

**INFORMATION TECHNOLOGY : ANALYSIS OF ITS EFFECTS IN SELECTED
TURKISH COMPANIES**

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ABSTRACT

INFORMATION TECHNOLOGY : ANALYSIS OF ITS EFFECTS IN SELECTED TURKISH COMPANIES

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This study aims at analyzing and explaining the use of information technology (IT) and its effect on organizational structures in SMEs in Turkey. Today, information technology has come to play a more and more important role in most organizations and especially in small and medium-sized enterprises (SMEs). Researchers give different meanings on the concept of IT as how IT is used or interpreted in organizations. This thesis focuses on the impact of IT on organizational structure. A framework for analysis consisting of four eras of IT use has been developed and forms the basis of research method for analyzing the effects of IT in SMEs. In the framework, the dominant technology actually creates an organization metaphor, which helps to determine how organizational structures will be affected by the use of information technology. The variables to be investigated in the areas of organizational structure are control, specialization, formalization, span of control, communication and collaboration, interorganizational relations. Through a case study of two small and medium sized companies in the electronics and manufacturing industries, it

is found that formation of information networks especially external networks has a precise effect on organization structures. The results prove that IT has significant impacts on decentralization, specialization, communication, and interorganizational relations. Also, it is clear that managerial support for IT and IT implementation is found to be a major factor for information technology to be used effectively.

Keywords: Information technology, Small And Medium Sized Enterprises, Organizational Structure, Network Organization.

ÖZ

ENFORMASYON TEKNOLOJİLERİ : SEÇİLMİŞ TÜRK ŞİRKETLERİ ÜZERİNDEKİ ETKİLERİNİN ANALİZİ

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Bu çalışmada, enformasyon teknolojilerinin kullanımının Türkiye'deki Küçük ve Orta Ölçekli İşletmelerde örgüt yapısı üzerindeki etkileri incelenmekte ve analiz edilmektedir. Günümüzde, enformasyon teknolojilerinin örgütlerde ve özellikle Küçük ve Orta Ölçekli İşletmelerdeki rolü hergeçen gün daha da önem kazanmaktadır. Araştırmacılar, enformasyon teknolojileri kavramı ve örgütlerde kullanımı ve açılımı ile ilgili farklı tanımlarda bulunmaktadır. Bu tezde, enformasyon teknolojilerinin örgütsel yapı üzerindeki etkileri üzerinde durulmaktadır. Enformasyon teknolojilerinin son 40 yıldaki kullanımı ile oluşturulan çerçeve, bu teknolojilerin Küçük ve Orta Ölçekli İşletmelerdeki etkisini analiz etmede araştırma metodunun temelini oluşturmuştur. Örgütsel yapı alanında incelenen değişkenler, kontrol, uzmanlaşma, resmileşme, örgütsel düzey sayısı, iletişim ve etkileşim ile örgütlerarası ilişkilerdir. Elektronik ve imalat sektöründen Küçük ve Orta Ölçekli İşletmelerde karşılıklı görüşmeler şeklinde yapılan analiz sonucunda, enformasyon şebekelerinin özellikle de dış şebekelerin kurulmasının örgüt yapısı üzerinde etkisi olduğu ortaya çıkmıştır. Sonuçlar, enformasyon

teknolojilerinin kontrol, uzmanlaşma, iletişim ve etkileşim ve örgütlerarası ilişkiler üzerinde anlamlı katkısı olduğunu çıkarmıştır. Ayrıca, enformasyon teknolojilerinin etkin kullanılması açısından bu teknolojilerin kurulmasında ve geliştirilmesinde yönetsel desteğin temel faktör olduğu görülmektedir.

Anahtar Kelimeler: Enformasyon Teknolojileri, Küçük ve Orta Ölçekli İşletmeler, Örgütsel Yapı, Şebeke Örgütler

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CHAPTER 1

INTRODUCTION

Information technology (IT) plays a role in many, if not most, of the everyday operations of today's business world. In prior years, IT had been viewed only as a supporting player within the overall strategy of the firm. The term IT is defined in a broad sense as “technologies dedicated to information storage, processing, and communications” (Ang et al., 1997). This notion of IT focuses on a combination of hardware, software, telecommunications, and office equipment that transform raw data into useful information for speedy retrieval. The literature lacks an explicit and unified classification of IT, as there is large variation among different researchers in interpretations of IT. In this thesis, different meanings as how the IT is used or interpreted in organizations are explained to establish the interaction between IT and organizations.

Today, information technology has come to play a more and more important role in most organizations and especially in small and medium-sized enterprises (SMEs). The focus is on SMEs because compared to large-scale enterprises they have more problems with the dissemination and application of knowledge concerning new technological innovations such as IT (OECD, 1997; La Rovere, 1996). Ballantine (1998) reported that prime drivers when selecting and implementing IT in SMEs are the pressures from major customers, and an emphasis on improving efficiency. Today, it is evident that increasingly SMEs are faced with more complex IT investment decisions. SMEs have different definitions in different countries and institutions. For the purposes of this thesis SMEs are defined as all companies with less than 150 employees. SMEs occupy an important place in the economic and social fabric of Turkey and account for 99.5% establishments, 61.4% of employment and 27.3 of value added in the manufacturing sector. (<http://www.kosgeb.gov.tr/kosg.htm>)

As a consequence of the deployment of information technology, dramatic changes in organizational structures are occurring. Organizational structure today has a different definition from the formal aspects of organizational functioning, such as the division of labor, hierarchical authority, and job descriptions. Today, structure typically includes whether the firm is centralized or decentralized, whether it uses a divisional, functional, matrix, or network organization. Although the transformation into a network organization allows a firm to build on existing foundations, it typically requires changes in organizational structure. The contribution of information technology to transform traditional hierarchies into networks consists of reducing the number of management levels, facilitating the direct communication between people and organizations and increasing organizational flexibility. For many industries and firms as well as SMEs, the network form has become critical for survival and continued competitive advantage.

The aim of this thesis is to analyze and explain the use of information technology and its effect on organizational structures of SMEs in Turkey. A model framework is developed to show how SMEs justify their IT expenditures, target of systems and the information model. In the framework, the dominant technology actually creates an organization metaphor, which helps to determine how organizational structures will be affected by the use of information technology. Thus, the research model uses organizational structure as the independent variable with information technology being used as the dependent variable. Control, specialization, formalization, span of control, communication and collaboration, interorganizational relations are tested as the structural variables.

A framework for analysis has been developed and forms the basis of research method for analyzing the effects of IT in SMEs. For the case study phase, two firms were recommended by Technology Development Foundation of Turkey (TTGV). TTGV is an independent non-profit organization that has undertaken a national mission of fostering the continuous and effective technology development activities of companies in the industrial sector. Two firms from different industries (electronics and manufacturing) that have adopted IT in their daily functions are

chosen for the case study. The inclusion of these two industries was to check that the phenomena were not industry-specific. As a result of the case studies, formalization and span of control were not affected because of the nature of SMEs. These firms employ not many people and the organization chart and hierarchies are very simple. Managerial support for IT and IT implementation is found to be a major factor for information technology to be used effectively. The use of IT such as the applications of external networks showed a movement towards the network organizational structure. The jobs are more characterized by delegation of responsibility and based upon cooperation and communication in more fluid internal and external networks.

Chapter 2 will start with describing the concept of information technology and summarize the fact that researchers give different meanings as how the IT is used or interpreted in organizations. Classification of information technology is actually very important because it captures core functions of different IT and provides a good conceptual framework for conducting empirical work. Chapter 2 then will continue with the use of information technology in organizations. This chapter introduces The Eras Model, which highlights the dominant information technology and how it has been used by organizations over the past four decades. The transformation into a network organization will be explained with the four eras tying each of them with the information technology that is used in that time period. In Chapter 3 the final model will be generated. This model hypothesizes that the factors proposed in the research model will make key contribution to the effects of information technology in SMEs and will illustrate if SMEs had any organizational changes. The findings based on the interviews in two SMEs will be explained and analyzed in chapter 4. In conclusion, the importance of network organization will be emphasized and also an IT diffusion policy will be underlined for setting up the infrastructure for the SMEs as well as addressing the IT usage issues.

CHAPTER 2

LITERATURE REVIEW

The term information technology is a broad term and because of the rapid technological developments in recent decades it has many outdated definitions. This chapter starts with the concept of information technology (IT) and continues with different classifications of IT. Different meanings as how the IT is used or interpreted in organizations are put forward to show the interaction between IT and organizations.

2.1. Classification of Information Technology

Lai and Mahapatra (1997) define the term IT in a broad sense as “technologies dedicated to information storage, processing and communication.” These authors emphasize “this notion of IT focuses on the hardware, software, telecommunication and office equipment that transforms raw data to useful information, adding new value in the process”. According to Sriram et al. (1997) “while there are many inconsistent definitions of what constitutes IT, a growing consensus argues that IT should be defined broadly to encompass hardware, software, telecommunications (including voice, facsimile and e-mail), as well as the personnel and resources dedicated to supporting IT.”

Researchers give different meanings on the concept of IT as how IT is used or interpreted in organizations. The literature lacks an explicit and unified classification of IT, as there is large variation in IT research questions and scope. Typically, researchers classify IT by technological functions (Kendall, 1997). Huber (1990) defines advanced IT to include computer-assisted communication technologies (e.g., email, video conferencing, electronic bulletin boards, and computer conferencing) and computer-assisted decision-aiding technologies (e.g.,

decision-support systems, expert systems, and executive information systems). This classification is actually very important because it captures the core functions of different IT and provides a good conceptual theory for conducting empirical work. From a broader view about IT, Haag and Keen (1996) categorizes information technology in organizations as five broad systems: transaction processing systems, management information systems, decision support systems, executive support systems and communication systems. Kendall (1997) proposes a classification that includes production-oriented technologies, coordination-oriented technologies (cooperative and control), and organizational-oriented technologies. This system of classification is more comprehensive than Huber's and covers a wider range of technologies. Another study uses a binary classification for IT: communication technologies (ITc) and decision-aiding technologies (ITd) (Song et al. 2001). In this distinction, ITc is equivalent to the communication technologies defined by both Kendall (1997) and Huber (1990) and it aims to increase, intensify, and expand interactions among users. ITd extends Huber's decision-aiding IT to include some of the production-oriented technologies listed in Kendall's classification, such as GUI, CASE, Expert systems, and Hypertext. These "production" technologies are included because they are designed to improve decision-making and information retrieval (Kendall, 1997).

The studies dealing with IT issues in general use aggregate IT measures. However, such measures are problematic for at least two reasons. First, they mix all kinds of technologies together, ignoring the fact that various types of IT work best for various purposes (Huber, 1990). Second, the results of such aggregate studies offer limited managerial implications because realistic IT selection, investment and management decisions are always associated with specific types of IT (Song et al. 2001).

This section continues with Chan's (2000) interpretation of information technology. Chan defines the roles of IT as initiators, facilitators, and enablers. (See Fig.1) In this figure, the role of IT is described by a tripartite distinction in which IT causes either an establishment as initiator or product innovation as facilitator or process

innovation as an enabler. Earlier Chan and Choi (1997) proposed a framework to break down the roles of IT through a What/How spiral of analysis. In Chan's new study (2000), he illustrates the utilization of this framework by a review of the impacts of IT and examines briefly the growth of IT's impact on business processes through specific forms of technology particularly computing, telecommunication, and imaging technologies.

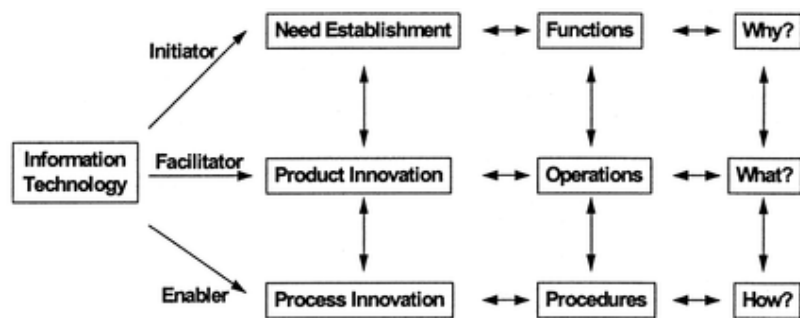


Figure 1. The role of IT (Source :Chan, S. L., 2000)

Chan's (2000) interpretation of IT as an initiator is a starting point for how different researchers classified IT in organizations. The use of new IT is a step towards new operations. Then, new operations may cause a new product development in which IT becomes a facilitator. IT is interpreted as an enabler when it provides the necessary assistance to accomplish things, but if it is not used appropriately, it can attain a disruptive role causing the rules of business to change. With the use of new information technology, old rules are broken down and the way business is done is different from before. With the realization of the potentials of IT, the integral role becomes important and the ties between goals, processes and organization are being formed. The relationship between organization characteristics and several organizational outcomes are formed using IT as a moderator. Looking at the most frequently proposed classifications of information technology in conjunction efforts, the following interpretations are explained in a logical consequence.

IT As Initiator

Chan (2000) defines an initiator as an agent of change. A causal relation is developed from this definition and a “Why” question as well. Hammer and Champy (1993) also states that “An important technology first creates a problem, and then solves it”. This statement shows that new operations may be initiated by the use of the available IT. Thus, IT becomes an initiator as it lets people recognize a powerful solution before seeking the problem it may solve (Hammer and Champy, 1993). Furthermore, new operations may be caused by the decision of using certain current IT. Chan and Choi (1997), for example, provide how imaging technology was used and initiated a total change in the process of ward ordering in a hospital.

IT As Facilitator

IT may serve as an aid to make work less complicated or workload lower. Thus, Chan (2000) notes that there is a need to design some new product to fulfill those new requirements or to create some new operations to accomplish those new functions. These products may not be necessarily new inventions. They may actually be forms of current technology, repackaged for the new need and current environment (Chan and Choi, 1997). This can be viewed as a “What” decision. As an example, in order to facilitate the use of computer imaging, an imaging system would have to be developed to include the operations of image preparation, image capturing, image transmitting, and image receiving, and image database management. IT also acts as a facilitator, because the design of a new operation may necessitate the creation of a new product. The availability of IT in this case serves as a facilitator. In other words, IT can be viewed as a part of the product itself and is frequently used to do things that could not be done before.

IT As Enabler

As discussed in Chan and Choi (1997), an enabler is something that offers the ability or the necessary assistance to accomplish something. Using IT as change

agent does not mean to throw computers on the problem. They will, in most case, speed up work and lead to temporary improvements, but the root of the problem will not be removed, but temporarily covered. In order to perform the necessary operations, procedures have to be followed and implemented. As another point of view, some new products are expected to be innovated after a “What” decision. In order to utilize these innovations, developments may cause some new procedures to maximize gains and to meet the intended objectives (Chan and Choi, 1997). Those procedures can be defined as the answers to the “How” question and are steps to be followed in order to achieve successful operations.

Even though information technology can be an enabler, if used innovatively, it must not necessarily drive change. As J. Yates observes when looking on the impact of IT development on organizational change, the period from implementation to change can vary significantly in time (Yates, 1989). It is not hard to point out that IT is only one of an assembly of change enablers and if used inappropriate, it might even be a disabling factor.

IT As Disrupter

Hammer and Champy (1993) emphasizes on IT as being disruptive, which means “its ability to break the rules that limit how we conduct our work, that makes it critical to companies looking for competitive advantage”. He identifies eight areas (Table 1) where IT can be used disruptively and rules are broken and replaced by new ones.

Table 1. IT : Disruptive Technology

Old rule	Disruptive technology	New rule
Information can appear in only one place at one time	Shared databases	Information can appear simultaneously in as many places as needed
Only experts can perform complex work	Expert systems	A generalist can do the work of an expert
Business must choose between centralization and decentralization	Telecommunication networks	Business can simultaneously reap the benefits of both
Managers make all decisions	Decision support tools	Decision-making is everybody's job
Field personnel needs offices where they can receive, store, retrieve and submit information	Wireless data communication & computers	Field personnel can send and receive information wherever they are
The best contact with a buyer is personal contact	Interactive videodisk	The best contact with a buyer is effective contact
You have to find things where they are	Automatic identification and tracking	Things tell you where they are
Plans get revised periodically	High performance computing	Plans get revised instantaneously

Source: Hammer & Champy (1993)

Shared databases allow companies to move from a sequential to a parallel performance of activities in a process, and provide information to all people involved in it. Hammer (1993) points out, the concept of expert systems does not refer to the earlier attempts of replacing experts by computer systems, but means to provide specialized knowledge to individuals in order to elevate their skills. With the use wireless data communication and computers field staff are able to keep in contact with their company. With the use of new information technology, old rules are broken down and the way business is done before is changing.

IT As Integrator

The recognition and realization of the potency of IT has caused the integral role to come forward. In prior years, IT had been viewed only as a supporting player within the overall strategy of the firm. Automation was, for example, limited to existing

organizational functions. But opinions have changed with the emergence and successful implementation of IT innovations.

It is particularly important that management understand the potentials of IT so that the business vision and consequent plans, and investments exploit it. Figure 2 is adopted from Butera's concept of the potential of IT to act as an integrator, by simultaneously linking the means to achieving the economic and other goals, with the main processes of the business, the organization, and social system. Here, the organization is represented to include structure, tasks, rewards, people, decision process and these concepts are explained in the section 2.2.

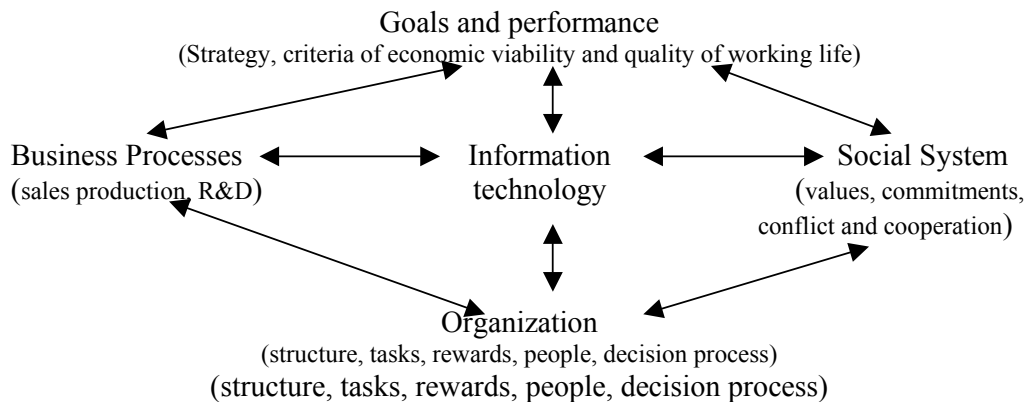


Figure 2. The Integrating Potential Of IT (Source :Butera, 1990)

IT As Moderator

In order to offer a more encompassing view of IT and organizational functioning, Dewett and Jones (2001) examines IT as a moderator of the relationship between organizational characteristics and several organizational outcomes, most importantly, efficiency and innovation (Figure 3). They believe that this approach both places IT in a more theoretically plausible position and offers a useful framework that allows the discussion of IT and a larger array of strategic organizational issues.

Taking non-IT enabled structural dimensions, information sources, communication processes, and so on, already serving to facilitate the link between organizational characteristics and outcomes, Dewett and Jones (2001) use IT as a moderator in the model. Thus, IT serves to alter or change the impact of these organizational characteristics on outcomes, thus moderating their effect in the model.

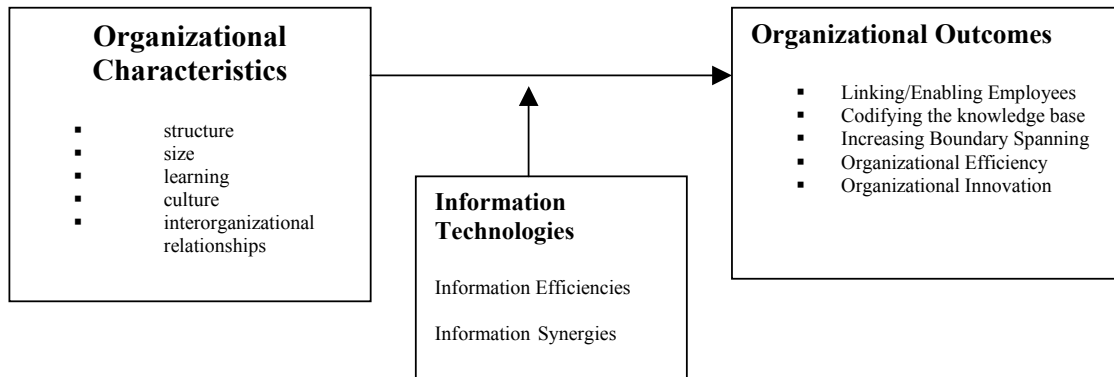


Figure 3. The Moderating Effect of IT (Source: Dewett & Jones, 2001)

In Dewett’s model, organizational characteristics include structure, size, learning, culture and interorganizational relationships. These characteristics with the moderating effects of information technology cause the outcomes such as linking and enabling employees, codifying the knowledge base, increasing boundary spanning, organizational efficiency, and organizational innovation. Organizational characteristics, in fact have an effect upon determining why some organizations invest heavily in information technology, while others spend relatively little. The interaction between IT and organizations is explained in the next section.

2.2. Information Technology & Organizations

Lakhanpal (1994) observed that in the past, researchers attempted to use theories from single disciplines to explain the complex relationship between information technology and organizations. He suggests that a multi-disciplinary approach is

necessary to gain a comprehensive understanding of the phenomenon. Lowry (1997) states that:

“Information systems research is difficult because it always involves people, technology, and the linkages and interactions between them. If we remove the technology, we are no longer studying information systems but are working in reference disciplines such as psychology, sociology, human communication, organizational behavior, philosophy, epistemology, ethics, logic, anthropology, and theology. Similarly, if we remove the human aspects, we position ourselves in computer science, electronic engineering, communication technologies, physics, chemistry, and other technological reference disciplines.”

Yap (1986) explains that it is difficult to establish the true relationship between information technology and organizations. As illustrated in Figure 4, he suggests that organizational factors may determine the use of information technology or the use of information technology may influence the organization, or some combination of both.

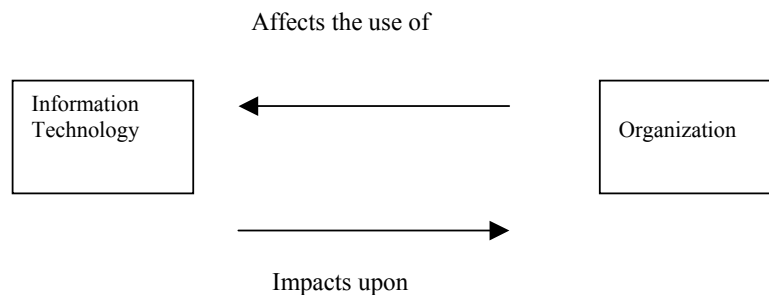


Figure 4. A Conceptual Model Of The Relationship Between Information Technology And Organizational Characteristics (Source : Yap, 1986)

Many theories and models have been used by researchers to explain the inter-relationship of information technology and organizations. Robey & Zmud (1992), mention the following models:

1. The political conflict model, which introduces the concept of multiple objectives, held by different interest groups or stakeholders.
2. The organizational ecology model, which views organizational form as a result of external controls rather than proceeding from the decisions or preferences of organizational members.
3. The managerial innovation model, which argues that the adoption of new technology depends on awareness of problems and organizational culture that encourage risk-taking.
4. The diffusion of innovations model, which argues that the spread of new technology depends on their application to the with work context.

Before explaining the interaction of information technology with other organizational variables, next sub-section starts with a simple framework for organizations.

2.2.1. Framework for Organizations

A simple framework for understanding the design of an organization is the business diamond, introduced by Leavitt (1965) and embellished by Hammer and Champy (1993). Shown in Figure 4, the business diamond identifies the crucial components of an organization's plan as business processes, values and beliefs, management control systems, and tasks and structures.

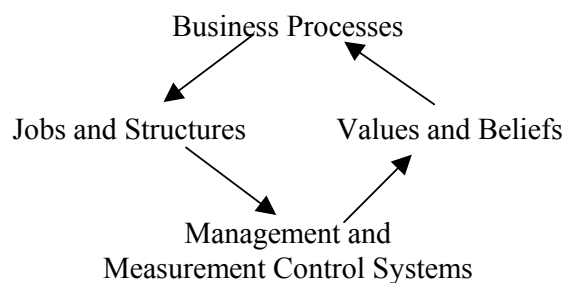


Figure 5. The Business Diamond (Source : Hammer M. and Champy J. 1993)

The simple framework such as the Business Diamond is useful for designing new organizations and for diagnosing organizational troubles. The crucial components interact with each other and for example, organizations that try to change their cultures but don't change the way they manage will not be effective.

Cash et al. (1994) provides a comprehensive framework for organizations. In this framework, organizational variables include decision rights, business processes, formal reporting relationships and informal networks. Control variables include the availability of data, the nature and quality of planning, and the effectiveness of performance measurement and evaluation systems and incentives to good work. Cultural variables comprise the values of the organization. Table 2 summarizes these variables.

Table 2. Framework for Organizations

Variable	Description
<i>Organizational Variables</i>	
Decision rights	Authority to initiate, approve, implement and control various types of decisions necessary to plan and run the business.
Business processes	The set of ordered task needed to complete key objectives of the business
Formal reporting Relationships	The structure set up to ensure coordination among all units within the organization.
Informal networks	Mechanism, such as ad hoc groups, which work to coordinate and transfer information outside the formal reporting relationships.
<i>Control variables</i>	
Data	The information collected, stored, and used by the organization.
Planning	The process by which future direction is established, communicated, and implemented.
Performance measurement and Evaluation	The set of measures that are used to assess success in the execution of plans and processes by which such measures are used to improve the quality of work.
Incentives	The monetary and nonmonetary devices used to motivate behavior within an organization.
<i>Cultural variables</i>	
Values	The set of implicit and explicit beliefs that underlie decisions made and actions taken.

Source: Cash et al. (1994)

Based on a discussion of methodologies of organizational design, Stebbins et al (1995) suggested that IT is a powerful tool for organizational design. According to

Galbraith (1977), organizations try to cope by reducing the need for information processing or by increasing the capacity to process information. Galbraith's main findings is that information needed to carry out any task increases as the goal becomes more diverse or changes in its nature; as the level of task performance becomes more demanding; and as the overall task is divided between more people (Galbraith, 1977). Figure 6 sets out the various options that Galbraith identified.

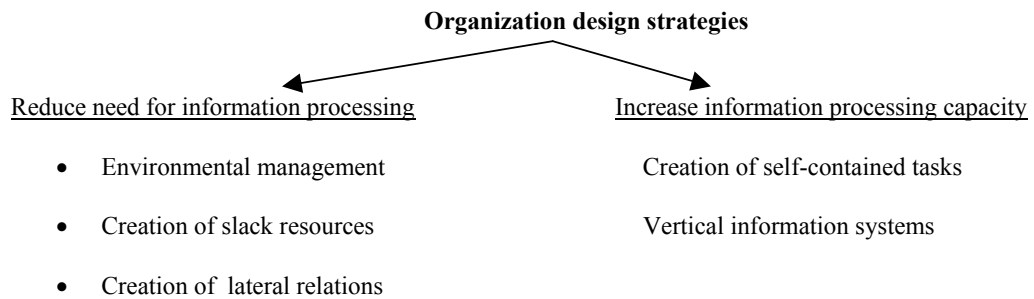


Figure 6. Organization design strategies. (Source: Galbraith, 1997)

Information is a part of basic work-flow and facilitates the managerial control mechanism. IT can aid the operation process. Organization's strategies, goals, decision systems and the environment should be taken into consideration when IT is added to the system.

Lucas and Baroudi (1994) provide a view on IT enabling for organizational change by adding the IT dimension to organizational design. They have categorized these variables, which are summarized in a list in Table 3.

Table 3. The Role of Information Technology in Organization Design

Class of Variable	Conventional Design Variable	IT Design Variable
Structural	Definition of organizational subunits Determining purpose, output of subunits Reporting mechanisms Linking mechanisms Control mechanisms Staffing	Virtual Components Electronic Linking Technological leveling
Work process	Tasks Workflows Dependencies Output of process Buffers	Production automation Electronic workflows Virtual components
Communications	Formal channels Informal communication	Electronic communications Technology matrixing Collaboration
Interorganizational	Make vs. Buy decisions Exchange of materials Communications	Electronic relations Customer/supplier relationships Electronic Customer/supplier relationships Electronic linking mechanism

Source : Lucas and Baroudi (1994)

Table 3 provides a useful list of organizational variables including structure, work processes, communications and interorganizational relationships. IT is believed to bring strategic or competitive advantage to firms (Porter and Millar, 1985). It can be a tool for them to improve their efficiencies and effectiveness in various aspects, like processing time and transaction costs. The firm may alter its operation, structure, culture or even strategy in order to cope with the fast-changing environment. There is no doubt that IT has brought uncountable changes to organizations. Schwarz (2002) identifies five dominant elements of change that are evident:

- (1) organizational structure will be forced to become more flexible,
- (2) organizations will have to forge strategic network partnerships,
- (3) decentralization will become the norm,
- (4) information dissemination will encompass this change in authority relations, and
- (5) job specialization and standardization will be negated as people's roles change.

In order to survive in such an environment, organizations need to make some changes in their structures; next sub-section will expand on how organizations are affected by the use of information technology.

2.2.2. The Use of Information Technology In Organizations

Various studies have been done to understand the nature of relationship between the use of information technology and its effect on the organizational characteristics. Davenport and Short (1990), identifies nine areas (Table 4) about information technology and organizational impacts:

Table 4. IT Capabilities and Organizational Impacts

IT Capability	Organizational Impacts
Transactional	IT can transform unstructured processes into routinized transactions
Geographical	IT can transfer information with rapidity and ease across large distances, making processes independent of geography
Automational	IT can replace or reduce human labor in a process
Analytical	IT can bring complex analytical methods to bear on a process
Informational	IT can bring vast amounts of information into a process
Sequential	IT can enable changes in the sequence of tasks in a process, often allowing multiple tasks to be worked on simultaneously
Knowledge Management	IT allows the capture and dissemination of knowledge and expertise to improve the process
Tracking	IT allows the detailed tracking of task status, inputs and outputs
Disintermediating	IT can be used to connect to parties within a process that could otherwise communicate through an intermediary

Source: Davenport and Short (1990)

Valida et al (1994) analyzes the IT utilization among 230 business organizations in Malaysia. They conclude that the use of IT in Malaysian organizations is strategic in order to gain competitive advantage. Thong and Yap (1995) develop an IT adoption model for small businesses. They conclude that small businesses that had innovative CEOs possessed more positive attitudes toward IT adoption. Another study at Singapore by Ang & Koh (1997) explores the relationship between user information satisfaction and job satisfaction by developing two constructs to measure the relationship and found to be correlated.

In Australia, Sohal et al (1998) examines the role and impact of IT in 530 Australian Business Organizations and finds IT usage is positively related to organizational performance. On the other hand, Fink (1998) studies 280 Australian small and medium business organizations and identifies ten IT adoption factors in the business firms. In Hong Kong, Burn (1990) studies the strategic use of IT in small and medium sized organizations. She surveyes three medium sized organizations and finds IT strategy is related to Porter and Miller (1985) model of competitive advantage. Porter and Miller (1985) explains how information technology changes the nature of competition, building the arguments on Porter's previous work (Porter, 1984). "Information technology can alter each of the five competitive forces and, hence, industry attractiveness as well. The technology affects value activities themselves or allows companies to gain competitive advantage by exploiting changes in competitive scope."

Various empirical studies to investigate the impacts of IT on organizations have been conducted. Dewett et al (2001) analyzes how IT moderates the effects of organizational structure, size, learning, culture, and interorganizational relations on the two most strategic organizational outcomes, efficiency and innovation. Damanpour's (1991) meta-analysis of over forty studies found that specialization, formalization, centralization, and vertical differentiation were all meaningfully correlated with innovation such that innovation was promoted in more organic organizational settings. Drawing on Damanpour's (1991) work, Dewett analyzes how IT moderates the effects of the above-mentioned structural dimensions on

organizational outcomes. Similarly Lau et al (2001) focuses on the impact of IT on organizational structure and culture. In Lau's analysis, the variables investigated in the areas of organizational structure are complexity, formalization, decentralization, span of control, specialization and lateral communication. Team working and learning are examined as organization culture. She found that IT has significant impacts on formalization, specialization, and lateral communication, team working and learning. In this study, control, specialization, formalization, span of control, communication and collaboration, interorganizational relations are analyzed as structural variables. These variables are defined first and then the hypotheses will be developed in chapter 3.

Control (Centralization/decentralization)

Control refers to what extent power is delegated or decentralized (Joergensen, 1998). Centralization or decentralization refers to the retention or delegation of decision-making prerogatives or command (Lau et al 2001). Centralization and decentralization are relative concepts but differ only in degree because every organization structure contains both features. Indeed, decentralization allows more flexibility with which departments and divisions can react to both internal and external environmental contingencies (Karake, 1992). Companies choose empowerment in order to compete more efficiently and to respond internally to developments in the external business environment more rapidly (Chan, 2000).

Specialization

Specialization typically refers to the number of different specialties or job types in a firm (Dewett et al., 2001). The organization is divided into functional lines, like accounting, manufacturing and sales, where specialization is desired and encouraged. The degree of specialization may be differing along the functional lines, depending on the products as well as on the management philosophy. An advantage derived from specialization is that it allows a task to be learned very

quickly as a result of its repetitive nature. This is beneficial to formal organizational structure; however, it has little significance in modern informal structures.

Formalization

Formalization denotes the extent to which rules, procedures, instructions, and communications are written (Lewin and Johnston, 1996). One indication of formalization is the degree to which decisions for handling various situations are programmed and decision-rules are pre-defined.

Span of Control

The span of control is the degree to which one person can extend his or her supervisory authority over other individuals or administrative units in an effective manner. Span of control can be defined as the number of subordinates that a superior directly controls. "This is the building block of hierarchy" (Perrow, 1972). Thus, the span of control, in turn, influences the degree of hierarchy, or the number of levels of supervision in an organization. The wide spans of control mean not many levels of authority, whereas the narrow spans of control refer to a narrow, tall hierarchy with many levels of authority (Perrow, 1972).

Communication and Collaboration

By 1970, information had begun to transform organizations. "We soon learned that the introduction into organization of information as a structural and organic element means the elimination of many, if not most layers of management." (Drucker, 1994). Communication barriers such as hierarchical chains of command, and preoccupation with rules and procedures, have impeded the efficient flow of information. Top-down management prevents leaders from hearing problems associated with the organization. When information flows from bottom to up as well as from the top to bottom, then barriers to communication are broken down. In formally structured organizations, "by the time information makes its way up

through the hierarchy, it is subject to suppression and distortion at the successive levels." (Graham & Hays, 1992).

Interorganizational relations

Knowledge and information sharing among organizations depends on the creation and maintenance of interorganizational relationships. Interorganizational relationships and other forms of organizational collaboration and linking together, represent an increasingly common strategy for the survival and growth of organizations as they seek to defend against their competitors, enter into new markets and gain access to new technologies. Interorganizational relationships are directly linked with the use of information networks in the organization.

2.3. The Importance of Information Networks

Today, IT has different emphasis from just standalone computation. In order to share databases and enhance telecommunication functions in IT, Information Networks (IN) are formed in order to connect various computers in the same or different locations (Lau et al., 2001). From the point of view of organization, the breakdown of network uses can be classified into four types (OECD, 1997):

- business operations (e.g., production and sales),
- business support (e.g., accounting and human resources management),
- marketing (e.g., customer information management) and
- hub functions (e.g., management planning and technology management)

IN can be classified as internal or external based on different purposes. Intra-firm IN refers to LAN (Local Access Network) in firms, especially in large companies. The internal networks are often used for managing production, keeping track of sales and inventory of products, raw materials and parts, accounting, marketing and

customer information, human resource management and management planning (OECD, 1997). For external networks, WAN (Wide Access Network) and EDI (Electronic Data Interchange) are commonly used.

2.3.1. Electronic Data Interchange (EDI):

EDI networks are defined as cooperative inter-organizational systems (IOS) allowing business partners to exchange business information electronically between separate computer applications. IOS's are defined as telecommunication-based computer systems that allow two or more firms to share business data, and possibly applications. EDI networks are a subset of IOS networks that possess the following four features:

1. It must have at least two organizations in a business relationship as users;
2. Data processing tasks pertaining to a transaction at both (all) organizations must be supported by independent application systems, (This property is unique to EDI; other IOSs are based on a single application system that is used by multiple users.)
3. The integrity of the data exchange between application systems of trading partners must be guaranteed by agreements concerning data coding and formatting rules; and
4. Data exchange between the application systems must be accomplished via telecommunication links. (Iacovou et al., 1995)

Firms utilizing EDI can only realize the full benefits of this IT if there is widespread adoption. One major impediment to widespread adoption of EDI is the reluctance of many SME's to adopt the technology. Three factors have been identified that influence EDI adoption in SME's. These are:

- 1) organizational readiness;
- 2) external pressures to adopt;
- 3) perceived benefits of adoption.

The organization readiness factor is important, because many smaller firms have low levels of IT and related resources. The external pressure to adopt is important because many of the smaller firms have weak market positions relative to larger firm EDI users. The perceived benefits of adoption factor are important because of the low impact IT has on many smaller firms due to under-utilization and lack of integration of the technology. (Iacovou et al., 1995)

2.3.2. The Internet

One specific type of information technology that is playing an increasing role across organizations is Internet-based technology. Internet technology stands to not only transform the ways in which organizations interact with their environments, but it also may have an impact on the internal structure of organizations. The Internet may have a significant impact on how organizations conduct research, how they market their products, and how they interact with clients.

Nowadays, the Internet links all the IT and IN features together. “As the Internet grows to form an international network of computers, this phenomenon will undoubtedly grow, further ‘informationalising’ the globalization process” (OECD, 1997). Business and home users can get various kinds of information and share information with each other via the applications of Internet browsing and Internet email.

The number of enterprises using Internet to market their products and services are rapidly changing and more and more SMEs become aware of the potential of this new technique. Poon and Jevons (1997) claim that Internet has created unpredictable and unprecedented opportunities for SMEs and they can access to certain markets similar way as large enterprises and are able to engage international marketing which otherwise could have been unaffordable due to huge amount of resources required. At the time being, more and more SMEs are setting up their own web-sites as a mean for disseminating their companies to potential customers and encouraging interaction. For SMEs, a web-site is an attractive low cost methods for sale promotion to global customers.

Hamil and Gregory (1997) describe that Internet can “provide a low cost ‘gateway’ to international markets and help to overcome many of the barriers and obstacles to internationalisation”. Because of international trade operations, SMEs will be able to compete more easily in the global marketplace. Svensson (1999) draws attention, that SMEs, which are starting to use the Internet for both domestic and international marketing, they must understand how this new media differ from traditional marketing tools. The ability to change is even more critical when being on-line since in the marketplace things change much faster than in traditional ones. Hamil and Gregory (1997) provide a framework of tools consisting of different information technologies and the potential targets for communication, market intelligence, marketing and sales promotion.

The Internet with its different components, especially with the foremost World Wide Web (WWW) brought entirely new set of tools. In the old days, IT was mainly concerned with numerical and logical operations. Even before the internet, the application of information technology in organizations had different purposes such as office automation and management information systems.

2.4. The Role of IT on Organization Structure

Ever since the 1950s, when computers first were employed in business organizations, information technology has played a major role in businesses. With increasing computing power at constantly lowered prices and the development of networks, computers have come to play a more and more important role in most organization.

Two types of organizations that reflect a traditional dualism in organizational theoretical history are explained here. It is important to recognize this usage of the model because Kanter (1983) was actually particularly interested in the relationship between innovation and organization. Her two organizational concepts, integration and segmentalism are her main elements in explaining differences in organizational variables. Table 5 describes what characteristics we can expect to find in integrative and segmentalistic organizations.

Table 5. Integrative and Segmentalistic Organizations

	Integrative organizations	Segmentalistic organizations
Function	Functional flexibility	Specialization
Control	Delegation of responsibility	The control located in the top of the organization
Internal network	Cooperation and communication across internal organizational boundaries	Little cooperation and communication across internal organizational boundaries
Organizing in groups	Organizing in groups are often used.	Organizing in groups are used very little
External networks	Cooperation and communication with external actors	Little cooperation and communication with external actors

Source: Kanter, 1983

The organizational variables in this model are function, control, internal networks, organizing in groups and external networks. These variables actually coincide with the above descriptions; function corresponds with specialization, control with centralization/decentralization, internal networks and organizing in groups with communication and collaboration, external network with interorganizational relations. These variables in fact form and affect the structure of organizations. Organization structure may be defined as “the established pattern of relationships between the component parts of an organization, outlining both communication, control and authority patterns. Structure distinguishes the parts of an organization and delineates the relationship between them.” (Wilson and Rosenfeld, 1990). “Today’s organizational structures demand extensive communications. They are facilitated, in fact made possible, by the vastly increased communication and coordination capability now available through information technology. Without information technology, it is highly doubtful that many of the organizational changes and experiments underway could exist.” (Rockart, 1998)

Malone and Rockart (1993) believes that the latest changes in IT leads to the development of new technology-intensive organizational structures. “The trend today is to flatten the corporate structure in order to speed up the decision-making

process, shorten lines of communication, and achieve savings” (Klein et al., 2000). The advances in IT would dramatically reduce coordination costs and lead to “new coordination-intensive business structures”. Thus, numerous changes in organizational structure are to be observed after the adoption of IT. These changes can be grouped in six areas (OECD 1997):

- (1) Business planning;
- (2) Research and development;
- (3) Information processing;
- (4) Sales and distribution;
- (5) Production -- blue-collar; and
- (6) Outsourcing of total production

Structure typically includes whether the firm is centralized or decentralized, whether it uses a divisional, functional, matrix, or network organization. In the words of Miles and Snow (1992): “Throughout the 1980s, organizations around the world responded to an increasingly competitive global business environment by moving away from centrally coordinated, multi-level hierarchies and toward a variety of more flexible structures that closely resembled networks rather than traditional pyramids.” Miles and Snow (1992) describe how the network form evolved from the three broad organizational forms that preceded it:

1. The functional organization, designed to achieve the necessary size and efficiency to provide products to a growing domestic market,
2. The divisionalized organization, where divisions are structured around clearly distinguished target markets, allowing maximum responsiveness in a diversified product arena
3. The matrix organization, which combines elements of both preceding forms.

The transformation into a network organization is explained below with the four eras in which the dominant information technology is used in connection with the organizational structures. The Eras model shows how organizations have used IT over the past decades.

Table 6. Eras Of Information Technology Usage In Organizations

	Era I 1950s-1970s	Era II 1970s-1980s	Era III 1980s-1990s	Era IV 1990s-2000s
Primary Role of IT	Efficiency Automate existing paper-based processes	Effectiveness Increase individual and group effectiveness	Strategic Industry /organization transformation	Value Creation Collaborative partnership
Justify IT expenditures	ROI	Increasing productivity and better decision quality	Competitive position	Adding value
Target systems of	Organization	Individual manager/group	Business processes	Customer, supplier, ecosystem
Information Model	Application specific	Data-driven	Business-driven	Knowledge – driven
Dominant technology	Mainframe “centralized intelligence”	Microcomputer “decentralized intelligence”	Client Server “distribution intelligence”	Internet “ubiquitous intelligence”

Source :Pearlson, (2001)

Applegate et al. (1998) identifies three eras as; the Mainframe Era, The Microcomputer Era and the Network Era where Client Server computing and the Internet are both used as the dominant technology. In Pearlson’s (2001) model (Table 6) the time frame is divided into four areas according to the main technology that was adopted in the organization. According to this model, from the 1960s to the 1990s internal organizational needs were important: first came the need to lower existing transaction costs; second, to provide support for managers by collecting and distributing information; and third, to redesign business processes. Each era was ushered in by a series of technological innovations that enabled a fundamental shift in IT architecture design (Applegate et al., 1998). Each shift in the technical architecture brought with it new capabilities that added to, and extended the capabilities of the past. Thus, the old technology does not get replaced by the new but added to what was already adopted. The four eras are established according to the primary role of IT in the organization, how organizations justified their IT expenditures, target of systems and the information model. The four Eras are

explained in more detail below and also the organizational metaphor that fits with the era is added according to the main organization structure.

2.4.1. Era I

In the early days of digital computing, information was processed centrally on mainframe computers. Sophisticated technical expertise was required to program, operate, and maintain these computers, and specialized management information systems units were formed (Applegate et al., 1998). The computer was primarily used to automate existing “back-office” information-intensive activities, and as a result, the role of IT was efficiency. In this era, it was relatively straightforward to calculate return on investment (ROI) paybacks to justify the IT expenses. Implementing these systems to achieve the desired benefits was also relatively straightforward, since IT projects were under the direct control of the IT department and did not require major organizational disruption and change. Target of systems was clearly the whole organization and the information model was application-specific.

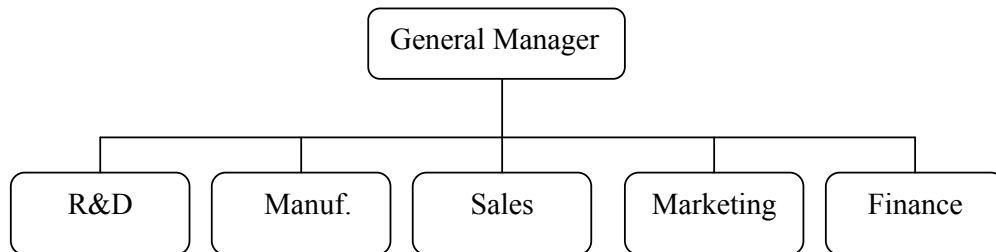


Figure 7. The Functional Organization (Source : Cash et al. 1994)

The organizational metaphor that fits with Era I is the functional organization. (See Fig. 7) In a functional structure, common activities are grouped together. Their activities are coordinated vertically by means of hierarchical supervision. Authority is evidenced by control over resources, rewards and tasks and the decisions regarding them. Each position has a span of control, which describes the number of

immediate sub-ordinated units. Careers are normally defined on the basis of functional experience and employees within a function adopt similar values, goals and orientations. This similarity encourages collaboration, efficiency and quality within the function, but makes coordination and cooperation with other departments more difficult. Since an organization's performance is dependent on all functions working together in a coordinated manner, the functional structure requires extensive information exchange among functions.

2.4.2. Era II

The commercialization of the microprocessor in the 1970s set the stage for the emergence of the personal computing era in the late 1970s and early 1980s. With the introduction of microcomputers and the proliferation of end-user computing and decision support applications in the early-to-mid 1980s, users began to take back control of their information that had been trapped in mainframe systems. Personal computers and spreadsheets automated planning, budgeting, and information reporting; personal/portable technologies and associated software to support collaborative work collapsed the geographic and automatic credit card scanners automated the sales process; and digital machine control and CAD/CAM automated production systems (Applegate et al., 1998). As personal computer technology penetrated organizations, measures of organizational efficiency like ROI became less useful. Instead, measures of individual productivity and decision quality were needed. Target of systems moves from the whole organization to the individual manager and the information model becomes data-driven in this era.

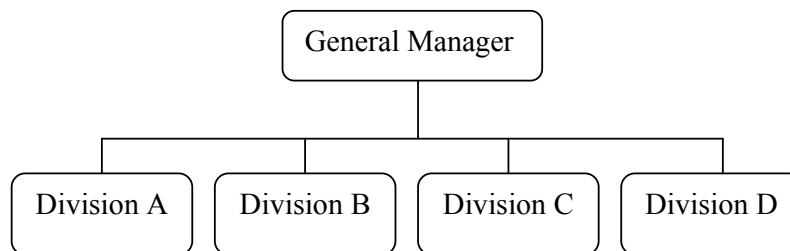


Figure 8. The Divisional Organization (Source : Cash et al. 1994)

The organizational metaphor that fits with Era II is the divisional organization. (See Fig. 8) This structure is aimed to group all decisions concerning a group of highly interrelated outputs under a unified command. Each division may be responsible for a different set of products, geographical markets or segments, or clients. Thus, one can have product, region, market-segment, or client-based divisional structures. Within a division, cross-functional coordination is stronger than coordination in a functional form. Employees identify with their division rather than with their functional specialty. The principal feature the systems have in common will be the output required by headquarters, which needs to monitor and control the performance of division. General management responsibility is important. Decisions to promote managers are typically based more heavily on integration skills- such as the ability to communicate with and motivate individuals of varying backgrounds, and understanding the interrelationships among functions.

2.4.3. Era III

While the strategic benefits of IT were becoming increasingly clear, the proliferation of local computing had seriously hampered the ability to share information across the organization. Struggling to make sense of the rapidly changing business environment, management embraced new approaches to “distributed information processing and management” available through “client-server” computing-a new approach to IT architecture that promised to link mainframe and personal computer (PC) technologies, preserving the benefits of both. (Applegate et al., 1998). With start in the late 1980s, the ideas of business processes took ground and dominated organization design for several years. Thus, business driven information model gained importance in this era.

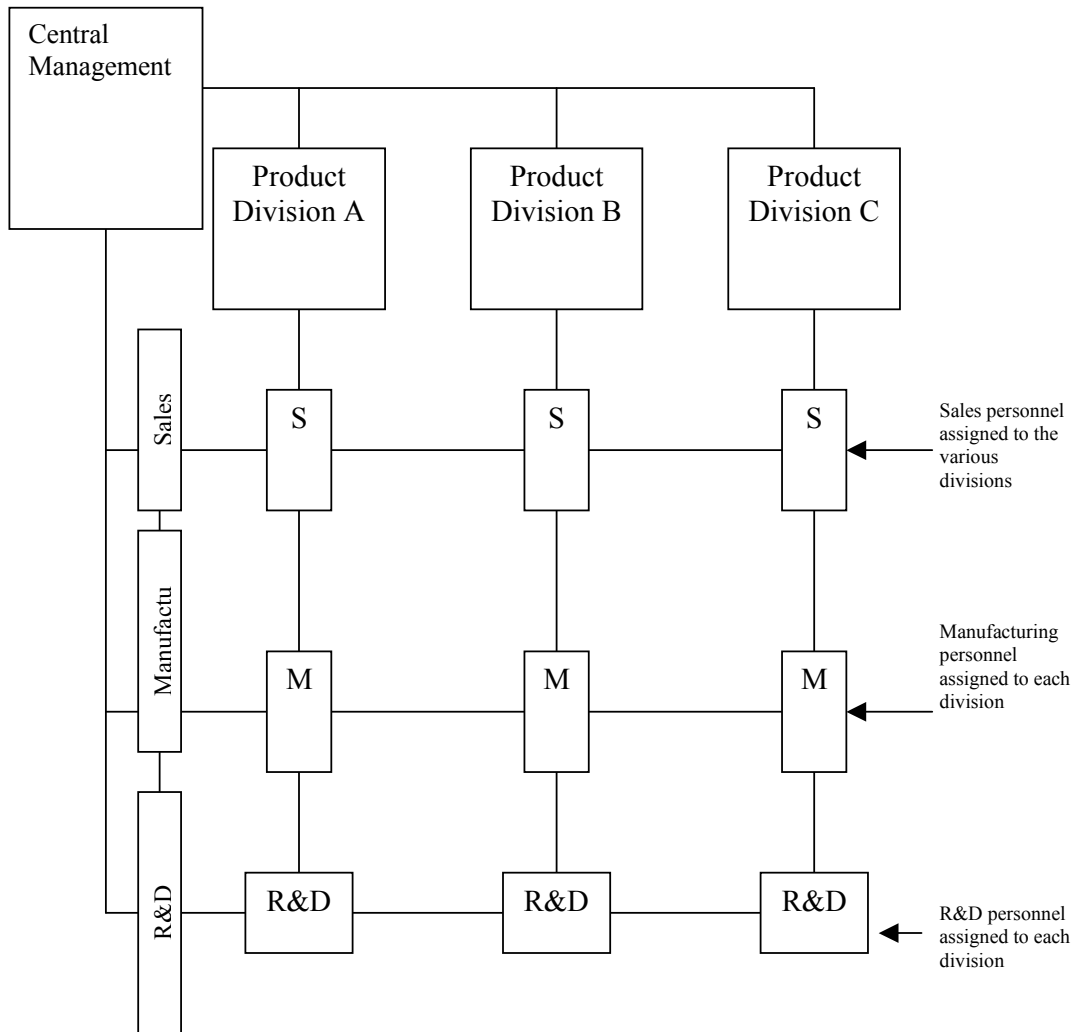


Figure 9. The Matrix Organization (Source : Cash et al. 1994)

The organizational metaphor that fits with Era III is the matrix organization. (See Fig. 9) The Matrix organization is aiming at bringing together the functional and product departmental bases and achieving a balance in information processing and decision making between the vertical (hierarchical) and the horizontal (product or project) structure (Cash et al., 1994). Matrix organizations are generally associated with characteristics that highlight the improved internal interaction mechanisms between different functional units. Gibson et al (1985) have identified the following positive attributes of the matrix organization.

- Better utilization of specialized staff and equipment, since these resources can be shared among different projects or product units, instead of being replicated.
- Flexibility in conditions of change and uncertainty due to improved internal organizational communication.
- Technical excellence through knowledge exchange between specialists from different functional units.
- Increased capacity for top-management to engage in long-term planning.
- Improved motivation and commitment due to delegation of decisions to project/product groups.
- Opportunities for personal development by cross-fertilization of knowledge.

The matrix organization has been widely applied in a wide variety of organizations in multiple industries. It has been able to resolve several of the most relevant problems being associated with the strictly hierarchical organization, such as the lack of communication between functional units working on the same task and the distance between deciding and doing.

2.4.4. Era IV

Fueled by the increased understanding that stemmed from “hands-on” experience in IT use at the local level, improved networks for sharing information inside and outside the firm, increased complexity and rate of change within the business environment, and the actions for a few visionary managers within information-intensive industries, business managers in a number of industries began to identify strategic opportunities for using IT to shift the balance of power and competitive position of their firms (Applegate et al., 1998). The emergence of the Internet, the World Wide Web, and browser technology in the mid-1990s fueled the transition.

The extensive use of information technologies renders it easier to coordinate across functional boundaries. For justifying IT expenditures, the notion of value adding

is important. The concept of value adding was described by Michael Porter in his book “Competitive Advantage” (Porter, 1984). He states that

“Every firm is a collection of activities that are performed to design, produce, market, deliver, and support its product. All these activities can be represented using a value chain. Value chains can only be understood in the context of the business unit.”

In the classical value chain an organizations’ activities form a linear flow from the supplier(s), through the business, to the customer(s). The value chain includes firstly the “primary activities”, i.e. the activities the company has to perform in order to justify its right to exist. These activities are adding direct customer value to the product or service and the effective link of these activities has a major impact on the overall performance of the organization.

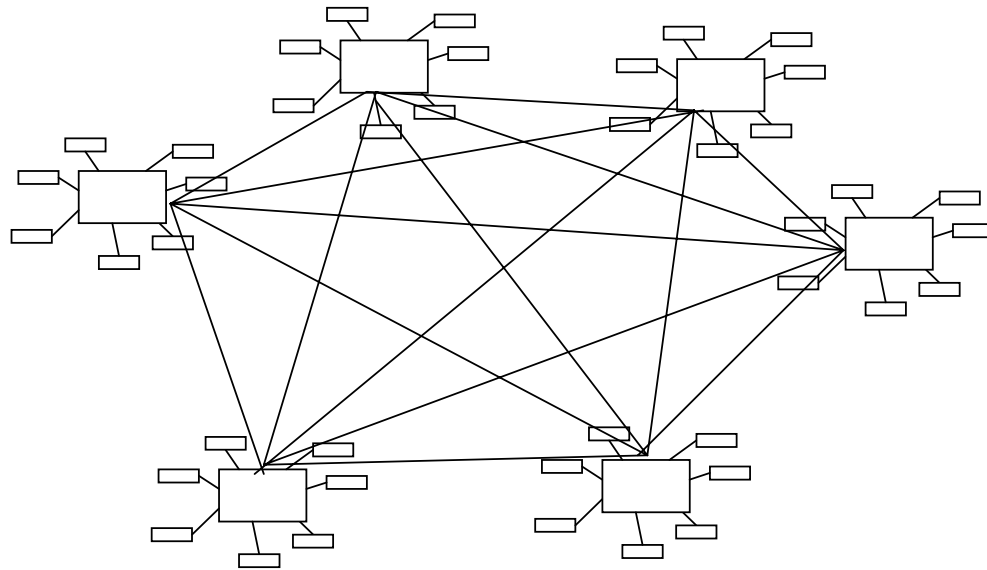


Figure 10. The Network Organization (Source : Pearson, 2001)

The organizational metaphor that fits with Era IV is the network organization. In order to overcome the limitations of bureaucratic organizational forms, multiple

new approaches to structure organizations have been proposed. Bush and Frohman (1991) criticized the traditional up-and-down communication model, as well as the sequential flow of functional activities, and instead proposed a model for a concurrent network organization. They claim that a network organization is better equipped for dealing with complex innovation processes as the prevailing, hierarchical and sequential approach. They identify the following reason for the dominance of the sequential model:

“The sequential model has established itself primarily because of its compatibility with the bureaucratic command and control concept of management in complex organizations. It “civilized” the innovation process by bringing it within the frame of reference of traditional corporate management; hierarchical organization, specialized functions, segmented tasks, and clear responsibility with individual accountability.”

Moreover, definitional issues remained as to precisely what is and is not a network form of organization. Nohria and Eccles (1992) focused on inquiring “whether ‘network’ referred to certain characteristics of any organization or whether it referred to a particular form of organization”.

Castells in *The Rise of the Network Society* (1996) points that networks are spreading and gaining strength as a distinct form of organization: dominant functions and processes in the information age are increasingly organized around networks. While the networking form of social organization has existed in other times and spaces, the new information technology paradigm provides the material basis for its pervasive expansion throughout the entire social structure (Castells, 1996, p. 469). Network organizations are those that utilize distributed information and communication systems to replace inflexible hierarchical controls. (Pearlson, 2001) Pearlson also emphasizes that coordination within teams is achieved primarily by professional negotiation and leadership, which rely on intensive communication and collaboration.

The network organization is one, which has moved away from mainframes and “stand alone” personal computers to integrated systems based on shared file servers

and electronic communication links. (Symon, 2000). Such new information technology includes: shared computer-based databases; electronic mail and organizational intranets; the Internet; computer conferencing software; groupware; computer supported cooperative work (CSCW) systems; and video mediated communication systems (such as videotelephony or videoconferencing).

Symon (2000) concludes that network organizations will only be achieved through ICTs in the following conditions:

(1) where an ideal combination of technological and non-technological support can be identified;

(2) where there are rules about appropriate and inappropriate uses of the technology;

(3) when technologies exist which can convey social cues and support “realistic” group work;

(4) where there is a group culture which supports technology use and eschews conflict;

(5) where there is a pre-existing participative culture in the organization;

(6) where managerial policy supports and enforces network ideals;

(7) where employees are largely professional and already autonomous (and probably male);

(8) where work to be conducted is not susceptible to standardization;

(9) where employees have internalized organizational goals.

This chapter started with the classification of information technology which led to the interaction between information technology and the organizations. The impacts on organizational structures were defined as a result of the use of information technology in organizations and how different types of organizations evolved with the use of different types of IT and the role of IT in organizations. Network organization was one of the organizations that coincided with the last era in Table 6, “Eras Of Information Technology Usage In Organizations” which leads to the development of hypotheses in the next chapter.

CHAPTER 3

RESEARCH MODEL

The aim of this thesis is to analyze and explain the use of information technology and its effect on organizational structures in SMEs in Turkey. Eras of information technology usage (Table 6) is the starting point for this study because, it states the dominant technology used in the corresponding Era. Hypotheses are developed to reflect the effect of information technology on organizational structure. The dominant use of information technology is examined to attempt to define fundamental types of organizational structures that would be appropriate with the use of it. The hypotheses will be expressed in terms of the “dominant” information technology- that is, the information technology that is used and expected to support the organizational form. Thus, the research model uses organizational structure as the independent variable with information technology being used as the dependent variable. A framework for analysis (Table 7) has been developed and forms the basis of research method for analyzing the effects of IT in SMEs.

Table 7. Final Model

	Era I 1950s-1970s	Era II 1970s-1980s	Era III 1980s-1990s	Era IV 1990s-2000s
Dominant technology	Mainframe “centralized intelligence”	Microcomputer “decentralized intelligence”	Client Server “distribution intelligence”	Internet “ubiquitous intelligence”
Transmission protocols	Proprietary WAN; packet switching, circuit switching	Proprietary LAN; ethernet, tokenring	Merging of LAN/WAN	Merging of LAN /WAN, frame lay, open standards
Primary Role of IT	Efficiency Automate existing paper-based processes	Effectiveness Increase individual and group effectiveness	Strategic Industry /organization transformation	Value Creation Collaborative partnership
Justify IT expenditures	ROI	Increasing productivity and better decision quality	Competitive position	Adding value
Location of use	Computer room	Desktop	Along matrix divisions	Everyone
Typical user	IT Specialist	IT literate business analyst	IT literate workers	Everyone
Information Model	Application specific	Data-driven	Business-driven	Knowledge –driven
STRUCTURAL DIMENSIONS				
Organization metaphors	Functional	Divisional	Matrix	Network
Control	Centralized-senior management team and technical staff Manager assumes responsibility for subordinates’ actions and decisions	Centralized-general management responsibility and resources	Distributed among matrix managers	Decentralized among individual knowledge workers External accrediting bodies Professionals maintain responsibility for action and decisions
Specialization	Functional	Primarily functional but may involve cross- training	Functional, market, geography, technology, and/or product	Often highly specialized around product and/or technology
Formalization	Formally defined and well understood at top, middle and bottom	Little formalization Organic Often vague and open to misinterpretation	Like the hierarchy except for the middle, where role is often vague and poorly understood	Like the entrepreneurial organization but more open to informal political manipulation
Span of Control	Highly centralized	Separation of strategy and execution	Shared	Highly decentralized
Communication and Collaboration	Standardization of work Hierachial supervision, plans and procedures	Division general manager and corporate staff Direct supervision	Dual reporting relationships Collaboration at areas of matrix intersection	Cross-functional teams Collaboration Professional negotion Leadership
Target of systems	Organization	Individual manager/group	Business processes	Customer, supplier, ecosystem

The framework was developed mainly as a result of the literature review, drawing on the major discussions and past research methodologies. It draws particularly on the work of Applegate et al. (1998) and Cash et al. (1994). The table consists of two main parts.

The first part of the table is put together to show which information technology is being used in which era. The Mainframe Era, The Microcomputer Era, Client Server Computing Era and the Network Era are established according the main technology that was adopted in the organization. This part of the table connects the use of IT with the internal organizational needs such as lowering transaction costs, providing support for managers and redesigning business processes. Besides the dominant technology, the primary role of IT in the organization, how organizations justified their IT expenditures, location of user, typical user and the information model are displayed in the first part.

The organizational metaphor that fits with each era is added to the second part of the table. The framework identifies various organizational structural variables such as control, specialization, formalization, span of control, communication and collaboration, interorganizational relations. These concepts as well as the organizational structures are defined in Chapter 2.

The four eras show the primary role of IT in the organization from the 1950s to the 2000s and the hypotheses are developed according to the information technology is used in the organization. Being in line with the time period, increasing use of information technology refers to the movement in the Eras from the mainframe to the microcomputer, client server to the Internet. The hypotheses are explained with building the relationship between the use of new information technologies and changes in the organizational variables.

3.1. The research hypotheses

H1: Increase in the use of Information Technology will lead to both centralization and decentralization together

The literature suggests that IT can thus enable both centralization and decentralization. Scholars seem to agree that the use of IT allows organizations to place decision-making authority across a greater range of hierarchical levels without sacrificing decision quality or timeliness (e.g. Huber, 1990; Keen, 1991). Keen (1991) combined the notions of centralization and decentralization in what is

termed a federated organization where organizations no longer have to choose between centralized and decentralized modes of organization; IT permits simultaneous centralization-with-decentralization.

In terms of organizational levels for a particular decision, for a highly centralized organization, use of advanced IT leads to more decentralization; and for a highly decentralized organization, use of advanced IT leads to more centralization (Huber, 1990). Keen (1991) noted that the client-server architecture in LAN and technologies like distributed systems facilitate the process of empowerment of the lower levels, especially in the present easy-access information era.

H2: Increase in the use of Information Technology will lead to less specialization

The need to integrate and coordinate activities within organizations “is the glue that holds organizations together” (Mintzberg in Cohen and Eimicke, p.79). IT can mitigate this tendency by providing greater information access to specialists through such technologies as e-mail, corporate intranets, access to the Internet, and so on. Most importantly, “greater specialization would be achieved by focusing on few core competencies” (Yogesh, 1993). Firms can then concentrate more on their core competencies and form outside value-adding partnerships in which groups of small firms share information freely and view the whole value-added chain as one unit (Lau et al., 2001). This results in less specialization and increased outsourcing activities. Amongst numerous network functions, jobs in business operation, ordering, distribution and technology management are more likely to be related to outsourcing than to other business support functions (OECD, 1997). Besides, its relation with outsourcing, the word specialization can also be used to describe people’s acquired knowledge in a given field.

H3: Increases in the use of Information Technology will lead to easier and less costly formalization

IT facilitates the recording and retrieval of information about organizational events and activities making the control of behaviors and processes through formalization more viable (Huber, 1990). IT offers the ability to diminish the negative effects of

formalization - the cost of search associated with locating company resources detailing relevant standards and procedures. Karake (1992) stressed that IT would lead to less formalization in organizations. “The real power of IT lies in its ability to enable an organization to break old rules and create new ways of working” (Chan, 2000).

H4: Increases in the use of Information Technology will lead in a larger span of control.

Meyer (1968) indicated that there were two strategies available to organizations:

- (1) Wide span of control, which promotes flexibility of response since the manager can change things quickly, and
- (2) Narrow span of control, which promotes more rational administration and more stable operations.

Thus, Malone and Crowton (1991) concluded that IT, by facilitating the standardization of coordination, would facilitate a wider span of control.

There are many factors that come into play when designing an organization around the span of control principle; such as, “

- (1) Physical proximity to the subordinates;
- (2) Level of complexity of tasks;
- (3) Homogeneity of the subordinates’ jobs;
- (4) Subordinates’ level of training, expertise, and motivation;
- (5) Capabilities of the manager; and
- (6) Availability of clear and precise plans” (Graham and Hays, p. 83).

With the integration of information technology, the physical proximity of subordinates to their supervisors is no longer a problem. The use of e-mail and telecommunication devices has facilitated the flow of communication so that individuals can interact any time or any place. The complexity of tasks has been simplified through the use of information technology, such as the Internet. Information, data and sources are readily available to anyone who has access to a

computer terminal equipped with World Wide Web software. With information technology, literally at the managers' fingertips, they can supervise far more people than they once could.

H5: Increase in the use of Information Technology will lead to more communication and collaboration

There are numerous methods of communication but it is the key way to bring or strengthen changes to organizations (Rudnick, 1996). IT can assist the development of lateral communication that takes place among members of the same work group, between managers or any horizontally equivalent personnel. It can save time and facilitate coordination. It can also reduce information overload on managers (Yogesh, 1993). Also, "lateral communication patterns have become the dominant form for transmitting information among different members. Free flow of information can guarantee the availability of timely and accurate data to every member from their precursor" (Hong, 1999). Some software applications like internal email and GroupWare are very useful for supporting collaborative work groups, particularly in large corporations (Drew and Coulson, 1997). Recently, email has become a common method of communication within and between firms, no matter what the firm size, because of its availability and low costs. "It is fostering new forms of learning, enabling new types of personal communications between employees and management, and leading to the creation of 'virtual' teams" (Rudnick, 1996). Furthermore, "technology is transforming employee communications, and the transformation is rooted in the growth of electronic information media" (Rudnick, 1996). This really facilitates the lateral communications within and between the firms.

H6: Increase in the use of Information Technology will lead to an increase in the interorganizational relations

Venkatraman (1994) has identified four categories of IT enabled interorganizational relationships: transaction processing (e.g., EDI), inventory movement (use of IT to move materials or information about inventories across organizational boundaries), process links (connect interdependent processes such as design and engineering across organizational boundaries), and knowledge leveraging (focuses on sharing

and leveraging expertise within a partnership). Malone et al. (1989) suggest that interorganizational electronic networks reduce the transaction costs associated with the search, evaluation, and monitoring of competing suppliers, often making market-type arrangements more attractive than hierarchies.

Partnership relations are also impacted by IT. For instance, aside from electronically linking backwards with suppliers, firms may use IT to link forward in the value chain to connect its operations with those of customers, something which reduces their costs and creates a disincentive for customers to seek other suppliers (Fulk & DeSanctis, 1995).

An additional perspective on how IT can enhance the effects of interorganizational relationships can be seen in how firms manage various structural parameters of partnerships. Hart and Saunders (1997) provide a theoretical treatment of EDI rooted in trust and power which concludes that firms with greater power can influence their trading partners to adopt EDI which might leave less powerful partners vulnerable to opportunism.

3.2. Research Method

In this research, the examination of IT usage and its impacts on organizational changes in SMEs in Turkey are examined. Not much local research has been done on this aspect before, as studies have only examined the general impacts of IT on the organization (Bengsir, 1996).

The multiple-case design was chosen to suit the objectives of description and theory building (Benbasat et al., 1987). Multiple case design is an intensive empirical research approach suited to the study of emerging and complex phenomena (Yin 1994). The term “case study” has multiple meanings. It can be used to describe a unit of analysis or to describe a research method. The discussion here concerns the use of the case study as a research method. Case study research is the most common qualitative method used in information systems (Orlikowski and Baroudi, 1991). Although there are numerous definitions, Yin (1994) defines the scope of a case study as follows:

“A case study is an empirical inquiry that: investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.”

The case study methodology has been subjected to scrutiny or criticism at various times. As a research tool, it has not been a choice that is listed in the major research texts in the social sciences. Some researchers have suggested that if the study were made conducive to statistical analysis, the process would be easier and more acceptable. This quantitative approach would be appealing to some of the critics of the case study methodology. Interviews are one of the most important sources of case study information. The interview could take one of several forms: open-ended, focused or structured.

Case studies are multi-perspective analyses. This means that the researcher considers not just the voice and perspective of the actors, but also of the relevant groups of actors and the interaction between them. Yin (1994) presented at least four applications for a case study model:

- to explain complex causal links in real-life interventions
- to describe the real-life context in which the intervention has occurred
- to describe the intervention itself
- to explore those situations in which the intervention being evaluated has no clear set of outcomes.

Information technologies involve all four of the above categories, but this study will only report on the last two. Clearly, the case study research method is particularly well suited to IS research, since the object of this thesis is the study of information technology in organizations, and "interest has shifted to organizational rather than technical issues" (Benbasat et al., 1987).

3.2.1. Selection of the Firms

Two firms were recommended by Technology Development Foundation of Turkey (TTGV). TTGV is an independent non-profit organization that has undertaken a national mission of fostering the continuous and effective technology development activities of companies in the industrial sector. TTGV serves all companies in the industrial and information technology sectors.

Two firms that have adopted IT in their daily functions are chosen, thereby providing two organizational settings for study but limiting the influence of industry effects. The firms were in the electronics and manufacturing industries, both are facing intense competitive pressures and are heavily reliant on information technology. However, they provide a contrast in their strategic use of information and information technology. The inclusion of these two industries was not aimed at cross-industry comparisons. Rather, the aim was to check that the phenomena that were not industry-specific.

3.2.2.Data Collection

Bakos (1987) indicated that IT was regarded as a dependent variable for analyzing its adoption in organizations in most of the early studies. Because the aim is to analyze and explain the use of information technology and its effect on organizations, there is a propensity to treat the organizational structure as the independent variable, with the information technology being used as the dependent variable.

For the data collection of two firms, company managers and a personnel from the company is interviewed. A semi-structured interview is applied with a clear list of issues concerning the use of IT and the structural variables. The schedule is displayed in the Appendix A. The schedule is a compilation of items from many sources. The schedule is designed to be directly administered by the interviewer. Questions raised in one interview could be presented to another personnel in a later interview. Interviews with company managers were the focal point.

The use of IT is measured in terms of:

- The computing platform that is used in the organization (e.g. mainframe, minicomputer, etc.)
- The communications platform (the applications of LAN or WAN, so as to know more about the applications of internal or external networks.)

The Impact of IT is measured through the structural dimensions related to the organization:

- Control is measured in terms of the level of authority for making decisions
- Specialization is measured in terms of job titles and departments in the firm
- Formalization is measured in terms of the degree to which rules, procedures and written documents are used in the company
- Span of control is measured in terms of the number of subordinates reporting to a supervisor in different departments, and the number of supervisors or managers
- Communication and collaboration is measured in terms of groups or committees formed for specific tasks and projects, and the amount of coordination
- Interorganizational relations is measured in terms of the relationship with suppliers, customers and other companies.

This chapter focused on the research model from which the hypotheses are developed. The use of information technology since the 1950s to 2000s is formulated in the eras model which also includes the types of organizations that fits with each era. Hypotheses are developed according to the increase in the use of information technology, which refers to the movement in the eras from mainframe to the Internet. Two SMEs were chosen for the interviews to test if they had any of the structural changes, which were proposed as the hypotheses. These are reported

in the next chapter that also includes a general overview of the use of information technology in Turkish SMEs.

CHAPTER 4

A CLOSER LOOK AT SME'S IN TURKEY

4.1. Findings

The findings of the case studies are reported in two ways. First, we discuss the descriptive data, using insights from the exploratory interviews where relevant, in order to describe the approaches used by the companies in using information technology. The second part of this section examines the relationship between variables and the use of information technology, specifically if the companies had any of the structural changes, which were proposed earlier with the implementation of IT. A third section is added to this chapter to give a general picture of the use of information technology in SMEs in Turkey.

4.1.1. Company A

Company A was founded in 1982, in 1993 reorganized itself as an Industrial Manufacturing & Trading Company. It has manufacturing line at its own factory having 1300 m² closed and 500 m² open area. Company A has done many projects from Russia to Turk Republics, from Middle East to Africa. It improves its products by using high technology investments. It mainly works with composite since 1997. They also are producing FRP materials and 3D panels by using RTM, Spray-up, Handy-up methods. Company A has a marketing company that markets its composite products and a company dealing with electrostatic painting. Company A has ISO 9002 Quality Assurance Certificate. 65 employees are currently working in many projects that are about steel, stainless steel, brass decoration products.

Information Technology in Company A: Company A is utilizing LAN. As for software, it uses Microsoft Windows for word processing and spreadsheet software, it uses the Internet and has its own Internet domain name. It has a website. After the

interviews with the company manager and some co-workers it was apparent that information technology has not changed much of the social culture in terms of control, specialization, and communication.

A summary of findings is fit into the framework introduced earlier to see how the use of IT affected the organization structure.

	Era I 1950s-1970s	Era II 1970s-1980s	Era III 1980s-1990s	Era IV 1990s-2000s
Dominate technology		Microcomputer “decentralized intelligence”		Internet “ubiquitous intelligence”
Transmission protocols		Proprietary LAN		
Primary Role of IT	Efficiency Automate existing paper-based processes			
Justify IT expenditures		Increasing productivity and better decision quality		
Location of use		Desktop		
Typical user	IT Specialist			
Information Model	Application specific			
STRUCTURAL DIMENSIONS				
Organization metaphors	Functional	Divisional	Matrix	Network
Control		Centralized-general management responsibility and resources		
Specialization	Functional			
Formalization	Formally defined and well understood at top, middle and bottom			
Span of Control	Highly centralized			
Communication and Collaboration	Standardization of work Hierachial supervision, plans and procedures			
Target of systems	Organization			

In Company A, the use of information technology helped to increase management's control over the workforce. Company A resembles a functional organization where the power will tend to be located in the top of the hierarchy, distributing power on a predetermined manner. General management has the upper responsibility and control for the resources. In most organizations like company A formal role structure, chains of command and spans of control are still seen to follow naturally from the assumption that there is "one best way" to organize labor. Formally defined rules are well understood at top, middle and bottom of this organization

where also communication and span of control are not much affected after the use of IT. In Company A, there is primarily functional form of specialization and for span of control the organization is not yet decentralized. In the organizational scope, information technology is still viewed as little more than another kind of new technology for improving productivity and reducing costs. Organizations such as Company A maintain their competitive power by struggling to secure a share of resources and by diminishing risks. The information industry continuously drives organizations to upgrade software and hardware in the workplace. Faced with the need for rapid installation and frequent upgrades, many organizations like Company A have little time to think about the value of IT. In this case, the implementation of IT has been a decision made by company manager who lacked the further step to employ an IT manager or necessary implementations about the proper education and usage of IT. Company manager described his use of Internet about the company interests as just for search purposes and he emphasized that the most important thing in business is touching and feeling the materials being sought for. He also expressed “trade is trust and face to face interaction is vital”. Primary role of IT in this company is efficiency and it was observed that the main purpose of using IT is to automate existing paper-based processes.

4.1.2. Company B

Company B provides services in the field of electronics, depot level maintenance of military/industrial systems, engineering work, software development and electronic manufacturing. Company B is the first private company, which has begun to operate with the support provided by joint venture with university (METU) and Government (KOSGEB Ministry of Industry). At its facility, built on an area of 3000m², the Technical Service along with Research & Development laboratory equipped with the State-of- Art Technological Systems, are being operated by experienced Technical Personnel. Company B has ISO 9001 Quality Assurance Certificate, AQAP 120 Industrial Quality Assurance Certificate and System Assurance and NATO Clearance. At the facility in METU-TEKNOKENT, the software for military, civilian, industrial projects, the infrastructure works and national projects are being developed and achieved. Company B has 150 staff,

which is providing consultancy, survey, mounting and training services on the subjects of turn key projects and establishment of repair laboratories.

Information Technology in Company B Company B is also LAN user and also uses the Server/Client LAN architecture with different applications on the server. The use of the server is mainly for file and print sharing. Company B has started using the WAN a short while ago, and currently working on a project to connect its offices in Turkey via the WAN system. The uses of advanced application software, electronic faxing, web hosting and Internet email are common. As for software, it uses Microsoft Windows for word processing and spreadsheet software, it uses the Internet and has its own Internet domain name. It has a website and they are planning to make it more interactive.

Again, a summary of findings is fit into the framework to see if there is any interaction between the use of IT and the organization structure.

Company B

	Era I 1950s-1970s	Era II 1970s-1980s	Era III 1980s-1990s	Era IV 1990s-2000s
Dominate technology			Client Server “distribution intelligence”	Internet “ubiquitous intelligence”
Transmission protocols			Merging of LAN/WAN	
Primary Role of IT			Strategic Industry /organization transformation	
Justify IT expenditures			Competitive position	
Location of use			Along matrix divisions	
Typical user			IT literate workers	
Information Model			Business-driven	
STRUCTURAL DIMENSIONS				
Organization metaphors	Functional	Divisional	Matrix	Network
Control				Decentralized among individual knowledge workers External accrediting bodies Professionals maintain responsibility for action and decisions
Specialization				Often highly specialized around product and/or technology
Formalization	Formally defined and well understood at top, middle and bottom			
Span of Control	Centralized			
Communication and Collaboration				Cross-functional teams Collaboration Professional negotion Leadership
Target of systems				Customer, supplier, ecosystem

The client-server architecture in LAN facilitates the process of empowerment of the lower levels. As a result of the use of information technology helped to delegate the workforce more decision-making authority so as to improve their responsibilities. It is observed that span of control is not affected by the use of information technology. In Company B there is high level of specialization. Rules and procedures are defined and well understood in the organization. Business processes have gained importance currently and they are moving in the direction of customer, supplier

relations. Collaboration has gained importance especially cross functional teams are being used for new projects. Communication also has increased since the adoption of e-mail system in the company. Company B is currently working on a project where it is developing a network system by itself to match their specific operation flows and accounting procedures.

4.2. Analysis of the Case Studies

In order to understand technology, it is necessary to understand the organizational context surrounding and embedding the technology. Thus, organizational context is the main purpose of the case study and the research tries to answer if the introduction of IT and organizational changes in Turkish SMEs are connected. After the observations done in two companies, it was realized to the framework generalized earlier was very detailed. Besides, it was very hard to fit the organizations into just one type of organizational model since the results in the table were very much scattered around. The organization structures were perfectly fit by the two companies and simpler model will be needed to analyze the results of the case studies. Kanter's (1983) approach of two organizational concepts, integration and segmentalism are used as an analysis tool, which actually suits better with the results of the case studies.

Company A with the applications of LAN and limited use of internet fell more in line with a functional organization. On the other hand, Company B utilizing LAN, internet and especially WAN moved towards the network organization structure. Using Kanter's approach, it is easier to see company A's organizational characteristics fall in the segmentalistic organization, while company B fits into the integrative organization. The greater use of IT means a movement towards integrative organizational configurations. This distinction is very close to one made by Burns and Stalker (1961) that distinguished between mechanistic (hierarchical, bureaucratic) and organic (networked, though still stratified) management systems. The organic form was deemed more suited to dealing with rapidly changing conditions and unforeseen contingencies, because it has "a network structure of control, authority, and communication" along with a "lateral rather than vertical

direction of communication” (Burns and Stalker (1961). In integrative organization, it must be assumed that information and communication patterns can flow freely across internal and external organizational boundaries (Joergensen, 1998). These are quite fundamental characteristics for the network organizations. Franson (1998) noted “the most important role of the network was to flatten organizations, creating a new culture in the process. This flat organization encourages individual contribution and responsibility, but it also fosters teamwork”.

Control, specialization, formalization, span of control, communication and collaboration, interorganizational relations are analyzed as structural variables in two companies. Formalization and span of control are significant variables not affected because of the nature of SMEs. These firms employ not many people and the organization chart and hierarchies are very simple. It is clear that with the use of IT, the jobs are more characterized by specialization, delegation of responsibility and based upon cooperation and communication in more fluid internal and external networks. With the use of IT, the jobs tend to become more specialized even though that these companies move towards more multi-functional jobs and this is because of the definition of specialization. Specialization here is used to describe people’s acquired knowledge in a given field. Comparing the two companies, there is a tendency towards decentralization as the use of information technology increases. Also, there is a movement towards jobs characterized by more cooperation and communication across organizational boundaries. For example, the cooperative and communicative skills as well as organizing in groups in company B was higher than in Company A. One of the main points of the case studies was a comment made by the Company B IT manager who emphasized importance of the cross-functional and multidisciplinary teams being vital to solving complex problems faster and gaining the energy and ideas possessed by the group. Furthermore the distinction and the importance of internal and external networks especially inter-organizational networks were realized by company B and they have made and still working on the necessary arrangements to become a network organization.

An increase in the use of IT in fact has caused some of the structural changes, which were proposed as the hypotheses. Comparing the two case studies, it was apparent that decision-rules in both companies were pre-defined and were not affected by the use of IT. The number of subordinates a superior controls did not change with the use of IT but increasing use of IT did make a move towards more decentralization. Creation and maintenance of interorganizational relations, most importantly was found to be affected by increasing use of IT and the use of information networks in the organization. It is hard to make these generalizations for all of the Turkish SMEs which implement and use IT in their daily functions. In the next section a general overview of IT usage in Turkish SMEs are provided through another interview with an expert on the subject from National Productivity Agency of Turkey and results of a recent survey about IT use in Turkish SMEs are put forward.

4.3. General Overview of IT Use in SMEs in Turkey

A general nationwide evaluation shows that small and medium enterprises occupy an important place in the economic and social fabric of Turkey, in terms of three important indicators including the number of enterprises, the number of employees and value added. (<http://www.kosgeb.gov.tr/kosg.htm>)

- Small and Medium Industrial Enterprises account for 99.5% of all manufacturing industrial enterprises.
- Small and medium Industry Enterprises have a 61.1% share within total employment in the manufacturing industry.
- As regards value added created, the share of Small and Medium Industry Enterprises is 27.3%.

General information about SMEs and the diffusion of IT in SMEs is provided in Appendix B. This section intends to give a more comprehensive look at the use of IT in SMEs in Turkey. First part of this section starts with insights from an interview. The interview was conducted with Dr. Mustafa Kemal Akgül from

National Productivity Agency about the use of Information Technology in SMEs in Turkey. Akgül has completed two projects named “The Infrastructure Needs of SMEs for E-Commerce and E-Business Applications” in 2000 and “Sustainable Productivity Management System Implementation and Application Planning Approach for Information Technology in SMEs” in 2002. The main points of the interview depending on the findings from the above projects are summarized as follows:

- SMEs in Turkey need to move to a stage where they utilize e-business and e-commerce technologies to compete with SMEs from developed countries where most of them use websites and internet but Turkish SMEs do not have the proper infrastructure and the hardware systems.
- 46% of the SMEs began using networks in the last 2 years and they utilize networks with different applications. Usually, the firms obtained those networks from distributors/resellers or IT consulting firms directly, and tailor-made them for themselves to match their specific operation flows and accounting procedures. The use of the network was mainly for file sharing and Internet use.
- 72% of the SMEs in Turkey use Internet in 2000 and Internet connection is lowest in SMEs which have 1-4 PCs. Internet usage is mainly for e-mail and information search. 40% of the SMEs had websites and the use of web page is mainly to promote their products and services.
- The problems encountered by the companies were the need for new software development and already existing systems not being adequate. The reasons for not using new IT were the lack of knowledge about the new system and the lack of support from the top manager. The use of current IT system was mainly established by the demand of the top management and also personnel demand.

Akgül has emphasized the size, production system and technological capabilities of the SMEs have an effect on the use of IT. For the effective implementation and use of IT in SMEs he mentioned the importance of implementation of WAN especially

in Organized Industry Zones and university and SME cooperation via networks. Akgül has made comments about Microsoft's "SME Research 2003" project and pointed out that this project included SMEs in just 4 major cities in Turkey but the real situation especially in smaller cities and eastern part of Turkey is different from the results of that project.

Microsoft Turkey made a survey with 728 company managers of SMEs in İstanbul, Ankara, İzmir and Adana. This project called "SME Research 2003" was published in January, 2003 and aimed to show the technological and economical performances of SMEs in major cities in Turkey. The starting point for the project was to establish and show the link between greater use of information technology and the productivity of economy in general. Some of the findings from the project is summarized as follows (<http://www.nethaber.com.tr>, <http://www.btnet.com.tr>, <http://turk.internet.com>) :

- The use of computers in SMEs in Turkey is 23 %, this rate is 90 % in developed countries. The average use of computers is 7 years, and laptops are 3 years.
- 49% of SMEs bought at least 1 PC in last year and 3% is planning to buy 1 in the next 12 months. PC penetration rate has increased 3 % since 2000 amounting to 855.000.
- The use of Internet has increased from 72% to 80% in last 3 years. 9% increase in Internet use is expected in next 12 months.
- SMEs having a website has increased form 40% to 53% since 2000 and the reason for website is for company to be recognized.
- E-commerce has increased from 2% to 7% since 2000.
- The reason for technology use in the company was answered by 96% of SMEs as the efficiency in the company.
- In the last 3 years, the personnel using IT have increased from 58% to 66%.
- The number of personnel has decreased 35% in the last 3 years, whereas the the budget for information technology has decreased 30% amounting to 5162 dollars.

- 62% of SMEs postponed their technology investments until the economic recovery of the country
- For software usage 83 % of the SMEs used production packages, 76 % used finance packages.
- 53 % use network structures and this rate haven't changed in last three years.
- Network server use has increased from 47% to 59% where in developed countries this rate is over 70%
- The relations with IT companies depend on the technical expertise and the professional experience of the personnel in that company.

These findings provide a general picture of IT usage in SMEs in Turkey. There are many reasons to support IT diffusion in SME's. SME's tend to exhibit a greater ability to produce new products after IT introduction. As can be seen from the results of this recent survey and also the other interviews, Turkish SMEs are using information technology in their daily functions and the network systems are gaining increasing importance. In the next chapter, results of this research will be discussed and general conclusions will be made through the hypotheses which were tested in the two companies.

CHAPTER 5

CONCLUSION

It has been argued that the adoption and use of information technology (IT) in organizations affects its structure. In this study, we found out different levels of restructuring occurred in SMEs as a result of IT implementation. This research aimed to focus attention on the importance and the impacts of IT applications. Hypotheses were developed according to the increase in the use of information technology and control, specialization, formalization, span of control, communication and collaboration, interorganizational relations were analyzed as structural variables. As a result of this research, more attention is needed on the aspects of decentralization, specialization and lateral communication. It was hypothesized that increase in the use of IT would lead to easier and less costly formalization and a larger span of control. After the research conducted in the two SMEs, formalization and span of control were significant variables not affected because SMEs do not employ many people and also have simple organization charts and hierarchies. It was evident that with the use of IT, the jobs were more characterized by specialization, delegation of responsibility and based upon cooperation and communication. Besides its relation with outsourcing, specialization was used here as people's acquired knowledge in a given field. With the use of IT, specialization increased even though that these companies moved towards more multi-functional jobs. Creation and maintenance of interorganizational relations, most importantly was found to be affected by increasing use of IT and the use information networks in the organization. As the use of information technology increased, decentralization as well as centralization also increased as a result of the process of empowerment of the lower levels and decision-making powers of the upper management.

Management needs to notice how IT affects the organizational structure and evaluate the improvements it creates. This may be the result of the recognition that managers' attitudes are endogenous: managers' attitudes are strongly affected by their perceptions of the organization's performance and by the effect of IT on the organization's structure. Yet this does not mean that the management loses control or decision-making powers. As Karake (1992) predicted, “the trend shows that with the advances of information technology, corporations are moving in the direction of a centralized-decentralized structure; that is business units are given the authority to make decisions under the close supervision of corporate management. This structure allows the latter to interfere when it sees fit, thereby preventing wrong decisions from being made and insulating the company from what is believed to be unsound judgments”. Managerial support for IT and IT implementation is found to be a major factor for information technology to be used effectively.

The findings in this research support the hypothesis that IT brings changes in certain areas in organization structure and creates improvements in various aspects. There are various changes to be found, not just to technology, after the implementation of IT practices. One of the benefits is using less paper and achieving faster distribution of documents within the company. Another is data sharing where the data are centralized in the central server for storage, updating or retrieval. Also, costs are lowered for certain operations in the firm.

As a result of the case studies, greater use of information technology did lead to changes in organizational structure and especially to a network form of organization. Today, for many industries and firms as well as SMEs, the network organization has become critical for survival and continued competitive advantage. The network organization is one, which has moved away from mainframes and “stand alone” personal computers to integrated systems based on shared file servers and electronic communication links. (Symon, 2000).

Drawing from Symon's (2000) findings about network organizations and information technology, an ideal combination of technological and non-technological support, rules about appropriate and inappropriate uses of the technology, group work and participative culture are also found to be important in Turkish SMEs. Especially creating a group culture which supports technology use and eschews conflicts is a must for Turkish SMEs. But the most important one is where managerial policy supports and enforces network ideals.

Extending these conclusions to all SMEs in Turkey and making generalizations out of this study for all the SMEs is not the right solution. Also, because the number of samples examined in this research is small, it is impossible to generalize the impact of the use of IT to other companies. More research is required to study the relationships between IT and organizational changes in different groups and especially larger companies. However, result should be used with caution and can further be improved with revised research methodology in future studies. Another weakness of this study is found in a way, it does not measure if the companies are really network organizations or not. Although the study is pioneering in its nature, yet it has provided some valuable information on the effects of IT use in Turkey. Based upon the experience gained from this study, an expanded survey can be planned where a more detailed research instrument will be used on a wider sample of the organizations to see if they form network organizations or not. This would provide a richer picture of use of IT into business practices in Turkey. Also, for future studies, it would be very interesting to perform comparisons of companies from various industries.

Most analysts agree that a specific IT diffusion policy must be pursued since SME's typically are not well informed about the benefits of IT and also have scarce resources. Therefore, an IT diffusion policy should consider not only setting up the infrastructure for the SME's but should also address IT usage issues. (Rovere, 1996)

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APPENDICES

APPENDIX A

Structured Interview

Organization

General questions concerning the information about the respondent and the firm (focus of the company, number of employees, potential customers..)

Information Technology

- Define the computing platform (e.g. mainframe, minicomputer, microcomputers and operating systems)
Has the firm adopted a client-server architecture?
Does the firm use internet? How?
- Define the communications platform (e.g. wide-area networks, local area networks, telephone/voice communications, video/teleconferencing, operating systems so as to know more about the applications of internal or external networks.)
- areas in which IT is implemented
- user participation
- perceived contribution of IT to organization's success

Control

Does the company use delegation of authority?
Has the job content been changed towards more autonomy at work?

Specialization

Do the company use planned job rotation?
Has the content of work become more or less specialized (More - less)?

Formalization

The degree to which rules, procedures and written documents are used in the company.

Span Of Control

the number of subordinates that a superior directly controls
the number of supervisors or managers

Communication And Collaboration

Has the content of work been changed towards more cooperation with colleagues?

Has the content of work been changed towards more cooperation with management?

Does the company use work groups in the organizing of work?

Interorganizational Relations

Has the job content been changed towards more contact to customers?

Has the job content been changed towards more contact to suppliers?

Has the job content been changed towards more contact to other companies?

APPENDIX B

Information Technology and SMEs

A significant number of SME's are attempting to implement IT. The broad impetus for most SME's is the possibility of diminishing many of the competitive advantages typically enjoyed by larger firms. In "Through the Looking Glass", David Freedman (1996) states that smaller firms

“want to erase the advantages big businesses have always had: large national or even international sales forces that can call on tens of thousands of customers; armies of managers that can bring vast stores of market research and expertise to bear on product development and marketing decisions; highly automated factories that produce goods at the lowest possible cost; and horizontal integration that makes it possible to offer a broad range of products and services.”

Freedman states that one explanation for why smaller firms tend to utilize technology more effectively may be due to their attitude. Small firms usually utilize technology to

“augment their existing capabilities-to raise speed and quality on the factory floor, for example, or to get a better handle on who their customers are. But large companies seem obsessed with increasing the efficiency of existing performance-to provide the same services with fewer employees, for example, or to cut out layers of managers without impairing decision making.”

Small And Medium Industrial Enterprises (SMEs) In Turkey

There is no official or universally accepted definition of an SME. The definitions used vary widely among countries, but they are most often based on employment. The most common definition in OECD countries is based on employment figures; correspondingly, an SME has less than 500 employees. Some countries differentiate between manufacturing and services SMEs. Some countries distinguish between autonomous SMEs and those that are connected to a larger enterprise or group, or identify an SME in terms of management structure.

OECD (1997) puts the case for SMEs as follows: "In all countries including the largest ones, SMEs play a very important role. In particular, it has been recognized for some 15 years that their dynamism, related in part to the technological and economic changes which have occurred over this period, has made an important contribution to the creation of new jobs, the economic revival of certain regions and also to technological progress."

There are a variety of definitions adopted for SMEs in Turkey. Different agencies have set up different criteria for entitlement to their services. Chambers of Commerce & Industries, Halk Bank, The State Institute of Statistics (DIE), The State Planning Organization (SPO), Chamber of Industry , and KOSGEB have been using different criteria's for defining SMEs.

Different quantitative (such as the number of employees, capital, profit, energy consumed, sales, value-added and market share) and qualitative (such as managed by owner-managers, lower level of hierarchy and specialization, insufficient financial resources and absence of modern managerial techniques) criterion have been used (Dinçer, 1996). However, the most common criteria used in the classification of SMEs is the number employees since it is easily measurable and readily available in most cases. Hence, the same criteria in selecting the sample is used in this study.

KOSGEB (Small and Medium Industry Development Organization) adopted a definition of SME based on the number of full time employees and classifies the industry into three categories:

- Small-Sized Industrial Enterprises :1-49 workers
- Medium-Sized Industrial Enterprises :50-150 workers
- Large Industrial Enterprises :more than 150 workers

According to the 1994 Census of Industry and Business Establishments, the total number of industrial establishments is 198264 and Small and Medium Industrial establishments comprise 197297 of them. Table C-1 gives the number and share of the Turkish small, medium and large industrial enterprises in terms of the total number of establishments, and the number of workers employed.

Table B-1 The Distribution Of Enterprise, Employment And Value Added By Size Of Firm In The Manufacturing Industry, Turkey

SIZE CATEGORIES	ENTERPRISES		EMPLOYMENT		VALUE ADDED	
	Number	%	Number	%	Trillion(TL)	%
1-9	186.574	94.4	545.809	35.6	20.7	7.7
10-49	7.972	4.0	175.660	11.5	17.2	6.4
Small Sized Industry	194.546	98.4	721.469	47.1	37.9	14.1
50-99	1.405	0.7	97.356	6.4	14.6	5.4
100-199	842	0.4	1116.319	7.6	21.0	7.8
Medium Sized Industry	2.247	1.1	213.676	14.0	35.6	13.2
SME (Small+Medium)	196.793	99.5	935.144	61.1	73.5	27.3
200+(Large Sized)	982	0.5	595.601	38.9	194.9	72.7
TOTAL MANUFACTURING INDUSTRY	197.775	100	1.530.745	100	268.4	100

Source SIS-Annual Manufacturing Industry Statistics 1994

Small and medium enterprises represent a quantitatively significant group among total enterprises: The first line of Table C-2 shows the share of SMEs in the total number of manufacturing enterprises in countries at different developmental levels. The lowest share is in England and even there, it reaches a level as high as 96

percent. Data collected by the Ministry of Industry indicates that this figure reaches 98 percent in Turkey.

The second line of Table C-2 shows the share of SMEs in total employment. The highest ratio is in Japan (81.4 percent). In England the SMEs are responsible for 36 percent of total employment. Turkey follows England with 45.6 percent.

Table B-2 A Comparison of Small and Medium Enterprises in Selected Countries

	USA	GER.	IND.	JAP.	UK.	S. KOREA	TURKEY
• The share among the total number of enterprises	97.2	98.9	98.6	99.4	96.0	98.8	98.8
• The share in employment	50.4	64.0	63.2	81.4	36.0	59.4	45.6
• The share of total inv	38.0	44.0	27.8	40.0	29.5	35.7	26.5
• The share of total prod	36.2	49.0	50.0	52.0	25.1	34.5	37.7
• The Share of total exports	32.0	31.1	40.0	38.0	22.2	20.2	8.0
• The share of total loans	42.7	-	15.3	50.0	27.2	46.8	3.0

Source: Müftüoğlu, (1997)

However, SMEs' role is not limited to their economic and employment contribution, they help in (Özgen and Doğan, 1997):

- improving the adaptability of the economy to changing market forces and conditions,
- supplying necessary raw and semi-manufactured materials for large firms,
- creating a competitive environment by producing similar products with the large firms,
- providing flexibility in the adoption of new technology and production systems,
- creating new economic centres (i.e. Gaziantep, Çorum, Denizli, Kayseri and Kahramanmaraş) they reduce the economic gap between regions and prevent migration, and
- diffusing capital to the lower stratum of the society and preventing an oligopolist economic development.

Diffusion of IT in SME's, Policy Issues:

In her paper "IT Diffusion in Small and Medium-Sized Enterprises: Elements for Policy Definition," Rovere (1996) argues that the role of SME's should be investigated with regard to innovation and regional development studies with a focus on industrial districts. This argument is based upon the increasing importance of flexible organizations in today's economic environment and the main elements of the flexible specialization model being: networks of small firms; flexibility of equipment, and human resources. Rovere further argues that these ideas must be thoroughly considered in defining an IT diffusion policy for SME's. The relatively inexpensive availability of IT products and services serves to create many new business opportunities for SME's. If flexible production capabilities do indeed lie within the environs of networked SME's, IT increases in importance to ensure the platform to allow for efficient information flow within and outside of SME networks. (Rovere, 1996)

There are many reasons to support IT diffusion in SME's. SME's tend to exhibit a greater ability to produce new products after IT introduction. On the other hand, larger firms tend only to utilize IT to diversify their existing product lines. Rovere argues that ". . . innovation (in current economies) may be closely associated with regional characteristics and the organization of firms in networks. Therefore, an IT diffusion policy is important for regional development since it can support networked SME's." (Rovere, 1996) Networked firms have the following potential benefits with regard to IT diffusion: the possibility for the creation of a "network of innovators"; greater ability to build relationships between SME's, their customers, and their suppliers; innovation stimulation from IT connections with universities, technology transfer centers, banks, clients, and consultants; increased regional development through reduction of SME dependency on location and on local markets. (Rovere, 1996)

Rovere had made some suggestions about IT diffusion policy in SMEs and argues that regional development can support networked SME's. With regard to IT

diffusion, Rovere (1996) puts forward the following potential benefits for networked firms:

- the possibility for the creation of a “network of innovators”;
- greater ability to build relationships between SME’s, their customers, and their suppliers;
- innovation stimulation from IT connections with universities, technology transfer centers, banks, clients, and consultants; increased regional development through reduction of SME dependency on location and on local markets.