planning

- Product development
- Prototype development
- Pilot works
- Mass production

Following is an examination and detailed explanation of the stages. These are:

- Idea generation
- Concept development
- Feasibility studies
- Decision making
- Detailed product and process design
- Prototype production
- Manufacturing production machinery
- Trial production
- Mass production and marketing
- Product innovation

Prototype production is naturally followed by the stage of manufacturing the mass production machinery. However, since this stage is not directly related to R & D, it will not be discussed.

7.11.1. Basic Stages of R & D Projects

1. **Idea generation:** This is done by various groups using different techniques. Since the customer and market are at the center, the feedback coming from these is a very important element. However, monitoring technological developments, evaluating ideas coming from proposal systems, as well as Value Engineering (Value Analysis) and Paretto analyses are among the other techniques used in idea generation.
2. **Concept development:** This is the stage where the idea developed is fitted into a product concept, the magnitude of innovation is determined, and a prototype is designed.
3. **Feasibility studies:** This stage covers market analyses, technical feasibility of the product, feasibility of the production, and detailed economic analyses.

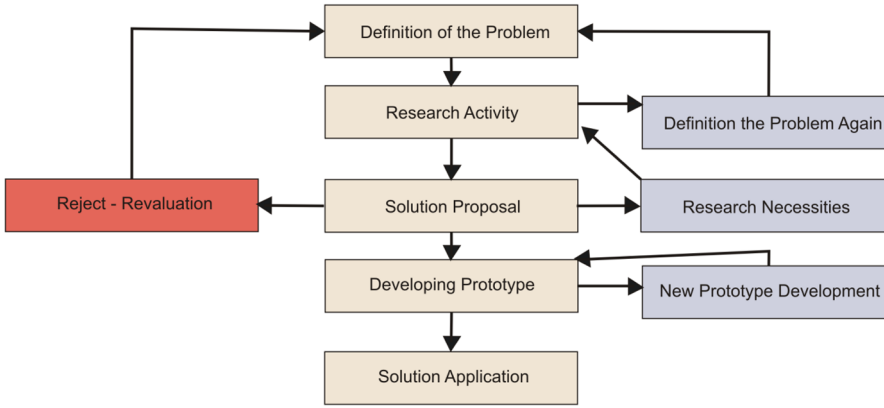

Figure 7.3. Basic Stages of R & D Projects (Badri et al., 1997: 593)

4. **Decision making:** The success of R & D works is directly proportional to the rightness of the decisions made. Since R & D means acting in an environment of uncertainty, making the right decisions is of vital importance for R & D. To make the right decisions, the "Decision Analyses" and "Decision Tree" techniques should be used.
5. **Detailed product and process design:** The next stage of an R & D project is the detailed product and process design. The production process and quality process should be dealt with together here. The purpose of process design should be achieving efficiency.
6. **Prototype production:** Before building mass production equipment, prototypes should be produced to see the product, to conduct some of its tests, and/or to use it in market research. Although many prototype constructing techniques have been developed, the prototype constructing technique should be chosen in line with the intended use of the product.
7. **Manufacturing production machinery:** Although this stage is not directly related to R & D, it is listed here to show the actual stage of R & D. Besides, the manufacturing of production machinery should be considered an important parameter, because the trial productions and modifications that follow this stage are an integral part of R & D and affect the "time of entering a competitive market."

8. **Trial production:** At the end of trial productions, the product appears in its real form. The means of production should be observed and all test of the product should be conducted. Trial production is the point where required product documentation can start to be created.
9. **Mass production and marketing:** Even though a product has started to be mass produced, it still part of R & D activities as it is of concern in terms of product innovation and product life.
10. **Product innovation:** An R & D project follows the same process as product innovation, but the goals used in relation to the innovations to be made in the existing product differ. The innovations made to a product are an important element in planning customer-driven research, quality improvement, technology development, and price reduction. Monitoring technological developments is a way of applying such developments to an existing product. Proposal systems are effective sources used in quality improvement, technological development, and cost reduction efforts. The Quality Tree, Value Engineering/Value Analysis, and Paretto Analysis (Paretto Optimum) are some other techniques used in this area (Altınay, 2000).

7.12. R & D Teams

R & D teams are touchy, which is sometimes envied, other times disliked, and mostly not understood by the other units in an organization. Good R & D teams are adhocracies; they tend to adopt haphazard ventures. As Alvin Toffler said, "The faster the environment changes, the shorter the life spans of organizational structures will be." There has been a transition from long-lasting structures to short-lived structures in managerial terms, for example, in architectural structures, from permanent to temporary. This is a transition from bureaucracy to adhocracy.

A structure of adhocracy has a property of being not rigid, not solid, but tending to be easily adaptable. It is characterized by task groups and temporary organizations. It increases the possibility of an organization to make innovations and discoveries, because it limits the organizational culture that prevents change in the organization or, in other words, that supports in a habitual way the motive of hiding behind organizational secrets and rules. In short, while traditional organizations spend their energies

in bureaucracy, structures of adhocracy turn their energies into creativity.

This does not mean that the adhocracy type of organization does not have any kind of structure; its organizational structure and culture make it possible for people to remove the obstacles that underlay the business. Although such activities actually represent one model of effective research and development, such activities cannot be predicted. A good R & D organization is one in which management accepts the loss arising from lack of prediction (Miller, 1986: 29).

7.12.1. Characteristics of R & D Teams

As people think of R & D as pertinent merely to cars, computers, spacecrafts, satellites, and similar products, it is normal to use terms such as scientist and engineer to define the experts of these organizations, but it is a fact that such organizations have also other experts. They include:

- Programmers who make computers ready for use
- Psychologists who help people use and deal with computers
- Personnel experts who design working environments
- Authors who create knowledge for end users
- Artists who work on creative packaging and making the product aesthetically attractive (Miller, 1986: 30).

Looking at R & D teams in the traditional sense, the team members work together, they sit close to each other, that is, they are in close proximity to one another, they frequently engage in communication among themselves, and they fulfill their designing duties via face-to-face collaboration (Kratzer et al., 2004: 1).

Those who work in R & D teams are the people who wish to work in the right business environment and to be motivated and directed by themselves. They are success-oriented wishing to contribute. They are the driving force behind progress and the providers of creative ideas. They can be defined as information workers in general. They work with ideas, concepts, and technical information specific to their roles. This need for individualism is one of the obstacles lying before R & D management.

The experts in R & D organizations are those people who use on-the-job training methods, and who are not merely practitioners but also a member of the organization. The leaders in R & D teams are usually se-

lected as being the people who are educated well technically and whose contributions in technical areas are prominent.

Technical skills are important for lower and middle level managers. Therefore, managers should be involved technical training activities. For this reason, as far as can be seen, unless some leaders in R & D organizations set up the training and policy to meet this need, soft and skeptical leadership becomes a general trait. Managing such an organization requires people who are knowledgeable in science and technology and are fond of these. In this way, current needs are satisfied.

People who like interpersonal relationships and are knowledgeable about the ways of managing people are also required. This combination is rare among R & D experts, because the second requirement is not normally incorporated into the education they receive.

Additionally, they have worked in a way to favor technical aspects for a long time. Thus, while all organizations complain about the deficiency in leadership and effective management, R & D organizations probably feel more than others the deficiency of leadership in understanding of people. Since there are very few people who can balance management of the human-related and technical aspects of R & D activity, this has become characteristic of the R & D environment.

It can be an education-based result or education may tend to reveal these. Generally, there is a human management and leadership deficit in R & D teams. The effect of this deficit is serious, because these engineers, scientists, and programmers produce products, processes, and services that make life easier and raise the standard of living. Thus, these people should be managed well. If the management and leadership in R & D organizations are improved, an enormous reserve of power hidden in these competent people may be brought out.

Certainly, there are also good managers and leaders in R & D teams who can balance the technical and human sides. Good leaders have the characteristic of bringing out some traits of the staff they work with that are unknown even to them. This process also encourages employees from time to time.

These leaders have completed their development in technical terms and they are also quite ambitious and successful in the management of human resources. They stress the fact that the engineers who work for the targets they set out should constantly improve themselves. Conveying these types of good traits to the others will produce a positive effect in the whole R & D organization.

With respect to the question of why technical managers are often unsuccessful, Bodaway stated that, "[T]he major reason for the administrative failure among scientists and engineers is weak interpersonal skills and deficient competencies."

Miller says also that, "Most of the technology experts are happier to deal with the issues in the laboratory than issues related to humans. In conclusion, most of the technology experts found out that their superiorities and administrative careers were restricted by the human factor rather than technical skills" (Miller, 1986: 30-35).

When defining their operations, companies focus on the intermediate units between their R & D laboratories and operational departments. They look for solutions to fulfill the requirements of technology for offering it to their customers later. Sometimes they form horizontal work groups to increase the exchange of experiences and development of new ideas. They even adapt to project management structures in general. The goal is to facilitate information transfer from the market to the technological research process and in this way to eliminate the worries of potential users in the R & D cycle (Quélin, 2000: 476).

7.12.2. Cross-Departmental Horizontal or Inter-Functional Work Groups

Horizontal work groups are teams of people working on different activities or in different functional areas. The general characteristics of horizontal work groups are:

- Their goal is to solve problems or propose a special solution
- Their life chains may have been limited at the beginning because of not being successful
- Despite successful implementations, the structure is not naturally continuous
- Three phases are frequently taken into consideration: reflection/creativity, convenience testing, and implementation
- The composition of the work group gradually builds up and is mostly dependent on the process stage at a special moment in time
- The project leader may change and the selection of a leader depends on the development and progress of the project
- The horizontal work groups are necessary to give appropriate responses to complex problems

- They make it possible to deal with problems not concurrently but in a result-oriented way
- They improve information circulation
- They give their employees the opportunity to help with the developmental activities of their company before achieving seniority (Quélin, 2000: 485-487)

7.12.3. How Do These Groups Operate?

They should get their legitimacy from senior managers. With the exception of project leaders, all project members should have the same status. The work groups should include potential customers.

7.12.4. What Are the Reflections of Horizontal Work Groups or Project Groups?

This is usually an excellent way of sharing various experiences obtained from many different assets that are buried in the depths of the company. If it fails, it is not the individual participants but the work group itself that has failed. All the members should continue with their regular operations in parallel to their activities in the work group.

A wide range of R & D activities is administered from outside due to globalization. When virtual R & D work groups, teams, and laboratories spread across several continents and countries, they can be seen as a response to the emerging problems.

Success will depend on the environment that is created around the virtual R & D work groups (Quélin, 2000: 485-487). R & D teams rely on both formal and informal communication against physical, temporary, and social status limitations. The capability of R & D teams to be aware of creative objectives depends on how well knowledge is:

- Acquired
- Interpreted
- Synthesized
- Developed
- Understood

Aspects of virtuality arise in many R & D teams as the expertise gradually increases in R & D. There are still several virtual forms even in R & D.

Being virtual is a matter of grade for most of the R & D teams. On one side, there is a virtual team whose members are irregularly scattered geographically where the communication among its members occurs only through electronic means. However, this structure is seen very rarely in R & D. It is seen more in large-scale projects such as development of a new airplane or satellite. Despite this, some scattered teams travel around the world so they can communicate face-to-face with each other. Although the prevalence of virtuality in R & D teams has tended to increases over time, there are still very few R & D teams that are fully virtual.

On the other side, there is the R & D team all of whose experts work under the same roof and all of whose communications are totally face-to-face. In reality, most of the R & D teams employ experts (customers) from many places across the world or, at least to some extent, people from other structures who communicate through electronic means. For this reason, it may not be possible in practice to draw a distinct line between traditional face-to-face teams and virtual teams.

The literature on virtuality mentions at least three factors that express the virtuality of a team. The first factor is the physical closeness of team members. The members work side-to-side in the non-virtual R & D teams known by everyone, whereas members work in different places in virtual teams.

The second factor is the model where the team members establish communication with each other. The communication in a non-virtual, totally traditional R & D team is based on completely face-to-face communication. On the other hand, only electronic communication is used in a totally virtual R & D team.

Finally, the third factor relates to the task coordination and structure of the team. The coordination of team tasks explains the nature of the interaction carried out later with new product development teams to complete the task of product development.

In a totally traditional, non-virtual team, the team members coordinate tasks together and in a common order. In virtual teams, the team task is structured at such a high level that there is no need for coordination among the team members. In virtual teams, such extensive coordination is nearly impossible and there is always high inefficiency.

Table 7.1 shows the differences between virtual and non-virtual traditional R & D teams. These three factors may naturally interact. For example, if all the members are in different places, face-to-face communication cannot be used for the most part and is very unlikely to occur.

Table 7.1. Traditional Teams versus Virtual Teams (Kratzer et al., 2004: 1-5)

Traditional Teams	Virtual Teams
All team members in the same place	All team members in different places
Face-to-face communication among team members	Communication among team members via personal means (synchronized and personal)
Team members coordinate team task together and in a common order	Team task is structured at such a high level that there is no need for coordination among team members

Since these three factors explain the degree of virtuality of a team, the literature defends that they also affect the creative performance of R & D teams. It turns out that there is a strong relationship between the management of virtuality and the outcome of creative performance. In other words, depending on how virtuality is controlled, the creative success of R & D teams may increase or decrease (Kratzer et al., 2004: 1-5).

7.12.5. Objectives of Virtual R & D Work Groups

A virtual R & D work group aims to:

- Increase access to resources, scientific and technological skills (for example, the software skills of the companies active in development of search engines or operation systems)
- Provide access to know-how and real skill types, which are not available yet in a given geographic area and, in this way, increase team efficiency
- Transfer the activities to less political or more ethical and sensitive areas (for example, laboratories specialized in gene engineering or biotechnology)
- Reflect the international nature of the projects that are financed, even if partly, by local donations
- Accelerate the development of the company by providing access to young and dynamic people. Siemens Group is an example of this. Gruo & Bengalli have confirmed that the average age

of their engineers is 24. The mean age of the generation of these two researchers is lower than the mean age in Europe (Kratzer et al., 2004: 1-5).

7.12.6. Advantages of Virtual R & D Work Groups

One is that protections on prices and wages in companies vary from country to country. Also, team communication shows that some coding of knowledge and at least of know-how is necessary. In addition, such virtual groups create a great opportunity to work with customers. Finally, they make it possible to test new forms of the R & D organization. Various stages of a project can be concurrent rather than successive and conclusive (Kratzer et al., 2004: 1-5).

7.12.7. Learning in R & D Teams

A large number of successful innovations have materialized through collective and individual efforts. R & D teams are groups that bring together their individual and organizational pasts for a limited period of time and work in close cooperation to market, develop, design, and create new products. According to the widely accepted view in the relevant academic and popular literature (Grant, 1996; Moorman and Miner, 1998), one of the major success factors in R & D teams is that the knowledge acquired by the individuals in the team surpasses individual intelligence and this knowledge becomes a collective asset helping to fulfill the team mission.

Understanding and explaining the processes and procedures of creation, sharing, dissemination, and usage of knowledge in R & D teams is a critical part of understanding the success of R & D teams. Learning in R & D teams requires an understanding of the learning process in its full sense, and expansion of the inclusion of its effects on project outputs (Akgün, Lynn, and Yılmaz, 2006: 210).

One way of expanding the knowledge on learning in R & D teams is to examine their cross-relation among different teams in different departments. For example, the organizational learning literature provides a rich and broad foundation to understand and define the mechanism and key factors brought about by in-group learning. The R & D teams within many organizations are in fact group activities involving the people in the orga-

nization and their mutual interactions, knowledge, behaviors, and functional cultures (Akgün et al., 2006: 211).

The article by Akgün et al. (2006) deals with the learning process in new product development teams and the effect of this process on product success from a socio-cognitive perspective, and they provide a learning model. They state that cognitive skills affect information processing and this processing affects project success (Akgün et al., 2006: 214).

Theoretical and experimental studies in the literature also show that learning has positive impacts on project success. Moorman (1995) states in his study on 92 R & D projects that sense-making is positively correlated with R & D performance (Moorman, 1995: 311).

Similarly, Moorman and Miner pointed out that a superior memory would positively affect creativity and short-term financial new product performance (Moorman and Miner, 1998: 91). They showed in another study of theirs that team improvisation under highly uncertain environment conditions had positive effects on the technical performance effectiveness of the product (Moorman and Miner, 1998: 1-20).

Lynn studied 281 R & D projects and showed that information acquisition and information implementation had a positive impact on R & D success. Cooper argued that knowledge dissemination is the cornerstone in R & D success (Cooper, 1993: 215).

Based on these results, R & D success will be inevitable if teams keep knowledge at their disposal and use it in an effective way.

7.12.8. Dimensions of Team Learning

Like all other organizations, project organizations also face the challenge of constantly improving the quality of products and services to be able to compete in a competitive environment. A competitive environment necessitates a change towards being knowledge-based and faster development of knowledge compared to rivals. The major point in quality is to produce products and services in line with the needs and desires of customers. Quality in a project-oriented organization can be defined as meeting customer needs within the framework of the technical performance requirements and program of the project and the projects costs. Constant distribution of quality projects depends on the project management skills of the project manager. This skill is gained from the experience acquired in projects in time. John Veollach, the supervisor for the technology branch of Black & Veatch, re-

evaluated the requirements to understand how to learn from project experiences. One of the most challenging things for any professional service entity is the ability to learn from experiences (Kotnour, 2000: 395).

a) Inter-Project Learning. Inter-project learning is the sharing and consolidation of lessons learned from projects to develop and implement new knowledge. The tools supporting inter-project learning involve the groups that share the knowledge in the organization and the means of information technologies. Sidel has offered a detailed example of an online system to learn lessons and approve, document and differentiate them in an organization (Kotnour, 2000: 395).

b) In-Project Learning. In-project learning is to create and share knowledge within a project. In-project learning focuses on the tasks in a single project and supports a successful project distribution by defining problems and solving them throughout the project. Learning occurs when the project team members discuss approaches to completing a task or solve problems. The inner chain of learning emerges in the course of a project and can be defined by the project stage.

The countdown process of the NASA space shuttle is an example of in-project learning. When a technical or administrative problem occurs, the problem is recorded. Repair plans are developed by a team to help solve the problem. Potential restraints are identified accurately and coordination is made to remedy them in time.

Problems and their solutions are recorded and they are simulated to be used in other launches (Kotnour, 2000: 395).

c) Learning Support. For learning to occur in a project organization, the organization members should create, share, and implement knowledge (Huber, 1991). The organization members create new knowledge with respect to the learning experience. Learning support is increased in the process of learning to meet expectations (Kotnour, 2000: 395).

8

Sixth Factor:
Managing the Supply Chain

by Nagehan Uca

Several issues will be covered in this chapter including procurement, the supply chain, supply chain management (SCM), performance within SCM, indicators of performance in SCM, the effect of performance in SCM on firm performance, the concept of uncertainty, and the smoothing effect of uncertainty on the relationship between performance in SCM and firm performance.

8.1. Procurement

Looking at its meaning in a dictionary, procurement means finding by searching, or providing. When its meaning is considered, it can be thought of as a department in an organization. This department is responsible for the purchasing of materials in line with the production flow. Meeting the need for materials is thought as part of the purchasing function. The procurement department is responsible for purchasing the kind and amount requested of the items in the material request lists that are prepared by the production control, engineering, and other departments which are authorized to request materials. The procurement unit is usually within the purchasing department in a business organization.

Although the procurement department seems to perform only purchasing and outsourcing, unlike a simple purchasing transaction, its personnel should have a good command of information such as technical details about the material to be purchased, production costs, and quality of materials. Instead of procuring only the materials requested, if they comprehend the specifications of the materials in their full sense by holding good

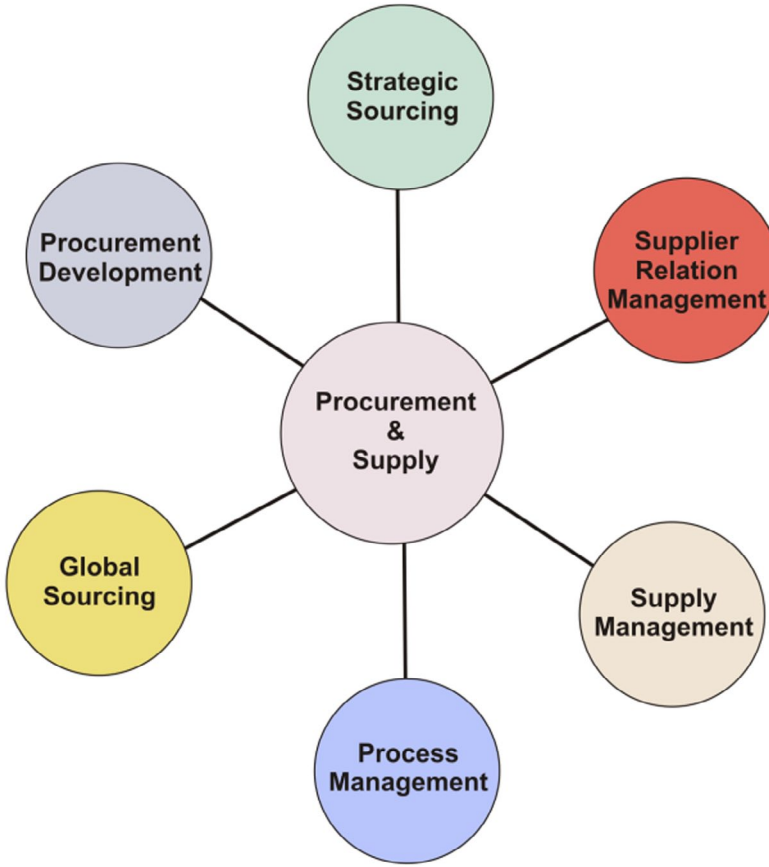

Figure 8.1. Procurement and Supply

dialogues with the concerned units and suppliers, this will help them better evaluate the available alternatives before the actual purchasing stage and thus fulfill their procurement and supply functions thoroughly as shown in Figure 8.1.

The main duties of procurement can be divided into the following groups (Şen, 1992):

1. Standardizing the specifications of required materials as much as possible and checking the material that best fits the intended purpose before purchasing

2. Selecting the most appropriate supply sources and setting out purchasing conditions, including delivery, and presenting purchasing orders to the concerned departments
3. Monitoring whether the delivery is made as scheduled and the quality and amount are as requested
4. Supervising and directing the signing of a contract between the concerned departments and suppliers for procuring all types of materials related to purchasing
5. By acting as an intelligence and information collecting agent in the market, sourcing continuously new and more effective suppliers, and new materials and products in order to reduce costs or to raise the quality of firm products

As shown in Figure 8.2, the requisition prepared for consumables or spare machine parts by the concerned departments, or by marketing if they are not needed by other units, is reviewed by the procurement de-

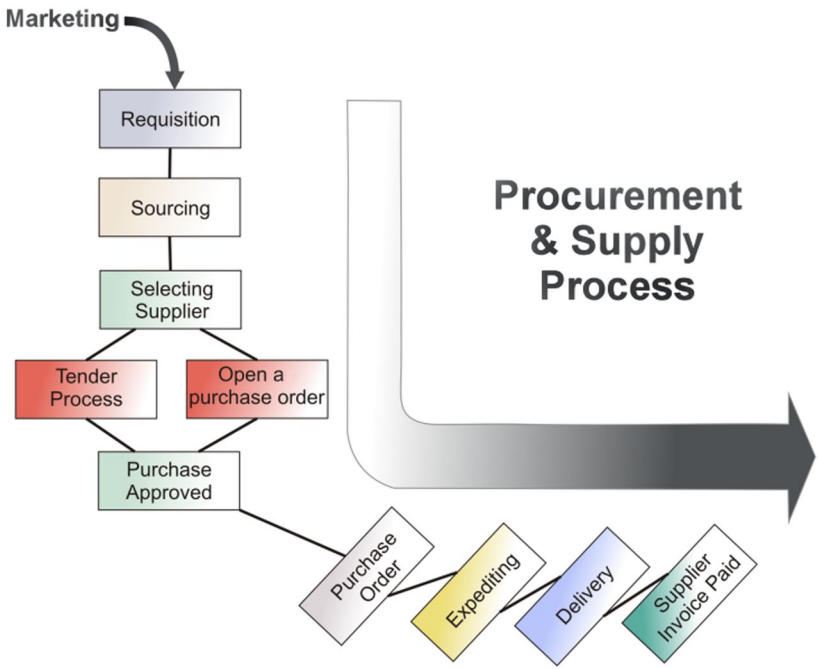

Figure 8.2. The Procurement and Supply Process

partment in coordination with the production and planning department. After sourcing, the supplier is selected and the order is placed through either a tender process or opening a purchase order depending on the order amount and material. After going through an approval process, the purchase order is sent to the supplier. Following the period it takes for the supplier to have the products ready, the process of delivery starts. Payment is made if the product delivered is in fact the product ordered.

Depending on the request received, the process of accepting the delivery of materials to be obtained from suppliers, checking them, and accounting for them takes place. Material movement and information flow is provided throughout the whole process.

Supply chain management is actually management of a flow. It manages information, money, and product flows. As one of the most important points within this chain, the procurement department establishes the firm's connection with the outer world. The effectiveness of the procurement system depends on the information flow from the various functions of the firm and sources external to the procurement department and from the procurement department to the other functions of the firm.

This information flow has become more accurate and speedy today with the widespread use of computers and installation of computer networks in companies. A procurement system supported by an enterprise resource planning (ERP) system increases the quality of customer services, minimizes information loss, and provides good integration.

When procuring materials, the procurement department follows some principles (Şen, 1992):

1. The goal should be to minimize the time between the procurement of materials and turning the materials into products, releasing them into the market, and selling them (turning them into sales income). This is possible only by placing the materials on the production line for processing without keeping them waiting in stocks.
2. As in all other production factors, materials must also be used economically. To achieve this, materials should be made ready for production in a certain order of flow, in satisfactory quality and quantity, at the right time and place, they should be used and consumed in production without delay, and they should be utilized in an optimum manner.
3. The goal is production without stocking; that is, placing the procured materials directly in the change/conversion process in pro-

duction and starting to process them in an uninterrupted order of flow without going to stocks.

There are two major problems with the efficient use of materials: The problem of time and the problem of obtaining the optimum benefit from the materials.

The problem of time in the efficient use of materials arises from stocking, that is, having on hand, and interruptions during production. The interruptions (halt/delay/idleness) in the material flow mean that the capital tied to material is delayed to return to the business as sales income because the sale of the end-product to be manufactured with this material will have been delayed as well. Therefore, it is essential that the time between the procurement and the return of the product sales income to the business is kept as short as possible. Any time lost in material movement will increase the costs because it also ties the capital tied to material. The need to keep these types of costs at a minimum and the need to keep the business ready for production must be balanced. Appropriate solutions may involve optimizing the order amounts and order times (Metz, 1998).

8.2. The Supply Chain

There are many definitions of supply chain in the literature from various researchers and authors. Although they seem different from each other, these definitions generally mention the same points.

According to Ganeshan and Harrison (1995), supply chain is the means of fulfilling the functions of purchasing materials, turning these purchased materials into intermediate or end products, and distribution of such products to the customers. Although the structure and complexity of a supply chain change from industry to industry and from firm to firm, they can be seen in both production and service organizations.

According to Ross (1998), supply chain is a network consisting of all activities, systems, and people involved in the process from the procurement of raw materials to the delivery of the end-products to end-users and repair and maintenance works or destruction of harmful substances contained in a product.

Supply chain is composed of suppliers, production sites, distribution sites, and retail stores as well as raw materials, inventories in process, and end-products carried within the system. The chain begins when raw materials are unearthed and ends when the product is used again or discarded.

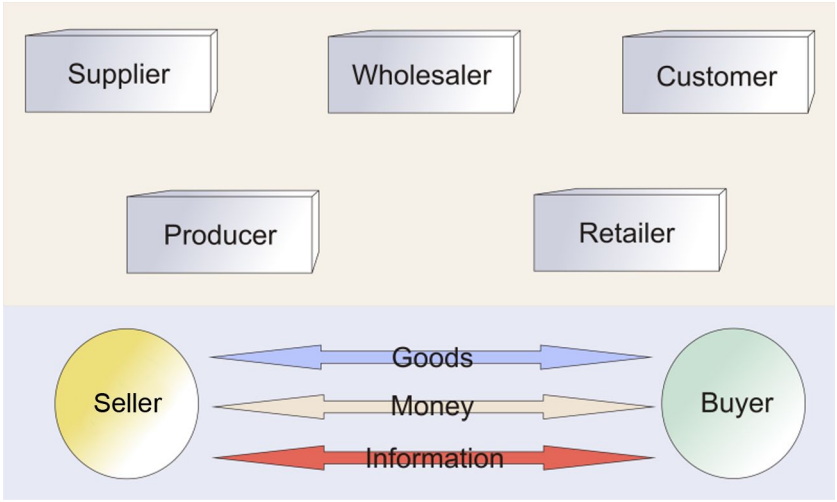

Figure 8.3. Supply Chain Flow Management

Another definition refers to supply chain as an integrated network consisting of physical and technological means, processes, or methods on a scale ranging from the raw material stage to the conversion of the material into an end-product and forwarding such end-product to the end customer or user (Beamon, 1998).

As shown in Figure 8.3, supply chain encompasses all product movements from raw material to end-user. It is a system involving stakeholders such as suppliers, manufacturers, wholesalers, distributors, retailers, and customers and services such as purchasing, procurement, production planning, ordering process, inventory control, transportation, stocking, and customer services. The units in this system can be companies independent of each other or they can be gathered under a single firm. The important thing is to ensure integration and supply chain management.

From a different point of view, supply chain refers to the inclusion of the production from supplier to supplier and from customer to customer as well as the handling of the end-product. It involves four major procedures: planning, procurement of materials, production, and delivery. What is included in these are management of supply and demand, procurement of raw materials and parts, production and assembling, storage and inventory control, order entry and order management, and distribution through all channels and delivery to customers.

8.3. Structure of the Supply Chain

Saturated markets, high energy costs, restrictions in energy and raw material expenses, labor costs, high interest rates, decelerating trend of productivity and, most importantly, inflation are the keywords describing today's economic conditions. Under these conditions, firms find it increasingly difficult to keep their profitability and have a good return on investment. For this reason, managers have had to seek alternative methods to increase profitability and decrease costs. One of the systems that is attempted to be improved continuously is the supply chain system.

The concept of supply chain management has undoubtedly been affected greatly by the Total Quality approach, which deeply undermined the structures and methods used by firms when performing their basic functions. With the effect of new tendencies and expectations, firms have had to operate in a more efficient and customer-oriented way. Today, firms have become irreplaceable for customers as long as they meet customer needs regularly and even do more than that. This is possible only through good analysis and estimation of customer expectations.

Today's definition of quality is satisfying customer needs. As mentioned before, firms have to introduce novelties beyond meeting customer needs to be able to keep their position and not to fall behind their rivals under conditions of increasing competition, because today's quality level will no longer be adequate when it is soon exceeded by a rival firm. While a quality level of 95% may be adequate in some cases, even a level of 99% may not be adequate in other cases. Developed firms constantly establish relationships with customers to understand in what direction customer needs develop and to estimate what their needs may be in the future. They have to do this to keep their current customers and gain new customers by surpassing their rivals with the products they newly develop.

In meeting all these needs, the supply chain in a business aims at acquiring the right materials and right services with the right technology in the right quantity, with the right product at the right time, at a low cost, and delivering them to the right customer.

As mentioned above, a supply chain is an integrated process that converts raw materials into products and then sells them to customers. Supply chain involves two basic areas, production planning and logistics; the logistic processes are divided into inbound logistics, the logistics of the products coming into the plant, and outbound logistics, the logistics of the

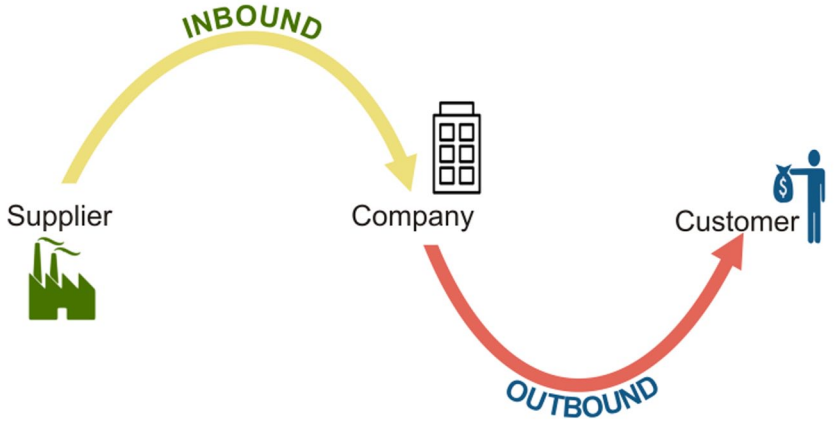

Figure 8.4. Inbound & Outbound Logistics

finished product that is manufactured in the plant. Looking at it in terms of material flow, the process is run as inbound logistics – production logistics – and outbound logistics as shown in Figure 8.4.

Production planning also involves material management. It consists of the manufacturing and in-production stocking sub-processes. More specifically, production planning covers the design and management of the whole production process, acquisition, and scheduling of raw materials, design and scheduling of production process, and design and control of the material handling system. As part of the logistic processes, inventory control involves the design and management of the stocking procedures for raw material and in-process inventories.

The logistic processes are not limited to storage and inventory control, but determine also how products will be transported from storage to retailers. These products can either be forwarded to retailers directly or be carried to a distribution site. This process covers the management of conveyance of inventories and distribution of the end-product. Briefly speaking, in a typical supply chain, raw materials are procured, produced, and delivered to the end-consumer. To reduce costs and improve service quality, effective supply chain strategies and interaction of the supply chain at various levels should be taken into consideration.

In a basic supply chain, raw materials are procured, goods are produced in the plant, they are sent to storage places for temporary stocking, and

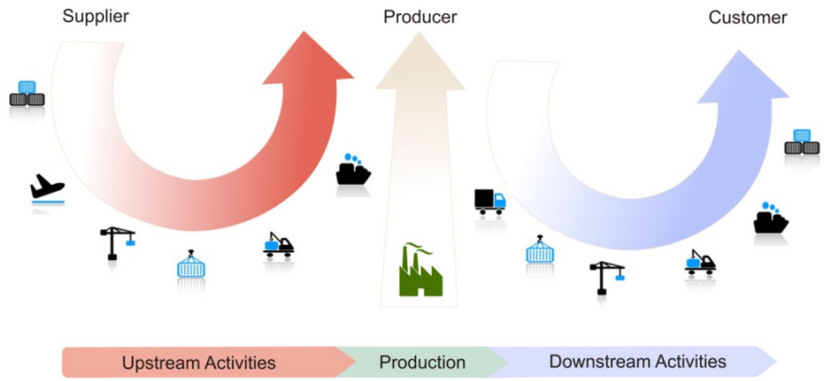

Figure 8.5. Upstream Activities & Downstream Activities

then they are delivered to customers. To reduce the overall supply chain costs and improve customer service quality, effective supply chain strategies are introduced at various levels of the supply chain.

As shown in the supply chain example in Figure 8.5, upstream activities involve a flow of the materials consisting of raw materials and components that are needed to produce the goods from the suppliers and their sub-suppliers to the plant where the production will take place.

These are brought together to produce the goods at the next level. In the downstream activities, goods are sent to distribution sites and from there to retailers or customers.

The internal functions of SCM include the processes in converse relation to the inputs that have been provided by the supply network. In other words, it relates to production of parts, scheduling, and the process of taking orders. Upstream procurement aims at correctly estimating and planning the expiration times between the organizations in the whole supply chain. In this way, SCM plays a role in selecting suppliers, setting out supplier performance requirements, monitoring execution of contracts, and maintaining the relationships with suppliers. The downstream supply chain covers all distribution channels required for the goods to reach end-users, and the processes and functions of packaging, storage, and handling of materials (Monczka and Morgan, 1997).

The marketing, distribution, planning, production, and purchasing organizations in a supply chain traditionally work independently. Each or-

ganization has its own goals and such goals usually collide with each other. For example, the goal of marketing for a good customer service level and maximum sales income collides with the goals of production and distribution. Many production operations are designed to maximize output and decrease costs to affect inventory levels and distribution capabilities. It is clear that a very good mechanism is needed for various functions to work in integration. The supply chain is a strategy to achieve such integration (Ganeshan and Harrison, 1995).

The coordination among the players of supply chain is one of the key factors that affect chain management. Cooper et al. (1997) compare supply chain management to a well balanced and well trained relay race team. If each player knows how to position at the start, this type of a team becomes more competitive. While the relationship between the players who directly pass on the baton is the most powerful one, the entire team has to make effort in coordination to win the race.

8.4. Supply Chain Management

Supply chain management (SCM) is a concept that emerged at the end of the 1980s as a result of rapid changes in industry and the competitive environment in business spheres. Although this approach or concept was first defined at the beginning of the 1980s, it became important at the beginning of the 1990s. The effect of supply chain management is great on today's understanding and literature of logistics. It can be said that it also has had an impact on the theory of marketing because of the close relationship between marketing activities and logistics activities in marketing channels (Mentzer et al., 2001; Chandra and Kumar, 2000; and mentioned by Svenson, 2002).

In the USA, which has played a great role in the development of business management and logistics, production-centered business understanding and market structure at the beginning of the 1900s have shown a sales-centered trend after the 1930s and a marketing-centered trend in the 1950s. While the concept of service rapidly developed from the 1980s on, customer-centeredness and market-centered movements have become valuable. The entire flow chain reaching the customer from raw materials in the historical development of logistics made a transition from its fragmented structure in the 1960s to a stage of integration in the 1980s. Ultimately, it became the supply chain management of today.

The Supply Chain Council describes supply chain management as encompassing "the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies" (APICS Supply Chain Council, 2001).

The Council of Logistics Management, a trade organization based in the United States, defines logistics as "the process of planning, implementing, and controlling the efficient, effective flow of the costs of raw materials, stocks in process, end-products and related activities from point of origin to point of consumption for the purpose of meeting customer needs."

According to Ciravoğlu (2006), supply chain management spans a broad spectrum consisting of sub-suppliers, suppliers, in-business operations, commercial customers, retail customers, and end-users.

The other concepts used other than supply chain are "demand chain" and "value chain." No matter which concept is used, what is meant by these concepts is creation of value for the end-user who is the final customer due to an integrated process management.

The definition of supply chain management was first introduced when it started to be discussed that a new perspective and approach was necessary for managing integrated marketing channels. Forrester (mentioned by Svenson, 2002) had confirmed that business activities in marketing channels were interconnected among them. The interaction between information, material, money, labor force, and capital market instrument flows can be shown as examples of these activities.

As a result of the studies they conducted in businesses in the USA, Japan, and Western Europe in 1992, Oliver and Webber stated that the traditional approaches to the management of integrated marketing channels did not function in a satisfactory way. They mentioned the necessity of a new perspective and a new approach to follow it (that is, SCM). Other scientists had already started using the concepts of supply chain and supply chain management previously (mentioned by Svenson, 2002).

Saunders (mentioned by Svenson, 2002) talks about their efforts to capture the idea behind the successive and interdependent tasks of the traditional supply chain concept. The sequence mentioned here serves like a

channel where each successive task adds value when the product/service passes from the manufacturer to the end user.

Lummus et al. (2003) stated that SCM involves the information flow required to see the logistic flow, customer order management, production process, and all the activities in each supply chain ring.

Mentzer et al. (2001) have stated that SCM means the management of the close relationships between businesses, and understanding partnership, are important in developing a successful retail supply chain relationship.

Chandra and Kumar (2000) have mentioned that many businesses try to improve their SCM to balance customer demand and profitable growth. These studies particularly focus on flexible organizations, organizational relationships, total supply chain coordination, advance communication within a business and between businesses, outsourcing in areas not considered as the main business, order-based production systems, stock management, and cost control.

According to Lambert et al. (1998), the objective of SCM is to maximize the competitiveness and profitability of the business and the whole supply chain including the end customers.

Coyle et al. (1996) maintain that there may be a definition stating that businesses are part of a pipeline bringing a product to the end consumer. A supply chain in its simplest form involves the dealers and direct customers of a business. From the perspective of a supply chain, these three units are in a sense partners bringing the end product to the market.

Carter et al. (1996) define SCM as an "approach in managing in a coordinated manner fulfillment of the customer services goal successfully while minimizing the flow of products from the supplier to the end customer, and storage and similar costs."

Johannson (1994) says that "SCM is an operational approach to supply."

A supply chain needs all of its units engaged for full flow of knowledge. In SCM, the connection and information flow between the various units of the supply chain are very critically important to the performance outcome.

According to another definition, by Ellram and Cooper (1990), SCM is an approach to manage and analyze the whole network from supplier to end customer for the sake of producing the best output for the system.

Christopher (2000) defines supply chain as a process which shapes the services or products that reach the customer's hands and a set of networks belonging to organizations where there are downstream and upstream flows in relation to the activities.

Towill et al. (1992) define supply chain as "a system of supplementary units involving material suppliers, production activities, distribution services and customers that are linked to each other with the forward movement of materials, and backward movement of information."

Cavinato says that supply chain is a series of supply and distribution channels actively managed by businesses which add value to a product until it comes to the consumer from the source of raw materials. He focuses on relational factors rather than procedural factors.

Novack and Simco (1991) states that supply chain management covers the flow of products starting from the supplier going through the manufacturer and distributor and reaching the end consumer.

According to Langley and Holcomb (1992), SCM focuses its attention on the interaction of channel members for the purpose of producing the best product or service comparable to the end user.

Ellram and Cooper (1990) say that SCM is an integrated philosophy of the management of the total flow from the supplier to the customer.

Given these definitions, a brief definition of supply chain can be made as follows: Supply chain is an integrated network of information, money and product flows, which fulfills, for the benefit of customers, the functions of procurement of materials, conversion of the procured materials into semi-finished and finished goods, distribution of such goods to customers by adding value to the chain, and which involves internal and external business functions as well as physical and technological means, processes, and methods.

Supply chain management is, on the other hand, the systematic and strategic coordination of business functions and plans of the entire businesses in a supply chain in order to improve the long-term performances of the chain and such businesses in that chain. Therefore, it is the integration of business processes from the initial supplier to the end user for the purpose of providing products, services, and information that add value for the customer.

These definitions and previous studies underline three important elements that contribute to the understanding of supply chain management. The first is the broadness of the partners of a supply chain. For example, all channels within a business or among businesses including suppliers, manufacturers, distributors, and customers get involved in the activities of the chain and the cooperation among its members. The second is the flow of information and materials. As can be understood from the con-

sensus among the definitions, this covers both downstream and upstream flow of all materials and information simultaneously within the chain, be it a raw material or a finished good. The third is the requirement for integrated and coordinated value-adding activities to manage material and information flow and create a high customer value (Lee and Kincade, 2003).

8.4.1. The Scope of Supply Chain Management

Achieving the desired competitive advantage by employing supply chain management in businesses can only materialize through a well-designed knowledge management structure. Since obtaining high quality goods or services depends on the healthy operation of the decision-making mechanisms of organizations at various levels and the most important component in a decision making process is knowledge, the management of knowledge has become the inevitable success factor.

The demand of experienced customers for higher quality and more reliable goods or services has led to supply chain management (SCM), which enables organizations to improve their level of customer services and reduce their costs in order to maintain and even increase their competitiveness (Franks, 2000).

Supply chain management involves basically timely distribution and logistics management. If a supply chain manages all types of product, service, and information flows from the procurement of raw materials to the last point where the product is consumed in an effective, planned, and controlled way to meet the needs of customers, then it can reduce operating costs (which represents 10% of the Gross National Product in the USA) by 10% as stated by Wu and O'Grady (2001).

Today, managers are aware of the fact that the success of a business depends on the strength of its weakest partner in the distribution chain. Supply chain management has a broad spectrum consisting of sub-suppliers, suppliers, in-business operations, commercial customers, retailer customers, and end users. The concepts used other than supply chain are "demand chain" or "value chain." Regardless of which concept is used, what is meant with these concepts is creating value for the end user who is the final customer through an integrated process management (Ciravoğlu, 2006).

Supply chain management has emerged from a system designed by Toyota to coordinate and manage their own suppliers. The primary factors creating this system are short product life cycle, demanding experienced cus-

tomers, need for high quality, and increasing product cost, which constitute today's market conditions, as well as improvements in communication and transportation technologies (Nagalingam and Lin, 1999).

As market conditions have changed to a large extent, manufacturers started facing great product diversity pressure (Romanowski and Nagi, 2002).

Supply chain management basically aims at reducing prices throughout the system. It also aims at establishing an integrated structure among the supplier, manufacturer, and retail sales channels in order to achieve the desired customer service level by taking into consideration the quality requirements of the product or service. To achieve these goals, it becomes important to set up the right strategies, procure materials at the right time, produce goods in the right quantity, and deliver them to the right destinations.

8.4.2. The Objectives of Supply Chain Management

The supply chain management structure, which involves more than one business, targets creating a synergy with the collective use of resources (process, human, technology, and performance measurements) by acting like a single business. The purpose is to advance the operations of a business by increasing its manufacturing capacity, developing its sensitivity to the changes in the market, and improving the relationships between consumers and those who assume supplying works (Paksoy et al., 2003), and through these, delivering high quality goods or services with the lowest cost in a speedy and reliable manner. From the perspective of the top management, the most important objective of SCM is to capture the highest level of customer satisfaction while minimizing the costs. Owing to this, all units in the chain try to develop themselves. In this context, all stakeholders of a supply chain should keep their products and services up-to-date in line with the continuously changing individual customer demands and needs.

Some of the important objectives of a successful SCM are:

- Reducing costs
- Increasing profitability
- Increasing competitiveness
- Increasing the value of the business
- Developing sensitivity to the changes in the market and increasing the market share
- Raising the customer service level

- Shortening the response time
- Decreasing stock cost

Achieving the expected objectives depends on the appropriate arrangement of the organizational structure, organizational processes, and internal relationships of the organization. Cross teams, common performance assessments, collective decision making, continuous communication, demand planning, and logistics and outsourcing make an effective supply chain management possible. If the necessary infrastructure has not been set up for some reason, no success can be achieved in the management of the supply chain (Ataman, 2002).

8.4.3. The Importance of Supply Chain Management

A new era has come for the role of competition superiority dynamics and supply. There is no mention of treating suppliers and customers as separate units and managing them in isolation any more. Now there is an integrated structure, increased visibility, even a process to obtain raw materials from their source, and conversion through various value added activities from their delivery to the customer. Success is no longer measured by a single procedure. In many examples, competition is a network the businesses working collectively make with other businesses throughout the whole supply chain (Spekman et al., 2002). Similar to the developments experienced in business management systems, the development and rise of supply chain management has gained strategic importance and value in terms of determining the share in the existing market.

Customer demand is classified in today's market environment as the "never-satisfied customer." The supply chain should ideally be able to meet the demands of this new type of customer in the shortest time, and with the lowest cost and highest customer service level. In order to respond to this type of demand, businesses look for suppliers that can offer the required skills, expertise, and capacities, in addition to their internal employees, and choose to establish partnerships with such suppliers.

The trend in firms once was to create a competitive environment among suppliers by increasing the number of their suppliers. Today, as firms have started to see their suppliers as partners, there is a tendency to transition to an integrated structure so they can manage all processes, including product design and manufacturing, until delivery of the product to the customer.

Supply chain management has gained strategic importance since the 1990s because businesses have continued to integrate vertically. Businesses have made it their goal to have a supply system that optimizes all their outcomes. Businesses operating in this way have found that both parties benefit when they work well with firms that perform the next stage of the supply chain (Lummus and Vokurka, 1999).

Also important in the supply chain is the continuous increase in national and international competition. Customers have several channels to satisfy their demands. Thus, it is quite important to provide maximum access with minimum cost. Businesses primarily try to solve the distribution problem in a supply chain. Yet, the dynamic structure of the market means that businesses that keep stock become risk-prone and stagnant. The purchasing habits of customers are constantly changing and rival businesses are continuously putting added value on their products. The cost of stock kept causes increases in the cost of products because funds are tied to stock.

Another reason for the supply chain to gain importance is because it was realized that increasing the performance of a department or function did not necessarily increase the performance of the whole business. If the purchasing department procures a product with an advantageous price through right source planning and right steps, this provides a cost advantage, but the cost of an unfinished product or a product delivered late will neutralize or even negate this advantage. Therefore, businesses must review the whole supply chain network to prevent the impact of a department on the overall production (Lummus and Vokurka, 1999).

8.5. Supply Chain Decisions

Since supply chain management relates to integrating suppliers, manufacturers, and distribution centers in an effective way, it involves all activities from those at the strategic level to those at tactical and operational levels. The decisions in a supply chain are seen at three different levels. These levels and types of decisions made are shown in Figure 8.6. Decisions at strategic level are long-term decisions. These decisions guide designers at the stage of designing the supply chain.

Decisions made at the strategic level include those such as layout of the plant, and determining its capacity, resource needs, and the optimal number of suppliers and plants.

Tactical level decisions are made medium-term and are planned monthly. Basically, supply planning decisions, including service and product flow optimization, are made here. General planning, resource allocation, and distribution planning come to the fore at this level.

Operational decisions are short-term decisions focusing on daily activities. Decisions such as raw material and main production planning and scheduling are made at this level. The purpose of this type of decision is to manage the product flow in the supply chain in an efficient way (Talluri and Baker, 2001).

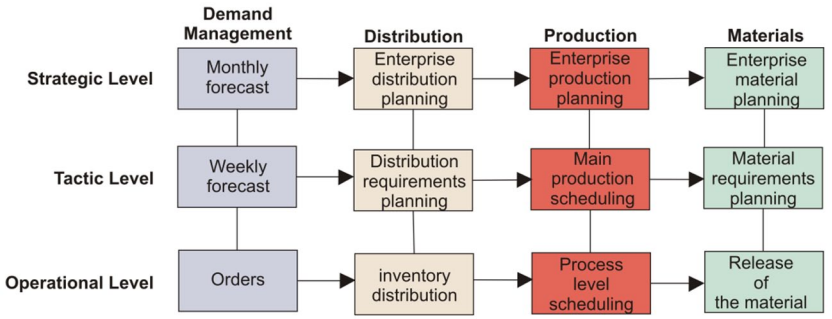

Figure 8.6. Supply Chain Decision (Fox et al., 1993)

8.5.1. Layout Decisions

Deciding on the geographical placement of production equipment and storage and source points is the first step in preparing a supply chain. Once the sizes, numbers, and locations of production means are decided on, the possible routes for the product getting to customers are also determined.

Since these decisions represent the main strategy for reaching customers, they are of utmost importance. They have considerable impact on revenue, costs, and service levels. Layout decisions are shaped by optimization procedures taking into consideration production costs, taxes, customs duties, and distribution expenses.

Although layout decisions have a strategic priority, they also relate to operational circumstances (Ganeshan and Harrison, 1995).

8.5.2. Production Decisions

Deciding on which product will be manufactured in which plant is a strategic decision. As mentioned before, this decision has a great impact on the firm's incomes, costs, and customer service levels. Such decisions take into consideration current equipment and determine all the ways through which the product goes to the equipment or comes from the equipment.

Another critical issue is the capacity of the production equipment. This capacity changes depending on the level of the vertical integration within the firm. Operational decisions focus on detailed production planning. Such decisions relate to the main production planning, production planning in the machinery, and equipment maintenance. Other elements to be considered are the balancing of workload and quality control measurements in the production process (Ganeshan and Harrison, 1995).

8.5.3. Inventory Decisions

These decisions relate to which inventory will be managed. Inventories are present at every step of the supply chain as raw materials, semi-manufactured goods, or finished goods. The first purpose of these decisions is to act as a buffer against any uncertainties that may occur in the supply chain. Since the cost of keeping inventories comprises an additional cost equal to 20% to 40% of the product's own cost, efficient management of inventories is a critical point in the supply chain operation.

However, many studies approach inventory management from an operational perspective. This approach involves finding the optimum level in layout strategies, control policies, order amounts, and reorder points, and adjusts the safety stock level at each stock point. These levels are critical as they are the primary determinants of customer service levels (Ganeshan and Harrison, 1995).

8.5.4. Transportation Decisions

One of the most strategic decisions in a supply chain is that regarding transportation. It is closely related to inventory decisions and should be made considering various advantages and disadvantages of transportation modes. Airline transport is fast, reliable, and secure for stock, but is an expensive method. Sea or railway transport provides a cost advantage

for large and bulky loads, but their delivery time is long. Although land transport is the most flexible transportation mode for door to door transport, it has disadvantages such as safety and environmental factors.

For this reason, customer service levels and geographical location play an important role in this type of decision. Since freight is more than 30% of logistic costs, selecting the right transportation mode and operational efficiency gain economic meaning. Transport size, routing, and scheduling of equipment are the key points in the efficient management of transportation strategy (Ganeshan and Harrison, 1995).

8.6. Business Processes in Supply Chain Management

Lee and Billington (1992) have identified eight basic processes in supply chain management; customer relationship management (CRM), customer service management, demand management, order processing, production flow management, supplier relationships (purchasing) management, product development and commercialization management, and return management.

8.6.1. Customer Relationships Management

The dimension of the relationship established between businesses and their customers has become important with the effect of increased competition under today's circumstances. The main reason for the existence of firms is the customers. It is becoming increasingly difficult to retain current customers and gain new customers due to proliferation of sources of communication and the very rapid globalization of the world. For firms to maintain their positions in the market and to further grow, they must constantly please their customers and well understand their demands and wishes.

To develop their relationships with customers, firms utilize the advantages provided by technology. They come closer to their customers through developing informatics technologies and systems. Solutions that manage the relationships of firms with their customers are called CRM (customer relationship management). With CRM, firms have the chance of monitoring their existing customers and offering them special services, and they can chose their new customers in a more conscious way. CRM enables firms to become more effective in terms of marketing and sales by providing them more up-to-date information. Besides providing measurable information about their customers, CRM systems also assume an important role in gaining customer loyalty (Lee and Billington, 1992).

8.6.2. Customer Services Management

Customer service management provides information to customers on the functions salient to them in a supply chain. Customer service tries to market products to existing and potential customers and allow them get the maximum benefit from them. This process serves as a primary source of information in letting customers know about issues such as obtaining the product, loading time, and status of the order. The real time information provided to customers is made available due to interfaces formed through common links with the firm's processes such as manufacturing and logistics. Customer service management is also responsible for executing the product and service agreements entered into with customers (Özdemir, 2004).

There are three basic decisions made by firms regarding customer services: What product will be included in customer service, what will be the service level, and how customer service will be provided. The duties of customer service in a business can be enumerated as follows (Şen, 1992):

- Delivery order
- Order cycle length
- Reliability in delivery
- Flexibility in reorders
- Accuracy in meeting orders
- Accuracy in documentation
- Compliance of documentation with organizational needs
- Continuity of supply
- Problems with supply and possibility of complaining
- Ensuring quality in the sales, technique, and servicing of the business

8.6.3. Demand Management

In demand management, sustomer demand and supply chain facilities in SCM are balanced. When this process is managed in a correct and effective manner, the deviations between supply and demand are eliminated. In a good supply chain, demand management obtains complete and accurate information from vendors and customers to ensure an efficient flow of goods and services (Fox et al., 1993).

When making decisions in demand management, all the procedures, including market requirements and production planning supply chain, should be taken into consideration. In this way, the supply chain will function better.

8.6.4. Order Processing

Tek (1999) determined that, in an effective supply chain, while orders are being met, customer needs should be also be satisfied, and stated that the activities in the whole chain should be integrated in unity when orders are being fulfilled. Additionally, while meeting customer needs it is also important to secure the cost advantage by setting up a system. To do this, a mutually functional structure and supplier-customer coordination are required.

8.6.5. Production Flow Management

In supply chain management, production flow management is a process that aims at conveying finished goods from the production center to final consumption points, ensuring flexibility of the supply chain and managing it. The flexibility, planning, and management should be diffused across the whole supply chain. Various systems are used in production flow management to enable managing production flow process, production activities, and flexibility applications (Fox et al., 1993). From these systems, some information is given below about manufacturing requirement planning (MRP) and enterprise resource planning (ERP).

8.6.5.1. Manufacturing Requirement Planning (MRP)

This is a method of trying to find the most economical answer to the questions of when and how much should be ordered with respect to dependent stock items. The principle underlying the MRP method is to make available the necessary parts and materials at the exact time when they are needed by going backwards from the finished good in independent demand (Kobu, 1996).

MRP serves in a business especially to ensure availability of materials and products for planned production activities and distribution to customers, to keep the inventory level at a minimum, as well as to plan and implement procurement, manufacturing, and distribution activities.

MRP starts as soon as it is known how many material and product components are required with respect to the demands coming from customers, and when they will be needed. MRP plans demand and inventory statuses, determines the procedures for them, and re-plans the needs in line with the changes.

8.6.5.2. Enterprise Resource Planning (ERP)

As one of the important benefits of use of information technologies, ERP increases the integration of the supply chain. With ERP, all the processes of firms from procurement to after-sale customer support are integrated in the information technologies environment (Murphy et al., 2004). In complex business structures that bring together many raw materials, other intermediary materials, and components used in production, enterprise resource planning systems, which are set up using information technologies, contribute considerably to increasing efficiency and integration. ERP facilitates the monitoring and analysis of all operations and activities in the entire business. Because of reliable and speedy sharing of information, it enables the integration of different departments in businesses under a single roof and minimizes loss of information. With this integration enabled in the whole system, the efficiency of resources and business performance are increased. There is also an increase in quality of goods and services through accurate information flow and right decision making (Bowersox et al., 2002).

ERP benefits a business especially in five major areas. These are integration of financial information, integration of customer information, ensuring standardization and increasing speed in manufacturing activities, optimization of stocks, and standardization of human resources (HR) information.

8.6.6. Supplier Relationships Management

Supplier Relationships Management defines what kind of relationships the firm should establish with its suppliers. Firms need to improve their relationship with their suppliers just as they need to improve their relationship with their customers. They should sign a product and service agreement with each supplier defining the rules of the relationship between them and should ensure that the suppliers comply with this agreement. Supplier relationships management, which manages this process,

is responsible for defining and executing this product and service agreement (Şen, 1992).

While purchasing assumed a passive role within businesses until the 1980s, it was included in the strategic planning process thereafter. Purchasing has since then become one of the important activities for a strategic supply chain due to increasing competition. As Just-In-Time (JIT) production has become more widespread, it has become important to establish longer term and closer relationships with suppliers. Partnerships are set up with suppliers and they are included in all processes through the delivery of goods to customers, including product design and production.

As strategic procurement has expanded, the buyer-supplier relationship has become very important, because suppliers have very deep impacts on cost, quality, time, and buying.

Of importance in buyer-supplier relationships are good communication, sufficient level of supplier base, establishing long-term and solid relationships, the right criteria for selecting suppliers, and mutual confidence and loyalty (Aydın, 2005).

8.6.7. Product Development and Commercialization Management

Firms are supposed to increase their product range to meet changing customer needs. When developing new products for this reason, they should both improve their R & D, production, and marketing functions and integrate their relationships with their suppliers. For a supply chain to be successful in a market, the product development process should be very short and efficient. However, since the increase in product range will also increase production planning and inventory costs, a balance should be established between costs and product range.

Managers who are responsible for this task in the product development process must identify the existing or customer needs not yet known to estimate the demand and take the CRM data into consideration before making decisions.

8.6.8. Return Management

Set up as an effective structure in supply chain management, return management is a key component. Although many firms do not attach the necessary importance to the return process and neglect it, this process gives

a sustainable competitive advantage to the firm. An effective return management process can help firms find ways of increasing their efficiency and complete their projects. Return management involves the activities within and between businesses such as recycling and reverse logistics.

Reverse logistics is the process of returning products to their source so they can regain value or be disposed of properly. According to the Committee of Supply Chain Management Professionals, reverse logistics is "the process of planning, implementing and controlling the flow of raw materials, inventory in-process, finished goods and the information relating to these from the point of consumption to their sources in an efficient and cost-effective manner for the purpose of recycling or destruction."

The better reverse logistics and product returns work in return management, the more advantage gained in securing the efficiency of reverse product flow, reducing product returns, and utilizing the facility of recycling in businesses and supply chains.

8.7. Benefits of Supply Chain Management for a Business

Research that explores how SCM can affect business performance generally focuses on increased customer satisfaction associated with improved quality and decreased delay time, lower costs, flexibility in production, and delivery speed and reliability. Besides performance factors, there are also studies mentioning the relational skills firms will gain (Crook et al., 2008). SCM applications will increase communication and cooperation between businesses. More innovative product designs and improved quality are observed in a well-managed supply chain due to lowered inventory levels, decreased costs associated with shortened order times, increased integration, and improved cooperation between stakeholders.

With the emergence of markets today that are growing, receding from each other, and functioning independently, increased complexity of the networks in the supply chain, rapidly developing technology, and shortened product life cycles necessitate coordination and strong ties between the elements of the chain. As information technologies advance, businesses choose to work more in harmony and within a more integrated structure. To secure such integration and coordination, there is increased importance in supporting a supply chain that focuses basically on material flow, and with an information sharing process that focuses on information flow (Flint et al., 2008).

Rather than seeing channels as separate pieces, each of which deal with their own businesses, the philosophy of SCM adopts a systems approach and sees them as a single unit functioning in unity. In this way, the concept of partnership goes beyond the boundaries of a business and is evaluated as a multiple-firm effort involving the management of product flow from supplier to customer (Mentzer et al., 2001). SCM targets managing raw materials entering the business, coverting materials into products, and delivering final products to consumers.

While businesses aim at focusing on their own basic skills and being more flexible in the global competitive environment, they lose most of their control over sources of raw materials and distribution channels. Outsourcing has become more common. For this reason, businesses contract non-core activities from firms that demonstrate better performance in those areas and provide the services at a lower cost. This, in turn, means more actors performing a series of tasks and units that work for customer satisfaction, but there are the risks of not being able to achieve coordination and lower managerial control. SCM functions towards increasing reliability, integration, and coordination among the chain elements. When all elements in a value chain work within an integrated system like a single unit, SCM has been shown to improve firm performance (Chandra and Kumar, 2000).

Table 8.1. Short- and Long-Term Benefits of Supply Chain Management for a Business (Mun and Mak, 2003)

Short-Term Benefits	Long-Term Benefits
Reduced stock risks and costs	Developing skills and resources
Shortened cycle time	Developing customer service and satisfaction
Reduced storage, distribution, and carriage costs	Improved rate of retaining customers
Facilitating demand fulfillment and purchasing activities, and increased efficiency	More effective marketing
Accelerated product distribution time	Improved competitive position
More effective product distribution efforts	
Lower manufacturing costs	

Saad et al. (2002) explained "fifth generation innovation" to refer to increased integration, network structure, cooperation, and partnership relations. Based on this, SCM is defined as a necessary novelty contributing to Total Quality Management (TQM) and Just-In-Time (JIT) manufacturing practices.

Effective implementation of SCM affects different benefits according to different studies. It can affect and improve all processes of a business such as reducing the complexity of the SC, facilitating selection of suppliers, making purchasing activities more efficient, directing effective storage, and easing distribution. The short- and long-term benefits that SCM will provide to businesses are shown in Table 8.1 as adapted from Mun and Mak (2003). Other benefits that SCM provides to businesses are found in the literature as follows:

- Faster customer response and higher rates of fulfillment
- Higher efficiency and lower costs
- Reduced stocks throughout the chain
- Improved accuracy of estimates
- Fewer suppliers and a shorter planning cycle
- Improved quality and products with advanced technologies
- Increased communication and cooperation among operations
- Shortened repair time and improved equipment preparation

8.8. The Concept and Criteria of Supply Chain Management Performance

The first stage to evaluate in designing performance measurement systems for the supply chain is to find the appropriate criteria to determine its effectiveness and efficiency (Beamon, 1999). Although the criteria used to evaluate the performance of a supply chain differ from the conventional performance criteria, the common point in all the criteria is constant development and end customer satisfaction.

When the reviewing the literature, the studies on performance measurement systems have seemed to gain importance in recent years. The studies underline that the conventional performance criteria based on financial criteria remain inadequate in assessing the performance of a supply chain

because they are based on past data, cannot determine important strategic performance levels such as customer satisfaction and product quality, and do not take into consideration the effects of uncertainty.

Lambert and Pohlen (2001) have stated that many criteria used in assessing the performance of a supply chain are logistic performance assessment criteria that enable internal focusing, and stressed that these criteria, while optimizing the performance of a business in the supply chain, ignore the performance of other businesses in the supply chain. Thus, logistic performance assessment criteria are not sufficient in assessing the performance of a supply chain.

One of the basic characteristics of reactive supply chains is that they can react rapidly to changes in customer needs. Therefore, supply chains need performance criteria that can accurately determine the ability to rapidly meet customer needs.

The most widely recommended system in assessing the performance of a supply chain is the balanced scorecard (Schmitz and Platts, 2004). Using the balanced scorecard to assess the performance of a supply chain enables assessment of all performance criteria, and those criteria can be compared to general goals and the approaches to achieve those goals.

According to Chan and Qi (2003), appropriate performance criteria should be identified for the main and sub processes of a supply chain in line with the strategies and priorities of the supply process. They assessed the critical dimensions of performance criteria for a supply chain as input, output, and combined. The input criteria may be time and cost. The output criteria involve those related to the final product and include distribution reliability, flexibility in production, rapidly meeting customer requirements, and assessment of the rate of launching new product. Combined criteria may be efficiency and effectiveness (Chan and Qi, 2003).

Beamon (1999) has stated that two different performance criteria are used in assessing the supply chain, namely, the cost and the ability to meet customer requirements within budget. The cost criterion includes cost of inventory, cost of operations. The criterion of ability to meet customer requirements includes supply time, the possibility of being out of stock, and the rate of fulfilling orders. Beamon (1999) has stressed that the criteria of cost, activity time, ability to meet customer requirements, and flexibility are used individually or collectively in the measurement of performance in a supply chain.

Chan (2003) conducted another systematically quantitative study which yielded important information regarding the formulation of performance criteria in a supply chain. Chan mentioned two groups, quantitative and qualitative, to measure the performance of a supply chain. The quantitative group consists of the cost and resource use criteria, and the qualitative group of the quality, flexibility, transparency, reliability, and novelty criteria.

Gunesakaran has underlined that the measurement objectives and the criteria used should take into consideration the supply chain objectives as a whole. Such criteria should offer a balanced approach and be classified at strategic, tactical, and operational levels, and as financial and nonfinancial. Gunesakaran et al. (2004) have evaluated the performance criteria for a supply chain in subgroups as criteria for assessing planned orders, criteria relating to the unity of the members of a supply chain, criteria at production level, criteria relating to distribution, criteria relating to customer service, and satisfaction and criteria relating to financial and logistic costs of the supply chain.

Gunesakaran et al. (2004) have proposed a structure that can be used in developing performance measurements for a supply chain. This structure, which is given in Table 8.2, is one starting point for the businesses that design a performance measurement system for their supply chains and such businesses can select different criteria in line with their own needs. Gunesakaran has listed the performance measurements and criteria taking into account the four fundamental supply chain activities of plan, resource, assembly, and delivery, and classified the criteria as strategic, tactical, and operational. The criteria have been chosen according to supply chain activity and planning level. For example, the product development time criterion is at the area where plan activity and tactical planning level intersect. For this reason, the product development time criterion can be useful in assessing the performance of middle level managers who deal with planning activities.

For performance criteria to give realistic results, such criteria should be able to measure all relevant dimensions of the supply chain. Thus, businesses should choose to employ integrated performance criteria rather than individual performance criteria (Lai et al., 2002).

If a business uses only the cost criterion to assess the performance of its supply chain, the performance assessment results obtained may not be realistic. For example, a business may be performing its activities with the lowest possible costs, but if the flexibility of the business is low, the

Table 8.2. Basic Structure of Supply Chain Management Performance Criteria (Gunesakaran et al., 2004)

Supply Chain Activities	Strategic	Tactical	Operational
Plan	-Level at which customer perceives product value -Order supply time -Information processing cost -Net profit, efficiency rate, cycle time -Product development time	-Product development time -Accuracy of estimation methods -Planning of cycle time -Order entry methods -Human resources efficiency	-Order entry methods -Human resources efficiency
Resource		-Supplier delivery performance -Effectiveness of cash flow methods -Pricing of suppliers	-Effectiveness of order cycle time -Pricing of suppliers
Assembly	-Diversity of goods and services	-Percentage of errors -Capacity usage -Cost per operational hour	-Percentage of errors -Cost per operational hour -Efficiency of human resources
Delivery	-Flexibility in meeting customer needs -Effectiveness of integrated distribution planning	-Flexibility in meeting customer needs -Effectiveness of integrated distribution planning -Delivery safety performance	-Quantity of delivered products -Timely delivery of products -Ratio of urgent deliveries -Information richness at delivery -Delivery reliability performance

ability to rapidly meet customer requirements in the supply chain may be limited.

Flexibility is an important factor in the effectiveness of a supply chain because there are many uncertainties. A supply chain should be able to rapidly react to the changes in demand, production conditions, etc. while ensuring effective use of resources. Therefore, flexibility is an important criterion to be considered in assessing the performance of a supply chain (Beamon, 1999).

When designing a performance measurement system for a supply chain, the average inventory level kept, the inventory turnover rate, the adaptability of the supply chain to customer needs as a whole, and the extent to which the relationships in the supply chain are based on mutual confidence are the important points to be considered (Handfield and Betchel, 2002).

The level of confidence among the members of the supply chain is also an important performance criterion in assessment. Chan (2003) has stated that it is important to share in order to build confidence among the members of a supply chain. Such sharing involves not only knowledge sharing but also risk sharing.

Chan (2003) mentioned a consistency criterion for assessing the extent of confidence among the members of a supply chain and proposed that this criterion be assessed with the ratio of late or unfair deliveries made to the point. The level of participation and support given to the solution of problems that occur in a supply chain by the members of that supply chain can be considered as an indication of the level of confidence among the supply chain members.

The manufacturer in a supply chain trusts its suppliers for its raw materials and the end users trust the distributors in that they will provide the products on time. Hence, any delay at any point along a supply chain affects the performance of the whole supply chain negatively (Chan, 2003).

Therefore, since competition can be expressed as arising between supply chains rather than between businesses, it is of critical importance to assess the performance of a supply chain as a whole and to improve it continuously. The available performance measurement systems remain inadequate in assessing the performance of supply chains.

Conventional performance measurement systems do not produce realistic results for the performance of a supply chain because they are cost-oriented and provide information on the past situation rather than the future. Additionally, since the performance criteria based on

cost are not integrated enough with the other criteria, they alone are not sufficient to identify the opportunities in a supply chain to improve performance.

With increased competition, cost should not be taken as the only criterion in assessing performance, and performance criteria that are not integrated can only give an overview for the businesses in a supply chain. Thus, financial criteria and nonfinancial criteria should be included in a balanced way in the assessment of performance in a supply chain.

Supply chains should be agile, and since the agility of a supply chain depends on its ability to react quickly to unpredictable changes, speed and flexibility criteria must definitely be included in the performance assessment of the chain.

The element of confidence in the relationships among the members of a supply chain is also very important in its effectiveness. All the members of a supply chain should volunteer to share information and the level of confidence and the extent of information sharing among the members of a supply chain is an important criterion in assessing the performance of that supply chain.

Assessing the performance of each member in a supply chain separately does not provide realistic information on the performance of the whole supply chain. Thus, the supply chain should be dealt with as a whole and its performance should be assessed. When designing a performance measurement system for a supply chain, the goals of the supply chain members should also be taken into consideration, but the priority should be given to the improvement of the overall performance of the chain. It should be noted that any negative performance of any member of the supply chain will negatively affect the performance of the whole chain.

The number of factors that need to be assessed in supply chains makes it difficult to design performance measurement systems for them. The characteristics of supply chains should also be considered when assessing their performance. The characteristics and complex structures of supply chains cause some criteria for assessing the performance of supply chains to become more important and bring about the need for developing new criteria. When performance measurement systems for supply chains can be effectively designed, it will be easier to identify opportunities for the success of supply chains (Yüksel, 2004).

8.8.1. Indicators of Supply Chain Management Performance

Supply chain management performance can be evaluated from a system-oriented viewpoint. For this reason, supply chain management performance has important indicators as mentioned below. These indicators involve not only so-called macro conditions such as the external environmental conditions faced by firms but also micro conditions that explain the relationships among individuals within the firm. These are knowledge sharing among firms, quality of knowledge, use of information technologies, confidence and loyalty, agility, flexibility, integration, and innovation.

8.8.1.1. Knowledge Sharing among Firms in Supply Chains

While individual firms learn by changing their internal routines (mentioned by Cheung, 2005), partner firms can learn only by changing their inter-firm routines or possibly through partnership activities. Knowledge sharing between firms may be seen as common knowledge acquisition between a group of organizations. Partner firms can develop their own common knowledge by structuring their inter-firm environments, work rules and options, and reshaping them (Cheung, 2005).

Although supply chain is defined as an integrated structure, it consists of a large number of businesses with departments within them. There is a communication pattern with which each business communicates within itself and the supply chain elements, and it is of critical importance for a supply chain to have a flexible and change-sensitive structure (Bakoğlu and Yılmaz, 2001).

While the end distributor in a conventional supply chain structure is the only supply chain member who can directly see customer information, all the other members have the information that comes from the member immediately preceding them. In the conventional supply chain, therefore, information can be damaged and may lose its value because it takes long to get it (Cox and Power, 1999).

The structure of sound information flow should be examined in two sections as full-time information and periodic information. Periodic information includes the changes in the firm's strategies and policies, price arrangements, and promotion of new products and services. Contrary to full-time information, periodic information reaches all the members of a supply chain periodically. Unlike the conventional hierarchical information

flow structure, the full-time information flow is made possible through an information flow network to which all the supply chain members are connected. On this network, all the members of the supply chain can directly communicate with each other and can receive the information they need on a full-time basis. Thus, increased communication between customers and suppliers indicates a high level of information sharing.

Bearing in mind the strategic partnership, a supply chain should be built with an integrated and dynamic structure. Owing to this information sharing structure, organizations will be able to evaluate their suppliers with their design competency. If the abovementioned information sharing structure and information flow structure are evaluated, the supplier selection criteria set out in the literature are obtained for the entities aiming at supplier selection under the criteria of best service, best production, best product, best management, and best cost in the supply chain (Aydın and Çörekçioğlu, 2001).

With technological developments, knowledge has become as important for businesses as the goods and services they produce (Bhatt and Emdad, 2001). The amount of knowledge in the hands of firms has increased, and usable knowledge and knowledge security have become important. The first step in bringing a competitive advantage to a supply chain is to have the chain members be willing to share information in an open way (Lummus and Vokurka, 1999). Businesses that perceive knowledge sharing as a security threat hesitate to share knowledge and this causes problems in the flow management in the supply chain.

Using information technologies for knowledge sharing among the members in a supply chain results in the formation of a virtual supply chain. A virtual supply chain is not based on physical products but on information flow. It is not possible to manage a supply chain effectively before the systems that will convey correct information to all the members in the supply chain are designed. Coordination among the chain members can increase the effectiveness of the businesses. The ability of businesses to access information quickly when needed enables them to be more sensitive to customer expectations and meet customer requests faster than their rivals.

Since the information flow among chain members happens faster than the physical flow of materials and products, it increases the possibility of reducing stock and using resources more effectively (Graham and Hardaker, 2000). Businesses increase order frequency while decreasing order

size. This causes an increase in material carriage activities and accordingly the information flow between businesses becomes important.

Some businesses may prefer to design their products in cooperation with their suppliers. In this way, products are manufactured by businesses in different parts of the world in cooperation with each other. The success of such cooperation largely depends on the ability of businesses to establish effective coordination with businesses outside their physical boundaries.

There are three different types of the functionality of knowledge sharing on a network. The first is simple data transmission from one place to another. This usually happens in the form of sharing demand-related information. The second makes it possible to use some information collectively besides simply transmitting messages. The third enables authorized persons to access the programs in a computer and use such programs. Once knowledge sharing is enabled among the supply chain members, exchange of resources and works between members can take place. Sharing information relating to common activities between the supply chain members is not sufficient. The businesses in the supply chain should also be willing to share the information relating to their particular core competencies (Yüksel, 2002).

Many previous studies have shown the relationship between knowledge sharing and the supply chain. Some results are given below.

In their study experimentally exploring the effectiveness of a supply chain, Crook et al. (2008) stated that knowledge sharing is an indicator of the effectiveness of a supply chain in their model. They concluded that information sharing helps supply chain effectiveness which affects firm performance.

Fawcett et al. (2007) stated that knowledge sharing abilities of firms help decide the performance of the supply chain. Li and Lin (2006) found similar results in their study, as did Zhou and Benton (2007). In a model investigating the effect of knowledge quality on the performance of supply chain, Petersen (1999) found knowledge sharing as an indicator of supply chain performance.

Sezen (2008) has characterized supply chain performance in three forms, namely, flexibility performance, resource performance, and output performance, and tested the design and integration together with knowledge sharing as an indicator of performance.

Selnes and Sallis (2003) defined knowledge sharing in their study as a common activity between supplier and customer. They claimed that knowledge sharing in a supply chain might lead to future dragging down of sup-

pliers and customers to a common memory and common action. They suggested that the value created in a supply chain through knowledge sharing would be more important than the value created by a business individually. They also stated that knowledge sharing between firms in a supply chain involved a multidimensional structure and the sub-dimensions of this structure were knowledge exchange, development of common perception, and integration of knowledge.

8.8.1.2. Knowledge Quality in a Supply Chain

Knowledge has the qualities of degrees of accuracy, timeliness, adequacy, and reliability (Monczka et al., 1998). The importance of the effect of knowledge sharing on supply chain management depends on what the shared knowledge is and how and with whom it is shared (Chizzo, 1998). Jarrell (1998) has stated that knowledge sharing may create flexibility in a supply chain as a whole, but this requires accurate and appropriate knowledge.

Knowledge is harmed due to delays and distortions while it continues to rise within a supply chain (Feldmann and Miller, 2003; and Jones and Towill, 1997). Yet, businesses often still distort their order information especially to hide their real intentions towards their customers, suppliers, and rivals (Jones and Towill, 1997). They sometimes see knowledge sharing as loss of power. To reduce knowledge distortion and raise the quality of shared knowledge, the knowledge that is shared should be as accurate as possible and businesses should enable the flow of such knowledge with minimum delay and distortion (Li and Lin, 2006).

Knowledge quality shows the degree of the shared knowledge between organizations, which satisfy the needs of organizations. If this degree is set high, the supply chain performance becomes that high. The quality of shared knowledge has an extremely important effect on the performance of supply chain management.

In their study identifying the dimensions of supply chain management practices, Li et al. (2009) explored the effect of supply chain management practices on competitive advantage and firm performance and showed the quality of shared knowledge as a dimension of supply chain management practices.

Hartono et al. (2010) investigated the effect of the quality of shared knowledge on the operational supply chain performance and stated that knowledge quality increased supply chain performance.

8.8.1.3. Use of Information Technologies in a Supply Chain

To develop their supply processes, businesses increasingly rely on information technologies. Not only knowledge sharing and knowledge quality but also widespread use of information technologies and the structure of the system used are becoming important now. One of the most important issues in a supply chain is integration. Studies have shown that use of information technologies has increased integration between firms and accordingly firm performance and supply chain performance have improved.

Wu et al. (2006) have explored the effects of information technologies on supply chain competencies and firm performance. They stated as a result of their research that increased use of information technologies affected supply chain competences, and supply chain competences affected firm performance.

Dehning et al. (2007) have explored the effects of information technology-based supply chain management systems on financial performance of manufacturing firms. Their results showed that information technology-based supply chain management improved firm performance by increasing the gross profit margin, stock turnover, market share, and sales revenue, and by decreasing sales, general, and management expenses.

Byrda and Davidson (2003) have experimentally explored the premises of the effect of information technologies on supply chain and the effect of information technologies on performance. They concluded that information technologies had a positive effect on supply chain and this was positively associated with firm performance.

Information technologies have a critical role at the planning and implementation stages of supply chain management. Information technologies have important effects in three areas of a supply chain, planning at the strategic level, planning at the tactical level, and planning at the operational level (Talluri, 2000).

Planning at the strategic level involves a supply chain network design that covers areas such as what the optimum number of suppliers will be and who the distributors will be.

Planning at the tactical level involves planning to optimize the flow of goods and services across the network. The decisions at this level include determining what products will be manufactured in which plants, in what amounts, and from where the raw materials will be procured.

Planning at the operational level involves preparation of all business production plans on a daily or hourly basis.

Çavuşgil and Calantone (2006) have stated that the use of information systems is a determinant of supply chain management and affects firm performance. In another study, Gunesekaran and Ngai (2004) concluded that information systems were an indicator of supply chain management performance.

8.8.1.4. Confidence and Loyalty in a Supply Chain

Confidence is an important determinant of positive performance in business relationships. Panayides and Venus Lun (2009) have investigated the effect of confidence on innovation and supply chain performance and have found that confidence affects supply chain performance positively, and confidence and innovation are the factors affecting high performance in a supply chain.

In their study investigating the effects of confidence and loyalty in a supply chain relationship, Kwon and Suh (2004) have found that the reputation of a partner in a supply chain in the market has a very strong impact on building confidence and the smallest complicated perception of the partner affects confidence negatively. They concluded that loyalty was strongly associated with confidence.

Yeung et al. (2009) explored the effect of confidence on internal harmony and supplier harmony. Their results show that confidence increases both internal harmony and supplier harmony.

In their research, Wu et al. (2004) said that confidence is among the behavioral dimensions of supply chain management. The results indicate that confidence and loyalty increase the performance of supply chain management.

Hua et al. (2002) concluded that increasing the confidence in a relationship in a supply chain will produce significant increase in performance.

8.8.1.5. Agility in a Supply Chain

The ability of a firm to withstand competitive challenges and turn them into a competitive advantage is the key success factor in today's global market. The dynamic nature of market spheres explains why agility is of vital importance for a firm's long-term success and survival. Agility may be defined as the ability of a firm to cope with unexpected challenges, its ability to survive before the unique threats of the business environment, and its ability to transform changes into advantages in the form of opportunities (Swafford et al., 2008).

According to Swafford et al. (2008), the agility of an organization depends on the agility of the supply chain of that organization. They even alleged that achieving supply chain agility is a function of other competences in the organization such as supply chain flexibility and information technology adaptation. Swafford et al. (2008) have found in their experimental study a domino effect between adaptation of information technologies, supply chain flexibility, supply chain agility, and competitive business performance.

Yusuf et al. (2004) identified agility as an indicator of supply chain management performance and investigated its effect on firm performance. The results show that agility is an indicator of supply chain management performance and an agile supply chain is of vital importance for firm performance and competitive advantage.

8.8.1.6. Flexibility in a Supply Chain

Flexibility can be defined as responding to the changes occurring in a competitive environment in a very short time. Flexibility may increase a firm's competitiveness (Sanchez and Perez, 2005). Quick adaptation of firms to changing environmental conditions and their ability to respond to the changing expectations of customers increase flexibility and, thus, supply chain performance.

Sanchez and Perez (2005) discuss agility as an indicator of supply chain performance, and they conclude that there is a positive relationship between flexibility and firm performance, and an agile supply chain increased firm performance.

8.8.1.7. Supply Chain Integration

SCM first focuses on the benefits of integrating the internal functions of a firm such as purchasing, production, and distribution. Therefore, the initial perspective of SCM is the integration of the internal supply chain so that the material flow is not interrupted.

This perspective on supply chain is closely associated with the "value chain" concept named by Porter. This understanding, which evaluates a supply chain in terms of an internal value chain, developed over time and exceeded organization boundaries, including production chains (upstream production chains) and distribution channels (downstream distribution channels) in its scope. In this way, supply chain management has gained an inter-organizational dimension.

The SCM network structure is one formed by the relationships between the stakeholders such as suppliers, manufacturers, wholesalers, retailers, and customers. SCM processes such as planning, procurement/purchasing, manufacturing, distribution, and recycling are business processes that add value to the firm and its customers. The SCM components are the components that determine the work concepts and methods of firms along the supply chain. These related elements comprise the roof of SCM.

Therefore, a supply chain that has completed both its internal and external integration will have an effect on firm performance. A literature search reveals studies showing a causal relationships between integration and supply chain management performance and between integrated supply chain and firm performance. Some of these are as follows.

Saeed (2004) has examined the relationship of integrated supply chain management with firm performance in the model he developed. Considering the integration among functions as a variable of firm performance, Ashenbaum mentioned the importance of integration. Vickery et al. (2003) stated that an integrated supply chain affects firm performance positively. Narasimhan and Kim (2002) discussed in their study integration with its internal and external aspects and explored its impact on firm performance, concluding that integration affects the supply chain performance and firm performance positively.

In another study, Drogea et al. (2004) used internal and external integration as the determinant of firm performance in their model and divided firm performance into two dimensions as market share performance and financial performance. Rosenzweig et al. (2003) explored the effects of an integrated supply chain on competitive skills and performance and pointed out the moderating effect of firm size.

8.8.1.8. Innovation in a Supply Chain

The effect of novelty and innovation on firm performance has been widely accepted in the literature today. There are studies of supply chain management that verify that innovation together with learning have serious impacts on supply chain performance as well as on firm performance.

Innovation is an important instrument that is built over competition and an imperative part of application components. Therefore, outputs relating to innovation affect business efficiency directly. Innovation can be defined as an area redefined in increasing change of products, services, and related markets; establishment of new production, supply, and dis-

tribution methods; and the application of changes in the management of business organizations, working conditions, and workforce competences (Koçoğlu, 2010).

Recent research on supply chain and logistics has started to increasingly underline the importance of innovation in SCM. The European Logistics Association (ELA) stresses that with SCM joining the process of differentiation in organizational competencies, with resources, can be turned into a competitive advantage in the form of low cost and high customer value. According to the ELA report for 2004, the instruments that will be useful to achieve this goal are as follows (Flint et al., 2008):

1. Cooperation in SC Process
   a. Knowledge sharing
   b. Cross border use of knowledge
2. Value Chain Management (Conveyance of value from suppliers to end users)
   a. Product design
   b. Sales

Technological innovation, product innovation, and business processes innovation are shown in Figure 8.7 as innovative activities that can be realized within the scope of SC relationships (Flint et al., 2008).

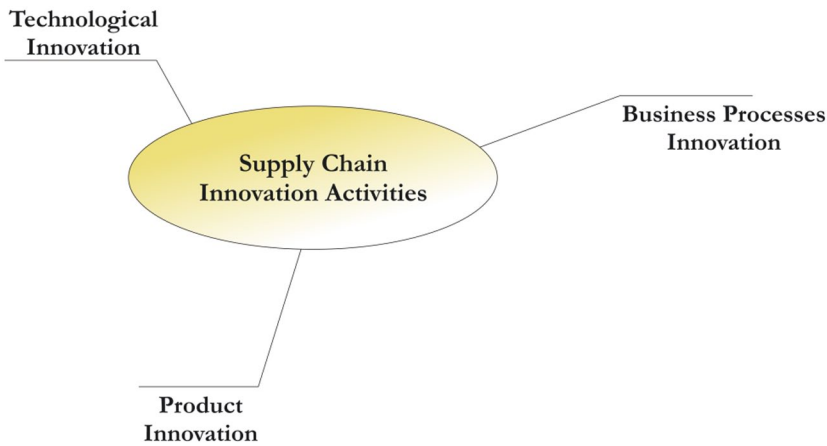

Figure 8.7. Innovation Activities in a Supply Chain (Flint et al., 2008)

Technological innovation is defined as the introduction of important technological developments in current products and processes or production of new products and processes (Koçoğlu, 2010). The fact that technological innovation has an important effect on industrial competitiveness and business success is supported with strong evidence in the literature. The reasons for technological innovation activities are listed below (Çağlayan, 2009):

- Product flexibility
- Conformity with standards and regulations
- Improving product quality
- Reducing labor cost
- Reducing material consumption
- Replacing new models of products with old ones
- Broadening the product range
- Reducing energy consumption

Product innovation is based on various determinant factors in SC relationships. These are determined according to duration of SC relationships, confidence in SC relationships, contractual perspective, and organizational learning (Çağlayan, 2009).

Depending on the changes experienced in the global arena, businesses perform their new product development activities in the SC network by including their partners and they even transfer them. The benefits a business can derive from the participation of its SC partners in product innovation are as follows (Koçoğlu, 2010):

1. Cost reduction
2. Shortened market access time
3. Improved quality
4. Increased efficiency
5. Increased confidence and loyalty to suppliers
6. Increased knowledge sharing
7. Risk and reward sharing
8. Shortened product life cycle
9. Reduced product delays

Firms resort to integration within the SC network to create changes in their business processes and to renovate their businesses with respect to the market, rivals, and customer needs. Businesses try to find ways to make innovations in their processes due to pressures such as innovation efforts of their partners, their responsibility to manufacture customer specific products, and their efforts to maintain a high level of bargaining power. The way to success in this pursuit is more resources, more samples, and more ideas that will feed the innovation. However, risks should also be well assessed. The importance of SCM is underlined to succeed in this. A considerable number of innovations can be made in business processes with the contributions of information technologies (IT) such as timely sharing of appropriate information to make real time decisions, effective material flow management, demand estimates, stock planning and demand management, and customer relationship management (CRM) due to competencies such as increasing customer share, active and loyal customer concept, and customer-specific production flexibility (Çağlayan, 2009).

Panayides and Venus Lun (2009) stressed in their study exploring the effect of confidence on innovation and supply chain performance that there is a positive relationship between innovation and supply chain performance.

Hurley and Hult described innovation as being open to new ideas as part of the organizational culture. In this context, the activities such as ongoing improvements in any product or production technology, learning, problem solving, product development, and process development may be evaluated as skills needed to successfully perform the applications businesses engage in. Such skills are the applications that can undoubtedly develop innovation. Thus, innovation and the ability/power to make innovations are considered as the great power of competitiveness in the global world.

8.8.2. The Effect of Supply Chain Management Performance on Firm Performance

The primary goal of SCM is to create a business model, which consists of members performing at a high level, working in harmony and cooperation with each other, by linking the main functions and processes to each other within a business and between businesses (Şen, 1992). Performance is a multidimensional concept that defines the success of a business, in other words, the extent to which a business has achieved its goals (Aydın, 2005).

The short-term targets of SCM are increasing efficiency, lowering inventory level, and shortening the cycle time, and its long-term target is to increase market share and profitability for all the members in the SC. To compare between organizations and to assess the actions of businesses in time, financial measurements and market measurement criteria are used as instruments.

When performance dimensions are considered with respect to a business enterprise, the first concepts that come to mind are profit and cost. Later, the factor of efficiency is added to these two dimensions. In fact, Drucker argues that performance consists of two important dimensions to attract attention to effectiveness and efficiency. Return on investment (ROI), market share, profit margin of sales, ROI growth rate, increase in sales, increase in market share, and competitive position are used in the literature as measurement criteria to measure organizational performance. New dimensions such as utilization of inputs, quality, innovation, and quality of working life were added to these factors in the 1990s, broadening the scope of performance. Employee behavior, market share, product or market leadership, and public responsibility have been added today to this classification (Koçoğlu, 2010).

Effective supply chain management has become a potentially valuable way of increasing organizational performance and achieving a competitive advantage within a supply chain. There are five dimensions of supply chain management applications in the model developed by Li and Lin (2006), which shows that a high level of supply chain management application increases competitive advantage and firm performance.

SCM plays a very important role in organizational performance in providing value to customers. The following should be used to create better performance in an effective supply chain (Fawcett et al., 2007):

1. Ensuring compliance to targets
2. Customer satisfaction
3. Process integration
4. Total cost
5. Use of inter-organizational cooperation as strategic providers of organizational performance

Bayraktar et al. (2009) stated that supply chain applications are positively related to firm performance and supply chain applications have im-

pacts on firm performance. Lenny et al. (2007) investigated the effect of SCM applications on firm performance and stated there are significant and positive effects of SCM applications on firm performance.

8.8.3. The Uncertainty Concept

Environmental uncertainty is an external condition that has an effect on knowledge sharing in supply chain management. In today's competitive environment, markets have become more international, dynamic, and customer-oriented, and customer demands have become more changeable, requiring better quality, higher reliability, and faster delivery (Thomas and Griffin, 1996). Product life cycles become increasingly shorter and technological developments advance more quickly. To respond to this uncertain environment, organizations need to increase their rate of outsourcing and customer-supplier partnerships (Krause et al., 1998).

Gupta and Wilemon (1990) have stated that perceived environmental uncertainty arises from the following four factors:

1. Increased global competition
2. Development of new technologies that outdate existing products rapidly
3. Changing customer demand requirements, which shortens the product life cycle
4. Increased need for participation from external organizations such as supplier and customer

Ettlie and Reza (mentioned by Li and Lin, 2006) stated that perceived environmental uncertainty stems from unexpected changes in customers, suppliers, and technologies (Li and Lin, 2006). This means that the subfactors of environmental uncertainty are customer, supplier, and technological uncertainties.

Customer uncertainty can be described as the unpredictable changes in customer demands and preferences. The conventional market necessitates a rapidly changing, complex, and customer-driven competition environment. Customer demands for products and services have become increasingly uncertain in terms of time, volume, and location. Customers today request more options, better service, higher quality, and faster delivery (Burgess, 1998; Hoek, 1999).

Supplier uncertainty is defined as the unpredictability and changeability in the product quality and delivery performance of suppliers. There are many sources of supplier uncertainty. These can be enumerated as supplier's engineering level, supplier's time management, supplier's delivery reliability, and quality of raw materials (Lee and Billington, 1992).

The uncertainty caused by suppliers for reasons such as delays and product damages may result in an organization's postponing its production process or even stopping it. Moreover, such uncertainties may increase the practices that would lead to undesirable results such as ineffective use of the resources in the supply chain, and increased logistics costs and storage costs (Yu et al., 2001).

Even in stable environmental conditions, it is very difficult for a manufacturer to provide high quality customer service if its main suppliers work at low quality and slow delivery rates. Such a manufacturer may be eliminated in the current changeable and competitive environmental conditions (Prasad and Tata, 2000).

Technological uncertainty is defined as the unpredictability and changeability occurring in the industry in which an organization operates. The developments in information technologies provide a wide range of opportunities for businesses. The inventions in information technologies provoke a movement towards the integration of supply chain and business processes, make many contributions to the firm, and make correct supply chain integration possible. Advanced information systems reduce the operational costs related to product flow control and enable faster response to customer needs.

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