CAD Adoption in the Swedish Architectural Industry

IT and the Professional Service Sector

Gert-Olof Boström

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ABSTRACT

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IT and the Professional Service Sector

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The adoption of information technology (IT) is an intensive and ongoing process in society. All types of firms, but especially service firms, tend to adopt IT. Professional services, a sub-section of the service sector, are heavy users of IT. These firms are special because their business builds on the knowledge of the people in the firm. Therefore, it is of special interest to study the impact of IT in these firms.

The impact of IT in professional service firms is identified in four ways: service quality, competitive advantage, bottomline (management visions), and industry structure. The empirical focus is on the Swedish architectural industry and the adoption of CAD in this industry. Two extensive surveys each consisting of several in-depth interviews and a mailed questionnaire provide the empirical data. The research design is longitudinal and changes in the industry were observed. In special focus were the differences between the firms that had CAD—adopter firms—and firms that did not have CAD—non-adopters.

Both the architects and their clients rated services performed with CAD to have better quality; e.g., the cooperation was eased by the use of this technology. The findings also suggest that CAD may be used as a competitive tool in the industry. The adopters increased their productivity significantly more than the non-adopters did between the two surveys and the adopters had significantly more loyal clients. CAD seems to be a tool that accentuates the differences between the adopter and the non-adopter firms.

The results suggest that adopters and non-adopters develop into two different types of firms. The characteristics of these firms indicate that a division of the industry appeared. For example, the adopters were significantly larger than the non-adopters and plans to expand their business. One explanation to the disparity between these two types of firms may be the differences in management vision. The adopters may be characterized as progressive firms and the nonadopters as traditional firms.

KEY-WORDS: professional service, information technology, service quality, competitive advantage, bottomlines, management visions, industry structure, dynamic service quality, CAD, architectural firms, innovation.

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This book is dedicated to my Mother and Father
Ing-Britt and Albert Bostöm.
Foreword

There are several people to whom I am deeply indebted due to their contribution to the work of this book; people who planted a seed of confidence and patience that has blossomed. These people have had to be patient because there has been an extensive search for “parts” that would fit together. In some cases the appropriate “part” has been closer than expected. The job has been tough as some of the “parts” were up side down, others covered, and still others were hard to spot because they were not “mature” for their actual place. The spirit of the work may be expressed by the following words by Gummesson:

What science is, is far from clear. There are those who claim they know. In my view ‘scientists’ who claim they know what sciences is are not scientists. They have stopped developing. Their search is over. (1991b, p. 18)

The support from my main advisor, Professor Rolf A. Lundin, Jönköping International Business School, has been vital. Professor Per Davidsson, Jönköping International Business School, has helped me to explore the nature of research in the early parts of this work. Professor Timothy L. Wilson, Clarion University, Clarion PA USA, has generously shared his knowledge and given me deep insights in how research work is done from an U.S. perspective, just do it. He also made it possible for me to come to Clarion University, Clarion, PA USA, as a guest researcher. Carin Holmquist, Stockholm School of Business, made a significant contribution with her supportive attitude in the latter phases of the work with this book.

I am deeply indebted to all the people in the Swedish architectural industry who put their tasks away to make this work come through. A large thank you to all of you, who responded to questionnaires, allowed me to interview them, and attend meetings. There is no possibility to name you all. There are, however, some people whom I would like to mention. Mikaela Eckered, ARKUS, Stockholm, was an essential person who among other things made the access to empirical data easy. Lars Hallin, Björn Smedberg, Sveriges Praktiserande Arkitekter, Stockholm, and Staffan Carenholm, Arkitektförbundet, Stockholm, have provided me with a lot of information and given several valuable comments. Other people from the architectural industry who have provided valuable insights into the architectural industry are Marja-Leena Agri, Åke Larsson Byggare AB, Stockholm, Svante Berg, Berg Arkitektkontor AB, Stockholm, Bo Kjessel, Bo Kjessel Arkitektkontor, Stockholm, Ragnar Östlund, Contekton Arkitekter, Falun. Laila Björnham, FFNS i Umeå, patiently listened to my questions about architects and architecture and generously shared her knowledge.
Associate professor Magnus Klofsten, University of Linköping, Dr. Agneta Marell Umeå School of Business and Economics, and Dr. Christer Pettersson Umeå School of Business and Economics gave valuable comments on a preliminary version of this book. Their comments were essential for the final design of the book. Dr. Glenn Rock and Mr. Roger A. Engle, and Dr. Isely Krauss supported me in my work during my stay in Clarion, PA each in their special way. It was Glenn Rock who long before me found the appropriate words for the work with this book and gave me the poem (below) by Robert Frost to my attention.

I am also indebted to my friends for giving me support, each in their special way, in the struggle with this book. You all made the work worthwhile and rewarding. My colleague and friend Jan Bodin has always had time to listen and to give support. Karin and Fredrik Sohlberg have been very important for me and their encouraging support helped me doing the job. My parents Ing-Britt and Albert Boström need special attention. I have dedicated this book to them as a way to show my esteem to their support for my choice of career.

There are two people whose importance is beyond words for me, my wife Katarzyna and my daughter Alexandra. Their love and care is it all.

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To each of you and to all of you not mentioned,

Thank you

An appropriate way to conclude the foreword would be by giving the reader some guidance for the coming text. Robert Frost has in a delicate way expressed the spirit of this book in the following poem:

But yield who will to their separation,  
My object in living is to unite  
My avocation and my vocation  
As my two eyes make one in sights

Gert-Olof Boström
Umeå July 2001
Author's note.
The original data in this book was provided by a large number of individuals. People have participated in different ways. Two in-depth interview surveys were conducted as well as two mailed questionnaire surveys. These individuals are quoted in the text without accompanying citation. That was part of the agreement with the involved people. All quotations are used with permission from the people who participated. ¹

¹ A similar way to use collected data is, for example, found in Berry (1991).
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Chapter 1: PROFESSIONAL SERVICE AND INFORMATION TECHNOLOGY

Information technology (IT) is a word associated with progress (Vedin, 1995b). The increased adoption of IT by firms and organizations clearly stresses the importance of this technology. Especially the service sector seems to expect much from IT; e.g., about 84 percent of the total US stock of IT items were owned by the service sector in 1988 (Roach, 1988, cf. Alice, 1994). The situation in Sweden appears to have been similar to the one in the U.S.; for example, both countries have the same degree of Computer Aided Design (CAD) adoption (Löwstedt & Norr, 1992 p. 4). What are the expectations of IT? What is the impact of IT on the perception of service quality and competitive advantage? What are the gains for the early adopters of IT? How does the introduction of IT in an industry affect the structure of the industry? It is especially interesting to address these questions to service firms because of their vital role in modern economic growth (Bateson, 1995; cf. Guile, 1988).

Information Technology and Business Dynamics

Certainly much is expected from new technology. Technology has been pinpointed as the most important factor for creating change in the business environment (Capon & Glazer, 1987 p. 1). In this book, new technology and IT are synonyms. Opinions about the impact of IT in service firms vary. IT is one of the most important factors affecting the service delivery process, and at the same time one of the least understood (Harvey, et al., 1993, p. 486). Service firms have often been lured to invest capital in new technology (Roach, 1991).

In the early 80s, the author of this book worked as a computer consultant with clients mainly from the service sector. Generally, the managers in these firms were eager to start using IT because it was supposed to prepare the firm for the future. According to several managers, the adoption of IT was an indication that the firm was ahead of the development pace in the industry. There was an absolute need to adopt IT if the firm wanted to stay in business according to these managers (cf. Monger, 1988 p. 6). IT would provide the firm with an essential competitive advantage regardless of management’s experience with and knowledge about this technology. The key to the future was embedded in IT. What opinions the customers had about the technology was not discussed; the managers’ opinion was enough. IT and service firms seem to be an
urgent area to study because of the different opinions about the matter and because of
the large expectations of this technology in service firms (cf. Barras, 1986 p. 751). This
book addresses the inquiry about the impact of IT in service firms.

**Professional Service and IT**

A subsection of the service sector, professional service, offers the market specific
types of knowledge depending on the type of business—e.g., architecture, law, or
medicine. The assets in these service firms are vested almost entirely in their human
capital and this is why IT may affect the nature of the services in these firms.
Professional service firms are centered on the knowledge of the people in the firm. It is
relevant to ask how these capabilities may be extended without hiring more service
providers, i.e., to empower the service worker. The introduction of IT into these firms
represents a possible example of this type of extension. IT might empower the
professional service worker’s productivity and ability to extend services. A well-known
problem in services is the fluctuation in demand (Zeithaml, et al., 1985). For this
reason, it is difficult to achieve the proper size of the personnel in a service firm. The
adoption of IT will perhaps address this problem. An additional reason to focus on
professional service firms is the limited knowledge about these firms. Studying the
variations in the service sector is required (Swartz, et al., 1992 p. 17).

**IT, Competitive Advantage and the Customers**

Customers consider services provided using new technology different from services
provided the traditional way (Stevens, 1991 p. 141). Smith (1988) has pointed out that
IT is a means for the service sector to gain a competitive advantage (cf. Blumberg, 1991
p. 96; Porter & Millar, 1985 p. 149). The question is when and how IT will affect an
industry and not whether IT will affect an industry. How does this opinion relate to the
customers’ judgement of the new technology? Is IT a tool for competitive advantage
regardless of the customers’ opinion of it? Usually the potentials of the new technology
seem to be seen as important regardless of customer opinion. Is it possible to consider
IT as a competitive tool in general? What is the relation between competitive tool and
the customers? Do all customers consider services done with IT to be better? Does the
type of service diminish the impact of the technology? Bitran and Hoech (1990 p. 89)
claim that technology does not necessarily increase the customers’ satisfaction, which
makes all the questions here relevant. Perhaps the statements from Porter and Miller
(1985) should be regarded as an enthusiastic opinion of an early stage of IT and Bitran
and Hoech’s (1990) statement should be considered as a more nuanced perception of a
more developed situation. Probably the impact of IT varies in different situations depending on several factors: the computer literacy in the industry, size of the industry, competition intensity, type of IT application, the costs of IT, and the importance of the application’s contribution in the firm’s production system.

Possibilities of IT in Professional Service

IT may be seen as a means of change in professional service. Individual knowledge may be transformed to organizational knowledge (Bharadwaj, et al. 1993 p. 89). Professional service firms are usually recognized in the market by some of their outstanding professionals. A transition in knowledge from individual to organizational may change the recognition of the individuals in the firm. Are these changes what the adopters expect when they start using IT? What will happen with the identity of an outstanding professional in the professional service firm when the customers recognize the firm’s reputation and not the individual’s reputation? Maybe the issue about the adoption of IT is not formulated well. Perhaps it is more important to regard the issue as a transformation of a craftsmanship’s tradition to industrial production. An example of this transformation might be the introduction of CAD in the architectural industry.

Sakr (1991) has described the introduction of CAD as an epochal shift in the architectural industry. CAD is the initial name for a category of software applications that assist in design (Bergvall & Lundequist, 1985; Wright, 1988). There is a range of software packages concerning complexity and technical requirements to use for the same type of application. CAD users usually talk about workstations, i.e., a computer with large screens and an extended ability (Reynolds, 1993) to manage large blueprints in the computer. What does the shift mean for the people and the firms in the adopting industry? What is the direction of the development in the adopting industry if any? Where is the path of development going?

CAD is an example of a computer application that is directly integrated in the delivery of service—a process influencing technology. Are such IT applications possible in professional service industries? There is a need for change in the settings into which CAD is adopted if the full potential of the technology is going to be achieved Zuboff (1985). Wikforss (1993) emphasizes the need to revise the working process for architects. Thus, there is need for changes when CAD is adopted. How extensive are these changes? Are people willing to make these changes? How fast can the changes occur? What is the learning curve for the new technology? How do these questions relate to IT as a means to increase a firm’s competitive advantage?
Management's Bottomline in Professional Service

Traditionally, the management of professional service firms has been regarded as different (Coxe, 1980). These firms seem to be different from other firms with respect to strategy and competitive advantage (Doorley et al., 1988). Architectural firms may serve the purpose of exemplifying management of professional service. Principals in these firms identify themselves as artists and not as managers (Boström, 1991). They hold the opinion that starting a firm is the best opportunity for them to perform their profession. Practicing the profession is central to these professionals, which is probably true for many small firms. Principals in architectural firms are largely governed by their professional values. What is good for the professional outcome is good for the firm.

The fundamental factor that differs between the management of a business and the management of an architectural firm is the perception of the bottomline (Coxe, 1980). For the general businessman, the bottomline is quantitative; therefore, they act according to business success measured in the amount of money or output. In creative professions, there is a strong qualitative bottomline; these principals are governed by the quality of their product and success is, for example, measured by how well-designed a building is. Managers with a qualitative bottomline consider the customer's needs as paramount. The professional's perception of the customer's service needs guides the work. The qualitative bottomline focuses on the result instead of the process; therefore, the most successful people in the architectural firm are those who are task oriented (Coxe, 1980).

The investment in IT is something new in the professional service firms. Some of these firms required very limited amounts of equipment for operating. There has been no demand for certain equipment when starting and running the firm. The introduction of IT may change this situation. It might be possible to use IT applications to facilitate their work. The resources needed for an investment in new technology may change the structure of the industry. There might be a need for firms of a certain size to be able to generate sufficient resources and there might be hurdles to overcome when starting a new firm due to the need of demanding (money and/or knowledge) technology. An adoption of new technology is more than using new technology; it requires creating and changing values about new technology. These changes might affect the bottomline.

Service Quality and Competitive Advantage

Several authors believe that IT will affect a firm's ability to compete. Service quality and competitive advantage are two constructs\(^1\) used in this book for assessing how IT may affect a firm's competitive power.

\(^1\) Construct is a concept used for a special scientific purpose (cf. Kerlinger, 1986 p. 26).
Service quality is something elusive that a service firm tries to capture (Cronin & Taylor, 1992). An understanding of service quality and how it is achieved in organizations has become a priority for research (Zeithaml, et al., 1988, p. 35). One way that a service firm might try to achieve service quality is by adopting IT. New technology does not by definition result in success; success depends on several factors of which the customers' perception of technology is important (Bitran & Hoech, 1990 p. 89). According to the prevailing definition of service quality (cf. Grönroos, 1992 p. 2), it is possible to say that customers govern the impact of new technology. Depending on how clients regard the changes caused by the new technology, the adoption of the new technology will proceed or stop. In an industry with strong professional values—professional service—the impact of IT, as a tool for changing service quality, is not obvious. Its power is, perhaps, not as strong as in other industries because of the firm's professional values—strong opinions about how work is to be carried out. The customers may also share these values and this is why the impact of IT in professional service may be weak.

IT and Competitive Advantage

New technology may cause expansion for certain firms in the industry and contraction for others (Petre, 1985); the long run competitive position of an individual firm usually depends on how well it learns to manage and increase its technological asset base. In other words, a firm's competitive position depends on its ability to manage new technology (Boter & Holmquist, 1996 p. 483; Monger, 1988). Due to the massive adoption of IT in service firms and professional services, these statements seem to be as valid for them as for manufacturing firms. What is IT's impact on competition in a service industry where manual production has been the tradition? Will people want to learn how to manage the new technology?

The presentation so far has praised new technology, especially IT. The distortion is a reflection of the contemporary perception of technology in society. Our values are technology friendly and the adoption of technology seems to continue at an ever-increasing pace.

Technology is never the driving force behind breakthroughs that we label as technical. Technology only gives us possibilities. It is the market and the society, habits, culture that decides what people choose to accept, and how they accept it. (Vedin, 1995a p. 1, author's translation)

According to Vedin (1995), new technology is a choice. The question is to whom is technology a choice? Is it a choice for the individual firm? Alternatively, is the choice related to an aggregate level? Does the possibility of choice mean that an industry may
not adopt technology? Alternatively, is the integration between different businesses in society at a degree that limits choice? Is the choice of technology only present at a planning level of society or at a philosophical level?

The prevailing way to think about competitive advantage in service firms refers back to Porter’s (1985) model about how to achieve competitive advantage: offer the consumer a similar product at a lower cost or offer the consumer a different and superior product. Is this way of thinking really suitable to apply in a service situation, especially a professional service situation? In this environment, the relation between the service provider and the client is a significant part of how the consumer experiences quality (Lundin, 1993 p. 7; von Matern, 1989).

*First mover advantage.*

Is there an advantage for the first firms that adopt IT? Will a firm that adopts new technology first increase its competitive advantage compared to firms that delay their adoption of a new technology? It is unclear if first mover will have an advantage in an industry of professional service. The idea about first mover advantage builds on the presence of disloyal clients (Lambkin, 1992). Clients either buy a lower priced product or a differentiated product (Porter, 1985). Hammarkvist, et al. (1982) claim that in the industrial market there are certain bonds between the seller and the customer. These bonds strengthen the relationship between the parties; e.g., the social bond seems to be vital in professional service. If the cooperation between the parties works out, then there is no incentive for the client to switch supplier (Boström, 1995).

How a professional firm attracts new clients emphasizes the different behavior in this market compared to the behavior suggested by Porter (1985). Around 40 to 50% of all new jobs come by referral in professional service (Day & Barkdale, 1992 p. 89). Does the large portion of customers’ referrals erode the basis of first mover advantage? In what ways will a large number of referral customers affect the diffusion of IT in professional service? The large number of referrals also raises questions about service quality. How does a transition process in service quality appear in such a market? Is service quality relevant to discuss in a professional service market where the clients seem to be tightly linked to the service provider? As indicated, professional service firms have a qualitative bottomline. What is the impact of this bottomline on service quality and competitive advantage?

*Industry Structure*

Quinn (1992) has broadened the view of the first mover advantage achieved due to the use of IT. He has suggested a pattern that reflects the structural changes that occur in a service industry. In the first stages of the adoption process in an industry, the large
firms will grow at the expense of the other firms in the industry, which will result in a large number of small and midsize firms unable to compete. Over time, however, the small firms will prosper but the midsize ones will have difficulties surviving in the industry. (Quinn, 1992). Is this pattern also valid for professional service industries? For example, the large firms were first to adopt IT in the Swedish architectural industry (Boström, 1991). About 87% of Swedish architectural firms had less than twenty people (Eckered, 1986). What does the introduction of IT mean for the industry structure? Will some large firms dominate the business in the industry? Does the new technology empower the small firms so they can coexist with large firms?

**A Basic Model**

It is possible to study the impact of IT using different indicators. Service quality and competitive advantage seemed to be the two most fruitful constructs to use regarding firm level. Both these constructs, for example, are closely related to the firm’s performance in the market and are therefore in line with the approach of the research in this book. Changes at an industry level are also of interest; i.e., structural changes in the business due the adoption of IT. A construct for observing changes at this level is industry structure. How does the adoption of IT change industry structure?

Looking at bottomlines aids in the study of the impact of IT. Bottomlines are used, according to Coxe (1980), to describe the values that the management has about the firm and its business. There are two main reasons why this construct is used. As indicated before, professional service firms, as compared to other industries, respond differently to strategy and competitive advantage (Doorley et al., 1988). The management in these firms is done according to a qualitative bottomline and other firms are managed according to a quantitative bottomline (Coxe, 1980). Secondly, studies on the diffusion of innovations suggest that certain characteristics of a firm decide when in the diffusion process it adopts the new technology (Attewell, 1992). These characteristics may be seen as a result of management intentions. That is, is there a difference in bottomlines between the principals in the adopter firms and the bottomlines in the non-adopter firms?

Figure 1.1—A Conceptual Model of the Research—illustrates the relationships among different constructs used for assessing the impact of IT. Information technology introduced to an industry of professional services is labeled “Information Technology” and “Professional Services.” The arrow from the information technology to professional service is labeled “Impact” and represents the possible impact that the introduction of information technology may have in the selected industry. In this book, four constructs—“Service Quality,” “Competitive Advantage,” “Bottomlines,” and “Industry Structure”—are used to assess the impact of information technology. The
constructs service quality and competitive advantage are used to assess the impact of IT on the firm level because these two constructs suggest an external perspective. The firm's relationship to the environment is of primary interest. The impact of IT is also observed on an aggregate level, industry level. At this level, the constructs bottomlines and industry structure are used as indicators of impact.

![Diagram](image)

*Figure 1.1 A Conceptual Model of the Research*

The adoption of CAD in Swedish architectural firms is an example of a professional service industry that is influenced by IT and it is used as the representative IT for the inquiry in this book. These firms are most suitable as representatives for a professional service industry because they are especially sensitive to changes in the market (Brown, et al., 1993). CAD will be used as the study object for IT. CAD is used because of the following two reasons: CAD, compared to "traditional IT," is a process influencing application and the application was new to the industry at the time the research was done for this book.

**Professional service—architectural firms.**

Swedish architectural firms are used as study objects for professional services because these firms have been studied in a very limited way concerning marketing. (See Blau (1984); Brown et al. (1993); Coxe (1980, 1990); and Coxe et al. (1987)). Architectural firms more than other professions are affected by the economic environment because these service firms' demands are directly related to the economic situation in society (Brown et al., 1993, p. 143). The introduction of IT may be seen as a change in the economic environment. Architectural services are not vital to people's health or their welfare in the same way as many other professional services: e.g., medical and legal services. The impact of a process influencing technology might be evaluated on the terms of a "free" market.

Often architectural firms are called architectural practices or design practices both in architectural literature and by practicing architects (cf. Coxe, 1980; Gutman, 1988;
In this book, there is a deliberate choice to avoid these two latter labels due to the research focus on the firms. The term architectural firm is used consistently.

A Swedish architectural firm usually houses two groups of professionals: architects and engineers. In some firms, of course, there were only architects. Whatever the mix between architects and engineers, all personnel are referred to as architects. There are several reasons for not separating the professional categories. The focus in the book is on the architectural firm and not on the different groups of professionals that might be active in such a firm. The architectural firms' performances are studied from an external approach and this is why there is no need to identify whether it is an architect or an engineer who performs a task. Moreover, it was ambiguous whether a task is considered an architectural task or an engineering task. An engineer in one firm could very well do a task done by an architect in another firm. There might be situations, however, in which special attention is put on engineers and in such cases this group is addressed specifically.

IT—CAD.

The choice of CAD as a representative for IT was natural because of the selection of Swedish architectural firms as representatives for professional service. CAD satisfies important criteria: it was a technological innovation in the architectural industry (cf. Sakr, 1991; Ström, 1988). CAD is used as an integrated tool in service production (Wikforss, 1992) why it has the possibility to be an essential part in the service process and affects the outcome of the service production. The customers are affected by the impact of this technology. Moreover, the technology has the potential to influence the character of the service production process because it facilities visualization, simulation, and animation (Wikforss, 1992).

In this book, IT is the same as CAD. CAD is the overall label for generally referring to a category of software that assist in design, i.e., the particular function of the software regardless of brand (cf. Bergvall & Lundequist, 1985; Wright, 1988). There are a number of different software packages with different levels of complexity and technical requirements. Other software applications that an architectural firm might have are not discussed, e.g., whether the architects in a firm work with word-processing or not. CAD was considered as a new technology for the architectural industry because before the introduction of CAD the design process was done manually and the impact of CAD on the design process was considered to be large (Sakr, 1991).

In the mid-1980s, the Swedish architectural industry began using CAD. Although this technology had been in use in the industry since 1975, the diffusion process did not
take off until about a decade later (Chart 1.1). In 1990, a sample drawn from the Swedish architectural industry showed that about 44% of the firms used this tool (Boström, 1991, p. 77).

![Chart 1.1 Adoption Year for the First Workstation in the Firm](chart.png)

**Inquiry**

This book aims at addressing the following question: *What is the impact pattern of IT in a professional service industry?*

The formulated path of inquiry suggests a very broad approach, which makes it difficult to investigate it within the limitations of this book. The specific directions developed for this book were the following purposes:

To identify the essential characteristics of the Swedish architectural industry and describe how these characteristics change because of the CAD adoption.

To analyze changes in service quality and competitive advantage in the Swedish architectural industry related to CAD adoption.

To identify the characteristics of a possible new industry structure that might develop due an adoption of CAD.

To recognize changes in the bottomlines in the industry because of a CAD adoption.

Generally, the path of inquiry is what the study is about—the comprehensive approach in the book. Specifically, the purpose reflects how the inquiry is performed—the empirical approach of the book. Another distinction that might be useful to identify is that the inquiry and the purposes are the different levels that these two statements represent. The purposes are on a detailed level, where individuals are the carriers of change and the path of inquiry is on an aggregate level, where the impact of IT is discussed on an industry level.
Outline of the Book

The outline of the book can be divided into the main parts presented below. Each of the chapters contains subsections that are an elaboration of the specific theme in that chapter.

Chapter 2: Theoretical framework.

Definitions of professional service suggest that professional service focuses on the complex knowledge of a professional and these services are usually traded in a business-to-business situation.

Essential for professional service is service quality. Depending on how the firm decides to distribute its resources, the customers will experience different levels of service quality. A trend in service firms and professional service firms is to adopt IT. Technology has shown to be a competitive tool. There is, however, a lack of knowledge about IT in professional service, especially regarding service quality and competitive advantage.

Chapter 3: Research plan.

The research process was built around two surveys. The first survey consisted of several in-depth interviews with a snowball sample of Swedish architectural firms and a mailed questionnaire (the initial) addressed to about half the architectural firms in Sweden. The second survey was built on a few in-depth interviews with architects and their clients, and a mailed questionnaire (the follow-up) addressed to the firms who responded to the initial questionnaire.

Chapter 4: Types of firms.

The empirical data was analyzed mainly to find out differences between the firms who had adopted CAD (adopters) and the firms that had not (non-adopters). There turned out to be a number of significant differences between these two types of firms. Adopters were large formal firms who wanted to expand and change. Non-adopters, on the other hand, were small informal firms who did not want to expand and change. The interviewees stressed the participation of the client in the service process. The cooperation between the parties strongly affected the quality of the architectural service as well as the final outcome. CAD was considered a competitive tool for an architectural firm in general among both the adopters and the non-adopters. Regarding its usability in the own firm there were significant differences between the two groups of firms.
Chapter 5: CAD—service quality and competitive advantage.

IT, service quality, and competitive advantage seemed to be related to each other. A large portion of the clients tended to prefer their services done with CAD. Both the service provider and the client in the adopter firms saw advantages with the new tool. According to both parties the most important advantage was smooth cooperation. These favorable opinions about the new technology from both the providers and the clients mean that a transition of service quality perception had started in the industry. A new quality standard, one that incorporated CAD, was emerging. Because the adoption was done at different times for the firms in the industry, certain firms gained a competitive advantage before others. A comparison of the adopters and the non-adopters showed that the adopters had a significant competitive advantage.

Chapter 6: CAD and transformation.

The adoption of IT in the architectural firms divided the industry is in two groups, adopters and non-adopters. These two groups will probably grow apart. Adopter firms tended to emphasize business values and the non-adopter firms professional values.

CAD eased communication, giving the customer a better service and increasing the customers' satisfaction with the end result. One of the possibilities that CAD offers is visualization, which means that the quality evaluation is moved from after the service delivery to an early point in the service delivery. The visualization possibilities may be used in marketing; the architect may be able to show the client a realistic rendition of the final product.

Chapter 7: One step further.

When the data for this book was collected, CAD was a new product for the architectural industry. Since then several new versions have been developed. New systems related to CAD will probably appear in the market regularly. This technology will be a continuous source for firms to improve, develop, and change. There will probably be CAD systems that are appropriate for each of the firms in the industry and most firms will have a workstation soon. It is no longer useful to study adopters and non-adopter with respect to the impact of CAD. Some other way of understanding the industry is needed.

Questions about research design are considered; the use of another design would have provided other insights about the industry. However, with respect to the questions stated in Chapter 1, the research design seemed most appropriate. Several new areas of research have emerged during the work on this book. Overall, areas for further research include the development of the industry structure, IT, changing business cycles, gender issues, internationalization, and the use of the "The Business Dynamic Model."
Chapter 2: THE THEORETICAL FRAMEWORK

Chapter 2 examines the theoretical orientation of the studied constructs: professional service, bottomlines, IT, service quality, competitive advantage, and industry structure. In addition, this chapter develops a framework of a possible relationship between the constructs. The last section of the chapter discusses a relationship that reflects the overall inquiry for this book.

The theoretical framework was developed using a marketing perspective. This approach was done for several reasons. There is need for research about marketing and professional service (Brown et al., 1993; Congram, 1991; Kotler & Bloom, 1984; Kotler & Connor, 1977). In an article reviewing the service marketing literature and the service management literature, Swartz et al. stress the need for contingency theories of service marketing and management:

Several scholars have invested much energy in analyzing the variance between the manufacturing and service sectors . . . However, it is now time to invest more energy in analyzing the substantial variance within the service sector . . . The research requirement, then is to develop and test propositions about what marketing and management practices are effective for certain types of services under certain conditions. (1992, p. 17)

Marketing, however, is a broad term and more precise language is needed. Brown and Swartz (1989) claim that service quality research has focused on discovering various theoretical aspects, but now there is need for empirical work that studies specific aspects—e.g., the impact of IT on service quality. This book analyzes the presented constructs as separate qualities and the joint relationship and impact of them (cf. Fisk et al., 1993; Kerlinger, 1973).

To study the impact of IT, marketing has to be interpreted in a broad sense in the spirit of Fisk et al. who suggest that the service marketing literature needs to be broadened “to incorporate theories and ideas from disciplines outside marketing, particularly management, operations, and human resources” (1993, p. 87). The choice of constructs will naturally incorporate ideas from other disciplines in this book such as management and operations will be included.

Professional Service and the Bottomline

Professional services exhibit specific characteristics (Bateson, 1977; Judd, 1964; Rathmell, 1974; Shostack, 1977). The differences that appear in the literature are usually conceptual variations. (See Lehtinen (1985b, p. 82), Murdick, et al., (1990, p. 26), and Zeithaml et al. (1985) for comparisons.) Another difference that appears in the
literature is the number of characteristics for a specific service. Normann (1983, p. 17) points out eleven such items. These eleven characteristics, however, may be summarized into four typical characteristics:

1. Services are more or less intangible.
2. Services are activities or a series of activities rather than things.
3. Services are at least to some extent produced and consumed simultaneously.
4. The client participates in the production process at least to some extent.
   (Grönroos, 1990, p. 29).

Although other authors have modified these characteristics, most believe that service production involves cooperation with the client. Cooperation is important because it provides a firm with a competitive edge (Christopher, et al., 1991, p. 6). A professional service, where cooperation between the client and the firm is essential, relies on a high degree of cooperation with the client in order to secure a competitive edge (Bitran & Hoech, 1990, p. 96). Normann stresses the importance of this cooperation by calling it "the moment of truth" (1978, p. 14, 1983, p. 18, 1992, p. 32).

Shostack (1977), in her seminal article "Breaking Free from Product Marketing," notes that the intangibility of a service is a classic problem in service marketing. The customer can not evaluate a service before the service is rendered; the evaluation takes place at the same time as the service is performed and after the service is rendered.

Communication is central in services in general and especially in a professional service (Bitran & Hoech, 1990, p. 92). These services are by definition complex and the professional service firms cater to a variety of clients who all have specific requirements (Hart et al., 1992, p. 122). Professional services are customer tailored and this is why cooperation between the service provider and the customer is fundamental (Day & Barkdale, 1992, p. 89; Kelley, et al., 1990, p. 315). There is a negotiation between the parties in which the outcome of the service is shaped (Cuff, 1982); i.e., there is a negotiation about what the customer considers quality service.

There are two types of cooperation in a professional service firm: cooperation between people in the firm who are members on the same job team\(^1\) and cooperation between the representatives of the firm and their customers (Gummesson, 1978, p. 92).

**Definitions of Professional Service**

Professional service can be defined in several different ways. In 1972, Wilson defined a professional service as

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\(^1\) An additional type of cooperation may take place in a professional service firm. The members on the job team could be external independent suppliers to the firm. The professional service provider might need to involve external consultants in order to fulfil the customer's need; e.g., an architectural firm may use an audio consultant.
one purchased by industry and institutions from individuals and organizations, and is designed to improve the purchasing organization's performance or well-being and to reduce uncertainty by the application of skills derived from a formal and recognized body of knowledge, which may be interdisciplinary, and which provides criteria for the assessment or the results of the application of the service. (1972, p. xvi)

The definition focuses on two characteristics: the business environment and the character of the service. Industry and organizations buy professional service to improve their performance or well-being; this suggests that these services be traded in a business-to-business situation. Holmlund and Kock (1992) share this opinion; they divide industrial services into two categories—professional service and others.

Professional service has a specific character: the service provider sells knowledge to the customer (Wilson, 1972). The character of a professional service may be expressed as

- generally intangible, relying on the expertise of the professional to be successful
- have a high risk of purchase to the buyer, an intense relationship between the buyer and seller
- the professional who sells the work is also involved with doing or delivering the service. (Bean, 1991, p. 169)

Both these definitions focus on the nature of the service. Another way of identifying professional service is by defining the firms that perform them. Bean (1991, p. 169) suggests that accountants, financial consultants, attorneys, and stockbrokers perform professional service. All these professionals provide knowledge that their customers do not have; professional services are bought because of a need of a specific competence. McDonald and Stromberger (1969) suggest five basic professional service areas: (1) accounting, auditing, and bookkeeping services; (2) advertising agencies; (3) business and management consultant services; (4) engineering and architectural services; and (5) legal services. Congram (1991, p. 479) also uses the type of profession as the basis for defining professional service:

- Among the professional service disciplines are architecture, accounting, law, medicine, and engineering . . . (and beside these) several fields in which certification is not required, but in which practitioners consider themselves to be professionals and develop similar types of service practices. These fields include consulting, investment banking, advertising, public relations, market research, design, and data processing. (1991, p. 479)

Gummesson (1978) has used another approach for defining this type of service. A professional service firm should have the following criteria:

- The service should be provided by qualified personnel, by advisory, and focus on problem solving.
- The professional should have an identity, i.e., be known in the market for his specialties and under a specific name such as ‘architect’ or ‘management consultant.’
The service should be an assignment given from the buyer to the seller.

The professional should be independent of suppliers of other services or goods.

(Gummesson 1978, p. 90)

Swedish professional service companies have the following characteristics. Compared to the other definitions, there seems to be no need for any geographical limitation of these latter criteria. To some extent, the specificity of Gummesson’s (1978, p. 90) criteria narrow the possible number of professional services. Essential components in professional service are diagramed below as the boxes labeled A, B, E, and F in Figure 2.1 (Gummesson, 1978, p. 91).

![Figure 2.1 Components of a Professional Service (Gummesson, 1978, p. 91)](image)

These four components—A, B E, and F—in Figure 2.1, are compulsory and the other components—C, D, G, and H—are optional (Gummesson 1978, p. 91). The components in Figure 2.1 were primarily used to help a firm work out a marketing strategy, e.g., determining a strategy for a firm’s service offerings. The framework, however, may help the firm with segmenting the market, promotion strategy, and sales tactics (Gummesson, 1978, p. 91). Here the framework provides an understanding of the character of professional service. Complexity is an additional attribute of professional service, which may be used to differentiate services (Hart, et al., 1992). This characteristic will be useful in the coming presentation as it explains the environment of professional service.

Congram (1991) broadly defined a professional service. For Congram, the service provider decides whether a professional service was performed or not. Wilson (1972) shares this broad definition of professional service. Over time, Gummesson (1991b) has
widened his definition. For example, for him knowledge based organizations perform professional services. Gutman (1988, p. 8) does not share this broad way of classifying professional service; particularly professions that define this service (cf. Kotler & Bloom, 1984, p. 3). Clearly, opinions vary about how broadly to define professional services. There is, however, a similarity in all the definitions: professional service provides complex professional knowledge, which is the definition of professional service used in this book, and these services usually are traded in a business-to-business situation where the service is specifically designed for the client.

Professional service firms and knowledge intensive firms are similar labels. This is because there is no corresponding word for professional service in the Swedish language (Gummesson, 1991a, p. 20). Knowledge intensive firms relate to a special class of service producing firms that are totally dependent on knowledge production and dissemination for their business (Lindmark, 1990). These firms or organizations offer, as well as the professional service, market specific knowledge. The knowledge is specific in the way it is used to solve complex problems for the customer (Sveiby & Risling, 1986, p. 11). Therefore, the knowledge has to reach a certain level; the majority of a knowledge intensive firm’s staff has a university degree (Sveiby and Risling, 1986, p. 11). A comparison between the definitions of a knowledge intensive firm and a professional service firm might suggest that these two words have the same meaning. Gummesson (1991a, p. 20), however, claims that there is a distinct difference between the two; a knowledge intensive firm is a broader concept and refers to all types of trade where knowledge is fundamental to the business, which also includes manufacturing firms.

The need for definitions.

There are two schools: one tries to define almost everything and the other one claims that it is useless to define anything because all definitions can be criticized (Lehtinen, 1985b, p. 81). These two schools must be seen as two extremes and according to Lehtinen, “the silent majority” has the opinion that there is a need for some definitions of strategic issues and basic points of research (1985b, p. 81). When discussing definitions, it is important to know that there is no ultimate definition (Grönroos, 1990). Wilson believes that if no practical definitions of groups are made then the findings are of limited value “There can be no cross-fertilization or synergism unless practical groupings can be devised” (Wilson, 1972, p. 1). Without a definition of the central concepts in a study, the findings can only be considered to represent a single case. If a classification system can be made, then it is possible to develop generic models for how to deal with specific situations, e. g., how to adopt IT in professional service firms. It is
important to develop from the specific to the generic (Burgess, 1984; Glaser & Strauss, 1967; Lincoln & Guba, 1985). The practical implication of the discussion is that there can be an accumulation of knowledge.

**Architectural Firms—an Example**

Architecture is said to be the basis of all other arts and a profession, along with engineering, law, and medicine, which have existed for centuries (Coxe, 1980). Architecture involves collecting and referring to information from many different sources: clients, consultants, catalogues, building codes, and so on (Mitchell, 1984). The act of creative design is probably the most decision-consuming process of man (Coxe, 1980). After collecting information, the architect processes the information in various ways: sorting, abstracting, analyzing, checking, drawing inferences, and synthesizing. Finally, the architect must disseminate information to colleagues, to clients, to consultants, and to builders (Mitchell, 1984). Due to the increased complexity in buildings, the number of consultants—electricity, ventilation, audio, and so on—is increasing (Reynolds, 1993). It is possible to get the impression that the architecture profession is homogenous regarding its contents, however, its contents vary. Architects work with a variety of different tasks ranging from “designing of details and interior design to society planning on a high level of abstraction” (Östnäs & Svensson, 1986, p. 18).

Porter (1985) labels the chain of interacting firms that cooperate to reach the ultimate buyer a value system. The composition of the value system largely governs the business conditions for a firm (Porter 1985). Coxe (1990) has identified six different audiences an architect must consider: clients, employees, the building industry, the profession, prospective clients, and the general public. What influence the individual audience has in each case depends on the characteristics of the individual audience. These audiences may be recognizable to the architect; however, due to the focus of this book a different emphasis of the audiences was made. For example, Coxe’s building industry audience is here included in the developer audience, and the prospective clients were separated into three different customers: estate owner, estate administrator, and user. Besides emphasizing different audiences than Coxe (1990), in this work a more detailed identity of the customer is shown to stress the variation in the customer’s perception of service quality and the range of demands that govern the design process. An estate owner, estate administrator, and user all have their individual and different needs that the architect addresses. For example, the estate owner may want a flashy building, one that it is regarded as expensive and easy to sell for a large profit. The developer may want a
building that can be built using standard and efficient production methods. The estate owner may want a building that has low maintenance costs. The user may want the building to be functional and to satisfy the needs of the inhabitants.

The following actors in the value system for an architectural firm are of special interest in this book: estate owner, developer, estate administrator, and user (Figure 2.2).

![Figure 2.2 Value System for an Architectural Firm](image)

An estate owner needs building contacts and an architect develops a concept for a building. This concept is developed and transformed into a set of drawings, a formalized way to transfer information. A developer constructs a building according to the drawings. The estate owner may sell the building to an estate administrator whose business it is to manage the building or the estate owner may do this work. One of the tasks for the estate administrator is to lease the building to a user/s. The value system in Figure 2.2 over simplifies the situation; according to Swedish architects, all jobs are different (Boström, 1997). The simplified description provides an understanding of an architectural firm’s value system. A professional service firm has certain characteristics that need to be stressed due to their influence: the business-to-business relation,¹ the derived demand, and the cooperation between the service provider and the customer.

Several customers.

The derived demand increases the number of customers² that the architect has to please. Therefore, the input information is not as linear as depicted in Figure 2.2. The architect must consider information from all actors during the whole service process (Figure 2.3). The architect’s work is central to the success of the ultimate outcome; i.e.,

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¹ The business-to-business situation is defined as “an exchange relationship between two firms doing business with each other” (Hallén, et al. 1993:64).

² The concept of customer is used when discussing derived demand due to common use of these pair of concepts. Coxe (1990) would probably have used the label audience instead of customer.
what the final customer is left with regarding quality, function, and cost. About 85% of a final product’s cost is determined during conception, design, and planning (Bock, 1994, p. 88). During these three phases, the architect has the significant role.

The different customers in the value system may have various opinions about the design (including function) of a new building (Blau, 1984; Östnäs, 1984). The situation is further complicated by the customers’ various distances from the architect (figure 2.2). For example, the user is usually far away from the architect and not involved in the design process of a new building, either directly or indirectly. Awad (1987) has investigated the problems between customers and architects. He showed that the users of a housing settlement who had direct contact with the architect were more satisfied than the ones who had to communicate through a mediator (Awad, 1987). The result stresses the importance of directly involving all the parties in the value system from the project’s inception. The importance of bringing all parties into the process is underlined by the architects’ opinion about their role. Their role is to have responsibility for the overall formation, the aesthetics, and the survey of the process and the outcome of the project (Östnäs, 1984, p. 26).

![Diagram of Customers of an Architect](image)

Figure 2.3 Customers of an Architect

Most architects give priority to the needs of the users (Blau, 1984). Coxe (1980) claims that customers’ needs are always seen as paramount. Although an architect may want to receive input from the user, it is sometimes difficult for the user to influence the process because of social and economic conditions (Blau, 1984). The importance of receiving input from all interested parties is stressed by the fact that one of the most frequent malpractice in design firms is the development of solutions to a problem different from the real need of the client (Coxe, 1980).

Each party in a business-to-business exchange relationship is affected and affects the other party; therefore, it is necessary to consider this relationship as an adaptation process (Hallén et al., 1991, 1993). If the relationship is to work out over time there is a need for both parties to continually build and maintain trust, and to understand each
other’s needs (cf. Huemer, 1998). The client’s trust in the service provider is vital when
the service is changed (Viardot, 1998). The adoption of IT in a professional service may
be an example of such a change.

Different Bottomline

Coxe (1990) claims that the profession of architecture is one of the architect’s six
audiences. Architects share values about their profession that they learned during their
education. They share the same values about what is right and what is wrong, what is
ugly and what is beautiful, and which types of building concepts are possible to
integrate. These set of values are not static; e.g., there is a continuous development of
ideas because contemporary ideas of architecture varies and changes (Östnäs, 1984).
Before the students are licensed to practice, they have to gain practical experience. The
situation can be compared to an apprenticeship. In addition, work provides a type of
apprenticeship—inexperienced architects start with simple jobs and successively
develop to more and more complicated designing tasks (Sakr, 1991).

An architect can work in a variety of situations (Östnäs, 1984), e.g., be employed by
a city for facility management or be employed in a private firm and work as a
consultant. The various working situations demand different kinds of knowledge and it
is not possible to include all these variations of knowledge in the architecture education
program; therefore, the apprenticeship system serves as a way to educate architects
(Östnäs, 1984, p. 19).

Examples of differences in bottomlines.

According to some architects there is an inherent contradiction between the needs of
the profession and the needs of the firm. “The ambition to do a good architecture job is
always in contradiction to the demand to run a practice without loosing money.”
(Östnäs, 1984, p. 21, author’s translation). This was, however, not the only dilemma
that architects experience in the practice of their profession. A large number of them,
about 63%, often or always experienced a conflict between ideals and theories about
architecture and planning and the possibility that they had to realize these values
(Östnäs, 1984, p. 25).

Architects tend to be fulfilled by their professional role and the time for managing
the firm seems to be as minimized as possible. The reward for an architect comes from
the design result and/or customer satisfaction, and the impact of all these on personal
lives style; the businessman wants the reward in monetary terms. For the businessman,
the volume of the business is the most important task and for the architect it is the work
accomplished and this work’s influence on society and the profession (Coxe, 1980).
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Gutman (1988, p. 4) suggests that people want to be architects because of the opportunity for self-expression and individual creativity the profession provides.

There are two different bottom-lines present: the qualitative and the quantitative. Differences between them are evident in several ways such as budgets. The quantitative man will freeze the situation when the budget is overrun, and the qualitative man will allow frequent overruns of the budget as long as it concerns a better solution. The qualitative manager does not really care about financial management systems. There is also a difference between these two managers concerning how they choose jobs (Coxe, 1980). A quantitative manager selects jobs according to their contribution to volume and profit objectives and a qualitative manager chooses jobs because of its professional interest, which may not be consistent with profit making. An architect's professional interest often overrides financial considerations. Gutman (1988, p. 4) does not fully agree with this description of the management of an architectural firm. He claims that there is a trend in the U.S. to conduct architecture business with greater attention to good management and profitability. In interviews with architects, Östnäs (1984, p. 21) found a concern to act more business like. Whether this concern reflected real change that had occurred in the industry or whether it was something that the architects feared is hard to tell from Östnäs (1984) presentation. There are strong forces in the industry against a transition to act more business like; e.g., an architect who is identified as a business person means that clients might consider him more interested in profitability and self-interest than in quality building and the well-being of the client (Coxe, 1980).

An architect's professional focus also affects how the firm is managed (Coxe, 1980). An architect's management experiences come mostly from managing customers' jobs. It is natural for an architect to use this experience when managing the firm why the firm is managed like a series of projects. The management of the firm is seen as a task and not as a process—project management versus practice management. A firm managed as a task does not have a life of its own. It is a means for accomplishing tasks for different customers (Coxe, 1980). Perhaps the management of the firm may depend on the process used for selecting the principal. According to Cross (1986), the most talented designer is selected to be president, which means that the firm loses a valuable designer and gains an unskilled manager.

The firm and its organization.

Architectural firms are usually small. In Sweden, 87% of the architectural firms had less than twenty people (Eckered, 1986) and in the United Kingdom the mean size was five people (Reynolds, 1993). If single person firms were excluded, then still over 90% of U.S. architectural firms were smaller than twenty people (Gutman, 1988, p. 4). Stevens reports that four people were working in the typical American architectural firm.
Traditionally, architectural firms are small; however, at the beginning of the 20th century larger firms, firms with four of five people, gained in importance (Östnäs, 1984, p. 131). Architects are trained to control most of their decisions themselves and they want to be in charge of everything, which naturally limits the size of firms (Coxe, 1980). Another explanation to the small size of the architectural firms might be the organizing of them. There is an elite in the firm and a number of subordinates who perform their task within strictly specified limitations; the large disparity in salary within a firm reflects this hierarchy (Östnäs, 1984, p. 25).

According to Coxe (1980), a growing architectural firm passes through three steps as it evolves that correspond to the size of the firm. In a firm with less than five people, there is no actual need for a manager in the sense that no one has to give up professional time for administrative matters. When the firm has five people or more at least one worker needs to give up professional time in order to manage the firm. This person has to give up being a renaissance person, the architect who masters all the aspects of the discipline—creative talent and implementation knowledge (Coxe, 1980). When the firm has 15 to 20 people, there are usually several principals—two or three people share the tasks of a principal: they contribute to the managing and administrative duties. A firm with 10 to 100 people has specific problems. In many of these firms, all jobs still are required to pass a principal for approval, which might consume a considerable amount of the principal’s time. One way to solve the problem is to authorize some of the most talented people in the firm to manage projects for approval (Coxe, 1980). The classic way to ensure quality of performance in an architectural firm is to promote the professionally most skilled people—people who have a qualitative understanding of the bottomline. The most talented people must be given greater responsibility if the firm wishes to keep them. Usually these people are offered the possibility to become partners, if not they will leave the firm. The firm is organized around a few essential people: a good creative designer, a top production technician, and a wise field specialist who knows how to get work done and who is respected by contractors. (Coxe, 1980).

The most important task for an architectural firm is the character and the quality of the services that the firm provides (Coxe, 1980). It is essential for an architectural firm to sustain the creative process; the fundamental task for management is to keep the quality of all jobs at the same level no matter how many people there are in the firm, which is a difficult task. Architects are often strong minded people who share their opinions about what they believe is quality work and they desire to have these values govern their work (Swartz & Brown, 1992). Basically, three characteristics make up

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1 Because the numbers overlap in the original source, it shows a range of sizes where two different organizational solutions are possible.
quality for a professional: the solution is technically sound, functionally excellent, creatively distinctive, or part of all three characteristics (Coxe, 1980).

Managers in professional service are usually closely related to the business of the firm because that is what they are educated and trained for. Architects have been used as an example here of a qualitative manager. Qualitative managers are frequently found in all types of professional service. From a customer perspective, professional service firms are also different because they have other customer-contact personnel structures. In opposition to many service organizations, where the lowest paid employees are the primary customer-contact persons, it is usually someone at a much higher level in this type of organization who has direct contact with customers (Swartz & Brown, 1992). Often the principal(s) in the firm manage the client contacts. To be able to have client relations in a professional service firm indicates power (Swartz & Brown, 1992). These people have reached a high level of the hierarchy in their professional service firm.

Largely, the customer contact organization in the professional service firm is explained by the customers' needs and their relationship with the person in charge of their job. Cooperation with a person that has power, a senior manager, in the organization provides certain advantages for a customer. The client is interacting with an experienced person, usually one of the firm's owners, and therefore has a perceived sense of importance and comfort (Swartz & Brown, 1992).

Professional values and change.

A number of changes can occur in professional service firms, "traditional professions find themselves in a whole new competitive environment" (Kotler and Bloom, 1984, p. 3). This statement seems to be always true irrespective of time. For example, a classic example of change would be the "Bates case"1 (Bates v. State Bar of Arizona, 1977). Due to this trial case, professional codes of ethics that specifically banned advertising had to be rewritten (Stevens, et al., 1993). Despite the change of codes of ethics, a national survey among American architects in 1987 revealed that a majority (66%) held a negative attitude towards advertising their service. There was, however, a significant difference in the sample; the younger architects were more positive to advertising than the older ones (Stevens et al., 1993, p. 21). Similarly, in Sweden, professional service firms have been restricted from advertising by their professional organizations. Today the attitude has changed and advertisements from professional service firms appear regularly in newspapers. A significant indication of this changed attitude is the industrial organization Sveriges Praktiserande Arkitekter participation in the trade fair "Byggmässan" in 1990. Now the architects use the Internet to advertise their services,

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1 Bates vs. State Bar of Arizona, was a case about an individual, professional service firm's right to market its services by advertising.
"architects.now [Internet address] search internet directories for architectural services. Look for an architect regarding preoccupation, region, reference jobs. With personal presentation of every firm." (Arkitektförbundet 2000-03-31, author’s translation)

Changes in professional service seem to be firmly governed by professional values. It is easy to get the impression form the example above that changes are related to the age of the professional person; younger professionals bring new ideas to the field that may contradict or challenge their predecessors.

Changing Business Cycles

The demand of architectural services is linked closely to the economic situation in society. Therefore, architectural firms are more vulnerable to economic fluctuations than other firms (Brown et al., 1993; Gutman, 1988). High rates of general employment have been followed by regular periods of unemployment in the American architectural industry (Gutman, 1988). It has been known for a long time that there are recurrent fluctuations in business, and that booms are followed by depressions (Schumpeter, 1934). These fluctuations have caused problems especially for service firms. In a study about problems in services, “The demand for services fluctuates” was the only problem that scored above the mean (Zeithaml et al., 1985). This research focuses on the impact of different business cycles on IT adoption. During periods of recession there are fewer resources available for IT adoption (Gatignon and Robertson, 1989).

A brief survey of the Swedish architectural profession shows fluctuations: periods of booms, recessions, and recovery are the constant reoccurring pattern (Östnäs and Svensson, 1986). A fundamental event for the Swedish architectural industry took place in 1969: the Swedish government decided that 100,000 apartments should be built each year for the next ten years, “the million program” (Östnäs and Svensson, 1986). As expected, this program resulted in a prosperous situation for architectural firms. “The million program” has had a great influence on the architectural industry and the building sector as a whole. Still, after thirty years, this program affects the organization of the construction sector. For example, the considerations about how to organize the building process, the roles of the interacting firms, the layout of documents, the purchasing of materials, projection, and production were all affected by this building program (Wikforss, 1993).

By the mid-1970s, problems arose with all the new constructed apartments. In the suburbs, where these new apartments were located, the number of unoccupied apartments had increased dramatically and reached large numbers. The essential market of apartment design vanished and a recession followed in the architectural industry (Östnäs and Svensson, 1986, p. 15). Recession prevailed in the industry until the early 1980s when a period of recovery started (Östnäs and Svensson, 1986, p. 14). The
recovery stage lasted to the mid-1980s and then a situation of prosperity developed. By the end of the 1980s, there was an exceptional boom in the industry—a tremendous demand for architects. The architectural firms tended to work without any financial limitations (Boström, 1991). This boom could be explained by an increased interest in architecture (Svanberg, 1991), which is not limited to Sweden. Gutman (1988) suggests that such a trend also appeared in the U.S. The boom was followed by a sudden and severe recession that started at the end of 1990 (Wikforss, 1993). The drop in the building sector was the worse drop since the Second World War (Olsson, 1991, p. 48). The recession has been described as a depression. In 1994, signs of recovery started to appear (Arkitekten, 1994).

Service Quality

Traditionally, the customer decides what is service quality and what is not. Several service quality models have been developed to reflect customer perceptions of service quality. Of special interest here are the models that suggest IT as a factor affecting the customer’s perception of service quality.

Orientation about Service Quality

A range of quality definitions exists, including the international standard for defining service quality, ISO 9004-2, “The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.” (Edvardsson and Thomasson, 1991, p. 61) It has always been the customer’s perception that has been the focus when defining service quality. “Service quality has from the beginning been based on the notion that it is what customers perceive as quality that is important, not what designers or operations managers feel is good or bad quality.” (Grönroos, 1993, p. 2) A definition of service quality could therefore be formulated as follows, “Service quality is what clients perceive as quality” (Grönroos, 1992, p. 2), which is the definition of service quality used in this book. Gummesson emphasizes the customers’ central role when defining quality:

The implementation of new concepts, the experience gained through the implementation, feedback, and revision, all done in real settings and in various types of service organizations, are necessary to prove the validity of the new quality thinking. The acid test, however, is when customers notice a difference and when this difference favorably affects the bottomline. (1991c, p. 20)

Thus, the customer's subjective interpretation of the experience defines the quality of a service. This is the prevailing way of defining service quality (cf. Berry et al. (1988, p.
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35), Farsad and Elshennawy (1989), Grönroos (1983), Gummesson (1978, p. 93), Gummesson (1990, p. 7), Lehtinen and Lehtinen (1991), Murdick et al. (1990), Tierno (1989), and Zeithaml, et al. (1990)). It also encompasses professional service (Brown & Swartz, 1989, p. 92). The clients decide the quality of services by comparing their perceptions of delivered services with their expectations of the service firm (Berry et al., 1988, p. 36). The customer should receive service quality that meets or exceed his or her expectations (Berry et al., 1988, p. 37). If the expected service quality equals perceived service quality, the quality is satisfactory. If the perceived service quality exceeds the expected service quality the perceived quality is more than satisfactory and will tend toward ideal (Parasuraman, et al., 1985). The client defines the quality of the service provided. Some authors, however, claim that it is not in the best interest of a firm to let all customers define service quality (cf. Bitner, et al., 1990). Other authors suggest that there should be some type of comparison standard to balance the influence of the customers’ service quality judgement (Bargatze, 1992).

Service quality is frequently confused with customer satisfaction (Parasuraman, et al., 1994). Satisfaction is an antecedent of service quality (Bitner et al., 1990). Customer satisfaction is transaction specific and service quality is related to a global impression of the firm (Liljander, 1995; Parasuraman et al., 1994, p. 122). According to Cornin and Taylor (1992), there is a need to distinguish between service quality and customer satisfaction as the latter has a stronger influence on purchasing intentions. More recent research has, however, shown that this is not the case. There are no different comparison standards for service quality and customer satisfaction (Liljander, 1995).

The concepts confirmation and disconfirmation has influenced how people think about service quality (Grönroos, 1992, p. 3). These concepts stress that quality is something unique to each situation because it is related to the individual client (Day & Barkdale, 1992, p. 89). Therefore, service quality can never be static or predetermined (Grönroos, 1990). In every situation, the individual service provider must have a possibility to handle the situation in accordance with what is perceived quality for the customer.

Service quality—a communication approach.

The concept of cooperation can be substituted with the concept of communication in a professional service situation. Cooperation in professional service consists of information exchange; the provider tends to want information from the client and the client tends to want information from the provider. Significant aspects of the provider-client cooperation may be discussed by using the common model for communication as shown in Figure 2.4.
During the process of communication the service provider sometimes is the sender and sometimes is the receiver and the same is true for the client. In terms of the model (Figure 2.4), problems can arise at any stage, but especially in the coding and decoding stages. The sender perhaps codes the message in a different way than the receiver decodes it. For example, the common jargon among architects may be hard for a client to understand. The information exchange between the parties may be complicated on many levels or by many "noises": vague details on an architect's drawing, for example, could be a "noise" that interferes with clear communication. "Noise" is a general concept for all the disturbances that can occur in the communication situation that do not directly belong to any other part in the model.

One fundamental factor affecting the quality in communication is the understanding of key-terms. The professional service provider is hired to interpret the client's ideas in the context of the profession. These services are mainly traded in a business-to-business situation, which means that the customer is informed and has knowledge about the service. It is important that the customer has knowledge about the provided service because "The selling of a professional service is usually more efficient for both parties if the buyer is knowledgeable" (Gummesson, 1978, p. 95, cf. Östnäs, 1984, p. 29).

Stages in the Service Process

"The Customer Relationship Life Cycle" is a three-stage model that describes the activities of the service provider and the customer in the service process—initial stage, purchasing process stage, and consumption process stage (Grönroos, 1990, p. 130). The communication with the customer changes according to which phase the service process is in.

The initial stage.

In the initial stage, a potential customer becomes aware of the existence of a firm that might be able to satisfy his or her needs. In this phase, the communication to a potential customer may be described as service marketing activities.
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The purchasing process stage.

During the purchasing process stage, the service provider and the customer negotiate the terms for the service and its contents (Figure 2.5). The provider offers the client a strategic identity, i.e., a set of resources (Kock, 1992), and the client states a single need or a group of related needs. It is critical for the customer to find a service provider that can address the stated needs (Robinson 1992). During information exchange between the parties, the provider tries to make the resources of the professional service firm match the client's needs. Eventually the provider tries to manipulate the customer’s needs to match the firm's resources, which is critical for an agreement between the parties. Whether an exchange is going to take place or not depends on if the customer thinks that his or her needs can be satisfied by the provider’s resources (cf. Hallén, et al. 1991). It may be difficult for the client to manage the dialogue with the service provider due to the difference in knowledge between the parties; e.g., the client may have difficulties expressing his or her actual needs that the service is going to satisfy (Gummesson, 1978, p. 95). When the parties have agreed, the service provider’s resources match the client’s needs.

![Diagram](image)

Figure 2.5 Constraints of the Exchange Process

Consumption process stage.

In the consumption process stage, the service provider has to fulfil the customer’s needs as agreed upon and the customer has to inform the service provider in detail about the contents of the desired service. Professional service is tailored to the individual client’s needs. Therefore, clear communication between the parties is essential. An important task for the service provider in this phase is to educate the client; i.e., to provide the client with a greater understanding of the services provided (Lehtinen, 1985a, p. 117). For example, an electronic equipment company improved their communication with their customers by educating them. The results indicated that the providers’ behavior was reflected in the customer (Bitran & Hoech, 1990, p. 96).
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The customer may change the initial needs to new ones as further understanding for the provided service during the service process is developed. Hence, the service provider has to be sensitive to changes in the customer's needs. It is also important for the service provider to make the counterpart committed to the service process because then the customer has a certain responsibility for the outcome of the process (cf. Cialdini, 1988, p. 68). In professional service, it might be easier to make the served person committed than in other services due to the close relationship between the parties. Partial employee is a concept used for describing the customer's close relationship to a service provider firm (Barnard, 1938; Lovelock & Young, 1979; Mills, 1986; Mills, et al., 1983; Parson, 1956; Parson, 1970). The customer is seen as a temporary employee, which is a way to ensure that the customer gets the right treatment in the service organization.

Depending on the type of provider, the contents of "The Customer Relationship Life Cycle" varies. A service provider in an architectural firm can either follow the client or lead the client (Coxe 1980). The latter type of provider will lead the customer to a solution that is often far beyond his or her original conception. To lead means help the customer define his or her quality expectations and then to transform these expectations into the service provided.

Grönroos' (1990, p. 130) model, "The Customer Relationship Life Cycle," was developed in an environment of consumer services. The origin of the model in a consumer environment does not diminish its usability here. The relationship with the customer is fundamental through all three stages in professional service (Day & Barkdale, 1992, p. 89).

Complex communication.

The Gap Model (Parasuraman et al., 1985, p. 44) depicts the complexity of service provider communication. The gaps in the model (Figure 2.6) show situations in which service quality is affected. Gap 1 shows the discrepancy between the customer's expectations of the service and the management's perception of these expectations. Gap 2 shows the difference between management's perceptions of customer expectations and the firm's service quality specifications. Gap 3 shows the discrepancy between service quality specifications and delivered service. Gap 4 shows the difference between what the service actually delivered and what the external communication promised. Gap 5 is a function of the four other gaps; i.e., the customer's evaluation of perceived service and expected service. Several other authors have adapted this model; for example, Christopher has added a gap labeled "Management perceptions of firm's performance" between the boxes service delivery and perceived service (1992, p. 69).
The gap between client experiences and professional perceptions of client experiences is the most important gap in professional service according to Brown and Swartz (1989). Thirteen physicians in private practice and a sample of their adult patients were used. The respondents judged sixty-five statements about the medical service encounter concerning the following three gaps that affected quality: (1) client expectations-client experiences; (2) client expectations-professional perceptions of client expectations; (3) client experiences-professional perceptions of client experiences. The third gap, the interaction with the patient, was the most important in assessing service quality in this professional service setting.

Cooperation and Service Quality

By carefully selecting a service provider, the customer tries to obtain the desired quality (Day & Barkdale, 1992, p. 90). The customers' perception of service quality is strongly affected by the cooperation with the service provider (Day & Barkdale, 1992, p.

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1 In the original version of the model the concept marketer was used but in the way the model is used here the concept service provider is used.
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89; Gummesson, 1978, p. 91; Solomon, et al., 1985). Research carried out among professional service firms has stressed the importance of smooth cooperation (Day & Barkdale, 1992, p. 89; Wheiler, 1987). Architects have been noted to say, "Good projects are observed when conflicts among individuals in project production are avoided" (Lundin, 1993, p. 7). A survey carried out among clients of professional service firms clearly showed that the most important factor for the clients was the providers' ability to cooperate (von Matern, 1989, p. 26). An experienced professional service provider expressed the qualities of a good working-situation in the following way:

It is only when the architect has good cooperation [with the client] that is founded in trust, and when he gets time to treat each situation as special, that good work can be done. One has to question, i.e., to go one step further in ones analysis than the contractor/client does, in order to be able to motivate one's effort. (Östnäs, 1984, p. 24, author's translation)

These observations show that both parties consider smooth cooperation as a fundamental part of service quality perception. Bitner (1990) has studied the impact of the physical environment and the employees' response to service failure during the service encounter; i.e., the customer's perception of service quality. The service encounter was defined as "a period of time during which a consumer directly interacts with a service" (Shostack, 1985, p. 243), which is synonymous with cooperation as the concept is used here. Perceived service quality was closely related to service encounter satisfaction (Bitner, 1990, p. 80). Bitran and Hoech (1990, p. 96) stress the close relationship between service quality and the personal relationship between the service provider and the customer in professional service.¹ A sense of the importance of this relationship is indicated by the following description of service quality, "[it] is more than a set of activities; it is, in the final analysis, primarily an attitude" (Berry et al., 1988, p. 43).

The management of a customer in a professional service firm is crucial for generating repeat business and new customers. Referrals play a critical role in the service provider a customer chooses (Day & Barkdale, 1992, p. 89); about 40 to 50% of all new jobs are referrals (Coxe, 1990). Satisfied customers are the most important competitive advantage for professional service (Coxe, 1990).

The network model focuses on the relationship between a provider and a customer. According to this model, the customer and provider are linked together by certain bonds. Five different bonds have been identified among cooperating parties: technical,

¹ These two authors use the term high "contact services" with intensive customer contacts. That labeling seems to be synonymous with the definition and the use of the concept professional service in this book.
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planning, knowledge, social, and legal and economic (Hammarkvist, et al., 1982, p. 23). These bonds seem to be present in every professional service (Boström, 1995).

Factors affecting service quality.

A customer receives a certain quality experience from the interaction with the service provider—interactive quality (Lehtinen 1985a); however, high degrees of interactive quality are often difficult to obtain due to the different perceptions of responsibility among the parties. Ayodele (1982) found, in a study about architects and their clients, significant differences between the two parties' perception of each other's responsibilities; i.e., it is the client's responsibility to clarify the user's needs and the client's responsibility to provide information with respect to the initial budget.

Yorke (1990) has investigated what clients of two different professional services expect from their providers and what the providers think that their clients want. Providers initially appeared to think that clients wanted expertise when they in fact wanted benefits. The longer the relation lasted, the more confidence the clients wanted. The perception among providers was that they were more perceptive to clients' changed needs than the clients experienced. Over time, however, the gap in perception lessened. The providers' perception of the ability to generate mutual trust was exaggerated compared to the clients' perception. Over the years, mutual trust was established between the parties, but after five years, there was a considerable gap in perception and reality. Clients' perception of service quality changed over time from an efficient service to an individual treatment from the provider. These findings showed that there were perception gaps between providers and clients concerning what they wanted in the situation and over time. Yorke (1990) expressed a successful cooperation over a long time as a "meeting of minds." He therefore suggested that providers of professional service use an interactive model in their communication with the market and that the providers be aware that at different points in time clients need different treatments (1990, p. 352).

The behavior of both the service provider and the customer affects the quality of the service (Kelly et al., 1990). The service provider behavior should appear professional (Norman, 1992, p. 32). Professionalism here incorporates the individual provider's skill, motivation, and the instruments that the provider uses.

Lehtinen stresses the customers' role by stating that "The client interprets service quality in a subjective way according to own quality criteria" (1985a, p. 117). The service provider may affect the client's quality perception by using "client participation guidance" (Lehtinen, 1985a, p. 117). This guidance refers to the contact in various forms, personal or physical, that the customer has with the service provider. It also refers to how the customer is helped by the provider in each contact in the service
process. The objective of this guidance is to influence the customer’s quality criteria and make the customer feel significant in the service production process, which will make it easier for the customer and provider to reach the quality goals.

Thus, the performance of a service from a professional service firm seems to be done in cooperation between the provider and the customer. Both parties are essential for the success of the final outcome. A communication between them is necessary, as they both are dependent on information from the other. Depending on how the cooperation between the parties works out, the client decides the level of quality. Cooperation is a significant part of service quality in professional service. Factors affecting the cooperation between the parties may change the customer’s quality perception. IT is a technology that might affect the cooperation and communication between the parties. The first step to investigate the influence of IT is to identify the role of it in service quality models.

Service Quality Models

Several models that describe service quality have been developed over the years. Two well-known ones are Grönroos’ (1983, p. 19) “The Perceived Service Quality Model” and Parasuraman’s et al. model, “Determinants of Perceived Service Quality” (1985, p. 44) (Figure 2.7 and 2.8).

In “The Perceived Service Quality Model” a number of concepts that affect service quality are listed. The perceived service quality is a result of the customer’s comparison of expectations and experiences. The expected quality is an aggregation of market communication, word-of-mouth about the firm, and the overall image of the firm.

In Grönroos’ model (Figure 2.7) the service experience originates from two different types or concepts of quality, technical and functional quality. Technical quality is what the customer is left with when the production process and buyer-seller interactions are complete. Depending on the interaction of knowledge, technical solutions, machines, computerized systems, and employees’ technical ability, a certain level of technological quality is achieved. Functional quality is how the client receives the service and experiences the interaction process in which the service is created and consumed. Functional quality comprises customer contact, attitudes, internal relations, behavior, service-minded, appearance, and accessibility. Technical quality and functional quality are filtered through the image of the firm (Figure 2.7) and this result is compared to the customer’s expected quality, a mix of quality expectations that the customer had before the service process started and expectations that the customer developed during the service process. The comparison between these two qualities results in a perceived quality. In his later versions of the model, Grönroos (1990, p. 41) has added customer
needs, which affects the expected quality. In a more recent version of the model, "Customer Learning" affecting expected quality was added and the circles around technical and functional quality overlapped (Grönroos, 1993, p. 51).

![Diagram of Total Perceived Quality Model](image)

**Figure 2.7 The Perceived Service Quality Model (Grönroos, 1983, p. 19)**

The model "Determinants for Service Quality" by Parasuraman et al. (1985, p. 48), suggests that service quality is affected by access, communication, competence, courtesy, credibility, reliability, responsiveness, security, tangibles, and understanding, knowing the customer (Figure 2.8).

![Diagram of Determinants of Perceived Service Quality](image)

**Figure 2.8 Determinants of Perceived Service Quality (Parasuraman et al., 1985, p. 48)**

In a more recent article, Berry et al. (1988, p. 37) reduced the number of determinants to five: tangibles—the physical facilities, equipment, appearance of personnel; reliability—the ability to perform the desired service dependably, accurately, and consistently; responsiveness—the willingness to provide prompt service and help customers; assurance—employees' knowledge, courtesy, and ability to convey trust and confidence; and empathy—the provision of caring, individualized attention to customers. The models "Determinants of Service Quality" and "Gap Model" have been
merged into one model, “Extended Model of Service Quality” (Zeithaml et al., 1988; Zeithaml et al., 1990). This model shows 16 sources that affect any of the gaps one to four that affect service quality (Zeithaml et al., 1988, p. 46). Berry, Parasuraman, and Zeithaml (1998) have continued to develop their model of service quality. For example, they have explored the different aspects of the expected service: desired service—the level of service that the customer hopes to receive; adequate service—the threshold of acceptable service level that the customer has; and predicted service—the level of service that the customer believes that it is most likely to get (Zeithaml, et al., 1993).

“The Perceived Service Quality Model” by Grönroos (1983, p. 19) and “Determinants of Perceived Service Quality” by Parasuraman et al. (1985, p. 48) are the departure or basis of most models about service quality. It is not possible and not necessary to investigate every model of service quality that has originated from these two models. One way to organize the investigation of a suitable model for this inquiry is to categorize the existing service quality models. Olsen (1992, p. 69) has suggested three categories that depend on the model’s character, interaction models, perception models, and conceptual models.

Interaction models describe which elements create quality for the customer in the meeting with the service organization (Olsen, 1992, p. 69). In other words, these models could be described as models explaining the service production system. The Sasser et al. (1978, p. 21) model—“operating characteristics in a service environment”—is an example of an interaction model. Three interaction factors define the service level in this model: material, facilities, and personnel. (Eiglier and Langerad (1987), Grönroos (1990, p. 208), Grönroos and Monthelie (1988, p. 58), Gummesson (1993, p. 95), and Lanegard et al. (1981) are examples of other interaction models.) According to the definition of interaction models that Olsen (1992, p. 69) has posited, the models labeled service blueprinting in the American literature may be included in the group. Service blueprinting models are used to depict the service organization’s service system (cf. Kingman-Brundage, 1989, 1992; Shostack, 1984, 1987, 1992; Shostack and Kingman-Brundage, 1991).

Perception models take their basis in the customer’s perception of the service: what does the customer consider important in order to achieve high quality? In general, these models suggest several characteristics that a service and a service organization should have according to the customers. Depending on which services the authors have studied and in which culture or country the study has been done, the characteristics vary. An example is the “Determinants for Service Quality” model by Parasuraman et al. (1985, p. 48) (Figure 2.8). Another example is Lehtinen and Lehtinen’s (1991) study about factors that affect the customer’s quality perception in a restaurant situation: pleasantness—the restaurant’s customers are pleasant to each other; chasing—the
Conceptual models are built on general concepts that affect quality. These models study quality from the perspective of the customer's participation in the service process. The concepts in the models are on a rather abstract level and this is why they can be divided into concepts on lower levels of abstraction that affects quality. For example, "The Perceived Service Quality Model," Figure 2.7, contains two types of quality concepts, technical quality and functional quality. On the lower levels of abstraction, they are developed into concepts that are more precise, e.g., IT, which is of special interest in this book.

Conceptual models are interesting because they use general concepts into which it would be possible to include IT. All three types of models would be possible to use for identifying IT as a means for service quality. The situation that is studied in this book, however, demands a specific approach: a new way of providing a traditional service is compared to the traditional way of providing the service. The relationship between IT and service quality needs to be defined. Perception models originate from what the customers' consider quality service. In a situation with an ongoing adoption of new service quality perceptions, it would be possible to get a low ranking of the new service because the bulk of customers are immature in terms of the new service quality perception. If lead customers were used as a sample, the perception models would probably be more appropriate to use (cf. von Hippel, 1988, p. 107).

Both interaction models and conceptual models are possible to use in the research done here. According to the definitions of these two classes of models, it seems easier to use conceptual models. It is not the primary interest of the conceptual model to depict the firms whole service system as with interaction models. The research in this book focuses on one means, IT, which might create service quality for the customer. Therefore, it is probably most fruitful to use a category of models that suggest something as quality—the conceptual models.

Conceptual models.

Conceptual models may broadly be divided into two categories: how the service is done and how the client perceives the service. In the "The Perceived Service Quality Model," Figure 2.7, the box labeled technical quality reflects how the service is done and the box labeled functional quality indicates the client's perception of the service.

Lehtinen and Lehtinen (1983, 1991) have developed a conceptual model for service quality in which they have identified three basic concepts affecting service quality:
physical quality, interactive quality, and corporate quality. Interactive quality relates to the interaction between the service provider and the client, including the people and systems that are interacting. Physical quality refers to the surroundings and equipment used in the service production process including the physical product (if any) consumed during the production process. Corporate quality is the overall image that the service organization has with its customers.

Gummesson (1978, p. 195) has developed a conceptual model for service quality—the 4 Q-model. This model for service quality was developed for a manufacturing firm (telecom corporation); however, this firm requires a great deal of service. Four quality factors were identified: construction quality—the quality that is built into the service; production quality—how the service offer is produced; delivery quality—how the service is delivered to the customer; and relational quality—the management of internal and external relations. The customer's perception of each of these quality concepts affects the perceived quality of the service.

"The Perceived Service Quality Model" and the 4 Q-model have been merged into the Grönroos-Gummesson model (Grönroos, 1990, p. 66) (Figure 2.9). The Grönroos-Gummesson model aims to manage quality for both manufacturing firms and service firms (Grönroos, 1990). The model is based on two different approaches of how quality is created. Gummesson's 4 Q-model is based on the notion that everyone in the firm contributes to quality and that there are a number of different sources of quality in the firm. Grönroos' model revolves around the perception of quality.

In the left top box in Figure 2.9, are Gummessen's four sources of quality: design quality, production quality, delivery quality, and relational quality. In the right top box of the model are Grönroos' two quality constructs: functional quality and technical quality.

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1 Lehtinen uses different labels for corporate quality; it is also labeled institutional quality, cf. Lehtinen, 1985a:110.
quality. These six quality constructs interact with each other to form the customer’s perceived quality. For example, if a customer becomes involved in the design process, the technical quality might be improved. The functional quality may be improved because the customer may realize that the provider really takes special interest in solving the assigned problem. This way of arguing can be applied to all the other factors in the 4 Q-model.

Of special interest for this work is what Grönroos calls technical quality, which is made up of knowledge, technical solutions, machines, computerized systems, and employees’ technical ability (Grönroos, 1983, p. 18). Lehtinen and Lehtinen (1991) also claim that services are made up of a number of elements, but they express it by saying that service quality consists of several details and it is important to understand each of them. There are indications in the conceptual models, especially in “The Perceived Service Quality Model,” Figure 2.7, that IT would affect service quality. This is the best model to use because it suggests a relationship between service quality and IT. Whether the relationship is valid for CAD and Swedish architectural firms or not is still to be seen.

**Origination of the service quality models.**

The development of service quality models tends to originate from empirical studies in the consumer market. Studies associated with banks and airlines have affected the development of these models (cf. Albrecht & Zemke 1985; Holmlund & Kock, 1992, p. 14; Murdick et al., 1990, p. 19; Parasuraman et al., 1985). Therefore, the service quality concept tends to be associated with the characteristics of these sectors, which offer the market mass-services. Although these industries have many organizational clients, few of the services that banks or airlines offer are tailored for institutional organizations. Therefore, the presented models of service quality may have a disproportionate input from the consumer sector.

Professional service tends to be traded in the industrial market (Bean, 1991; Congram, 1991; Gutman, 1988). In the industrial market, purchasing is done by a professional purchaser who is informed about the purchased service and how this service may affect trading terms. Usually, the buyer and the seller establish a relationship in the industrial market that lasts over time and this results in the customer being treated as an individual, a client (Berry and Gresham, 1986; Hammarkvist et al., 1982). These characteristics of the industrial makes this market different from the consumer market, which suggest that there is room for studies about service quality in the industrial market as service quality models tend to originate from the consumer market.
"The Perceived Service Quality Model" has been adapted into an industrial setting by developing it with the ideas about the Network model (Holmlund & Koch, 1992, 1993; Holmlund & Ravalda, 1992; Kock, 1991). This model aims to assess the bonds of the network model in terms of service quality and this is why it focuses on the bonds between an individual service provider and an individual customer. Therefore, it is not appropriate to use it; the research in this book focuses on changes in an industry and not relationships between individual providers and clients.

**Relative Nature of Service Quality**

A common strategy among service firms is the delivery of greater quality (cf. Brown & Swartz, 1989; Parasuraman, et al., 1988). The service firm constantly tries to improve its services in terms of the market's quality perception. Implied in this strategy is the anticipation that service quality is a dynamic construct. Grönroos (1993) says that his static model has not effectively captured the dynamics of service quality and notes that developments are evolving. Customers' preferences are continuously changing and this is why old services have to be carried out in new ways, or new services have to be developed. It is necessary to develop a dynamic model for managing service quality and to be able to depict the ongoing process of changing quality perceptions (Grönroos 1993). In addition, Kahn (1998, p. 45) indicates that the customer's quality perception is dynamic which means that it is necessary for a service firm to offer its customers a diversity of service options. An important competitive advantage for the 21st century is to meet the customer's needs over time (Kahn 1998).

In its basic sense, service quality can be regarded as a relativistic construct because customers want a range of qualities—"customer quality elasticity" (Bitran and Hoech, 1990, p. 90). Berry and Parasuraman express this idea as "customer's expectation levels are dynamic and fluctuate in response to a variety of factors" (1991, p. 59). The customer tends to have two levels of expectations: the desired service and the adequate service. The actual service has to be performed in between these two levels (Berry and Parasuraman, 1991, p. 58). Service quality is a dynamic construct; there is need to develop it continuously (Babbar 1992). The static service quality construct is not an appropriate reflection of the character of service quality (Grönroos 1993). There are few indications in the literature that service quality should be treated as a dynamic construct. Gummesson considers the concept in his 4Q-model to be fuzzy sets (1991, p. 253); a way to stress the relative nature of service quality. By considering the concepts in the model as blurred, they are a better reflection of reality according to Gummesson (1991a, p. 252), "Besides service firms, markets, customers, and competitors are very blurred concepts. Despite the fact that these concepts are blurred, they all have a core of
something essential that we perceive by experience and by intuition.” (Gummesson, 1991a, p. 252, author’s translation). The static quality approach is not an appropriate reflection of the character of service quality (Grönroos, 1993). A dynamic model is needed; one that is be flexible over time; i.e., it has to capture changes in a customer’s quality perception. Day & Barkdale express the dynamic character of customers’ perception of professional service as “expectations and evaluation criteria [that] are varied and dynamic” (1992, p. 89).

Babbar (1992) has presented a management model for facilitating continuous changes in an organization for delivering service quality. According to the model, top management should shape the organization’s quality framework through system design, regional office centers should control the system, and the branches should execute the organization’s service (Babbar, 1992, p. 44). Babbar’s (1992) model has a normative approach as it suggests how the firm should organize in order to have a contemporary content of service quality. A normative approach to service quality seems somewhat strange due to the changing contents of the construct. The dynamic nature of service quality has been barely investigated; there is no model that captures a transition of service quality over time.

**Service Quality and Technology**

In the conceptual models, different concepts contribute to the perception of service quality and the combination of the firm’s resources decides the customer’s quality perception. Due to the special attention on IT in this book, there is a specific interest in what Grönroos (1983, p. 18) labels technical quality, which is assumed to affect the customer’s perception of quality. Similarly, Shostack argues about service quality: “Combinations of discrete elements that are linked together in molecule-like wholes [make up a service]” (1977, p. 74). A change of one of these elements might change the whole entity. Although two services are identical except one of them uses IT, customers may see the service that uses IT as a different service.

Service quality and technology may also be discussed from an image perspective (Keller, 1999). It may be of special interest to pay attention to the image of the firm when analyzing the impact of IT as this technology may be a new experience for the customers (Ward et al., 1999). Firms using the technology may become a certain image in the industry but the outcome is open because IT may not necessarily increase a customer’s satisfaction (Bitran and Hoech, 1990, p. 89).

Technology may affect the quality of professional service. Professional service is a subjective matter. According to Grönroos (1993), the perception of service quality changes over time, this suggests that adoption of new technology may affect service
quality. The use of new technology may be associated with quality services (Gummesson 1978, p. 91). The more abstract the service is, the more tangible the attributes are to indicate a superior service experience (Shostack 1977). Technology may play the role in tangible attributes that may assign the service certain quality.

Information Technology

Technology is an important part of the production system in service firms. In the service sector, the investment in IT overrides the manufacturing industry’s investments in this technology. Architectural firms are no exception; they continue to adopt CAD technology. The potential impact of this technology in architectural firms is very large.

Some Definitions of Technology

The importance of technology to drive development in our society is difficult to overestimate (cf. Kallinikos, 1996). It is the most important type of knowledge in order for society to progress (Lundequist, 1983). The history of innovation emphasizes the central role of technology by showing the leaps in the development of the industrialized world. Technological innovations were the core in the Industrial Revolution (Mokyr, 1990, p.52); however, technological changes did not begin with the revolution. These changes were present before the advent of the revolution, but after 1750, technological change occurred at an exponential rate (Mokyr, 1990, p. 52).

Technology is an almost mythological concept that has various associations for different people. Several definitions of technology are available and some of them will be investigated to give this presentation a framework. A general definition of technology defines it as information (Rosenberg 1982, p. 143). In the Collins Cobuild English Language Dictionary technology is defined as “the activity of study of using scientific knowledge for practical purposes in industry, farming, medicine, business, etc.” (Sinclar, 1987, p. 1501). Kallinikos adds one aspect to the definition of technology by saying that knowledge is accumulated: “Technology can be considered as accumulated knowledge, a sort of intelligence that summarizes and embodies the functional lessons of experience” (1996, p. 11). In addition, Capon and Glazer define technology in general as know-how and in specific as related to a firm as “the information required to produce and/or sell a product or service” (1987, p. 2). Capon and Glazer identify three different components of know-how: product technology, process technology, and management technology. Furthermore, to distinguish technology from the more general notion of knowledge per se, technology is defined as knowledge intended to be used (Capon & Glazer, 1987, p. 2). Quinn defines technology
as a specific type of knowledge: "Technology is systematic knowledge of industrial arts" (1960, p. 71). These definitions suggest that technology may be considered as knowledge that is expressed as information, scientific knowledge, accumulated knowledge, know-how, and systematic knowledge. In this book, technology is defined as a specific accumulation of knowledge designated for use.

Technology comprises an increasing proportion of a firm’s resource base. One reason for this increase is its dynamic progression; the technological environment is no longer stable. A strategy for technology begins with an understanding of how changing technologies effect the strategic and operational decisions of a firm. (Capon & Glazer, 1987, p. 2) The most recent wave of technological change is as dramatic as any time in history. It has implications for a firm’s decision making, which is perhaps more pervasive now than at any other time and involves numerous important areas of corporate strategy and structure. This situation creates a new role for a firm; it should be a broker of its own technology (Quinn, 1993; Quinn, et al., 1990). There should be a balance in the firm’s technology portfolio; that is, there should be a mixture of entries at different stages of technology/product life cycles.

**IT in Services**

A significant trend in the service sector is the adoption of IT. In the U.S., the service sector owns a great deal more IT than the manufacturing sector owns. About 84% of the total U.S. stock of IT items are owned by the service sector. For the past 35 years, the service sector has increased its IT capital by an average of 10% per year; on the other hand, the service sector has increased its other investments about 2.5%. From 1970 to 1985, the U.S. service sector’s investments in IT went from 6.4% to 15.5% of the capital stock, which was an increase by 2.5 times (Roach, 1988). The increase in technology is significant and managing these technological innovations is the greatest challenge for service firms (Kendrick, 1988, p. 116).

IT is also largely used among professional service firms. Among U.S. firms, five of the top ten firms which use daily use personal computers could be classified as professional service firms (Doorley et al., 1988). There are no indications of a slowdown of IT adoption among professional service firms. It is estimated that accounting and legal firms in the U.S. spend about 2% of their billings on IT (excluding service fees and internal development) (Doorley et al., 1988). Obviously, professional service firms are adopting IT at rapid rate. The importance of this technology as support for service production is continuously growing because of the increased adoption of the technology by service providers and because of the manufacturing industry’s adoption of it.

The diffusion of IT changes the ways in which business is conducted and IT changes the relationship between companies and customers. Organizations are reconfigured
from the ground up with the computer as a primary resource for conducting business. There are three classic cases in Harvard Business School case studies. Merrill Lynch and Co. used the computer to create one of its most successful new products: the Cash Management Account. This product efficiently manages a customer's money as information about a customer's checking, savings, credit card, and securities accounts which are presented on computerized monthly statements and automatically moves idle funds into interest-bearing money market funds. Rival companies have come forward with similar offers; however, Merrill Lynch and Co. secured 70% of the market (Harris, 1985, p. 109).

American Hospital Supply Corp. (AHS), the object of the second case study, a distributor of health-care products, set up computer links to its suppliers and customers. This allowed hospitals to enter their own orders. Due to this change, AHS could cut inventories, improve customer service, and obtain better terms from the suppliers for higher volumes. Moreover, the most important gain that resulted from computer use was locking out competing distributors because competitors did not have a direct link to the hospitals. This information system also enabled AHS to collect and transform industry data to trends and customer needs more quickly thereby staying ahead of competitors. Another advantage of computer technology may be that clients that favor change will also favor the company that adopts IT first (Fellowes & Frey, 1988).

American Airlines Inc., the object of the third case study, uses computer technology to start a new business. The development of Sabre, a computer based reservation system, has resulted in the American Airlines Inc. doubling their share of total bookings from 35% to 70% (Petre, 1985, p. 43).

**IT in Architectural Firms**

Computer Aided Design, (CAD), also referred to as Computer Aided Design and/or Draft is a design assisting tool operated on a computer (Huang, 1988; Ives & Learmonth, 1984, p. 1193; Magnusson & Johansson, 1993). CAD makes it possible to develop interactive and integrative designs. Although originally developed for aerospace applications, CAD has found increased application in manufacturing and construction. As early as 1962, basic capabilities were shown in these latter areas, but more applications depend on both cost reductions and capability increases in both hardware and software. By 1964, the potentials of CAD in the architectural design were noted (Langefors, 1964). Sakr divides the practice of architectural design into four major epochs depending on the tools used:

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1 Some authors tend to just capitalize the first letter: Cad (Anulf, 1989; Löwstedt & Norr, 1991).
(1) pre-agricultural society (cave man) in this society the problem was solved by creating the artifact;
(2) agricultural society, trial and error, when extended knowledge about scale blueprints, perspective and models developed allowing a separation between the architect and the builder;
(3) industrial society, traditional tools, the development of mathematical tools made it possible for the architect to represent more distinct design knowledge, a further separation between builder and designer;

A traditional architect workplace and a CAD architect workplace look radically different. The most striking difference is the absence of drawing boards because the architects make drawings on a computer screen. This saves space: an architect that works with CAD needs about two-thirds of the space compared with one that works with a drawing board. A reduction in space means savings in rental, maybe enough to pay the costs of the computer in a CAD-system (Reynolds, 1993).

Studies about architectural firms and CAD.

Huang’s 1988 dissertation examines whether there are any differences between users and non-users of this technology regarding perception of work1 in a random stratified sample of 130 people in architectural firms in Chicago. Discriminate function analysis was employed using the following criteria: the length of time the firm had had the equipment, the size of the firm, and computer literacy (how many computer program languages the person managed) for classifying an adopter or a non-adopter group. No discrimination could be found between the two groups of people because CAD was a tool that had been fully integrated in the architectural practice or this technology had not been adequately introduced into the firm’s architectural practice. It was not possible to say to what degree the firms had adopted the new technology (Huang, 1988).

Laplante’s 1989 master thesis focuses on changes in the working process for an architect who used CAD. The thesis built on experience from architectural work in a Canadian architectural firm and a literature review. Architectural using CAD was a totally different experience from work that did not use CAD; the representation of the work and the working process were altered. Although it was more time consuming to start a CAD job than a manual job, using a computer offered several possibilities: the ability to make three-dimensional viewing, simulation viewing, and a more efficient

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1 Perception of work is an abbreviation for the following, “the four phases of architectural practice and communication, perception of task characteristics, perception of possible alternatives at the local job market, job satisfaction, and withdrawal intentions” (Huang, 1988, p. 86).
storing (disks) of blueprints. The only way to gain these advantages was to train the personnel. Training is the key to success when adopting CAD (Laplante, 1989). The conclusion of the study was that using CAD was a fundamental change for the architects: a new complex tool was adopted into a process with few tools this changed the design process and the characteristics of blueprints (Laplante, 1989).

In Sakr’s (1991) dissertation, the day-to-day integration and impact of CAD on architects was studied. Two different approaches (adopted from Zuboff, 1985) were used: automate and informate. Automate is an automation of the process—what was made by hand was now done by a machine, i.e., a computer. Informate, on the other hand, is an approach that considers the potential of the implemented machine, e.g., the computer’s capacity to generate information about the design process and its administrative process. Data in this study was gathered through observation and interviews with one or two architects from the twenty-one CAD-using firms in the Ann Arbor and the Detroit areas in the U.S. The shortcomings in the automate approach were major and the informate approach demonstrated “the full potential of the computer to solve many organizational problems and to change, to some extent, the nature of design” (Sakr, 1991, p. 91). When acting according to the informate approach the architect’s role changes to an information broker role (Sakr, 1991).

All these works focused on the effects caused by IT use that occurred in the firm—an internal approach. An external approach would probably reveal both internal and external impacts of CAD use, “Problems often occur when computers are introduced for purposes of competition without considering their role or influence on the design process” (Sakr, 1991, p. 115). An informate approach does not mean that all firms using this approach will obtain the same competitive advantage. There might very well be large differences in how well the firms manage to implement an informate approach. It is possible to hypothesize a range of informate approaches from unsuccessful to very successful. An informate approach may also be classified regarding scope: narrow or small changes and wide or substantial changes. Please note that an outside person may classify two firms who both have used the informate approach in different ways regarding the scope variable; however, the principals in the two firms may have another opinion.

Competitive Advantage and Industry Structure

Competitive advantage from a resource-based view is of special interest here. Adopting new technology is an example of this view. The impact of IT as a competitive tool is related to how and when it is adopted. It is also a question of the customers’
evaluation of the changes that the new technology causes. Market approval of a new technology may increase users and cause changes in industry structure.

**The Competitive Advantage**

Competitive advantage is an ambiguous construct; there is no absolute meaning of it in practice or in the marketing strategy literature (Day & Wensley, 1988, p. 2). There are two widespread meanings for competitive advantage: (1) distinct competence, i.e., relative superiority in skills and resource; or (2) positional superiority, i.e., superiority in customers’ value or the achievement of lower relative costs (Bharadwaj et al., 1993; Day & Wensley, 1988). Shostack develops the definition of positional superiority: “When a firm or provider establishes and maintains a distinctive place for itself and its offerings in the market, it is said to be successfully positioned” (1987, p. 34). These two interpretations of competitive advantage do not provide a complete picture, but used together they describe both the state of advantage and how this state is gained (Day & Wensley, 1988, p. 2). Competitive advantage can be gained in two ways (Barney, 1991, p. 99). First, as a result from a value-creating strategy that is not simultaneously used by any current or potential competitors. Second, it is achieved by superior execution of the same strategy as competitors. In the discussion about competitive advantage the focus is on the resource-based approach. Difference in competitive advantage between the firms who have adopted IT and those who have not is analyzed. A structural approach, difference in competitive advantage between the firms related to the industry structure, is of less interest.

![Figure 2.10 Elements of Competitive Advantage (Day & Wensley, 1988, p. 13)](image)

Day and Wensley (1988, p. 13) suggest a framework for identifying the different elements that create competitive advantage for firms in general (Figure 2.10). It is not possible to understand any specific competitive situation without defining the following
three features: sources, positions, and performance outcomes (SPP). None of the elements in the model can be replaced by the other (Day & Wensley, 1988, p. 13).

Advantage comes in the form of superior skills or superior resources (Figure 2.10). Superior resources are tangible requirements for a firm, to operate efficiently, e.g., a CAD system. Essential resources for a professional service firm include the following factors: firm size, number of local offices, and use of computers (Gummesson, 1978, p. 92). Superior skills are distinct capabilities of the firm's personnel that set it apart from the competing firms' personnel. These superior skills may very well be identified in an individual function in the firm, e.g., knowledge about and experience with IT.

A positional advantage in the model is related to two different elements, superior customer value, and lower relative costs (Figure 2.10). Positional advantages for a business are directly analogous to competitive mobility barriers that hinder firms from shifting strategic position in the market (Day & Wensley, 1988, p. 3).1 A firm has a differentiated position either when most of its activities are done at a lower cost compared to the competitors and the firm is offering a parity product or when some value adding activities are done in a way that customers perceive superior value. The customers must be willing to pay a price premium for the superior performance that covers the added costs of it. There is a myriad of different ways to distinguish a business by its products (Day & Wensley, 1988, p. 4). The impact of the customers' willingness to pay a premium price might be especially crucial in professional service. A study of architectural and engineering firms show that price is a central factor that affects the customers' quality expectations and their ultimate evaluation of the firm's services (Day & Barksdale, 1992, p. 88). Johnston (1988, p. 206) stresses the importance of a positional advantage by differentiating some of the following areas: service quality, price, availability, and the range of services offered (cf. Reid and Sandler, 1992). A service firm can select any of the elements or a combination of them in the model to achieve a positional advantage (Figure 2.10).

Competitive advantage was assessed as performance outcome; four different elements were employed for doing the evaluation: satisfaction, loyalty, market share, and profitability (Day & Wensley (1988, p. 17). Market share and profitability are not enough as indicators of performance as these two factors are actually a result of satisfaction and loyalty. Day and Wensley (1988) particularly stress the importance of a customer perspective when assessing performance outcomes especially in dynamic markets with shifting mobility barriers, many competitors, or highly segmented end-user markets.

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1 These two authors build their argument about positional advantages on Porter (1985). It is possible to trace the ideas about the whole model to Porter (1985).
Sustainable Competitive Advantages (SCA).

Competitive advantage has to be sustainable, i.e., resist competition (Porter, 1985, p. 20). A sustainable resource/skill should meet the following criteria: it must be valuable, unique among a firm’s current and potential competitors, imperfectly immutable, and non-substitutable (Barney, 1991, p. 106). Much attention about SCA has focused on resources and positions, but organizational processes such as marketing orientation may be used (Kohli & Jaworski, 1990, p. 17). Market orientation is defined as “the organization-wide generation of market intelligence pertaining to current and future customers needs, dissemination of the intelligence across departments, and organization-wide responsiveness to it” (Kohli & Jaworski, 1990, p. 6). Market orientation, according to this definition, is based on three concepts: (1) intelligence generation—information system for collecting information about customers current and future needs and how these needs may be effected by exogenous factors; (2) intelligence dissemination—how the information from the intelligence is distributed in the organization; (3) responsiveness—the responsiveness to the market intelligence. The benefits of adopting a market-oriented behavior naturally depend on the environment in general. In markets with limited competition, stable preferences, technology turbulence, or booming economies it might be less useful to become market oriented (Kohli & Jaworski, 1990, p. 6).

There have been some critiques to the common approach of sustainable competitive advantage (SCA):

A closer examination of the source of competitive advantage in the context of service industries can provide unique managerial insights into strategic problems and opportunities that may not be readily apparent from an examination of the sustainable competitive advantage (SCA) related issues at a more aggregate level. (Bharadwaj et al., 1993, p. 83)

Bharadwaj et al. (1993) treats service firms as something that are different from manufacturing firms with respect to competitive advantage. The “Contingency Model of Sustainable Competitive Advantage in Service Industries” (Figure 2.11) is an elaboration of the model developed by Day and Wensley (1988) (Figure 2.10). The new model stresses two dimensions: the environment and the sustainability of a competitive advantage. A brief version\(^1\) of the model is shown in Figure 2.11. There are a number of sources that provide a competitive advantage (Figure 2.11); for example, “Potential Sources of Competitive Advantage” and more sources are suggested—scale, brand

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\(^1\) In the original model, there are more statements under each headline in the boxes except for the box “Reinvestments in Resources and Skills” that does not have any statements. In this book, it is of no interest to elaborate the model further.
equity, communication, corporate culture, IT, and functional skill. All these potential sources of advantages are in Day and Wensley's (1988) model (Figure 2.10), but they are labeled superior skills and superior resources.

![Diagram of Contingency Model of SCA in Service Industries](image_url)

**Figure 2.11** A Contingency Model of SCA in Service Industries (Bharadwaj et al., 1993, p. 85)

The environment's effect on competitive advantage—in what context the competitive advantage is used in—is incorporated in the model developed by Bharadwaj et al. (1993). Several boxes in the model—"Service Firms Characteristics," "Characteristics of Services and Service Industries"—represent the environment. "Barriers to Imitation of Resources and Skills" reflects the incorporation of the environment. The contribution of the environment as a variable in the model allows for the possibility to judge the sustainability of a competitive advantage in the environment where it is going to be used. Barney's question complements this, "Is the resource

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1 Brand equity has to be interpreted in an extensive way; it could, for a service firm, also reside in the name of the firm itself (Berry & Parasuraman, 1991).
valuable, is it rare, is it imperfectly immutable, and are there substitutes for that resource?" (1991, p. 115).

One way to look at the "Contingency Model of SCA in Service Industries" is to compare it with Day and Wensley's (1988) model "Elements of Competitive Advantage," which represents the essence of competitive advantage and the Bharadwaj's et al. (1993) model as a comprehensive "checklist" for details about SCA in service industries. In this book, it is appropriate to use the indicators that Day and Wensley's (1988) suggest for indicating competitive advantage (performance outcome), satisfaction, loyalty, market share, and profitability. In this book, the impact of a specified competitive resource, CAD, is going to be assessed in a selected industry, the Swedish architectural industry. The impact of the environment on the assessed competitive resource has been stressed by Bharadwaj's et al. (1993) as necessary to consider when studying SCA in service industries and the environment needs to be considered also when using Day and Wensley's (1988) model. A firm's use of competitive tools depends on the managers' perception of the environment.

Managers' interpretation of competitive advantage.

Managers use models for representing competitive advantage. Day (1994, p. 41) identifies four types of models: self-centered model, competitor-centered model, customer-oriented model, and market-driven model (Figure 2.12).

![Figure 2.12 Managers' Interpretation of Competitive Advantage (Day, 1994, p.36)](image)

These models emphasize two criteria: customer judgments and competitor comparisons. Managers using the self-centered model pay little regard to these criteria; their strategies are unstable. Competitor-centered managers monitor competitors closely and their strategies are formulated to defend or counter a competitor's actions quickly. Managers
with a customer-oriented representation rely on detailed analyses of customer benefits and customer satisfaction within end-use segments. These managers do not track competitors’ actions to any greater extent but they rely on the information from their customers of how competitive their offer is. Strategies from these managers seem to be stable. Market-driven managers have achieved a balance between the competitor and customer perspective and they use a variety of data to avoid the oversimplification inherent in representations that are biased toward either the customers or the competitors. Day (1994, p. 41) suggests the market driven representation is the best. All four representations imply that managers pay selective attention to their environment and define their situation in relatively narrow terms; simplifications and narrowing may come at the cost of myopia and dulled sensitivity to challenges outside the prevailing framework.

Myopia naturally leads to the seminal article “Marketing Myopia” by Theodore Levitt in 1960 in which Levitt warns managers about the dangers myopic views in their perception of the environment. Levitt emphasizes the importance of a customer perspective (1960). Levitt’s article (1960) and the Day’s article (1994) lead to the examination of whether there is any chance for the management to attend to all areas of information relevant to the firm’s performance, especially when it comes to making decisions about the future, e.g., investments in new technology.

**IT—Competitive Advantage**

Technology has shown that it can change the competitive environment. It is one of the principal drivers of competition (Porter, 1985) and it determines a firm’s long run competitive position (Capon & Glazer, 1987). Clearly, since the Industrial Revolution, technology has repeatedly proven to cause dramatic change in the competitive environment (for example, the steam engine and the Spinning Jenny). Since this revolution the technological environment and consequently the competitive environment, has been changing.

There are innumerable examples of firms that have benefited from the adoption of electronic technology as well as of firms that have suffered from resisting it. An example of the former is Citibank in New York. Citibank launched their automated teller machines in 1977 and the bank’s market share almost immediately increased from 4% to 13.4% (Glaser, 1988). On the other hand, the Swedish firm Facit did not adopt electronics because the management was convinced that the market wanted mechanical calculators, and due to this miscalculation the firm almost went out of business (Lundgren, 1991). The forces of technology are so strong that they decide the future of specific industries and markets (Capon & Glazer, 1987; Kallinikos, 1996). The rule
appears consistent: a firm has to adapt to technological changes or suffer (Nelson, 1987). It is very difficult, however, for a firm to make the necessary changes when a radical technological shift appears. The traditional pattern is that the conditions for competition will change abruptly and new actors will come in and take over the industry’s customers (Giertz, 1987, 1989).

Porter and Millar note that “it is hard to underestimate the strategic significance of the new IT” (1985, p. 149). According to these two authors, the question is when and how IT will affect an industry not whether it will do so. Therefore, the companies that anticipate the power of this new technology will be in control of the market and the companies that do not respond will be forced to accept changes that the other firms initiate and these non-adopters will be at a competitive disadvantage (Porter and Millar, 1985, p. 160). According to Porter and Millar (1985, p. 149), IT can aid a firm in obtaining SCA in three ways: (1) by providing firms with a new way to outperform competitors by lowering costs and/or increasing firm differentiation, “[IT] allows a business to achieve a differentiation advantage by securing relationships through improved service quality and enhancing its ability to quickly respond to market shifts” (Bharadwaj et al., 1993, p. 93); (2) by building switching costs, building barriers to entry, and in some cases completely changing the basis of competition; (3) and by spawning entirely new businesses.

A careful study of service firms identifies the following uses of new technology as competitive advantage: scale effects, and product, production and managerial innovations (Bharadwaj et al., 1993, p. 88). The possibility of using technology as a competitive tool naturally depends on the character of the service; in equipment based services the impact is greater than in people based industries. Professional service is a people based service why the impact of IT might be little. Another way for service firms to achieve scale effects is by centralizing service production facilities while decentralizing customer-contact facilities, or centralizing certain critical (and/or equipment-intensive) activities and localizing less critical (and/or people-intensive) activities in regional centers.

Teece (1987, p. 171) uses the concept of tacit knowledge when discussing innovations, i.e., knowledge that is impossible to articulate. He suggests that each member in the organization should only have knowledge that is usable as an element in a system, i.e., each individual’s knowledge is a limited part in the firm’s production system. This strategy seems hard to realize in professional service because the people in these services need knowledge about the whole service process. Instead service firms “have successfully used IT to capture tacit organizational knowledge and retain property rights over the resulting innovations” (Bharadwaj et al., 1993).
The impact of new technology may directly affect the firms; e.g., management may use IT to differentiate the firm from its competitors in the eyes of the customer, may try to become a low cost producer, or may seek a special niche in the market (Ives & Learmonth 1984, p. 1196). There are also indirect impacts associated with IT on the image of the firm, "Computers are potent symbols of progressivism" (Stevens, 1991, p. 142). Successful firms use new technology as an overall success strategy. In this presentation, technology has been crucial to success. The studies quoted here reflect the contemporary research about this issue. The positive view of technology dominates the literature because of the prevailing values in society about technology and especially about IT. Society's view of technology might bias the judgment of professional service firms regarding the adoption of IT.

**Professional Service and Adoption**

The adoption of new technology in an industry is a dynamic process: in a static world, there would be no incentives to invest in new technology because the benefits of the adoption only occur over time (Sato & Tsutsui, 1984, p. 2). Due to the massive adoption of IT in the service industry, there seem to be a strong belief among the managers that this technology will give their firms a competitive advantage. Whether this intensive adoption is a result of mass behavior, a demand from a service production point of view, or from the firm's customers is not clear.

A sample of larger Swedish architectural firms show that 34% of them used CAD in 1988 (Ström, 1988). This is high compared to the U.S. where only 10% of the firms used CAD in 1991 (Stevens, 1991). The difference may be explained by the different samples of firms and probably the Swedish figures are somewhat lower as there were a disproportionately portion of large firms in the sample. A conceptual illustration of the accumulated adoption in an industry is illustrated in Figure 2.13. The adoption of CAD in a random sample of 200 manufacturing firms in Sweden followed closely the traditional S-shaped-diffusion-pattern (Löwstedt & Norr, 1992). A change in technology was not only important for the employees in the firm but also for the firm's customers (Harvey & Filiatrault, 1991). The customer's acceptance of new technology decides the pace of adoption (cf. Reynolds, 1993). The customers' influence on the adoption rate probably was affected by the degree to which the customers are affected by the new technology. von Hippel (1988) distinguishes different sources of an innovation such as manufacturers and users. Depending on which of these two sources is the strongest one to demand the use of the new technology, it is possible to talk about a technology push or demand pull (Barras, 1986, p. 749). By demanding services that require the use of
new technology the customers may affect the firm’s decision to adopt technology; for example, architectural customers’ demand more complex buildings (Reynolds, 1993).

![Distribution of Adoption](image)

*Figure 2.13 Distribution of Adoption (Rogers, 1983, p. 11)*

New technologies a construct that changes its contents over time. During the adoption process, from the innovators to the laggards, there is a significant development of the product; CAD systems are probably no exception. When the first architectural firms adopted CAD these systems were not thoroughly developed and designed for architects; however, as the development process continues to develop, CAD systems will be specifically designed for this professional group (Giertz, 1987; Giertz, 1989).

**Approaches to Adoption**

Two different approaches are used when adopting technology—an automate and an informate approach (Zuboff, 1985). An automate approach means that there are no changes in the organization into which the new technology is adopted. This way of acting pays little attention to the setting in which the new technology is implemented in and the potentials of the technology. In architectural firms, this is “the development of CAD systems which attempt to achieve productivity gains by substituting automated procedures for traditional, manual approaches” (Sakr, 1991, p.14). An informate approach occurs when the adopting organization is changed so the new technology can be completely incorporated in production. An adoption of new technology according to the informate approach means that the firm will proceed along the experience curve (Mokyr, 1990). There is an “interaction” between the new technology and the environment into which the adoption is done and this is necessary if the full potential of the new technology is to be achieved. The interaction between the new technology and the environment can be expressed in many ways. Nehls (1988) uses the expression learn-as-you-go. It is possible to interpret the informate approach as the successful management of new technology (cf. Bancroft, 1992; Harvey et al., 1993). This interpretation is similar to Drucker’s opinion that productivity gain from technology in a
service firm usually comes when redefining the task instead of doing a task faster (Drucker, 1990, cf. Davenport, 1993). The difference between a successful adoption of new technology and an unsuccessful one is the firm's ability to manage new technology; that is, the technology per se does not distinguish the adopters from the non-adopters (Boter & Holmquist, 1996; Monger, 1988).

The adoption process.

Rogers (1962, 1983) categorizes the adopters according to when they adopt new technology. Innovators are the first 2.5% of the adopters to adopt new technology (Figure 2.14).

![Figure 2.14 Categorization of Adopters Due to Their Innovativeness (Rogers, 1983:247)](image)

Early adopters are the next 13.5% of the adopters. Early majority adopters are the next 34%. Late majority adopters are the following 34%. The Laggards are the remaining 16%. Each of these adopter categories has specific characteristic (Rogers, 1983, p. 247): innovators are venturesome, early adopters are respectable, early majority adopters are deliberate, late majority adopters are skeptical, and laggards are traditional. Adopters of laptop computers have the following profile: they process negative information, they have greater access to personal information, they have a high tolerance for instability, and they have an ability to categorize and to infer (Gatignon & Robertson, 1989, p. 45). The diffusion of the innovation among the different groups of adopters in an industry is a social process; the active users influence their friends to adopt the technology (Czepiel, 1974; Granovetter, 1973; Rogers, 1962, 1983). The importance of personal communication and information dissemination to the adoption decision is emphasized in the discussion here.

Early adopting manufacturing firms was characterized as solution handling and late adopting manufacturing firms was characterized as problem solvers when they adopt CAD (Löwstedt & Norr, 1992, p. 21). Solution handling means that there are no clear-cut ideas of the benefits the company will achieve by using new technology. The

1 These individuals can make a more informed decision (Gatignon and Robertson, 1989).
The process can be characterized as a trial and error phase where different solutions are evaluated to find future advantages of using the new technology. At this adoption phase, the industry is focused on modernization because they are trying new ways of doing the traditional work. Problem solving procedures are incorporated in the adoption process when late adopters adopt new technology (Löwstedt & Norr, 1992, p. 21). The firm desires to solve a specific problem in an efficient way by adopting a new technology. At this stage, there is ample knowledge about new technology and this makes it possible for a firm to adopt the new technology for solving a problem that an organization faces, a problem not directly linked to an automation of the production process.

The difference between solution handling and problem solving patterns is how they are applied: to individual firms or to industries or sectors (Löwstedt & Norr, 1992, p. 21; Barras, 1986, p. 750). Closely related to solution handling and problem solving patterns is the idea that new technology tends to go through three application phases (Barras, 1986, p. 750). According to Barras (1986, p. 750), new technology in the first phase is used for improving the efficiency of delivering existing services, subsequent applications are used for improving the quality of existing services, and finally new technology is used for generating new service activities. Most European service firms have passed through the first phase and the two latter phases dominant firms adopting IT (Barras, 1986, p. 754).

An industry with the following characteristics will favor the adoption of laptop computers: higher concentration, close relationship between the firms and their suppliers, vertical coordination, and supplier incentives (Gatignon & Robertson, 1989). The higher a concentration in the industry is, the more likely an adoption will occur. In professional service industries, it is useful to make higher concentration equal to the size of the industry. It is possible to compare a concentrated industry with a small one, in both cases the actors are well informed about each other. Examining the close relationship between the firms and their suppliers might be of limited use in professional service firms because the supplier side is not very important in these firms. Vertical coordination and supplier incentives may not be possible to apply to a service provider customer situation (Gatignon & Robertson, 1989). In a professional service firm, vertical integration may be important; e.g., in architectural firms it is common to let some parts of the work in a customer project be done by sub-contractors, such as audio consultants.

Adoption and market advantages.

Due to the external approach of the research in this book it is useful to interpret the "Distribution of Adoption" (Figure 2.13) from a customer perspective; the diffusion
curve represents the emergence of a new market. The adoption of new technology by service firms creates new services that in turn leads to new markets (Barras, 1986, p. 749). Adopting new technology gives a firm a larger market share (O'Callaghan et al., 1992). Depending on the customers' evaluation of the new service, the market for the old one may evaporate. Therefore, it may be important to be the first firm on the market with a new technology if market share is to be developed and increased.

Typically, a market pioneer dominates the market (Chandler, 1990, p. 34): Merrill Lynch and Co., American Hospital Supply Corp., and American Airlines are examples of firms that experienced first-mover advantages. Chandler stresses the importance of the firm's size in this situation.

The entrepreneurs who invested in plants big enough to exploit the economies of scale and scope in the production, in product-specific facilities and skills in distribution (and also in research in technologically advanced industries), and in the managerial organization essential for coordination of these activities brought into being the modern industrial enterprise. (1990, p. 34)

An early adoption of new technology is more successful in firms that have certain characteristics related to the size of the firm. Here it is of interest to find out if first mover advantage is possible to attribute to the early adopters, innovator, and the early adopters in terms of Rogers' understanding (Rogers, 1983).

Firm size is not enough for success; it must be reflected in the market. The market pioneer has to invest sufficient resources to mount a large-scale assault on its market, if not the firm faces a severe risk of losing market share to later entrants. A firm that makes a large investment is more likely to create barriers to entry for later entrants and to enjoy the highest return in the long turn. The success of this strategy is affected by industry conditions; pioneers who have a higher degree of concentration in their market and a smaller number of competitors are most successful with this strategy (Lambkin, 1992, p. 17). Implied in this strategy are market control and unit cost. The pioneer will gain market control due to the size of its market share and the size of the share will be achieved by low unit costs. Embedded in this line of arguing is also the assumption of disloyal customers. Customers favor the firm that offers them the best value. It is questionable whether the customers of professional service firms will favor the best value offer or be loyal to a traditional firm. The close relationship between the customer and the service provider suggest loyal customers. If a majority of the customers in the industry are loyal, the impact on the market pioneer's advantages will be diluted. In terms of the network model (Hammarkvist, et al., 1982, p. 23) the bonds between the parties are tight; customers select a professional service provider carefully (cf. Day & Barkdale, 1992, p. 90) and the cooperation between the parties is intensive (cf. Bitran & Hoech, 1990, p. 96). On the other hand, architectural firms are very sensitive to changing business cycles (cf. Brown et al., 1993; Gutman, 1988) and therefore a change
in the economic climate may make customers disloyal. They are forced to look for a cheap solution.

Another way to portray market pioneers is suggested by von Hippel who talks about lead users:

1. Lead users face needs that will be general in a marketplace, but they face them months or years before the bulk of that marketplace encounters them, and
2. Lead users are positioned to benefit significantly by obtaining a solution to those needs. (1988, p. 107)

The lead user firms are homogeneous in their drive to explore innovations. Surprisingly, however, the product concept preferences of lead users and non-lead users were very similar (von Hippel, 1988, p. 114). Thus, both groups of firms evaluate the new product in similar ways, which would suggest that the lead users were ahead in market development compared to non-lead users.

So far, this presentation has focused on the adoption of new technology as more or less as a one time activity. The impact of new technology such as a SCA, however, depends on its maintenance: "the maintenance of a SCA requires the constant monitoring of and reinvesting in the present sources of advantage, as well as in investing in other potential sources of advantage." (Bharadwaj et al., 1993, p. 87) The adopters need to maintain their advantage by continuously investing in new technology in order to broaden the scope of the new technology. Architectural firms can do this, for example, by buying more workstations. In addition, adopters of new technology can increase their advantage by making the scope of the new technology larger. For example, architectural firms can adopt a complementary application for CAD such as animation development.

**Competitive Advantage and Industry Structure**

Chandler (1962, 1977) stresses technology as a boundary; technology shapes the structure of the company and the industry. The impact of technology is so strong that it plays a major role in changing industry structures (Porter, 1985). Quinn (1992, p. 23) suggests that the adoption of technology in professional service firms produces a pattern of different phases where each phase has special characteristics (Figure 2.15).

![Figure 2.15 Patterns in Industry of Technological Diffusion (Quinn, 1992, p. 23)]
These phases form a pattern that occurs regularly in an industry. It is important to recognize every step because each step offers a particular set of strategic options for firms undergoing these changes.

**New economies of scale.**

In the first phase, new economies of scale tend to develop; the new technology in the industry tends to centralize in large institutions. The industry goes through a consolidation where many small firms that lack capital and expertise go out of business. After this centralization, decentralization may follow when smaller units connect into a network and will be able to provide the new technology. Branches are equipped with the new technology and can therefore provide their local market with the service, or they can support other firms that provide the service. In addition, small firms can benefit from the new technology by decreasing unit cost and increasing productivity. Midsize firms suffer in this phase because they are not able to afford the new technology and they are too large to support a straight local market. They are frequently forced to grow; usually they merge with other firms, change their services radically, or go out of business.

**New economies of scope.**

The new technology usually allows a firm to provide a more extensive output without any significant increase in costs. In fact, depending on management, it is possible to offer an increased variety and flexibility of services while decreasing unit costs at the same time. Even firms concentrating on a part of the market can rarely serve this market with the same flexibility, quality, or cost advantages as the firms who adopted the new technology and therefore they increase their presence in the market. Firms that use innovation increase their market shares, both in the market they traditionally service and in new markets.

**Increased complexity.**

New technology, if supported with appropriately trained people, has the potential to handle much more complicated situations, “processing technologies now routinely design, build, and test radical new designs for boat hulls and aircraft” (Quinn, 1992, p. 26). This regularly passes beyond the limitations of the initial plan. People believe that the new technology is possible to use in every situation.

**Disintermediation.**

There is a tendency to bypass traditional technologies because they appear to be obstacles. Outside parties want direct access to the new technology; e.g., users of
transportation systems desire direct access to airline reservation systems. The effect on smaller intermediaries is to either specialize in highly developed services or become representatives of larger entities. The whole structure of industry has changed. Areas that traditionally belong to one industry are accessed by other industries and this results in rampant cross-competition.

*Redispersion and redecentralization.*

This phase occurs when there is a need for new intermediates. The firms originally connected to the network of a providing firm's computer tend to need professional help that is custom designed. When new technology achieves a new level of outreach and connectivity in the marketplace, it provides possibilities for emerging enterprises in different niches. The new firms may compete with existing larger companies.

*Comments on Quinn's pattern.*

Quinn (1992, p. 26) suggests this pattern, which contradicts the traditional perception of what happens in an industry when there is a radical technological shift. Traditional firms do not incorporate new technology in their strategic thinking (cf. Chandler 1990; Lundgren, 1991). Instead of adopting the new technology and exploring its benefits, the firms reject the adoption and often they go out of business.

An additional aspect of adoption and industry structure depends on how and which firms adopt innovation (Hannan & McDowell, 1990). When large firms acquire new technology, the market structure will be concentrated and when the small firms adopt new technology the degree of concentration is reduced (Hannan & McDowell, 1990, p. 167). Hannan and McDowell propose that the industry structure in the banking sector will tend to gravitate over time in predictable ways depending on the variations in efficiency between large and small firms. Both large and small firms will prosper depending on their efficiency.

**Theoretical Framework Model**

The theoretical framework suggests a possible relationship between the constructs: professional service, IT, service quality, and competitive advantage. Depending on the strength of the relationship between the constructs, certain changes may occur, e.g., some characteristics of management may be encouraged by the technology. In this study, architectural firms were the professional service examined and CAD was the IT examined. A model is built around the central constructs in this book.
Chapter 2

A model.

The inquiry in the book is the impact of IT on professional service. IT is regarded as a new technology (Figure 2.16).

![Revised Theoretical Framework](image)

**Figure 2.16 A Revised Theoretical Framework**

The common perception of the diffusion of an innovation is that the members in a population adopt at different times depending on certain characteristics that the individual member has. Management values influence whether an adoption will take place early or late compared to the other firms in the industry (cf. Rogers, 1983). These values decide a firm's development therefore they were illustrated in the model (Figure 2.16) as embracing the professional service firm. Embedded in the decision to adopt are the assumptions about the advantages gained when using the new technology. In this book an external approach is used, which means that advantages the adopter gains in the market are of special interest. Service quality and competitive advantage were used to assess the impact of the new technology. Both these assessment dimensions are related to the performance of an individual firm. Services performed with IT might be regarded as having different quality compared to manually performed services of the same type. A change in the individual customer's service quality perception suggests that the contents of this concept change over time, which is symbolized by the curved arrows around service quality in the model. A change in service quality perception among the customers suggests that the added feature of the service may be regarded as a potential competitive tool. A new means for competitive advantage has arrived in the industry. The changing nature of competitive advantage is shown in the model by the curved
arrows around competitive advantage. On an industry level, the impact of information
technology may be reflected as changes in the industry structure. The model in Figure
2.16 summarizes the presentation of the theoretical framework regarding the inquiry for
this book. In addition, the structural ideas from "A Conceptual Model of the Research"
(Figure 1.1) were built into the model. The flow in the model is a result of the inquiry
and relationships that the theoretical framework suggested between the constructs. Due
to the external approach of the study, it was natural to assess service quality before
competitive advantage.
Chapter 3: THE RESEARCH DESIGN

In this chapter the research plan is presented and discussed in relation to the inquiry of the book. The research plan is further developed in a detailed program of activities. Each of the four data collections is developed into their final design and the quality of the collected data is analyzed. The last section of the chapter contains a discussion about the guidelines for the analyses of the collected data. Detailed information is presented in the chapter to help the reader to consider the validity and reliability of this work (cf. Eneroth, 1984).

The Research Process

The research uses two surveys. To examine the spread of innovation a longitudinal study is used. This section provides an overview of the work and a framework for the subsequent sections in the chapter.

![Figure 3.1 Model of the Research Design](image)

**Overview of the Research Process**

In survey one (S1), data was collected with two different instruments. A judgment sample of primarily people in executive positions in the architectural firms was selected for in-depth interviews. Thirty-one interviews were done to assist in the design of the questionnaire. The mailed questionnaire in S1 was addressed to a random sample of 805 firms. A conservative estimation of a response-rate of 50% would produce an error of estimation of ± 4.9% at a confidence level of 95% (Naresh, 1999, p. 358). An
extensive questionnaire was designed around the studied constructs. About 46 months after S1 a follow-up survey (S2) was conducted. Information collected during six in-depth interviews was used to revise the initial questionnaire. The redesigned questionnaire was distributed by mail to a selected set of firms, largely those who had responded to the initial questionnaire. The research design is summarized in Figure 3.1. The adoption of CAD formed two groups of firms in the industry: adopters and non-adopters. Characteristics between these firms were identified and analyzed. Of special interest were those differences that would indicate superior service quality and superior competitive advantage for any of the two groups of firms.

An external approach.

Several studies emphasize a marketing perspective when developing strategies, i.e., an external approach (Doyle & Hooley, 1992; Erickson, Jacobson, & Johansson, 1992; Hooley, Lynch, & Jobber, 1992; Lambkin, 1992; Ruekert, 1991). An internal approach examines changes within a firm, e.g., changes in the work process due to the adoption of CAD. An external approach that studies CAD provides insights about a firm's relationship to the market. According to Drucker (1954), this relationship is of primary interest; the firm's performance decides its future.

An external approach assesses the aggregate forces of all activities in the firm. The firm integrates activities such as finance, design, construction, and marketing. This type of study is an output perspective. An older way to analyze a firm was the production view where the different professions in the firm would be of central interest - the chimneys. Because small firms such as architectural firms have problems with marketing, the external approach is the most effective way to study IT influences on firms (Dodge & Robbins, 1992).

Nature of the Performed Research

Within the purpose of the research it was possible to choose between a cross sectional and a longitudinal study. The major difference between the two approaches is the number of times that data is collected. In a longitudinal study, data are collected from a group of subjects more than once (Churchill, 1987, p. 85). Parasuraman calls true longitudinal analysis for time a series analysis (1986, p. 135). Green et al. call repeated measurements of the same sample a time series (1988, p. 217). A longitudinal study was used because an organization that adopts IT needs to adapt if the potential of the new technology is going to be achieved (cf. Zuboff, 1985). If the impact is real and not based on peoples' opinions about the future, then a longitudinal study is most appropriate due to the time needed for the adaptation.
There are different types of longitudinal studies, i.e., time series and panel studies (Markus, 1979). According to Markus (1979), there are two differences between time series and panel data. In a time-series, data is collected a relatively large number of times whereas in a panel study data is collected only a few times, usually four or less. A time series focuses on a single entity and a panel study focuses on many entities, e.g., principals, firms, groups of firms. In addition, the unit of analysis differs between the two: in a panel study the focus of analysis is the individual and in a time series study it is the time point. This project uses a panel study. There are two data collections with a large sample and the firms are the unit of the analyses.

**Research Design Considerations**

The two surveys were built around the idea that a mix of qualitative and quantitative data would provide the best information. The in-depth interviews provided information that assisted in the design of the questionnaires. Each of the mailed questionnaires aimed to provide a picture of the industry.

**Thoughts about the Design**

The design of the research process is guided by producing a project that is "as validly, objectively, accurately, and economically as possible" (Kerlinger, 1986, p. 280). This book integrates the different surveys and within them the two data collections in a supportive and progressive way so there is an accumulation of knowledge during the whole research process. The research process was designed at two different levels: the framework and the individual data collection. The framework stated the relationship between the data collections and defined the purpose of each of them. The individual data collection was adapted to the investigated situation. The choices of methods were made without considering any method superior to another (Burgess, 1984, p. 143; Gummesson, 1991b, p. 173).

Randomizing was used, which is a significant way to obtain valuable results (Kerlinger, 1986, p. 299). All the members of the population were listed and each of them had the same chance to be in the sample (Dillman, 1978, p. 41). Due to the variable used for grouping the firms, the hold of CAD, there was no possibility to randomly assign members to the groups.

It is, however, not necessary to be as dogmatic as Kerlinger (1986, p. 293) who claims that the controlled experiment is the ideal way to conduct research. A type of research that might be described as a mix of experimental and non-experimental research is a natural experiment. In the natural experiment, contrary to the controlled
experiment, the researcher does not manipulate any variables, the variables of interest occur in a natural setting (Green et al., 1988). The researcher interference is the assessment of the dependent variable.¹

There has been some criticism concerning the use of natural experiments in marketing research situations. It is not possible to anticipate that natural experiments will provide sufficient independent variation in all the variables that are of interest (Green, 1992). The criticism is understandable when the natural experiment is used in cross-sectional designed marketing studies, i.e., studies about buying behavior (cf. Green et al., 1988). Due to the research design used here, the criticism of the natural experiment is not relevant.

A quantitative approach and a qualitative approach.

Largely, there were two different approaches to choose between when designing the research process: a broad approach, which involves many subjects, and a narrow approach, which involves few subjects that are studied in-depth. The choice of approach may also be expressed as quantitative and qualitative. There are some variations in how different authors define qualitative research. Kirk and Miller define qualitative research according to the way research is conducted, “Qualitative research is a particular tradition in social science that fundamentally depends on watching people in their own territory and interacting with them in their own language, on their own terms” (1986, p. 9). Parasuraman, on the other hand, defines qualitative research according to the type of data collected, “Qualitative research involves collecting, analyzing, and interpreting data that cannot be meaningfully quantified, that is, summarized in the form of numbers” (1986, p. 240).

The counterpart to qualitative research is quantitative research, “Quantitative research in contrast to qualitative research, is characterized by more structure and by larger, more representative respondent samples (Parasuraman, 1986, p. 241). Quantitative research is more broad and structured with respect to questioning a large number of subjects than qualitative research is (Parasuraman, 1986, p. 240). The quantitative and a qualitative approach contribute in various ways to the understanding of the situation (Gummesson (1991b, p. 4). Each approach provides the researcher with different views—“slices of data” (Glaser & Strauss, 1967, p. 65).² In this study, 4 data collection processes were used. According to Glaser and Strauss: “there are no limits to the techniques of data collection, the way they are used, or the types of data acquired” (1967, p. 65). Other authors are not so liberal in this matter (cf. Eneroth, 1984).

¹ One of the most famous natural experiments is the study of twins at the Minnesota Center for Twin and Adoption Research in Minneapolis (Mann, 1994).
² Normal typeface added by the author
The choice of approach was guided by its efficiency regarding what kind of information was needed. Of course, the use of a certain data collection technique does not qualify the research to be either qualitative or quantitative. Analyzing and interpreting the data must also be carried out in a way that corresponds to how the data is collected.

Quantitative and qualitative methods were used to collect and process data. The mailed questionnaires in survey 1 and 2 may be regarded as a quantitative approach and the in-depth interviews conducted may be seen as a qualitative approach. Parasuraman identifies qualitative research two ways: non-structured questioning and few subjects (Parasuraman, 1986, p. 240).

**Purpose and Comments about the Data Collections**

The research process consists of two surveys each using two different data collection methods. Each subsequent data collection used the accumulated knowledge of the prior ones. The purpose of each data collection is shown in Table 3.1.

<table>
<thead>
<tr>
<th>Initial In-depth Interviews</th>
<th>Initial Mailed Questionnaire</th>
<th>Intermediate In-depth Interviews</th>
<th>Follow-up Mailed Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
<td>Industry Status</td>
<td>Special Attention</td>
<td>Industry Status</td>
</tr>
</tbody>
</table>

In the initial in-depth interviews information and knowledge about the characteristics of the architectural industry in general and ongoing changes in specific was collected. The following were the guiding questions for these interviews: What is going on in the industry? What jargon do the architects use profession (cf. Anderson, 1990, p. 128)? What is the architects’ way of thinking about their business? The purpose of the initial in-depth interviews may also be expressed as a way “to create concepts about the phenomena” (Eneroth, 1984, p. 49, author’s translation), (cf. Burgess, 1984, p. 166; Glaser & Strauss, 1967, p. 45; Kirk & Miller, 1986, p. 60; Lincoln & Guba, 1985, p. 221).

The initial mailed questionnaire provides an initial picture of the architectural industry, “the longitudinal study . . . provides a series of pictures which . . . provide a movie of the situation and the changes that are occurring” (Churchill, 1987, p. 91; cf. Parasuraman, 1986, p. 135). This mailed questionnaire survey was conducted to provide a baseline for the studied processes and the changes that occur.

The intermediate in-depth interviews addressed the relationship between CAD and service quality. How do the different parties, provider and client, regard new
technology in terms of service quality? What are the advantages and the disadvantages of the technology? What do the providers and the clients think about CAD?

The follow-up mailed questionnaire followed the initial one. The magnitude and the direction of the changes indicated in survey one are assessed. This mailed questionnaire survey also identified a "new" area—the impact of the recession.

**Primary data.**

No useful secondary data about the inquiry could be found why primary data had to be collected. Several organizations were asked during spring in 1989 if they could provide data that might be useful in this book: SPA, ARKUS, AF, SAR, SIR, and LAR. In addition, SCB (Statistical Central Bureau) was contacted for a request of data about architectural firms. Their lowest level of data aggregation was a classification labeled "Technical consultants." The architectural firms were roughly about 20% of the firms in this group.

In-depth interviews were used in data collection one. They were the most efficient way to obtain the required information regarding both time and number of contacts. Moreover, an in-depth interview offers the possibility to have a dialogue with the data provider (Parasuraman, 1986, p. 127). A dialogue allowed the possibility to elaborate and discuss topics that the interviewee considered important and vital. A dialogue is also valuable because "What is trivial to us (the researcher, note added by the author) may be of vital concern to the researched" (Punch, 1986, p. 48).

The initial mailed questionnaire investigated the extent of on-going changes in the industry. Therefore, an efficient data collection method for collecting a limited amount of data from a large group of subjects was necessary. Questionnaires distributed either by mail or by telephone are the best ways to do this. Personal administration of a questionnaire was not considered (cf. Churchill, 1987, p. 241; Parasuraman, 1986, p. 343). Several lists of advantages and disadvantages for telephone questionnaires and mailed questionnaires were closely studied and compared (Churchill, 1987, p. 241; Dillman, 1978, p. 74; Langlet & Wärneryd, 1983, p. 11; Lekvall & Wahlbin, 1979, p. 66; Parasuraman, 1986, p. 229). The most useful data collection technique within the limitations of this project—time, money, resources, and the type of data and the amount of data—was a mailed questionnaire. Moreover, the type of data to be collected did probably disqualify questionnaires distributed by telephone. Some of the questions on

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1 Sveriges Praktiserande Arkitekter (Sweden's Practising Architects) author's translation
2 Arkitektförbundet (Architects' Association) author's translation
3 Sveriges Arkitekters Riksförbund (Swedish Architects' National Association) author's translation
4 Sveriges inredningsarkitekters riksförbund (Swedish Interior Designers' National Association) author's translation
5 LandskapsArkitekters Riksförbund (Landscape Architects' National Association) author's translation
the questionnaire would probably require the respondent to search for information such as their revenues over the previous three years. Other questions required some thoughtful responses, e.g., the three most important goals for the firm.

In the intermediate in-depth interviews data about the relationship between service quality and CAD was collected. Information about this relationship was collected using an in-depth interview with CAD using architects and some of their clients.

The follow-up questionnaire was a follow-up to the initial questionnaire. Due to the number of respondents, the questionnaire could be administered by telephone, but this would mean that the data collection would change and this might affect the responses given (Tyebjee, 1979). The recent questionnaire was also comprehensive (15 pages with questions) making it unsuitable to be administered by telephone. Prior experience also indicated that telephone contact was difficult.

Data Collections

A judgment sample of 31 people was used in the initial in-depth interviews. Mainly principals in larger firms were interviewed. The initial mailed questionnaire was sent out to a random sample of 805 Swedish architectural firms. A response-rate of 65% was achieved. Non-respondents did not influence the data. Six in-depth interviews were done to assist in updating the initial questionnaire. The firms that responded to the initial questionnaire were approached with a follow-up questionnaire. A response-rate of 94% was achieved.

Survey One

A mailed questionnaire was used for collecting the data and a number of in-depth interviews were conducted to assist in questionnaire design.

Preparations for the Initial Questionnaire

The questionnaire had to meet the following four criteria: 1. It should be a reflection of the conditions in the architectural industry. 2. It should use language familiar to the respondents—the architects. 3. The questions should be expressed in a relevant way. 4. The questions should be interesting for the architects. Rolf A. Lundin (the main advisor for this work) has researched the Swedish architectural industry (cf. Bröchner et al. 1991; Knuuttila & Johansson, 1987; Lundin, 1990). In addition, Gummesson's (1991b) work provided some background information for this book. Contacts established with
people in the industry, which made it possible to put together a reference group, also provided information for this book. The participants in this focus group represented each a different perspective in the industry during interviews and dialogue sessions (cf. Parasuraman, 1986, p. 243).

**The In-depth Interview Sample.**

A judgement sample, a non-probability sample, was used in the in-depth interviews (Burgess, 1984, p. 55; Lincoln & Guba, 1985, p. 224). Progressive firms were selected, i.e., firms that were seen as innovators—a behavior that could cause change in the industry (cf. Bancroft 1992, p. 1). Literature suggests that the adoption of an innovation in an industrial setting occur within a social network. Czepiel (1974), for instance, studied the adoption of continuous casting within the steel industry. He found positive evidence that a social system existed that assisted adoption of the innovation (cf. Lundgren, 1991; Rogers, 1983). Architectural firms in Sweden are largely clustered around three main cities—Stockholm, Göteborg, and Malmö. Changes tended to originate in areas close to these cities (Geer et al., 1986). Firms located in these areas were chosen for in-depth interviews. In addition, firm size was anticipated to be relevant: larger firms cause change more often than smaller ones (Huang, 1988). Focusing on larger firms has to be regarded in terms of the size distribution of firms in the industry. In general, the architectural firms were small; 87% of them had less than 20 employees (Eckered, 1986). A higher percentage of firms in the sample had 20 employees or more and this was larger than the actual size-distribution in the industry.

Actual participants in the in-depth interviews came from referrals from the reference group or referrals from participants themselves, a snowball sampling (Burgess 1984, p. 45; Lindfors, 1993, p. 101). The sample of interviewees were selected in a way to imply that the number of people interviewed can not be decided on beforehand, but rather was developed by what Glaser and Strauss (1967) call an ongoing inclusion, i.e., names of potential people to interview were continuously gathered. When 31 interviews were conducted, it was decided that the new information an additional interview would provide was too low—theoretical saturation was achieved (Glaser & Strauss, 1967).

Of the 27 in-depth interviews with people in architectural firms, 19 were with principals and 8 with people in the executive group. The interviewees represented 25 different firms; 19 of them were located in the 3 main cites in Sweden. In 14 of the firms, there were 20 or more employees. Four additional in-depth interviews were done with other important people. A principal was interviewed from each of the industrial

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1 For more information about the reference group, see Appendix A.
2 For a list of the interviewed people see Appendix B.
organizations—AF, ARKUS, and SPA and a management consultant with extensive knowledge about the architectural industry.

All the in-depth interviews were conducted in the same manner. A number of topics were discussed with the interviewee. The interviewer had a list of several topics\(^1\) that were presented for the interviewee in a way to direct the discussion. The list of topics was used as a checklist for covering the different subjects, not as a compulsory list to be addressed in a particular order. All interviewees agreed to have their interviews taped.

The in-depth interviews were analyzed in the following order. The tapes were transcribed and the interviews were content analyzed. Statements and topics associated with the inquiry were marked and noted. Some of these statements were used as quotations in this book.

**Design of the Initial Questionnaire**

The questionnaire tended to be comprehensive.\(^2\) Business people are time-sensitive (Jobber, 1989) therefore the questionnaire had two parts. Part one, addressed to the principal of the firm, contained strategic questions. Part two, directed to the person in charge of the bookkeeping, was built around questions about background information. The questionnaire was designed around different topics. These topics originated from the initial in-depth interviews and from the theoretical framework. The design of the individual questions within each topic was a mix of theoretical considerations and the results of the initial in-depth interviews. Each question was carefully formulated to be as comfortable as possible for the respondents.

The following topics and questions were placed in part one of the questionnaire.\(^3\)

"Management and Ownership," question 1 to 5, addressed background information of the principal and plans about the ownership of the firm. "Goals and Critical Resources," question 6 to 9, addressed the goals for the firm, resources, total competence in the firm, and ways to obtain new knowledge. "Organization and Personnel," question 10 to 14, addressed the need for personnel, arguments for recruiting new collaborators, and education of the collaborators. "Business and Market," question 15 to 26, addressed changes in the firm and in the clients, perception of the architect’s role in a job, areas of business—niches, plans about the business, and the most valued characteristics of a client. "Competitors and Competitive Advantage," question 27 to 30, addressed perception of the competition, the own competitive advantage as well as the competitors’ competitive advantage, and the characteristics of competitors’ behavior. "Future," question 31 to 32, addressed the business cycle, the

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\(^1\) For a presentation of the topics discussed in the in-depth interviews see Appendix C.

\(^2\) A translated version of the questionnaire is shown in Appendix D.

\(^3\) For a detailed design of the questionnaire see Appendix D.
nature of the prevailing cycle, its duration, and when a normal business cycle would begin. “Market View,” question 33 to 36, addressed outstanding business performances of other architectural firms, outstanding performance in architectural work as a firm, outstanding performance in architectural work as an individual architect, and potential firms in the industry.

Part two of the questionnaire contained the following topics and questions. “Start, Company Form, and Ownership,” question 1 to 9, addressed how a firm started, how companies form, and ownership of the firm. “Employees,” question 10 to 12, asked for the number of employees, personnel turnover, and the number of people in charge of jobs. “Financial Issues,” question 13 to 19, addressed revenues, costs, assets, debts, and billing hours. “Clients,” question 20 to 25, addressed the number of clients, size of different clients, and types of performed jobs as well as the size of them. “Education,” question 26 to 28, asked for education costs and the number of people in education. “CAD,” question 29 to 42, asked for ownership, size investment, year of CAD adoption, brand of software and hardware, CAD training, and plans for CAD use.

Pre-testing is indispensable for a flawless questionnaire (Parasuraman, 1986, p. 372). It is especially important to pre-test mailed questionnaires because feedback is not available when administering such a test. Dillman (1978, p. 155) suggests the procedure that was used. The first test of the questionnaire was among friends, people who understood the aim of the study. The second pre-test group consisted of people who use the data. The third group of pre-testers was from the general population (Dillman, 1978, p. 157). The questionnaire was first tested among friends re-designed and tested among the people in the reference group, and by the industry organization SPA. The third group of pre-testers consisted of six architectural firms in Umeå who were, in addition to respond the questionnaire, asked to comment on the questionnaire design. This last test group was used to find the most appropriate design and wording of the questions (cf. Dillman, 1978, p. 95).

Sample for the Initial Questionnaire

The first step in the process of identifying the relevant population was to formulate a rule defining the population (cf. Kerlinger, 1986, p. 46). Due to the purpose of this research, it was most appropriate to use a definition that focused on the firms’ business instead of professional competence. Two different definitions of an industry were considered: “strictly a group of sellers of close-substitute outputs who supply a common group of buyers” (Bain, 1959, p. 6) and “as the group of firms producing products that are close substitutes for each other” (Porter, 1980, p. 5). Either of these definitions would be possible to use, however, the latter one seemed to be better because it only focuses on the provider side and does not put any limitations on the buyer group. It was
anticipated to be important to include all kinds of buyers of architectural services because the research was about a new way of providing traditional service and therefore the "uncommon" buyers may be of special interest.

Six address directories were provided by industry related organizations to use to identify a firm's address. In addition, there were two other directories provided by organizations not connected to the industry. The most efficient way to obtain addresses to the firms and to receive the best representation of the population was to use the directories from the following organizations: AF, SPA, and POA. AF, the union for architects, had also a service organization for managers. SPA is an organization that supports the member firms in business matters. Memberships in these two organizations were on a voluntary basis. The Post Office Administration in Sweden (POA) provided addresses for the architectural firms. Firms in this directory had to have at least one person in the firm as a member in one of the following professional organizations: SAR, SIR, and LAR. In addition, the firms' addresses are available in Swedish telephone directories; however, using this method would take too much time to be practical.

The three selected directories did not contain addresses to all architectural firms in Sweden. Representatives from SAR, SIR, LAR, AF, SPA, or any one in the reference groups could not identify how many firms were excluded. There was, however, a consensus among these people that the overlooked firms were of no importance for the research done in this book because the market share of the firms in the selected directories would be very close to 100%.

The final hierarchical order used to choose firms for this project was the SPA directory, AF directory, and POA directory (decreasing order). Due to the bad experience in SPA with non-current addresses in the POA directory, the use of this directory was minimized. Duplicates had to be removed as membership in the SPA and the AF directory was not mutually exclusive (cf. Dillman, 1978, p. 95). In general, a firm starts as a member in AF. As the firm grows it becomes a member of SPA, which provides more current information.

Because of financial restrictions and time limitations, it was impossible to approach all firms in the industry. According to the catalogues, there were 1565 firms in the industry: 324 firms in the SPA-directory, 404 in the AF-directory, and 837 in the POA-directory.1 From the SPA-directory, all firms were selected; from the AF directory, a random sample of every second firm was selected; and from the POA directory, a random sample of every third firm was selected.

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1 These figures were calculated using the directories in the hierarchical order identified above when the duplicates had been removed.
Random samples were achieved by randomly choosing the firm that began the count (cf. Dillman, 1978, p. 41). The sample of firms (805) adds up to 324 from the SPA-directory, 202 from the AF-directory, and 279 from the POA-directory.

Processing of the Initial Questionnaires

An introduction letter was sent out in January 1990 to all the respondents. After two days, this initial letter was followed by a package containing the questionnaire, an information letter, and a return envelope with postage paid. After 14 more days, the first reminder was sent out. After another 21 days, the second reminder was sent out. Enclosed in this last reminder were a questionnaire and a return envelope with postage paid. Table 3.2 provides an overview of the mailing dates and volume.

Table 3.2 Dates of Mailing and Numbers of Letters for the Initial Mailed Questionnaire

<table>
<thead>
<tr>
<th>Date</th>
<th>Mail Contents</th>
<th>No. of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 15</td>
<td>Introduction Letter</td>
<td>805 Cases</td>
</tr>
<tr>
<td>Jan. 17</td>
<td>Questionnaire and Cover Letter</td>
<td>805 Cases</td>
</tr>
<tr>
<td>Jan. 31</td>
<td>First Reminder</td>
<td>673 Cases</td>
</tr>
<tr>
<td>Feb. 2</td>
<td>Questionnaire and Second Reminder</td>
<td>564 Cases</td>
</tr>
</tbody>
</table>

After two reminders, a telephone follow-up was used in order to encourage a greater commitment from the respondent (Cialdini, 1988). These activities produced a final response-rate for initial mailed questionnaire of 65% (Table 3.3).

Some of the firms kept their own records. At the time of the data collection, if a firm was not conducting business it was excluded from the further processing (see "Not in Business" in Table 3.3). Other firms in the sample were excluded because they were irrelevant for this book for the following reasons: (1) the owner was in the process of closing the firm; (2) more than half of a firm's revenues came from non-architectural business; (3) the firm's principal was 65 years or older; and (4) the firm's principal only worked part-time in the firm (cf. Gutman 1988, p. 4). Sixty-five was the legal age for Swedish architects to obtain pension from the government at the time of the data collection. These principals were not totally dependent on the income from their architectural firm. They, however, frequently kept the firm and conducted business that especially appealed to them for several reasons. The most frequent part-time job was a position as a teacher in an architectural school. Because of the additional sources of

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1 A translation of the enclosed letter is shown in Appendix F.
2 A translation of the first reminder is shown in Appendix G.
3 A translation of the second reminder is shown in Appendix H.
4 The response-rate has been calculated using the following formula: number of returned questionnaires / (number in sample - (non-eligible + non-reachable)) (Dillman, 1978).
income, either from a pension or from a part-time job, these firms did not have to respond to the changes taking place in the industry (Gutman, 1988, p. 4).

Table 3.3 Response-Rate for the Initial Mailed Questionnaire

<table>
<thead>
<tr>
<th>Sample</th>
<th>805 cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not in Business</td>
<td>78 Firms that did not do business at the time of the data collection.</td>
</tr>
<tr>
<td>Not Relevant</td>
<td>129 Firms that did not do architectural business and/or the principals were too old.</td>
</tr>
<tr>
<td>Not Accessible</td>
<td>32 Firms not accessible.</td>
</tr>
<tr>
<td>Duplicates</td>
<td>25 Firms listed in more than one register.</td>
</tr>
<tr>
<td>Total</td>
<td>264 Firms not accessible.</td>
</tr>
<tr>
<td>Replied Quest.</td>
<td>541 cases Includes branches responding through their parent companies</td>
</tr>
<tr>
<td>Response-rate</td>
<td>65%</td>
</tr>
</tbody>
</table>

Among the responding firms, twelve were companies who had branches. There were multiple contacts with these firms; both the parent companies and the branches received a questionnaire. As it turned out, in several cases, the branches were not permitted by their parent companies to respond to the questionnaire. Instead, the parent companies provided data, including data about the branches. In the calculation of the response-rate, the 78 branches of the responding parent companies have been considered as respondents. This provides a response-rate reflecting the scope of the obtained responses.

A Comparison of Early and Late Respondents

Comparative analyses of key-characteristics were done in order to examine the possibility of non-respondents' bias. Early respondents (first half, FH) were compared with late respondents (second half, SH). This procedure has been used by several authors (Gatignon & Robertson, 1989; Heide & John, 1988; or Traynor & Traynor, 1994). It follows the approach of extrapolation methodologies (Achrol & Stern, 1988; Armstrong & Overton, 1977; Dwyer & Welsh, 1985). The test assumes that respondents who answer late are more similar to non-respondents. A significant difference between FH and SH suggests that non-respondents might be a problem (Armstrong & Overton, 1977); the non-responding firms are different from the responding firms. All the responded questionnaires\(^1\) (389) were employed in the comparison analyses between FH and SH respondents. The following key-variables were used: CAD adoption, revenues, and number of employees.

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\(^1\) All responded questionnaires means all questionnaires that had been responded to, no limitations made.
Adoption of CAD was a central variable for the whole research process; the firms were classified due to this variable and significant differences between the adopters and the non-adopters were analyzed. A cross tabulation between FH and SH for the variable revealed no significant difference\(^1\) (Table 3.4). Approximately the same number of adopters and non-adopters were found in the two halves.

Table 3.4 Cross Tabulation between First Half and Second Half Regarding CAD Adoption

<table>
<thead>
<tr>
<th>Sample</th>
<th>Category</th>
<th>FH</th>
<th>SH</th>
<th>Chi-Square (Pearson)</th>
<th>P Value</th>
<th>Sign Y/N</th>
<th>n= Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Adopters</td>
<td>40.3%</td>
<td>40.6%</td>
<td>0.003</td>
<td>0.96</td>
<td>N</td>
<td>336: 53</td>
</tr>
<tr>
<td></td>
<td>Non-adopters</td>
<td>59.7%</td>
<td>59.4%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPA</td>
<td>Adopters</td>
<td>58.8%</td>
<td>59.0%</td>
<td></td>
<td></td>
<td></td>
<td>168: 17</td>
</tr>
<tr>
<td></td>
<td>Non-adopters</td>
<td>41.2%</td>
<td>41.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POA</td>
<td>Adopters</td>
<td>28.6%</td>
<td>24.4%</td>
<td>0.170</td>
<td>0.680</td>
<td>N</td>
<td>76: 22</td>
</tr>
<tr>
<td></td>
<td>Non-adopters</td>
<td>71.4%</td>
<td>75.6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF</td>
<td>Adopters</td>
<td>19.6%</td>
<td>16.7%</td>
<td>0.170</td>
<td>0.680</td>
<td>N</td>
<td>92: 14</td>
</tr>
<tr>
<td></td>
<td>Non-adopters</td>
<td>80.4%</td>
<td>83.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Firm revenues for the most recent financial year were also a central measure because it helped assess competitive advantage (market share was equal to the size of the revenues and productivity was the relation between revenues and number of employees). The number of employees was used to assess two measures of competitive advantage: change in the number of employees and change in productivity. These two measures were used as a denominator in several of the other analyses as well. By relating figures connected to the number of employees, the impact of variations in size between the firms was leveled out.

A t-test for independent samples\(^2\) was performed to analyze the differences between the first half and the second half regarding revenues and number of people (Table 3.5). There were no significant differences for any of the analyzed groups. The non-respondents were randomly distributed.

For all analyzed groups of firms the median values were considerably less than the mean values which indicates that in all the groups of firms there were some larger firms affecting the mean values. The sizes of the responding firms were randomly distributed concerning when they answered the questionnaire and the variation in firm size was randomly distributed among the respondents. The insignificant differences between FH and SH suggest that non-respondents have characteristics regarding the analyzed variables similar to the responding firms.

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\(^1\) In the comparison of first and second half respondents the significance level was set to 0.05.

\(^2\) FH and SH were considered as two independent samples because the responding firms were a random distribution.
Table 3.5 Comparison between First Half and Second Half Regarding Number of People and Revenues

<table>
<thead>
<tr>
<th>Number of people</th>
<th>Sample</th>
<th>FH Mean (SD)</th>
<th>Median</th>
<th>SH Mean (SD)</th>
<th>Median</th>
<th>t-Value</th>
<th>P Value</th>
<th>Sign Y/N</th>
<th>n=</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>14.38 (SD 46.00)</td>
<td>11.25 (SD 25.31)</td>
<td>0.785</td>
<td>0.433</td>
<td>N</td>
<td>351:38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPA</td>
<td>24.77 (SD 63.85)</td>
<td>20.00 (SD 34.11)</td>
<td>0.604</td>
<td>0.546</td>
<td>N</td>
<td>168:17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POA</td>
<td>9.86 (SD 22.71)</td>
<td>3.50 (SD 4.30)</td>
<td>1.634</td>
<td>0.111</td>
<td>N</td>
<td>81:18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AF</td>
<td>2.25 (SD 2.07)</td>
<td>2.46 (SD 2.30)</td>
<td>-0.484</td>
<td>0.629</td>
<td>N</td>
<td>102:4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Revenues

<table>
<thead>
<tr>
<th>Sample</th>
<th>FH Mean (SD)</th>
<th>Median</th>
<th>SH Mean (SD)</th>
<th>Median</th>
<th>t-Value</th>
<th>P Value</th>
<th>Sign Y/N</th>
<th>n=</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>7,949,283 (SD 27,511,462)</td>
<td>1,968,537</td>
<td>12,281,228 (SD 53,001,764)</td>
<td>2,314,068</td>
<td>-0.834</td>
<td>0.405</td>
<td>N</td>
<td>255:134</td>
<td></td>
</tr>
<tr>
<td>SPA</td>
<td>13,000,000 (SD 37,956,119)</td>
<td>4,750,000</td>
<td>14,000,000 (SD 30,338,484)</td>
<td>5,747,583</td>
<td>-0.084</td>
<td>0.934</td>
<td>N</td>
<td>127:58</td>
<td></td>
</tr>
<tr>
<td>POA</td>
<td>5,961,120 (SD 12.853,397)</td>
<td>750,000</td>
<td>21,000,000 (SD 100,000,000)</td>
<td>1,042,000</td>
<td>-0.759</td>
<td>0.451</td>
<td>N</td>
<td>55:43</td>
<td></td>
</tr>
<tr>
<td>AF</td>
<td>885,949 (SD 1,119,356)</td>
<td>500,000</td>
<td>1,185,000 (SD 1,550,956)</td>
<td>560,500</td>
<td>-0.958</td>
<td>0.342</td>
<td>N</td>
<td>73:33</td>
<td></td>
</tr>
</tbody>
</table>

Analysis of Non-Respondents

There seemed to be a significant difference between respondents and non-respondents regarding whether their location was central or not, i.e., whether the firm was located in Stockholm, Göteborg, Malmö, or outside these cities. It was only possible to make an analysis about the location of the non-respondents due to limitation in data. There was a significant difference between the location of the respondents and the location of the non-respondents (P value 0.088, Table 3.6).

Table 3.6 Cross-Tabulation between Respondents and Non-respondents Regarding their Locations, P value 0.088 (Fisher’s exact test), n=509

<table>
<thead>
<tr>
<th>Sample</th>
<th>Respondents</th>
<th>Non-Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Location</td>
<td>56.1%</td>
<td>62.6%</td>
</tr>
<tr>
<td>Non-Central Location</td>
<td>43.9%</td>
<td>37.4%</td>
</tr>
</tbody>
</table>

1 The only data that could be used for this analysis were the firms’ zip codes.
Chapter 3

The firms that did not respond to the questionnaire after two reminders were contacted by telephone for an additional request to respond to the questionnaire. The information achieved during these telephone calls suggested that the non-respondents were similar to the respondents regarding this book’s aim.

Survey Two

The follow-up survey provides data for a description of the industry at the second stage. The intention was to track and verify the changes caused by the adoption of CAD in the industry. The responses in the follow-up survey were compared to the responses in the initial survey. Therefore, a mailed questionnaire was used (cf. Tyebjee, 1979).

Preparations for the Follow-up Questionnaire

In-depth interviews were conducted to examine the relationship between CAD and service quality and the present situation in the industry. A judgement sample of two architectural firms and three clients were selected because there is no need for a large number of interviews to understand the mechanisms of change (Gummesson, 1991b, p. 2). The responses from the interviewees seemed similar regarding the key questions about CAD and service quality, which was interpreted as saturation was achieved (cf. Glaser & Strauss 1967).

The two architectural firms selected for the in-depth interviews were located in Göteborg. One firm had 19 employees and the other firm had 24 employees, which was above average, mean size at S1 was 11 employees. The two firms started in 1969 and 1979 respectively, mean starting date for the firms was 1975 at S1. One of the firms adopted CAD in 1987 and the other one adopted it in 1988, mean value of adoption year was 1987 at S1. Both firms were well known in their local market and they both had “general” clients and jobs. One did larger jobs than the other did. In total, 3 employees were interviewed 1 architect in one firm and 1 architect and 1 engineer in the other firm.1 The architectural firms’ clients were real estate firms.2 The 3 interviewed clients were employees in real estate firms. They had similar positions, to administer architectural work. It was among the issues for this position to specify the conditions for eligible architects—to decide whether CAD should be used or not.

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1 For more information about the people interviewed in the intermediate in-depth interviews see Appendix I.
2 Each firm constructed rental buildings, and they still owned these buildings.
Design of the Follow-up Questionnaire

The information obtained about the architectural industry using the initial survey and in the in-depth interviews made it possible to redesign the questionnaire; open-ended questions were changed to questions that provided the most likely responses as fixed alternatives and an open-ended alternative. This change made the processing of the questionnaire faster (Parasuraman, 1986, 1991), which made it possible to address the questionnaire to one person—the principal. One of the experiences from the initial mailed questionnaire was that addressing the questionnaire to two different actors was confusing for some of the respondents and it delayed the return of the questionnaire in several cases. To address it only to the principal made it possible to question the person who actually responded to the whole initial questionnaire.

The questionnaire was extensively tested among colleagues and friends. After taking into consideration the testers' point of views, the questionnaire was tested by the industry organization SPA. The board of ARKUS tested this redesigned version of the questionnaire; all the people on this board were involved in the industry either as a working architect or by administering research carried out about the industry. The questionnaire was redesigned again, reviewed by the statistical department at Umeå University, and again tested by the industry organization SPA. A redesigned version of the questionnaire was distributed to a test-group of 25 architectural firms. These firms were notified by telephone and asked to comment on the questionnaire in addition to answering it. From these comments and from the findings from the responses, the questionnaire was produced in its final form.

The questionnaire covered the following topics.1 A group of questions under the heading “Enterprise Changes” (questions 1 to 5) addressed changes in specific areas—the firm's name, reconstitution of the firm, ownership, premises, and for parent companies the number of branches—that might have occurred in the firm between S1 and S2. A group of questions under the heading “Background Information” (questions 6 to 19) asked about the number of employees in the firm, need for personnel changes, revenues, the competence in different areas in the firm, and ways to obtain new knowledge. A group of questions under the heading “Goals and Critical Recourses” (questions 20 to 24) asked about plans for the firm, the firm's goals, and resources. A group of questions under the heading “Market” (questions 25 to 30) addressed the perception of the architect's role in a job, niches, ways of acquiring new jobs, the amount of “work done for free,” and activities in the international market. A group of questions under the heading “Clients” (questions 31 to 41) asked for client profiles, ways of finding new clients, perception of what clients valued, size and number of clients, and types and sizes of performed jobs. A group of questions under the heading

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1 A translation of the questionnaire can be found in Appendix J.
“Competitors and Competitive Advantage” (questions 42 to 45) addressed the firm’s as well as the competitors’ competitive advantage, changes among competitors, and the intense of the competition in the industry. A group of questions under the heading “CAD” (questions 46 to 60) addressed CAD use, year of adoption, information sources affecting adoption, reasons for adoption, the extent of use, reasons for use, advantages and disadvantages of use, and the perception of this equipment as a competitive tool. A group of questions under the heading “Recession” (questions 61 to 64) addressed preparations for and managing of the recession and the size of a possible black market. A group of questions under the heading “Managing and Ownership” (questions 65 to 69) asked for background information of the principal and plans about the ownership of the firm.

Sample in the Follow-up Questionnaire

Two different samples could have been used for the follow-up mailed questionnaire: the total sample from the initial mailed questionnaire (805 firms) or some part of it. The latter alternative was used because it was necessary that the firms had responded the initial questionnaire. Changes that had occurred in the individual firm were in focus, why only the firms who had responded to both the mailed questionnaires were of interest. Therefore, only the firms that had provided usable questionnaires in S1 were approached (274 respondents).

Processing of the Follow-up Questionnaires

About 46 months after the initial mailed questionnaire, the follow-up questionnaire was sent out (October 1993). A package containing the questionnaire, return envelope with postage paid, and a letter¹ was mailed to the principal of the firm. After two weeks, the respondent got the first reminder.² About a week after the first reminder, the respondents who had not returned the questionnaire were contacted by telephone. After an additional 3 weeks another telephone call was made to those who had not responded to the questionnaire. About 1 week after the last telephone call a package containing the questionnaire, a return envelope with postage paid, and a letter³ was mailed to the respondents who had not returned the questionnaire. These efforts produced a

¹ A translation of the enclosed letter is found in Appendix K.
² A translation of this letter can be found in Appendix L.
³ There were two different designs of this letter depending on whether it was possible to reach the respondent by telephone or not. The differences between the two letters were minor and this is why only a translation of the letter used when contact by telephone was made is shown in Appendix M.
collection response-rate of 94%\textsuperscript{1} (Table 3.7). The follow-up data collection resulted in 208 responded questionnaires. Included in these questionnaires were some respondents who would be considered as non-survivors (see "Classification of Survivors and Non-Survivors" in section 3.4).

A closer analysis of the non-respondents showed no systematic characteristics of these firms. They seem to have been randomly distributed regarding essential characteristics.

\textit{Table 3.7 Response-Rate in the Follow-Up Mailed Questionnaire}

<table>
<thead>
<tr>
<th>Sample</th>
<th>274</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not in Business</td>
<td>27</td>
<td>Firms that did no business at the time of the data collection</td>
</tr>
<tr>
<td>Not Relevant</td>
<td>12</td>
<td>Firms that did not do architectural business.</td>
</tr>
<tr>
<td>Not Accessible</td>
<td>13</td>
<td>Firms in accessible.</td>
</tr>
<tr>
<td>Total</td>
<td>222 cases</td>
<td></td>
</tr>
<tr>
<td>Replied Quest.</td>
<td>208 cases</td>
<td></td>
</tr>
<tr>
<td>Response-Rate</td>
<td>94%</td>
<td></td>
</tr>
</tbody>
</table>

\textbf{Preparations for the Analyses of the Questionnaires}

At the time of the survey, a boom in the industry was occurring and at the time of the second survey, there was a depression in the industry. About 10% of the firms did not survive. CAD users broke down the following way: 33% were adopters, 20% were late-adopters, and 47% were non-adopters. No new members were added to any of these groups during the studied period.

\textit{Boom and Depression}

When Survey 1 was completed, the architectural industry in Sweden was booming. At this time there was a supply shortage and an abundance of demand. In the building sector the situation was extreme; there was a surplus of potential architectural customers and the architectural firms were doing as much business as possible. They literally worked day and night to serve the market and to put potential customers on hold. In spite of this effort, customers had to be turned down and referred to other firms according to one of the interviewees:

\textsuperscript{1} The response-rate is calculated using the same formula as in the initial mailed questionnaire survey: number of returned questionnaires / number in sample - (non-eligible + non-reachable)) (Dillman, 1978).
Chapter 3

We are working overtime in this firm, if I say that we are 63 employees in the firm it is actually not true, if the accumulated overtime is transformed to number of employees we are about eighty people. We actually work that much overtime.¹

Ninety-four percent of the respondents believed that their firm had experienced a boom in business. There was no significant difference in opinion between the adopters and the non-adopters. According to the respondents, the boom did not last long about one year after the initial mailed questionnaire was sent out (median value: February 1991). There was a difference between mean and median value of about 1.5 years. Several principals believed that the boom would end within a year or less and a few principals thought that the prevailing boom would continue for a long time.

There was awareness among the people in the industry that the boom would end; the architects were well aware that their industry would suffer, one architect said: "Now we are experiencing a boom [in the building sector] but as soon as something happens, there is a decrease in the building of offices, than this part of the sector [the building sector] will be hit very fast."

At S2, the economic situation was totally different; there was a severe recession in the industry. Some people used the word depression to describe the situation. The change in the economic climate was so obvious that there were no direct questions about it in the follow-up questionnaire. The volume of business decreased by about 9% between S1 and S2.² Similarly, there was a decrease in the mean value of employees from 15 to 10 employees between S1 and S2. About 32% of the people in the architectural industry had to leave their jobs between S1 and S2. It was natural that some firms did not survive during this period (non-survivors).

Classification of Survivors and Non-survivors

Survivors and the non-survivors were classified using business area and financial continuity. A survivor received more than half of its revenues from architectural business and was not in bankruptcy or forced into liquidation between S1 and S2. If a firm did not fulfill these two conditions it was classified as a non-survivor.

The firms \( n=13 \) not possible to establish contact with in the fourth data collection needed special attention. Several attempts were made to establish contact with these firms at different times and in various ways. It is therefore unlikely that they still were in business at the time of S2; they are classified as non-survivors, however, due to the uncertainty of CAD adoption in these firms they were excluded from the analysis. Four

¹ All quotations in this chapter are translated from Swedish to English by this author unless stated otherwise.
² The assessment was based on the firms' aggregate sales figures.
of the responding firms received less than half of their revenues from non-architectural business and therefore were classified as non-survivors. Eleven responding firms were classified as non-survivors because they had been in bankruptcy or forced into liquidation.

**Classification Due to Possession of CAD**

At S1, around 34% of the firms used CAD and about 66% of them did not use it \( (n=317) \). Firms that had CAD at S1 and still had it at S2 were classified as adopters. Between S1 and S2, approximately 20% of the firms in the industry adopted CAD and were classified as late-adopters, expressed differently: about 30% of the non-adopters at S1 became adopters before S2. During the same period, around 1% of the firms stopped using CAD, new non-adopters. The situation is illustrated in Figure 3.2.

Adopters and non-adopters are of particular interest. Only the firms that were classified as adopters and non-adopters at both S1 and S2 were included in either the adopters or non-adopters group, which would make the characteristics of the adopters and the non-adopters as distinctive as possible. Several authors have suggested that the adoption of CAD in an architectural firm demands several adaptations; changes that will take time to make (cf. Laplante, 1989; Milliken, 1983; Sakr, 1991; Wikforss, 1992, 1993). Therefore, no new members were added to the adopter group. The next question was whether the late-adopters should be included in the group of non-adopters. The late-adopters were in transition during the studied period why they were not included in the non-adopter group or in the adopter group.

The short time adopters both adopted and stopped having CAD between S1 and S2. New non-adopters used CAD at S1, but between S1 and S2 they stopped having it. Both these groups of firms are similar; they used CAD for at least a short time. The separate treatment of the two groups only comes from the time they got CAD, before or after S1. The question was whether to include these firms in any of the other groups or
to exclude them. A closer analysis suggests that both these groups should be excluded. It seems as if these firms wanted to be an adopter but for certain reasons did not manage to do so.

At S2, about 53% of the firms had CAD, approximately 63% were adopters, about 37% were late-adopters, and about 47% of the firms were non-adopters (n=317). (New non-adopters and the short time adopters were excluded). Figure 3.2 reflects two snapshots of the industry. A summary of the groups used in the book is shown in Table 3.8.

Table 3.8 Classification Due to Adoption of CAD, n=317

<table>
<thead>
<tr>
<th>Category</th>
<th>CAD Status</th>
<th>Portion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adopters</td>
<td>Used CAD at S1 and still used it at S2.</td>
<td>33%</td>
</tr>
<tr>
<td>Late-adopters</td>
<td>Did not use CAD at S1 but used it at S2.</td>
<td>20%</td>
</tr>
<tr>
<td>Non-adopters</td>
<td>Did not use CAD at S1 and did not use it at S2.</td>
<td>47%</td>
</tr>
</tbody>
</table>

Choice of Significance Level

The most appropriate choice of significance level in this book was the 0.1 level. There are 3 levels of significance that are possible to use: 0.01, 0.05, and 0.1 (Daniel, 1990). The significance level, $\alpha$, is the level at which $H_0$ (the null hypothesis) will be rejected. Another way to express the significance level is to compare two means in a t-test. The chosen level of significance will indicate the level of chance the differences between the means will be accepted (Norusis, 1993).

There were several factors affecting the choice of significance level: regional variations, variations between the firms, the adoption of CAD is a process, and the natural setting. This research explores the relationship between IT, professional service, bottomlines, service quality, competitive advantage, and industry structure. This relationship is naturally effected by other changes occurring at the same time in the industry. A nation wide sample might be affected by regional changes in the business cycle (Brown et al., 1993). Despite the prevailing business cycle, some firms in the industry may experience a deviation. Moreover, other firms will not be able to keep up with the changes in the economy. Gutman (1988) says that some established American architectural firms do not have the ability to keep up with the changing situation in the industry. Newer firms that are more aggressive in their behavior will over take these firms, which probably is the situation in the Swedish architectural industry too.

Other studies of adoption of innovations have shown that it is a process (cf. Rogers, 1983), which suggest the use of a 0.1 level of significance. The adoption of CAD has to

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1 For more information see Appendix N.
be carefully planned if the technology is to be used successfully (Sakr, 1991) and changes in the working procedures has to be revised (Wikforss, 1992, 1993). Milliken (1983) has warned for expecting too much to soon; there is a need of time when adoption the technology. Thus, the impact of CAD will probably not be possible to observe immediately. The difference between a firm using the technology and one that does not use it will be clearer over time. Thus, the 0.1 level of significance seems most appropriate to use.

Several other factors suggest the use of the 0.1 level of significance. There were many changes going on and forces affecting the studied sample. The studied relationship was affected by the dynamic situation and probably also diffused by it. Moreover, the relationship was studied in a real situation, the work environment. There was no manipulation done to the studied subjects.

Guide for Finding Relationships

The central effort in the next chapter is to identify characteristics of the firms that adopt IT. Most of these characteristics may be directly found in or may be derived from the literature about segmentation. Segmentation approaches to the industrial markets have been summarized (Rangan et al., 1992). A limiting factor in any approach is information availability. In this regard, early approaches that focused on a "macro" step using externally available information followed by a "micro" step using information developed on a specific firm are attractive (Wind & Cardozo, 1974). The rich and extensive literature on diffusion of innovations has been reviewed (Löwstedt & Norr, 1992). From the basic approach to segmentation and the details supplied from diffusion literature, the following set of macro and micro variables was identified for use.

Macro Variables

Secondary sources provide information that might be used as an initial orientation to identify the tendency to adopt IT. Four variables are used here.

Larger companies tend to adopt innovations earlier than smaller companies (Huang, 1988, p. 66; Mansfield, 1963, 1968). Process innovations such as CAD, in contrast with product innovations, may be particularly affected by the size of the firm (cf. Löwstedt & Norr, 1992). Östnäs (1984) notes that larger firms can devote more time to do tasks not directly related to finishing a job (cf. Cyert & March, 1963) and therefore spend more time on innovation.

Some architectural firms in Sweden have grown by developing satellite branches (Hindersson, 1990). Aspects of both organization and communication theory would suggest that adoption of CAD in such a situation would be favored. For example,
Quinn (1992) claims that companies organized in a group either as parent companies or as branches are early adopters.

Previous studies have suggested that firm age may have a negative effect on tendency to adopt. That is, older firms may not be as willing to adopt innovative products early in the adoption stage as younger firms are (cf. Anderstig & Karlsson, 1987).

It might be expected that the age of the operating manager might have some effect on the propensity to adopt an innovation. In the original study on diffusion, Rogers notes that “the relatively earlier adopters in a social system tend to be younger in age” (1962, p. 192).

Micro Variables

Likewise, there is “micro,” or primary, information that further suggests adoption tendencies, which may prove useful in segmentation. This information, however, is most readily obtained from interviews within the firm. These variables are listed below:

A high degree of specialization in design and R&D departments of manufacturing firms discourages the adoption of CAD (Löwstedt, 1986). Because to work in niches is essentially a more general form of specialization, it might also be expected that a niche orientation might delay innovation introduction.

Webster has indicated that competitors would be unlikely to share information (Webster, 1970). On the other hand, in a competitive situation, firms with a need to develop a competitive advantage would be inclined to adopt IT. A “law of capture” has been described. This generalization says that latest technology takes over demand from earlier generations (Norton & Bass, 1992). One way for firms with a competitive disadvantage to strengthen their competitive advantage would be to be early adopters of an innovation.

Somewhat analogously, firms that perceived themselves as having a competitive advantage seem resistant to adopt any innovation that might change their business. “Competency traps” have been discussed in this respect (Levitt & March, 1988). Perceptions of a competitive advantage would appear to be one of these traps.

Firms used to changes would seem likely to be adoption candidates. Willingness to change seems to favor adoption (Webster, 1970).

Clearly, personnel needs could either promote or retard adoption of an innovation. It is suspected that the latter might be the case; some amount of slack time would appear necessary to integrate the adoption into the firm. This time may be unavailable in a situation where operating personnel is in short supply. Adoption of CAD requires time (Radford & Stevens, 1987; Rocha, 1988).
The operating manager in an architectural firm is frequently a practicing architect (Boström, 1991). The more this individual's time is taken up by job related work, the less likely that the individual would have time to consider adoption of IT. Thus, adoption tendency is expected to vary directly with the amount of administrative work done by the manager (Radford & Stevens, 1987; Rocha, 1988).

Large clients are demanding, “buyers concentration is an important determinant of a seller’s close attention to buyers’ needs” (Narver & Slater, 1990, p. 31). If a firm has two or three clients who are responsible for over 50% of the billings, for instance, it is likely to assume that the firm is very responsive to the needs of these clients.

Assessment of Service Quality and Competitive Advantages

Relative figures for service quality and competitive advantage were used for assessing change; i.e., the change in the variable between S1 and S2 is analyzed.

Service Quality—Customer Demand

Transitions in service quality were assessed by the clients’ change in demand of manually performed architectural services and architectural services done with the assistance of CAD. An increase in demand for any of these two services at the expense of the other one is interpreted as the increasing one has better quality. The customer’s perception defines the quality of a service, which is the prevailing way of assessing service quality also in professional service (Brown & Swartz, 1989, p. 92).

Competitive Advantage

Competitive advantage is hard to assess using a one-dimensional assessment. Day and Wensley (1988, p. 3) have developed a framework for describing the relationship between the elements of competitive advantage and suggest some different assessment dimensions (Figure 2.11). CAD was used as “Sources of Advantage” according to the model in Figure 2.11. In terms of this model, a firm with this technology may have “Superior Resources” and “Superior Skills” compared to a non-adopter firm. The focus of this book is superior skills that are related to the profession, skills that enable the firm to do jobs that are not possible to do without these skills. Here the skills are as important as the CAD system in the ability to provide market exclusive services. “Positional Advantages” provide “Superior Customer Value” and/or “Lower Relative Costs.” “Performance Outcomes” are assessed as “Satisfaction,” “Loyalty,” “Market share,” and “Profitability.” Satisfaction was assessed as the change of productivity and the change of the number of employees.

Change of productivity, instead of profitability, was due to the difference in size of the firms. Productivity was measured as the relationship between the firm’s revenues
and the number of employees in the firm. The variable was chosen as an indicator of competitive advantage because of the increase in productivity that might occur in the architectural firm due to the use of CAD (Kish, 1991; Kendrick, 1988; von Hippel, 1988, p. 5).

Change in the number of employees was used to indirectly assess competitive advantage. The variable was added due to the use of productivity instead of profitability. None or a very small change in the number of employees and a significant change of productivity would suggest that one of the firm groups gained competitive advantage compared to the other groups.

Loyalty was assessed as the relationship between new and old customers. A significant larger portion of older customers would suggest that the firm had more loyal customers. According to Narver and Slater the firm with the highest customer retention also had the highest market orientation, i.e., reflects the customer demands best (1990, p. 31).

Change of market share was assessed using the firm's revenues. Stevens (1991) claims that CAD is an excellent tool for expanding a firm's market share. Due to the difference in size, number of employees, revenues, etc. between the firms in the industry, it made better sense to study the relative (percentage) change of the variable—the firm's revenues.

Due to the specific economic situation that occurred in the Swedish industry after the initial survey, one assessment variable for competitive advantage was added—survival. To survive is the basic and most important task for a firm (Drucker, 1954). The choice of the variable may also be explained from a population ecology perspective. A dramatic change in the market, e.g., a substantial change of production technology, means that a new market is created (Lambkin & Day, 1989, p. 10). The introduction of CAD into the Swedish architectural industry might be an example of such a change. Instead of anticipating that all firms in the market can or will adapt to this fundamental change, some firms will probably not make the transition due to structural inertia. Therefore, two groups of firms will emerge in the industry: firms that use the new technology and firms that do not use it. Population Ecology originates from biology and is applied to organizations in the form of the concept survival of the fittest; i.e., the firms that manage to achieve the best fit to the environment have the best chance to survive (Hannan & Freeman, 1977). A significant difference in survival for the adopters and the non-adopters between S1 and S2 would indicate that one of the firm types was more suited for the changing business conditions in the industry.

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1 For an elaboration of the classification terms for survivors and non-survivors, see the heading "Classification of Survivors and Non-survivors" in section 3.4.
Chapter 4: TYPES OF FIRMS

The aim of this chapter is to present a comprehensive picture of architectural firms and to identify differences between the firms, primarily between adopters and non-adopters. Moreover, changes in the industry are related to the research in this project.

Data from all four data collections is presented in this chapter. Survey 1 (S1) includes the initial in-depth interviews and the initial mailed questionnaire. Survey 2 (S2) includes the intermediate in-depth interviews and the follow-up mailed questionnaire. The data presented in this chapter was selected due to its importance for understanding the purposes set out in this book. In addition, the theoretical framework and the models used in the book guide the selection of data presented.

Chapter 4 is built around the following themes: architectural firms, business, clients, competition, and CAD. Two different aspects were considered when developing these themes: logical flow for the reader and major issues from the theoretical framework. This chapter is organized from the general, architectural firms (professional service) to the specific CAD (IT in architectural firms).

Some comments to the reader:
- In this chapter the valid level of significance is set to the 0.1 level. For more information about this choice, see the previous chapter.
- Weighted data from the questionnaire have been used in the analyses.
- The number of missing cases for the analyzed variables are only discussed in cases that may influence the results.
- All quotations in this chapter come from either of the two in-depth interviews. These interviews were conducted in Swedish and the quotations have been translated by the author.
- Explanations and conclusions in this chapter are done by the author if other not stated. These statements are based on interpretations of the information collected in the two surveys.

Diffusion of CAD

This section provides a framework for the coming ones. CAD adoption is of central interest here. At S1, about 34% of the firms were adopters and between S1 and S2 the adoption continued. The adopters acquired additional workstations and some new firms adopted CAD—late-adopters.
Chapter 4

Distribution of workstations.

About 76% of the adopters had one or two workstations at S1 (Chart 4.1).

![Chart 4.1 Distribution of Workstations at S1](image)

The top 4% of the firms had about 40% of the workstations in the industry. The heavy concentration of workstations in a few firms might indicate some leading firms in the industry regarding the adoption of CAD. The situation may also be affected by size of the firm (group of companies). About 6 employees shared one workstation\(^1\) (Table 4.1).

Approximately 51% of the non-adopters had plans to adopt CAD at S1 (Chart 4.2).

![Chart 4.2 Plans about CAD-adoption at S1](image)

The adoption was usually planned for near future. Approximately 47% of the non-adopters who had plans to adopt intended to do it during the present year (the year the initial mailed questionnaire was sent out) and about 24% of them planned to do it during the following year. About 22% of the non-adopters had plans to adopt the equipment in the future. Adoption was contingent on some subjective constraints, expressed in the questionnaire by some respondents as: "When we consider CAD to be profitable" or "When CAD reaches its potential." Some potential adopters were not clear when they were going to adopt CAD.

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\(^{1}\) Calculated for the individual firm as: (number of architects + number of engineers) / number of CAD stations.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Late-Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD Distribution at S1</td>
<td>34%</td>
<td></td>
<td>66%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAD Distribution at S2</td>
<td>33%</td>
<td>20%</td>
<td>47%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. Workstations at S1, Mean value</td>
<td>3.28 (SD 6.20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architects per Workstations, S1</td>
<td>6.00 (SD 3.95)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. Workstations at S2, Mean value</td>
<td>4.54 (SD 8.02)</td>
<td>1.36 (SD 0.78)</td>
<td>.000</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Architects per Workstation, S2</td>
<td>2.84 (SD 1.59)</td>
<td>2.66 (SD 1.63)</td>
<td>.500</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

**Number of Workstations at S2**

The adopters continued to adopt workstations between S1 and S2. Their number of workstations increased by around 47% and about 3 architects shared one station.1

Around 54% of the adopter firms had one or two workstations. Approximately 76% of the late-adopters had one workstation and about 3 architects shared one station. About 28% of the non-adopters intended to adopt CAD. Around 38% of the non-adopters were ambivalent about adopting CAD (Chart 4.3).

Approximately 50% of the non-adopters that planned to adopt CAD intended to do it within the coming two years. The others did not know when they were going to adopt it or the adoption was linked to a condition expressed by some respondents in the questionnaire as “When a big job turns up” or “As soon as I can afford it.”

Between S1 and S2, there was a drop in the number of firms who intended to adopt CAD from 51% to 28% among the non-adopters. The drop may, perhaps, be explained by the late-adopters’ adoption. The portion of non-adopters that had explicit plans not to adopt increased from 20% at S1 to 35% at S2.

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1 The number of architects sharing a workstation was probably affected by the reduction in the number of employees that occurred between S1 and S2.
These changes might indicate the start of a technological saturation among the non-adopters, which also may explain why the number of non-adopters who do not plan to adopt the new technology will probably increase.

**Architectural Firms**

The adopter firms were large formal firms organized as limited companies whose organizational culture encouraged change. The non-adopter firms were small informal firms in which the principal usually was still active in running the company. These firms tended to resist change. Architects started firms because this provided them with the best way to satisfy their personal values and ideas about architecture. The architects considered themselves artists; questions about management were usually of limited interest because the architect's primary focus was on the profession. Most principals participated in jobs.

**Firm and Management Characteristics**

The majority of the architectural firms were established rather recently, mean starting year 1975 (Table 4.2). Adopter firms were significantly older than the non-adopter firms were, mean difference 9 years. In about 78% of the firms, the founder was still active. This person(s) was active in significantly more non-adopter firms. One explanation for this might be the difference in the start year for the two groups of firms. There was no significant difference in the principals' age between the adopters and the non-adopters; mean age for a principal in the industry was about 46 years,\(^\text{1}\) which suggests that a new principal had succeeded the founder in the adopter firms.

Unexpectedly, the adopters were the older firms (cf. Anderstig & Karlsson, 1987). It was anticipated that the principals in the adopter firms would be younger than the principals in the non-adopter firms (cf. Rogers, 1962, p. 192), but there was no significant difference in the principals' age in the two groups of firms. The activity of the founder seems more important for the rejection of the new technology than the age of the firm and the age of the principal. A plausible explanation might be that the founder considered the firm to be his/her property. Usually the firm carried both the first name and surname of the founder. The challenge for the founder was to start the firm and develop business. The next generation of principals looked for new challenges and they might have considered the adoption of CAD to be such a challenge. These principals may also have a different perception of the firm. They might consider it an

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\(^1\) Please note that all principals of 65 years or older were excluded. For more information about this discussion, see 3.3 ("Processing of the Initial Mailed Questionnaire").
independent entity that should continue to exist regardless of the principal's lifecycle. When the present principal wanted to cut back he/she will be succeeded by a new one.

The principal was usually a male in both the adopter firms and the non-adopter firms; about 90% of the firms had a male principal. It seems as if the female principals were concentrated in the late-adopters. About 24% of the principals were female in this group compared to 6% in the other two groups—adopters and the non-adopters. This significant difference suggests that the female principals had a specific behavior regarding the adoption of CAD. They seem to be late-adopters, somewhere in the middle of the population, in the proximity of early and late majority in the words of Rogers (1962, 1983). Between S1 and S2, the portion of female principals in the industry decreased by 20%; however, the number of female principals in the three firm groups were about the same as at S1. Due to the small number of female principals in the industry, the percentage change should not be overemphasized. Nevertheless, there is an indication that a number of female principals were succeeded by male principals.

House architecture education was the most common education for a principal; about 75% had this education. Around 11% of the principals had an interior decorator education or a landscape architectural education. Principals in the adopter firms tended to have a house architect education or an engineer education. In the non-adopter firms, the principals usually had an interior decorator education or a landscape architectural education.

In Sweden, there were three schools for house architecture education and two for the interior decorators and two for landscape architects. Due to this small number of schools it is likely that there were similar professional values at all of them. Especially since these schools were located near one another. In addition, in the architectural firm the prevailing professional values were transformed to the "new" architecture. The principals were very much "fostered" into the same paradigm regarding professional values and business values.

Architectural firms were very hierarchical; all drawings had to be approved by the principal. Roughly, the overall task for the employees was to realize the principal's ideas. When the architects left their formal education programs their apprenticeship started, one interviewee said: "I have been employed at one architectural firm for five years, but after that I started my own business." Young architects were required to do simple tasks and as time went on the complexity in the tasks increased. After their apprenticeship, their drawings reflected the characteristics of the principal. Ultimate career advancement was achieved when the architect had direct responsibility for clients and had become partner in the firm.

The hierarchical structure of an architectural firm was stressed by the clients' way of putting together a job team. One client said, "it is obvious that most architectural firms
are dominated by some names and then there is a group of efficient workers in the firm.” The clients supported the structure by selecting architects with a good reputation. It is probably not too farfetched to argue that this process makes some architects more valuable than others. The architects with the best reputations are sought for the best jobs with respect to their profession, e.g., these architects’ jobs are candidates for publication in architectural journals.

Table 4.2 Management Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Founded, Year mean value</td>
<td>1970 (SD 14)</td>
<td>1979 (SD 11)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Founder Active in</td>
<td>72%</td>
<td>87%</td>
<td>.003</td>
<td>Y</td>
</tr>
<tr>
<td>Sex, Principal</td>
<td>94% Male</td>
<td>94% Male</td>
<td>.948</td>
<td>N</td>
</tr>
<tr>
<td>Age, Principal Mean Value</td>
<td>46 (SD 6)</td>
<td>47 (SD 8)</td>
<td>.578</td>
<td>N</td>
</tr>
<tr>
<td>Education Principal</td>
<td>House arch.</td>
<td>Interior Decorator, Landscape arch.</td>
<td>.002</td>
<td>Y</td>
</tr>
<tr>
<td>Work Time, Jobs Administration</td>
<td>66% (SD 24)</td>
<td>81% (SD 14)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>32% (SD 25)</td>
<td>15% (SD 8)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>2% (SD 7)</td>
<td>4% (SD 12)</td>
<td>.085</td>
<td>Y</td>
</tr>
</tbody>
</table>

Work-time.

Almost all, 99%, of the principals in the architectural firms participated in jobs; about 36% of the principals worked 90% or more of their time with jobs. The average principal spent about 76% of the work-time participating in jobs, around 21% on administration, and approximately 3% on other activities such as “education,” “facility management,” and “real estate agent.” Principals in the adopter firms worked significantly less with jobs than the principals in the non-adopter firms did. The time spent for administering was approximately an inverse of the time spent working on jobs.

The distribution of a principal’s work time was usually a reflection of the firm size; in a smaller firm, there was less need for administrative tasks. The principals’ desire, almost demand to participate in jobs, was an explanation for the distribution of work-time revealed in the in-depth interviews. This desire was also one of the most important reasons for starting the firm.

The more time a principal spent doing administration work, the more likely an adoption would occur, and vice versa (Radford & Stevens, 1987; Rocha, 1988). A logistic regression analysis showed that about 71% of the firms could be correctly classified as adopters and non-adopters using the variables about utilization of work-time.
Attitudes of the principal role.

There were two main reasons why a person became a principal of a firm according to the architects: "I do it because I am interested in this task." and "I do it because someone has to do it." An architect who was interested in being a principal described the selection process in the following way: "In the beginning there was no one who was principal. But because I was interested in administrative questions, I became principal." One architect, who became principal because he believed someone had to do it, responded to the question "So you are the principal, now what?" in the following way: "Yes, someone has to do that job too. Nobody wants to be president in this firm; no one even wants to go to the meetings." The reason no one wanted to be the principal or participate in meetings was explained by the interviewee in the following way: "The most fun is to draw... You have to give up drawing for a while [to be a principal]."

It was very important for the principal to participate in actual projects that required designing and drawing. Principal's tasks were done when there was time. The principals did not identify themselves as administrators, one architect said, "I do not consider myself as an administrator even though I am the principal because I participate in the project work too." It seems as if the principals had a strong need to be related to project work. They probably got their professional identity from participating in project work. Doing only administrative tasks would mean that a principal's professional identity would be lost.

Establishing Procedure and Company Formation

Data from the initial mailed questionnaire revealed that firms were established from 1915 to 1989. About half of the firms in the industry had been in business 10 years or less (Chart 4.4). The prevailing situation of prosperity and the relative simplicity in starting an architectural firm explains the large number of firms that started relatively recently. By and large, there were two different reasons for starting an architectural firm according to the architects: "I started the firm with some pals from Teknis (Royal Technical University in Stockholm)." and "I worked there [another firm] for ten years and then we started this firm... There were three of us who [all from the same firm] that started this new firm."

At S1 the market situation was prosperous and a number of employees saw an opportunity to start a firm by themselves. One principal expressed that the people who left the firm evaluated their present situation in the following way: "Do I want to stay here and be on the board of a large business? There is a chance today, there is much to do, and I do not want to wait and see." There were no reasons for hesitating in establishing a firm by oneself or with some colleagues in the prevailing market
situation—a surplus of demand. When some friends from school started a firm it was usually because they had won an architectural competition. The winners automatically\(^1\) were awarded the job of developing the ideas from their entry.

![Chart 4.4 Starting Year for the Firms](chart)

The desire to draw was the most frequent argument used for explaining why people started an architectural firm. Administration was a large part of their work time and they desired to make blueprints according to their preferences and values without answering to another person or the tradition of the firm they worked for. Those people who started a new firm could usually continue to do business with the clients they had served before.

It is simple to start an architectural firm. There was no need for any particular equipment; however, a change was going on. One architect expressed the changed situation in the following way,

\begin{quote}
Today it is probably necessary to judge the profitability for a longer period, more than a year. It is necessary to do so due to the drawing boards that are used today. There is no one more than we [the three partners] that use this kind of table [two trestles and chipboard]. Instead, the others have the advanced things that cost something between 25 to 30,000 [Swedish crowns]. The fixed costs are much higher today.
\end{quote}

Here drawing boards were used as an example for the increased need of investment when starting an architectural firm. CAD would have served the same purpose.

\(^1\) This situation has changed and the firm that wins does not automatically get the job to develop the suggested design concept.
An architect that had been active for several years in the industry had usually started several firms in different configurations. One interviewee gave the following description,

I am fifty-two years old and I left Teknis in 1961 [Royal Technical University in Stockholm] and I have been working in the building industry since my first employment. I have been employed at one architectural practice for five years, but after that, I started my own business in 1967, rather long time ago. At the start I worked with my father for three years and after that I joined two colleagues to start a firm when we won a competition in Haga for the design of a cultural center. One of my colleagues died, and the two of us left, split in 1978. After that, I worked with my own business up to 1981, when we started this practice. Thus, I have been working in many different constellations and I suppose that I am rather representative for this industry, the arrangement varies very much.

When the founder retired, two procedures for the firm could be identified: either the firm was sold or the founder closed the business. In the former case, the firm was frequently sold to employees, usually more than one. In addition, after the firm was sold the founder could, to some degree, still be active in the business. The second closing procedure required the personnel to leave the firm and the founder kept the firm, i.e., the judicial right to do business in the name of the firm. The business usually changed and the founder only took the jobs that for some specific reason were appealing to him/her as sole employee of the firm.

Firm organization.

There was a significant difference in the company’s organization between adopters and non-adopters at S1. Adopters were organized as limited companies, and non-adopters were organized as limited companies or private firms (Table 4.3). The situation was approximately the same at S2. It seems as if the organization of limited companies where the financial risks for the owner(s) are limited favored an adoption. Due to this difference in company organization between the two groups of firms, it was natural to find that the adopters were significantly more frequently members in a group of companies. During the studied period, this difference between the two groups of firms increased.

An adoption of CAD would be more frequent among firms that were members in a group (cf. Quinn, 1992). As member in a group the individual firm “increased its size”. The larger the revenues and firms are the smaller the risks of a CAD investment are. These firms have the financial resources and the time for CAD training during regular work hours. It is possible for the large firms to use work time for training in the early
CAD jobs. The difference between CAD training and job work is subtle. Time is also critical for getting the most appropriate system to the firm. At S1, the firms used 308 different combinations between the software and the hardware.

Table 4.3 Organizational Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Form, S1</td>
<td>91% Limited Company</td>
<td>64% Limited Company</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Firms Members in a Group, S1</td>
<td>26%</td>
<td>5%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portions of Firms Members in a Group, S2</td>
<td>30%</td>
<td>3%</td>
<td>.000</td>
<td>Y</td>
</tr>
</tbody>
</table>

In the non-respondent follow-up telephone calls at S1, the non-respondents stressed the importance of education. Firms were often closed because the work was too strenuous, not leaving enough time for other interests. Moreover, education in small firms was limited. Work time available had to be dedicated to project work. According to these people, the situation was intolerable in the long run. These employees believed that education should be made possible in an architectural firm.

Ownership structures.

An adopter firm was owned by significantly more people than a non-adopter firm was (Table 4.4). The significantly different company forms for the two types of firms may partly explain the situation; a private firm is owned by one person and a limited company may be owned by several people.

Table 4.4 People on the Board and Owner Concentration

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>People on the Board</td>
<td>4.36 (SD 3.05)</td>
<td>2.47 (SD 0.83)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>External Board Members</td>
<td>1.73 (SD 1.09)</td>
<td>1.38 (SD 0.65)</td>
<td>.078</td>
<td>Y</td>
</tr>
<tr>
<td>Percentage of External Members</td>
<td>47% (SD 29%)</td>
<td>51% (SD 14%)</td>
<td>.411</td>
<td>N</td>
</tr>
<tr>
<td>Founder’s/Principal’s Owner Share</td>
<td>75% (SD 35%)</td>
<td>98% (SD 12%)</td>
<td>.000</td>
<td>Y</td>
</tr>
</tbody>
</table>

Often firms kept key persons in the firm during the boom by making them partners. There were significantly more partners in the adopter firms due to the size of these firms. Partnership usually lead to a chair on the board, which explains why these firms had larger boards and why there were so relatively few external people on the boards. It is possible to assume that a larger number of people on the board correlated to early

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1 Early jobs refers to at what time CAD was adopted regarding the start of the adoption in the industry.
adopters. A large board probably means that younger employees were included in the board. These employees would see a need for CAD before the management did.

**Professional Attitudes and Job Management**

The spirit of an architect was related to inviolable professional values. To be an architect was a way of life not a profession with regular work hours; one architect expressed by the following words: “The architectural profession is as you surely already have understood or will come to understand a rather difficult profession to choose, because for many people, but not all of them, it becomes a way of life.” There seemed to be no time constraints for being an architect; an architect judged, according to the initial in-depth interviews, every situation, from an architectural perspective. The architects considered the design of buildings as an activity that shaped and affected society.

The architects were considered members of a craft-guild; one interviewee said: “They [the architects] are a pronounced craft-guild.” For people active in the industry that did not belong to the craft-guild the existence of such an organization was obvious, one interviewee expressed in the following way: “I am not an architect, so perhaps I might see it more obvious than the architects themselves do. They are a small clergy.” Much of an architect’s identity was related to the craft-guild. The important judges of the architect’s work were their colleagues in the industry; one architect said: “It is important to be regarded as a skilful professional among your colleagues, as a capable person. The judgement has its importance in the craft-guild.” A craft-guild was possible because of the number of architects. About 5,000 architects were active in Sweden. This made it possible for professionals to monitor themselves and control the quality of work produced.

The architects wanted to realize their personal values and beliefs through the design of buildings. The design process was a highly personal issue with respect to the ideas that guide design. It was fascinating to hear the architects express their sensitive perception of buildings. An architect’s professional identity influenced the design of a building to such a degree that the professional clients could frequently identify which architect had done the design. One of the interviewed clients in the intermediate interviews said the following, “I think that you can recognize the work of architects when walking around town and looking at the different buildings. You see which architect has done which building. It is very obvious at many places.”

Architectural magazines evaluate an architect’s work. It was very prestigious for a Swedish architect to have a building published in the national magazine “Arkitekten.”
A publication was a strong indication of the architect’s rank according to the present architectural values in the craft-guild.

**Outstanding architects.**

There were similar and at the same time significantly different opinions in the industry regarding outstanding architects. A ranking of the three most outstanding Swedish architects showed the following result; about 31% had named the same person for the first place “Designer One.” The second highest ranked architect, "Designer Two," was selected by about 24% of the respondents. The in-depth interviews indicated an internal ranking of the practicing architects but none of the interviewees was willing to discuss this matter with an outsider. The unwillingness was also recognized in the questionnaire, 18% did not respond to the question. A large portion of the adopters and non-adopters considered designer one and designer two to be outstanding architects (Table 4.5).

**Table 4.5 Most Outstanding Architects**

<table>
<thead>
<tr>
<th>Architect</th>
<th>Adopters’ Ranking</th>
<th>Non-adopters’ Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designer One</td>
<td>Third (16%)</td>
<td>First (39%)</td>
</tr>
<tr>
<td>Designer Two</td>
<td>First (31%)</td>
<td>Second (20%)</td>
</tr>
<tr>
<td>Sum of Percent</td>
<td>47%</td>
<td>59%</td>
</tr>
</tbody>
</table>

According to the adopters, “Designer Two” was the most outstanding architect, chosen by about 31% of these firms. Around 39% of the non-adopters had noted “Designer One” as the most outstanding architect. When considering these responses it is important to recognize the character of the architectural business. According to the architects, it is an artistic profession; therefore, the choice of outstanding architect is probably a subjective choice. It was interesting to note that a cross tabulation between “Designer One” and “Designer Two” for the adopters and the non-adopters showed significantly different opinions (Table 4.6). The adopters and the non-adopters might have different professional values.

**Table 4.6 Ranking of Outstanding Architects**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding Architect, Ranking</td>
<td>D1 16%</td>
<td>D1 39%</td>
<td>.005</td>
<td>Y</td>
</tr>
<tr>
<td>Designer One, D1</td>
<td>D2 31%</td>
<td>D2 20%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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1 Respondents, approximately 19%, responded “do not know” and “do not want to respond.” These responses were excluded when processing the question.

2 P value 0.007.
Attitudes about the profession and the firm.

The principals considered themselves artists and architecture as a special kind of art; one architect said: "Everyone in this industry considers themselves to be creative types, individualist, therefore, we want to be lone wolfs." The profession was extremely important for the architects. According to one interviewee, "There are very many architects that are convinced that what they do is the right thing and it really does not matter if they force themselves into bankruptcy." Starting an architectural firm was a way for the principal to practice the profession. There was an intrinsic conflict between the firm and the profession. The architects tended to use the word practice instead of firm. According to the architects, practice was a word related to the profession and firm was not. The word firm was associated with administering and bookkeeping for the architects according to the initial in-depth interviews. One interviewee noted that the firm was a secondary concern for the architects, "There was really no discussion about the firm. It was nothing especially interesting; the interesting matter was the architecture. The focus was on the architecture. That is the situation today too." Managing a firm interfered with the actual practice of architecture. Another way to express the contradiction between the profession and business management came up in the attitudes about the industry culture. There was no overlap between the firms regarded as successful businesses and firms regarded as producing excellent architectural work according to the initial questionnaire.

The attitude in the architectural schools among the students was, according to the interviews, that the students should start their own firms. One architect said: "This was the common attitude. Most of us had in mind a future as independent architects with our own practice. We joked around and said that those who did not manage to do that had to be city architects." Even if the ambition was to start a firm the establishment of it was not of primary interest according to the architects, "The firm was not something that came to mind, it was something that came along when going into business." The firm was a way to produce work in the profession. One architect described the start of the firm in the following way: "The situation had to be organized quickly so that the work could start, people had to be hired and premises had to be found." In the interviews, the process of starting and managing a firm was described by the architects as something that more or less went on automatically, "It was about managing a lot of money and personnel and more money." A change has occurred among the architects concerning starting a firm. In the in-depth interviews the older people in the industry said that the new architects look at themselves more as employees and acted that way too, they want to work regular office hours.

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1 See the headline "Industry Culture" in this chapter.
One architect expressed the relation between the profession and the firm in the following way,

Yes, I would like to call that for a business mission but I would claim that the fundamental idea is not really business-like instead it is professional. It is the professional fellowship that is important. There are many interests that push the architectural firms to act business-like. We ought to do that [act more business-like]. There are many people who tell us to do so. We try to do it, we try to assert our category prices with the clients and we get a decent revenue for our jobs so in that way we act like a business, but we are not different from the others [the other architectural firms] in any way.

The firm was a means for the profession and the managing of it was not central in the architects' mental picture of being an architect. There was a clear mental distinction between the firm and the profession. The situation was naturally a deliberate choice; however, the choice might have been made without any considerations about the paradigm of an architect.

There was a change going on in the industry towards a more business-like behavior. A common perception among the architects was that this development demanded a more business sensitive firm. The jobs became larger and more complex, i.e., more people and money were involved in each job. The architectural firms' counterparts were more business-like. One architect expressed the situation in the following way: "I think that the architectural practices are becoming more and more business-like. They are certainly trying. Personally I am not a good businessman.” The architects considered themselves to be inadequate as businesspeople. This would result in a slow transition to more business-like behavior in the industry—perhaps it will take generations.

**Job Management.**

Significantly fewer people were responsible for jobs in the adopter firms compared to the non-adopter firms (Table 4.7). Job management refers to the people in charge of and responsible for jobs. The relationship between the number of architects responsible for jobs and the total number of architects might be interpreted as concentration of responsibility in the firm and its hierarchy. On the average firm, more than half of the employees were responsible for jobs (0.63).

The significant difference between the adopters and the non-adopters was strongly affected by the large number of one-person firms, about 25% of the firms. Even if these firms were excluded there was a significant difference between the adopters and the non-adopters. In the non-adopter firms, there was less concentration of responsibility than in the adopter firms according to the analysis. About 40% of the employees in the adopter firms and around 60% in the non-adopter firms were responsible for client jobs.
Types of Firms

In relative terms, few people in the adopter firm had contact with clients. In other words, the adopter firms were more hierarchical than the non-adopter firms were.

Table 4.7 Responsible for Jobs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portion of Architects Responsible for Jobs</td>
<td>Mean 0.48 (SD 0.26)</td>
<td>Mean 0.78 (SD 0.28)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>One-Person Firms Excluded</td>
<td>Mean 0.45 (SD 0.23)</td>
<td>Mean 0.71 (SD 0.30)</td>
<td>.000</td>
<td>Y</td>
</tr>
</tbody>
</table>

Personnel and Knowledge

Approximately 91% of the architectural firms were classified as small firms at S1 (Table 4.8).

Table 4.8 Firm Size at S1

<table>
<thead>
<tr>
<th>Firm Size</th>
<th>Small, 1-19 Employees</th>
<th>Middle Size, 20-49 Employees</th>
<th>Large, 50 Employees or More</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution</td>
<td>91%</td>
<td>7%</td>
<td>2%</td>
</tr>
</tbody>
</table>

The size of the firms ranged from one employee (24%) to 497 employees. The mean size of an architectural firm was approximately 11 employees and the median size was around 4 employees. The difference suggests that several firms had few employees and some had many employees (Chart 4.5).²

Significantly more people worked in an adopter firm, about 26 employees, compared to a non-adopter firm, about 3 employees (mean values) (Table 4.9). A specific analysis

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¹ The firms were classified according to Gutman (1989).
² Please note that a line starting from the origin of coordinates and having a 45-degree slope would have showed an even distribution of the different firm sizes.
Chapter 4

of CAD adoption and firm size showed a close relationship between these two factors. All large and middle size firms were adopters. This finding should be interpreted with care because 73% of the adopters were small firms with fewer than 20 employees. A specific analysis of the small firms showed that the adopters were significantly larger than the non-adopters were. A logistic regression analysis showed a strong association between adoption and firm size. About 87% of the firms were correctly classified (see Chapter 3). Larger firms were more often early to adopt than small ones (cf. Huang, 1988, p. 66; Löwstedt & Norr, 1992; Mansfield, 1963; Mansfield, 1968; Östnäs, 1984, p. 21).

Need for Personnel.

There was a tremendous need for more architects and engineers in the industry at S1. It was almost impossible to recruit anybody from these professional categories according to the interviewees in the initial in-depth interviews. Some firms tried to recruit people who were still enrolled in formal architectural education programs.

About 55% of the firms in the industry needed for more personnel (architects and/or engineers). Significantly more adopters than non-adopters needed additional people. In addition, there was a greater need among the adopters for more personnel.1 The relative need for personnel in relation to the number of people in the firm, showed that non-adopter firms needed more personnel than adopter firms. Despite the intensive need for people among the non-adopters in relative terms, the adopters continued to be the larger firms. These figures were estimates provided by the firms.

Some principals expressed a desire to keep the present size of their firm if possible because the present size was optimal. The principal had time to participate in jobs and the time to manage the firm was not too extensive. One architect expressed it in the following way: “The goal is to have fewer than 15 employees, maybe 12, or something like that. That is not possible when one has so much to do as we have. I think 15 employees are too many.” The situation in the industry supports the idea that the need for personnel would delay CAD adoption. In relative terms, the non-adopters had the greatest need for employees but these firms did not have the time to adopt CAD use (cf. Radford & Stevens, 1987; Rocha, 1988).

Recruitment arguments.

The three most important recruitment arguments for architects were analyzed. “Stimulating work and challenging tasks” was the most frequently used argument for

1 The analysis of the number of employees needed was only performed for the firms with an apparent need.
both adopters and non-adopters at SI (Chart 4.6); a number of respondents had only used this alternative. Significantly more adopters than non-adopters used this alternative as well as the alternatives “Higher salary,” “Continuous education,” and “Possibilities for career.” Non-adopters had used the open alternative significantly more than the adopters had and the noted recruitment arguments were usually related to the working environment, “A good team to work in” and “Nice working environment and good colleagues.” Some respondents had used this alternative to declare that they never made new hires. It was common among the non-adopters that they never hired new employees. Besides the ones who had noted this response in the open alternative about 42% of the non-adopters did not respond to the question, which might be an indication of its irrelevance to them.

Chart 4.6 Recruitment Arguments at SI. The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), “Higher salary,” “Partnership,” “Stimulating work and challenging tasks,” “Work abroad,” “Continuous education,” “Possibilities for career,” “Possibilities to start a branch,” “Fringe benefits,” and “Other.”

The adopters seemed to be functioning as large firms do by offering continuous education and possibilities for career development. Non-adopter firms also offered stimulating work and challenging tasks but in these firms a good and familiar working environment were emphasized more often. Eventually the non-adopters stressed arguments like these because that would differentiate them from the adopter firms. Significantly more non-adopters had only noted one argument, which underlines the importance of the working environment as a recruitment argument in these firms. Another reflection is the way new employees are recruited in a non-adopter firm; it seems to be informal and the principal often already knew the potential employee according to the initial in-depth interviews.
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Number of employees at S2.

There was a dramatic decrease in the number of employees in the firms between S1 and S2, about 32% of the personnel left the firms during this period. The adopters decreased their number of employees more than the non-adopters did, about 33% compared to approximately 22%. It seems as if the adopters had more problems in keeping their personnel between S1 and S2. The non-adopters probably had to use other means for managing the recession than decreasing their pay roll. At S2, approximately 17 employees worked in an adopter firm and about 2 employees worked in a non-adopter firm (mean values).

Knowledge profile.

Knowledge about house architecture was the most developed knowledge in the firms (mean value), which, of course, does not mean that all firms had this type of knowledge. Each respondent ranked their firm's knowledge for several subjects from "none" (1) to "excellent" (7). A mean ranking of the self judged knowledge levels among adopters and non-adopters for the suggested subjects are shown in Chart 4.7.

![Chart 4.7 Knowledge Profiles at S1 (mean values). The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), "Economy," "Law," "House-architecture," "Interior design," "Landscape-architecture," "Personnel management," and "Job management."](image)

Adopters ranked their knowledge on average significantly higher than the non-adopters did except for knowledge about "Landscape architecture." Landscape architecture is a different type of knowledge according to the interviewees. Interior decorating is

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1 Please note that firms that started between S1 and S2 were not considered, therefore the number of employees who left the firms might not be the same as the number of people who had to leave the industry.
possible to do even for a house architect but landscape architecture is, as the architects expressed it: "harder to dabble in." The adopters had significantly greater knowledge in subjects unrelated to professional knowledge—"Economy," "Law," and "Personnel management"—because the size of these firms. It was somewhat more surprising that the adopters ranked their professional knowledge higher as well. In a non-adopter firm the employees probably specialized in one of the categories of architectural knowledge. In a presentation of mean values, a lack of knowledge in one subject affects the level for all the firms in the group. Thus, a conservative interpretation of the differences in knowledge profile means that the adopters had a broad knowledge profile and the non-adopters were specialized.

Between S1 and S2, the main change in knowledge between the two firms was that the non-adopters had significantly increased their knowledge in personnel management and the adopters had decreased their knowledge in this area. There was no significant difference\(^1\) between the two groups of firms in this subject by S2. One explanation might be that fewer employees left the non-adopter firms than employees who left the adopter firms by S2.

Sources for additional knowledge.

Client jobs provided the most important source for additional knowledge; it was through such regular work that the architects learned new skills and knowledge. Six different sources for additional knowledge were ranked by the principals from "none" (1) to "dominating" (7). The ranking of the mean values for adopters and non-adopters are shown in Chart 4.8.

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\[^1\] P value 0.224.
The second most used knowledge source for adopters was internal education and for non-adopters it was self-study. Internal education in the adopter firms may be the same thing as self study in the non-adopting firm. Internal education was done by one person and therefore classified as self-study. Of course, there are differences in the two sources of knowledge; internal education is formalized and compulsory and self-study is informal and voluntary. According to the principals, two sources were used to a lesser extent—architectural competition and new employees. This may be an indication of the homogeneous architecture that a firm produces according to the principal.

In the initial in-depth interviews, gaining knowledge on field trips was highly appreciated. Most firms in the industry arranged once a year or every second year a field trip for all employees. These trips went to places that were especially interesting due to their architecture—London, Paris, New York, and Istanbul. At S2 the adopters used architectural competitions as a source for new knowledge more often than at S1. One explanation may be the difference in business climate. According to the intermediate in-depth interviews, participating in competitions was a way to find new jobs. A general change in the clients' behavior between S1 and S2 was their increased interest in competitions. Due to the less demand for architectural services, a client gained knowledge about several architectural firms for very little money by arranging a competition (call for elaborated proposals).

Table 4.9 Data about the Personnel in the Firms

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Val</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of People, S1</td>
<td>26 (SD 61)</td>
<td>3 (SD 2)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Size of Small Firms, S1</td>
<td>9 (SD 5)</td>
<td>3 (SD 2)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Firms in need of personnel, S1</td>
<td>70%</td>
<td>30%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Need for Number of Employees, S1</td>
<td>5 (SD 8)</td>
<td>2 (SD 1)</td>
<td>.001</td>
<td>Y</td>
</tr>
<tr>
<td>Relative Need of Employees, S1</td>
<td>33% (SD 24%)</td>
<td>95% (SD 73%)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Recruitment arguments, S1</td>
<td>Salary (.005)</td>
<td>Branch (.078)</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tasks (.000)</td>
<td>Other (.038)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Education (.000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Career (.095)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Employees, S2</td>
<td>17 (SD 41)</td>
<td>2. (SD 2)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Change in Number of Employees</td>
<td>-9 (SD 23. )</td>
<td>-0.6 (SD 1.4)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Percentile Change</td>
<td>-27%</td>
<td>-12%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Subjects with Highest Knowledge, S1</td>
<td>House Architecture</td>
<td>Landscape</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Economy, Law</td>
<td>Architecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest Ranked Knowledge Sources, S1</td>
<td>1, Client Jobs</td>
<td>1, Client Jobs</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2, Internal Education</td>
<td>2, Self-Studies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Table 4.10 Outstanding Business Behavior and Outstanding Architectural Performances

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-Adopters</th>
<th>P Value</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding Business Behavior, Top Firm</td>
<td>73%</td>
<td>78%</td>
<td>.428</td>
<td>N</td>
</tr>
<tr>
<td>Outstanding Architectural Firm, Top Firm</td>
<td>42%</td>
<td>67%</td>
<td>.001</td>
<td>Y</td>
</tr>
<tr>
<td>Second One</td>
<td>13%</td>
<td>7%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Critical Changes in the Firms

Critical changes in a firm over the last three years\(^1\) were significantly more frequent among the adopters than among the non-adopters at SI (Chart 4.9).

Chart 4.9 Critical Changes in the Firm at S1. The abbreviations in the chart were expressed as follows in the questionnaire, (from left to right) “The firm’s organization,” “Expanded,” “Premises and technical equipment,” “Personnel,” “Market and marketing,” “Ownership,” and “Unchanged.”

Changes in the firm seem to have been related to the size of the firm according to the initial mailed questionnaire. The adopters had done organizational changes—“larger working tasks” and “increased turnover”—to a greater extent than the non-adopters had. The adopters had also expanded more than the non-adopters had—“Established more branches” and “Bought another firm.” In addition, they had increased their personnel. They also changed more equipment and facilities in the firm than the non-adopters had—bought CAD or changed locations. The non-adopters had also made these types of changes (not bought CAD of course) but not as frequent as the adopters had. “No

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\(^1\) Respondents were given room to note three response alternatives: the first one being the most important one. Each noted response alternative was processed in the same way. The answers to the question were content analyzed according to responses and their sub-texts. Within each group, the answers were coded into subgroups to achieve a better structure of the answers and a possibility of elaborating the findings. In every case, each group and each subgroup covered a range of different answers. Similar answers were first coded into subgroups. These subgroups were organized into larger groups. The name of a group and a subgroup were chosen to reflect the answers. This information should be considered when the results are interpreted.
Industry Culture

Industry culture was identified by asking the principals to rank the three most outstanding architectural firms and architects. About 72%\(^1\) of the respondents had noted the same firm as the most outstanding regarding business behavior. Adopter and non-adopters gave similar responses (Table 4.10). Outstanding business performance was related to the size of the firms; firms were mentioned for their outstanding business performance. About 52% of the firms in the industry had pointed out the same firm as the most outstanding one concerning architectural performance. Adopters had a significantly more scattered opinion regarding this question in comparison with non-adopters. The adopter firms had different professional values compared to the non-adopter firms. This difference was also noted in opinions about the most outstanding practicing architect. A situation of two different professional ideals emerged.

There were no overlapping responses between firms known for outstanding architectural performances and firms known for outstanding business behavior. The in-depth interviews revealed that these characteristics were not related.

The identity of the firm.

An architectural firm's image depended on the evaluation of the buildings they designed. One interviewee expressed the situation as follows:

One looks at houses;\(^2\) I do. It is only the houses that count. How they are designed, how they are planned. That is absolutely the only criteria. That is what counts. How a firm organizes its internal organization is not interesting within the industry.

A firm's professional performance was the only criteria for evaluating its quality of work; outstanding business performance was not considered important. Firms known for their business performance did not have the same reputation. This way of thinking really stresses the performance of the principal and reduces the rest of the firm to production recourses.

\(^1\) The respondents seem to have experienced these questions in the questionnaire as a delicate subject, especially the question about firms that may be outstanding in the future, several firms "do not know" and "do not want to respond." In the discussion about "Industry Culture" these responses were classified as missing cases.

\(^2\) The architects tended to use the concept houses when they wanted to address buildings in general.
change” was the single most frequently noted answer among the non-adopters. Perhaps the number of non-adopters responding this way might had been even higher (about 34% of them did not respond to the question). Changes among the non-adopters were usually related to their market activities, “More diversified categories of clients,” or “More clients.” The adopters seem to have been more discontented with their situation than the non-adopters were. They had made changes in the firm and they were used to the changes. The adoption of CAD may be regarded as a change (cf. Webster, 1970).

Critical changes between S1 and S2.

Three specific types of changes were assessed between S1 and S2: changed name, changed ownership, and changed premises. The most frequent changes were ownership and premises (Table 4.11). Significantly more adopters than non-adopters made these two changes. During the recession, the adopters had to release more personnel than the non-adopters had. New partners or partners that left were the most frequent reasons why the firms had changed their ownership during this period. When the number of employees decreased, the premises became too large. The change of a firm’s name was rarely done.

Table 4.11 Significant Changes in the Own Firm

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant Changes, S1</td>
<td>Expanded 24%</td>
<td>No Change 37%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Changes at S2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>33%</td>
<td>12%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Changed Premises</td>
<td>38%</td>
<td>26%</td>
<td>.047</td>
<td>Y</td>
</tr>
</tbody>
</table>

Business

The principal for an architectural firm usually held the vision for the firm. Employees received this vision—mission and goals—through regular work. Frequently there was one area of architectural business in which the firm specialized; it had a niche, usually expressed in very broad terms. An adopter firm was engaged with several types of jobs and a non-adopter firm did few types of jobs. Due to the large variation of firm size in the industry, there were large variations in revenues and market share. The adopters dominated the market and would probably continue to do so because these firms intended to expand their business volume in various ways, which the non-adopters did not do.
Chapter 4

Business Directions

The principal developed a firm’s business mission. When the interviewees were asked to express their firm’s business mission they usually said: “To draw beautiful houses.” According to the architects, the business mission was equivalent to the reasons why the architectural firm was started—the desire to design. It was natural for the principal to make the others aware of the business mission without having to express it in words. Contacts between the employees and the principal were informal. More than 98% of the principals participated in the daily work of the firm. The coffee break was another occasion to communicate with employees because often employees gathered together for their breaks. The apprenticeship process also facilitated the communication of the unarticulated business mission. Before an architect was responsible for clients, the architect was taught the architectural norms in the firm. In a situation like this, there is no obvious need for a more specific business mission than to draw beautiful houses.

Types and Characteristics of Jobs

About 64% of the firms in the industry did specialized work or niche jobs at S1. Adopters and non-adopters worked in niches to about the same extent (Table 4.12). Because specialization may retard the adoption of new technology, it was surprising that the two groups did niche work to about the same extent (Löwstedt, 1986). The firms worked in many different niches, “Smaller new buildings,” “Remodeling, renewing of frontages,” “Special buildings for elderly people,” “Interior decorating of shops,” “Offices,” “Planning of cemeteries,” “Hospitals,” and “Environmental analyses.” The most frequent niche among the adopters was public buildings and among the non-adopters it was special types of buildings such as “Hotels.” Usually the adopters and the non-adopters were active in one niche, which probably is explained by the size of the niche that the firms worked.

For both the adopters and the non-adopters, the main revenues came from niche business. About half of the firms got 65% or more of their revenues from their three largest niches. A niche could be the reflection of the principal’s interest, which might explain the scope of this business.

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1 Respondents were given room to note three response alternatives: the first one being the most important one. Each noted response alternative was processed in the same way. The answers to the question were content analyzed according to responses and their sub-texts. Within each group, the answers were coded into subgroups to achieve a better structure of the answers and a possibility of elaborating the findings. In every case, each group and each subgroup covered a range of different answers. Similar answers were first coded into subgroups. These subgroups were organized into larger groups. The name of a group and a subgroup were chosen to reflect the answers. This information should be considered when the results are interpreted.

2 Few firms had noted more than three niches. When computing the portion of a firm’s revenues from the niche business only the firm’s three largest niches were included.
Table 4.12 Niches

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Val.</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portion of Firms Working in Niche, S1</td>
<td>61%</td>
<td>62%</td>
<td>.846</td>
<td>N</td>
</tr>
<tr>
<td>Most Frequent Niche, S1</td>
<td>Public Buildings 20%</td>
<td>Special Buildings 25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portion of Revenues from Niches, S1</td>
<td>60% SD 36%</td>
<td>65% SD 31%</td>
<td>.349</td>
<td>N</td>
</tr>
<tr>
<td>Portion of Firms Working in Niches, S2</td>
<td>62%</td>
<td>64%</td>
<td>.783</td>
<td>N</td>
</tr>
<tr>
<td>Most Frequent Niche, S2</td>
<td>Public Buildings 27%</td>
<td>Public Buildings 47%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portion of Revenues from Niches, S2</td>
<td>73% SD 29%</td>
<td>77% SD 24%</td>
<td>.379</td>
<td>N</td>
</tr>
</tbody>
</table>

About the same portion of firms worked in niches at S2. The most frequent niche business for all firms was public buildings. Both adopters and non-adopters increased their business in the niches between S1 and S2. More than 70% of a firm’s revenues came from niche business.

Types of jobs at S1.

“Dwellings” and “Offices” were the two most frequent types of jobs among the firms1 at S1. Frequently there was a significant difference between the adopters and the non-adopters regarding the number of firms involved in a type of job. Due to their larger size the adopter firms could be active in more and different types of jobs than the non-adopters could. The non-adopters seem to concentrate on a few types of jobs and obtain a significantly larger portion of their revenues from these jobs. Firms doing “Planning and Investigation” jobs obtained 73% of their revenues from this type of job.

Changes in jobs between S1 and S2.

Between S1 and S2 there was a general decrease in the revenues from each type of job. It seems that all firms in the industry desperately tried to get any type of job available. The changes in jobs between S1 and S2 for the adopters and the non-adopters were about the same. More adopters than non-adopters stopped working on “Hotels and Restaurants” and the adopters started doing more “Planning and investigation” jobs than the non-adopters did. A larger number of firms in both groups started doing this latter type of job. The increase of “Planning and Investigation” jobs was probably a reflection of the severe recession. In such an economic climate there is more planning than actual design and construction of buildings and the decreased revenues from these latter jobs

1 See Appendix O.
supports this. The analysis of types of jobs was done on an aggregate level and this might explain why the changes for the individual firms might be somewhat different.

In the initial in-depth interviews increased complexity and the shortage of time were frequently stressed, "It is going so fast now." There seemed to be some frustration in the industry about the increased pressure to get the drawings done immediately, one architect stressed the situation by saying the following: "They are building at the same time as we are producing the drawings." The increased complexity was evident in a number of different situations. For example, new building materials were continuously introduced into the building market. The architect had to choose the best material for the job. This required more time because of the increase in building material options. Moreover, each job was different; there were always new parameters in every job and each situation had to be judged individually.

**International jobs.**

Significantly more adopters than non-adopters did international jobs (Table 4.13). Both the adopters and the non-adopters, however, received the same portion of revenues from international jobs. Between S1 and S2 several adopters secured international work and during the same period some of the non-adopters that had done these jobs stopped doing them. The change of international activities was apparent in the change in revenues. However, the business volume for international jobs was low at S2 and it is possible that a firm did not invoice all its international jobs the same year as they were done, which may be taken into account when interpreting the results about international jobs.

Some of the adopters started doing international jobs as a way to manage the recession. The number of adopters doing international jobs increased by about 13%. The non-significant change in job mix between S1 and S2 suggests that the firms offered the same services abroad as they did nationally. The adopters' relatively small portion of revenues from international jobs supports the idea that these firms used the international market as a way to extend their national market. Non-adopters, on the other hand, decreased their portion of their revenue from international jobs between S1 and S2, which might indicate that these firms had resource limitations that only made it possible for them to operate in one market. Other explanations might be that the international clients started to seek firms using CAD or the competition on the international market increased.

Significantly more adopters than non-adopter had the intention to enter a foreign market in the coming three years.\(^1\) Non-adopters seemed to continue to do business in

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\(^1\) This analysis includes only the firms not active in the international market.
their national environment whereas the adopters saw a possibility to increase their business by entering the international market.

*Table 4.13 International Activity*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Val.</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portion of Internationally Active Firms, S1</td>
<td>34%</td>
<td>16%</td>
<td>.001</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues from International Jobs, S1</td>
<td>14% (SD 28%)</td>
<td>22% (SD 17%)</td>
<td>.255</td>
<td>N</td>
</tr>
<tr>
<td>Portion of Internationally Active Firms at S2</td>
<td>47%</td>
<td>12%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues from International Jobs, S2</td>
<td>14% (SD 26%)</td>
<td>10% (SD 11%)</td>
<td>.597</td>
<td>N</td>
</tr>
<tr>
<td>Change of Revenues from International Jobs</td>
<td>+2%(SD 11%)</td>
<td>-8% (SD 22%)</td>
<td>.050</td>
<td>Y</td>
</tr>
<tr>
<td>Plans to Enter a Foreign Market, Portion of Firms</td>
<td>30%</td>
<td>12%</td>
<td>.002</td>
<td>Y</td>
</tr>
</tbody>
</table>

*Non-architectural business.*

Significantly more adopters than non-adopters did non-architectural business (Table 4.14).

*Table 4.14 Other Business*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portion of Firms doing other than architectural business, S1</td>
<td>22%</td>
<td>12%</td>
<td>.064</td>
<td>Y</td>
</tr>
<tr>
<td>Most Frequent Business: Business Related to Construction, S1</td>
<td>81%</td>
<td>33%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of Revenues, S1</td>
<td>16% (SD 15%)</td>
<td>14% (SD 12%)</td>
<td>.599</td>
<td>N</td>
</tr>
<tr>
<td>Portion of Firms doing other than architectural business, S2</td>
<td>52%</td>
<td>28%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Most Frequent Business, S2</td>
<td>Construction Manage. 60%</td>
<td>Design 45%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of Revenues, S2</td>
<td>18% (SD 21%)</td>
<td>16% (SD 15%)</td>
<td>.768</td>
<td>N</td>
</tr>
</tbody>
</table>

The adopters seem to concentrate on construction\(^2\) whereas non-adopters varied their businesses. The adopters seem to do non-architectural businesses that used computer support such as facility management and construction management. Non-adopters did

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1. This analysis includes only the firms not active in the international market.
2. Respondents were given room to note three response alternatives—the first one being the most important one. Each response alternative was processed in the same way. The answers to the question were content analyzed according to responses and their sub-texts. Within each group, the answers were coded into subgroups to achieve a better structure of the answers and a possibility of elaborating the findings. In every case, each group and each subgroup covered a range of different answers. Similar answers were first coded into subgroups. These subgroups were organized into larger groups. The name of a group and a subgroup were chosen to reflect the answers. This information should be considered when the results are interpreted.
non-architectural businesses that were a reflection of the principal's special interest—photograph, illustration, and research.

Between S1 and S2, both groups of firms increased their business outside the architectural industry. Still significantly more adopters than non-adopters did this type of business. The most frequent business type for the adopters was construction management and for the non-adopters it was design. The volume for this business was about the same as at S1

Revenue, Productivity, and Market Share

There were significant differences in revenues between the firms. The top three firms had around 32% of the industry's total revenues at S1. Productivity was used in this analysis to compensate for the differences in firm size. The adopters had significantly higher productivity than the non-adopters had, around 19% higher (Table 4.15). A specific analysis of the small firms (19 employees or fewer) showed that the adopters in this group had significantly higher productivity as well.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues S1 M. Sw. cr.</td>
<td>14 (SD 35.414)</td>
<td>1.037 (SD 0.950)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Productivity, S1 M. Sw. cr.</td>
<td>0.491 (SD 0.167)</td>
<td>0.414 (SD 0.192)</td>
<td>.002</td>
<td>Y</td>
</tr>
<tr>
<td>Productivity in the Small Firms, S1, M. Sw. cr.</td>
<td>0.473 (SD 0.138)</td>
<td>0.414 (SD 0.192)</td>
<td>.012</td>
<td>Y</td>
</tr>
<tr>
<td>Change of Revenues Between S1 and S2</td>
<td>-2% (SD 49%)</td>
<td>-7% (SD 44%)</td>
<td>.363</td>
<td>N</td>
</tr>
<tr>
<td>Revenues, S2 M. Sw. cr.</td>
<td>12 (SD 29.193)</td>
<td>1.023 (SD 1.129)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Productivity, S2, M. Sw. cr.</td>
<td>0.674 (SD 0.312)</td>
<td>0.465 (SD 0.297)</td>
<td>.000</td>
<td>Y</td>
</tr>
</tbody>
</table>

The firms decreased their revenues between S1 and S2. There was no significant difference between the adopters and the non-adopters when assessing the percentage change in revenues. The variations in revenue change between the firms were large (from -94% to +186%). Both the adopters and the non-adopters decreased their revenues during the period; when the change was assessed in percentage there was no significant difference between the two groups. Both the adopters and the non-adopters increased their productivity between S1 and S2. However, the adopters had significantly higher productivity than the non-adopters had at this occasion too. This result might suggest an association between CAD and productivity.
Market share plans.

At S1, adopters had a market share\(^1\) of about 82% and non-adopters had a market share of around 8%.\(^2\) The adopters and non-adopters had similar plans for their market share for the coming three years at S1.\(^3\) Most of the firms wanted to remain their present market share (Chart 4.10).

\[\text{Chart 4.10 Plans about Market Share at S1}\]

At S2 the adopters had a total market share of about 81% and the non-adopters had a total market share of around 8% of the total market.\(^4\) It seems as if the adopters lost about 1% of their market share to the late adopters between S1 and S2. Still, however, the adopters had a market share more than 10 times the non-adopters and more than 7 times the late-adopters.

There were significantly different plans between the adopters and the non-adopters about their market share for the coming three years at S2.\(^5\) More adopter firms had plans to expand than non-adopter firms had (Chart 4.11).

\[\text{Chart 4.11 Plans about Market Share at S2}\]

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1 The market share was estimated using the firms' revenues. The sum of the total revenues in the sample was set to 100% at S1 as a reference basis. Note that this processing was done with weighted cases—industry situation.

2 For more information see "Classification of Adopters and Non-adopters" in Chapter 3. The remaining 10% of the market was held by the late-adopters.

3 Cross tabulation was performed for the firms that wanted to keep or expand their market share. The p value was 0.529.

4 The remaining 11% of the market were held by the late-adopters.

5 P value 0.007.
At S2 the adopters had a more aggressive attitude toward the market; they wanted to expand their market share whereas the non-adopter wanted to remain or reduce their market share.

**Plans about market scope.**

At S1 both adopters and non-adopters had plans to expand their business outside architectural business (Table 4.16). At this stage significantly more adopters than non-adopters had plans to expand their business within architectural business. At S2 significantly more adopters than non-adopters had plans to expand their business both within and outside the architectural business. The analysis stresses the adopters' intentions to expand and the non-adopters' intentions to remain their present situation.

**Table 4.16 Business Plans**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-Adopters</th>
<th>P Value</th>
<th>Sign, Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expand within Architectural Business, S1</td>
<td>62%</td>
<td>47%</td>
<td>.026</td>
<td>Y</td>
</tr>
<tr>
<td>Expand outside Architectural Business, S1</td>
<td>37%</td>
<td>27%</td>
<td>.141</td>
<td>N</td>
</tr>
<tr>
<td>Expand within Architectural Business, S2</td>
<td>72%</td>
<td>42%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Expand outside Architectural Business, S2</td>
<td>65%</td>
<td>34%</td>
<td>.000</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Clients**

According to the architects, a client should have knowledge about architecture and the architect's working process. A knowledgeable client eased the communication and cooperation between the parties and this improved the outcome. The three largest clients were essential for the firms and the importance of these firms increased over time; however, the non-adopters were significantly more dependent on these clients. Adopters conducted more business with old clients compared to non-adopters.

**Client Qualities and Values**

About 43% of the respondents noted that the most valued client quality at S1 was knowledge. Knowledge had a very wide definition;¹ it covered everything from specific

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¹ Respondents were given room to note three response alternatives—the first one being the most important one. Each response alternative was processed in the same way. The answers to the question were content analyzed according to responses and their sub-texts. Within each group, the answers were coded into subgroups to achieve a better structure of the answers and a possibility of elaborating the findings. In every case, each group and each subgroup covered a range of different answers.
knowledge to an ability to express what they wanted from the architect—"A client that has knowledge" and "Professionalism." The adopters and the non-adopters had similar opinions about client qualities at S1 (Chart 4.12). "Relationships" was the next most often group of responses and it reflected answers about personal characteristics. In the group labeled "Understanding," answers concerning agreement were gathered—"That the client has ambitions, understands and respects the work of an architect, and values good architectural work." Responses about "Ability to decide" and "Clear decisions" were all noted in the group "Straight Answers."

![Chart 4.12 First Client Quality at S1.](chart)

The abbreviations in the chart were expressed as follows in the questionnaire, (from left to right), "Ambitions and understanding," "Economy," "Knowledge," "Straight Answers," and "Relationships."

There were no particular changes for the distributions of the second and third client quality. Knowledge and relationships were the dominating qualities. An architect wanted a client to have knowledge about the work that the parties were going to do and the architect wanted to have a good relationship with the client, a sense of "fair play." These wishes seemed to be the same for both adopters and non-adopters.

One architect expressed the thoughts about good clients in the initial in-depth interviews in the following way:

My opinion is that when one [an architect] really gets to know them [clients] there are very many that are good, really. It is not so many that are totally impossible. Even if it is tough and hard and the money is short, they understand. It is hard to rush a good solution.

Obviously, according to this architect, it is possible for clients to understand an architect's point of view, the architectural work, and the architect's work-process. A

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Similiar answers were first coded into subgroups. These subgroups were organized into larger groups. The name of a group and a subgroup were chosen to reflect the answers. This information should be considered when the results are interpreted.

1 P value for the primary client quality was 0.545. "Economy" was excluded in the analysis because so few respondents noted it.
frank dialogue was used to educate clients about how architect’s work and to express the intentions of the architectural firm’s work:

We try to explain how we look at it [the architectural work] and we hope that they [the clients] understand what we say. It is very important to be clear. It is possible to be clear when you have a large firm ‘behind’ and it is a well-known firm, if so it is possible to be frank. When you says what is your opinion I think that most [clients] respect it, understand what we say. In that case, it is possible that there is discussion, we understand, but now the situation is like this. It is natural that it happens.

Client qualities at S2.

Due to the changed economic situation between S1 and S2 the client qualities changed too. There was a dramatic decrease in the number of respondents who had noted a client quality classified in the group knowledge and an increase for the number of respondents who had noted responses belonging to the group relationships at S2. About 50% of the adopters and the non-adopters had noted “Relationships” as the primary client quality (Chart 4.13). A good relationship became the most important client quality at S2. It was especially important during a period of recession that the client could be trusted and that the agreements were honored, according to the intermediate in-depth interviews. Frequently clients could not or would not pay for the work that the architectural firm had done.

![Chart 4.13 First Client Quality at S2](image)

*Chart 4.13 First Client Quality at S2. The abbreviations in the chart were expressed as follows in the questionnaire, (from left to right), “Ambitious and understanding,” “Economy,” “Knowledge,” “Straight Answers,” and “Relationships.”*

Architects' perception of clients' expectations at S2

Cooperation seems to be the characteristic that the architects thought that the clients wanted most. “That the final outcome corresponds to the expectations” was the second
most frequent expectation. Adopters and non-adopters seemed to have similar opinions\(^1\) about what a client valued in an architectural firm (Chart 4.14).

![Chart 4.14 Perception of Client Expectations at S2. The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), "Smooth cooperation," "No questions or demand from the architect," "An architect with firm points of view," "Fast jobs," "Well worked out propositions," "That the final outcome corresponds to the expectations," and "Low prices, fee."

There were small differences in what the adopter firms and the non-adopter firms anticipated the client’s expectations to be. There were, however, two significant differences between the adopters and the non-adopters. The adopters considered that "Low prices, fee" was significantly\(^2\) more important to the clients than the non-adopters considered. Non-adopters, on the other hand, believed that significantly\(^3\) more clients wanted "Well worked out propositions." These differences between the adopters and the non-adopters might indicate that there were some variations in the client expectations between the two types of firms. The demand for low prices might be interpreted as the result of intensive competition among the adopters’ customers rather than among the non-adopters’ customers. It is difficult to interpret the non-adopter’s response "better worked out propositions." Perhaps the use of CAD among the adopters supported the presentation of the propositions for the customers or there was a common trend among the non-adopters’ customers to demand propositions that were worked out better, a development that had already taken place among the adopters’ customers.

**Demands from the Clients**

The architects came in at an early stage in the process of developing the final product. Several other customers were ahead before the outcome reached the ultimate client. Partly because of this place in the production chain and partly due to realizing

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1 P value 0.131. Due to few or no respondents the classes "No questions or demands for the architect," "A quality system," and "An architect with firm points of view" were excluded.

2 P value 0.032.

3 P value 0.026.
the architect’s result, there were several interests to consider in the design of the new building. There was tension between the architect and the developer according to the initial in-depth interviews. By and large the developer wanted a rational building process, a building that was simple to construct, which roughly meant a standardized building process in which several pre-fabricated building elements could be used. The rationality was from the developers’ perspective overriding the values guiding the architect.

Another interest affecting the architect was the owner of the building. Depending on this person’s intentions with the planned building the interests varied. If the owner was an administrator, this person usually wanted to maximize the development of the buildings and have buildings that were inexpensive to maintain. If the owner wanted to develop the building and sell the planned building when constructed, then this person did not have any demands on the maintenance costs. Their interest was to earn as much money as possible when selling the building and building materials were chosen according to this aim.

It seems as if the architects had a special relationship with the user. If the user was not present in the project group, the architects tried to give voice to their needs during the design process. The architects seemed to have a special interest in understanding the needs of the end user according to the initial in-depth interviews. One architect expressed the central role of an end user in the following way: “I mean that the whole building industry in Sweden is going through a transition from product orientation to customer orientation.” The transition could also be identified among the three interviewed clients. One client described how they worked to collect ideas from the users.

We decided to build a sample apartment here (at the construction site). . . . a completely finished apartment. It became a reference where we could go in and check all parts and that the design was the way we wanted it. Then we were able to correct the continued production. At the same time we arranged a two-day show here at the construction site. About 8,000 people passed through the apartment. Several of us [people from the firm] were there and showed the apartment and talked with those who came to see it. By doing so we got a large variation in what they [the users] considered to be quality and what the advantages and disadvantages with what we had done were. In this way we were able to adapt to the present demand. In that way we were able to understand quality.

There seems to be several different demands that the architect has to consider in the design process. It is probably a delicate balance between different interests, which was a natural part of the work for an architect. Due to their holistic view, the architects considered that they were especially skillful in pleasing all the involved parties—including parties not present—in the design of a building. One architect expressed this
situation in the following way: “There are few who have the holistic view as architects have. . . . to simply optimize a project, both from the point of view of the user and from the point of view of the estate administrator.”

**Clients' Role in the Service Process**

The cooperation between the architect and the client was a central part of the project work. Both parties had firm points of view of how this cooperation should be done. One architect described the work process between the parties in the following way: “When we [the architect and the client] have agreed upon and decided that this is something to continue from, then we go to the next phase in the project.” As indicated by the quotation, the client was seen as an active participant in the work process. In fact, it was the client who determined the progress in the service production by deciding when to proceed. Having the client in charge of the pace of the service process was a demanding situation for both parties. Because the guidance from the client was infrequent, all jobs are unique for the client. One client noted that: “Every object is normally unique.” This situation means that the client usually had limited information to give the architect as guidelines for the design of the planned building. One of the first tasks for an architect is to identify and survey the client’s needs regarding the new building; there are usually some needs that the client can express as guidance for the architect.

It was a time consuming process for the architect and the client to work out the guidelines for the new building. The architect wanted to find the concept for the new building, i.e. the idea to build the design around; e.g., one architect had a job that was to design new premises for a newspaper. This architect expressed the concept for the planned building as, “The printing press in the center.” Inspiration in this phase came from books, journals, and study tours. During the boom it was frequent that the whole architectural firm went to places such as Rome, Paris, or New York to study some famous architecture. This part of the architectural work is a difficult struggle according to the architects; however, concept creation is the essence of the artistic dimension for an architect. It is fundamental to find the concept for the planned building because this concept will guide the rest of the work. The artistic process takes time. The architects wanted to talk about this time as a developing process that enabled one to understand the building, to find the soul of the new building. One interviewee expressed the situation in the following way:

It takes some time for us human beings to understand the problem, to understand what has to be done. It takes some time for the client, a purchaser, to understand what kind of things that he needs and when we show it [the blueprint] than he has to reconsider the suggestion.
The dialogue with the client was eased if the client had some understanding of the architectural work process. There is a need for the client to understand the output of the architect so the service process could be agreed on. One architect explained why a client consulted an architect in the following way: “The main reason is that they do not by themselves have the competence.” Many variables had to be considered when making the design of a new building. One architect put it this way: “We ought to find good solutions where optimizations of technology, economics, and aesthetic are integrated. If we do not have a participant that is receptive to all these three variables it is an impossible act of communication.” The architects made a number of statements about the importance of having the possibility to be able to realize their professional values, which is understood in the term aesthetic values in the quotation above. To be able to work according to these values was important for the architect; this possibility governed the perception of a successful job. One architect described a favorable architect-client relationship in the following way:

If you are really lucky, you work directly with the person who will administer the house. This provides continuity. I think this situation is the best one because it is easier to gain a mutual understanding for the house for a longer period, how it ages and how it would be possible to use it in different ways.

The quotation shows the architect’s desire to design buildings according to their professional values. A situation that demands that a client be familiar with the architectural work process and its values. One architect expressed the desired situation in the following way:

If we compare with Finland for example, the mining engineers still order architectural services. . . . there is a long tradition by those who order architectural service, these people have a good education, a good grounding so to say, not only the narrow expert knowledge of mining engineers. Instead they, through their families or through other interests, they have a broader perspective on life. They have a more solid holistic view of what society is about.

The architect wanted a client with architectural knowledge because the client greatly influenced the work process. To be able to do so completely, in the manner desired, the client almost had to be an architect herself/himself. The client was, however, rarely an architect. In some way the differences in knowledge between the parties had to be overcome. Confidence seemed to bridge the gap; “It is a question about the confidence between the architect and the present client so it is different from time to time.”

A client’s view of cooperation.

The clients who were interviewed in the intermediate in-depth interviews had the capability to lead the jobs on new buildings. They took an active part in the production process of new buildings from concept to the finished building. Their role in the firm
was to coordinate the activities for designing a building. One of the clients was active in a developer that built on commission for other clients, and also built and managed buildings. The other two clients described their main business as estate development and management. Below their opinions about the cooperation with the architects is presented:

[T]here were a lot of different meetings that we had for checking. . . . Everyone had to do their part. It is a whole series of meetings so everyone has to have done their little part and on time. It requires cooperation among many people.

Cooperation was required during the whole building process. There were many details that had to be decided on during the process. “The color and similar details are determined while the construction is taking place so it is important that it (the cooperation) works well.” Cooperation guaranteed that all details would be solved in an efficient way. One client indicated the importance of the cooperation by saying that:

[Architects had] to be able to have a dialogue with the client and convince the client to make the decisions in the right order. This is quality. He [the client] might then discover that this is not what I wanted, this is what I want instead.

Thus, the clients also expressed the importance of cooperation in terms of communication. The clients seemed to value the architect’s ability to communicate with them. The architect’s skill in developing a cooperative relationship was reflected in the proposed concept for the new building produced by the architect. “It is quality when the architect perceives my level of ambition and he manages to capture this ambition in the right way.” Another client gave a more elaborate answer concerning the expectations of an architect; especially concerning the professional skills of an architect:

The architect has to be knowledgeable and competent first regarding the idea stage, in the next phase when the program work is to be carried out. . . . It is important in the early phases that they [the architects] are competent regarding the authorities, that they manage the contacts with the fire authority, local housing committee.

The clients wanted an architect with professional skills; one who was able to manage the client’s job through all the different stages until completion. Professional skills that an architect should have were not limited to design. The architect should also have knowledge about the subsequent phases in the value system. One client, for example, believed that an “architect should have very good knowledge about materials and know about the different options about materials available in the market.”

Cooperation was the key to securing future jobs with the client as well, “As long as one feels that one is having stimulating cooperation and that they [architects and other involved consultants] aim for the costs that one wants, there is no need [to change architect].” The quotation shows that cooperation was something fundamental for the
Chapter 4

client. As long as the client had the impression that the cooperation worked out there were no incentives to change architects. There were several demands on the architect from the clients: the architect should cooperate with the client, be knowledgeable, guide the client in the right direction, and do it all within the costs that the client expected. The costs seem to have been central for the clients, “A good architect should have knowledge about prices so he can match design with costs.” At S2, the costs were a central variable guiding and affecting the architects work.

Client Dependence

The adopters billed about four times more clients than the non-adopters for the previous financial year at S1 (Table 4.17). An analysis of the number of invoiced clients per firm showed that the adopters did about twice as large jobs as the non-adopters did at S1. A larger job probably meant a more complicated and challenging job, more need for education on the job, and more slack (time) in the job, e.g., offer the possibility of CAD training.

Between S1 and S2 both the adopters and the non-adopters increased the number of jobs per employee and the jobs tended to be smaller. A job lasted approximately 3 months in an adopter firm and about 1 month for a non-adopter firm. Although these figures are estimates, they are important for understanding how the possibilities for education in the firms varied.

According to the architects, the most important source for new knowledge was client jobs. Large jobs provide more opportunity for the employees to increase their knowledge base.

Dependence on the three largest clients.

Almost all the firms tended to be critically dependent on their three largest clients. About 65% of a firm’s revenues came from these clients. The non-adopters seem to be significantly more dependent on these clients than the adopters were. Despite the fact that the non-adopters had more clients per employee they were significantly more dependent on their three largest clients. One client could have several different jobs in a firm during one year, which is probably the case for the non-adopters. Due to these circumstances the possibilities for education may not be so limited in a non-adopter firm as first indicated.

Both the adopters and the non-adopters increased their dependence on their top three clients between S1 and S2, which suggests that the firms kept some key clients during the recession and the importance of these clients increased. For some firms these large clients seem to have played an essential role:
Types of Firms

One can probably say luckily for us we had a pair of large jobs that so to say kept us afloat in the initial phase [of the recession], actually through the whole process [recession]. One can say that these jobs kept us afloat because many other jobs crumbled away, there was a pair of jobs that barely kept us afloat. It was not important [for us to have these large jobs]; it was fundamental.

For this firm it was vital to have some large jobs. It may, however, be the other way around. Due to little dependence on the three largest clients the firm survived. One firm went bankrupt because three of its ten largest clients went bankrupt.

Mix of private and public clients.

About 62% of a firm’s clients were private and the remainder was public—municipals, county councils, and the government. Adopters and non-adopters seem to have had about the same client mix at S1. Both the adopters and the non-adopters decreased their portion of private clients between S1 and S2. The adopters increased their portion of public clients more than the non-adopters did. There was no significant difference between the two firms’ client mix at S2. The portion of public clients increased probably as a consequence of the changed business cycle.

Table 4.17 Client Dependence and Mix of Clients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>p value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Invoiced Clients, S1</td>
<td>60 (SD 115)</td>
<td>16 (SD 13)</td>
<td>.001</td>
<td>Y</td>
</tr>
<tr>
<td>Invoiced Clients / Employee, S1</td>
<td>4 (SD 3)</td>
<td>8 (SD 7)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Invoiced Clients / Employee, S2</td>
<td>4 (SD 4)</td>
<td>12 (SD 29)</td>
<td>.004</td>
<td>Y</td>
</tr>
<tr>
<td>Revenues 3 Largest Clients, S1</td>
<td>57% (SD 25%)</td>
<td>75% (SD 24%)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Revenues 3 Largest Clients, S2</td>
<td>66% (SD 24%)</td>
<td>82% (SD 20)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Private Clients, S1</td>
<td>60% (SD 27%)</td>
<td>60% (SD 35%)</td>
<td>.942</td>
<td>N</td>
</tr>
<tr>
<td>Portion of Private Clients, S2</td>
<td>47% (SD 31%)</td>
<td>52% (SD 33%)</td>
<td>.181</td>
<td>N</td>
</tr>
</tbody>
</table>

Client Retention

According to the initial in-depth interviews there were no problems in finding new clients; they almost lined up outside the firm. The problem was to convince the clients to wait until there was time to service them. The initiative for new jobs came from the clients. The situation altered totally during the recession. Many clients disappeared and the initiative for new business was the architect’s responsibility, "The architects had to vacuum the market for new jobs." During the recession it was difficult for the architects...
to find new jobs. They had to be active and innovative and scan the market continuously for any signs of a new job. As soon as there were any indications about a potential job, the architect had to make contact with the appropriate people as soon as possible.

Chart 4.15 Client Retention at S2. The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), "First time client," "Second or third time client," and "Fourth time or more client."

The two most important ways for both adopters and non-adopters to get new clients and new jobs were contacts and returning clients. Other ways were bid and competitions but these alternatives were used infrequently (Chart 4.16). There was one significant difference between the firms. Non-adopters used returning clients more frequently than the adopters did. It is striking that the means for finding new clients and new jobs were the same. This situation suggests that the architects used some type of defined network for finding new jobs and for finding new clients. The network that the firms used defined whether CAD use was important. The impact of the network on the firm's decision to adopt CAD was probably decisive.

Chart 4.16 Ways of Finding New Clients at S2. The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), "Bid competition," "Through contacts," "Through old clients," "Participate in competitions," and "Other."

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1 P value 0.004.
One of the interviewed clients in the intermediate in-depth interviews stressed the importance of reference objects.\textsuperscript{1} From these objects the client got an understanding of how the architect realized a certain object: "[F]ind some suitable reference objects that they have made [the architectural firm] and if that feels right and one can see that they have made what one will make oneself then one can hire them."

**Competition and Competitive Advantage**

The adopters considered the competition to be significantly more intense than the non-adopters did at both S1 and S2. At S1 quality was the outstanding competitive tool among the firms, which was changed and at S2 contacts and the fee were frequent competitive tools. CAD was considered to be a competitive advantage for a general architectural firm by both the adopters and the non-adopters. An assessment of the firms' competitive advantage between S1 and S2 showed that the adopters managed the period better than the non-adopters did.

**Competition Intensity**

At S1, the adopters considered the competition intensity to be significantly more intense than the non-adopters did.\textsuperscript{2} The adopters considered it to be "Relatively Intense" and the non-adopters considered intensity to be to be "low" (median values) (Chart 4.17).

![Chart 4.17 Perception of the Competition at S1.](image)

Most firms experienced an increase in competition intensity between S1 and S2. At S2 the adopters considered the competition intensity to be significantly\textsuperscript{3} more intense

\textsuperscript{1} Buildings that the architectural firms have designed.

\textsuperscript{2} P value 0.001.

\textsuperscript{3} P value 0.000.
than the non-adopters did, "Intense" and "Relatively Intense" (median values) (Table 4.18). This may be the result of the two groups competing in different markets.

![Chart 4.18 Perception of the Competition at S2.](image)

**Critical Changes among Competitors**

The adopters and the non-adopters had significantly\(^1\) different opinions about what changes their competitors had made before S1 (Chart 4.19).

![Chart 4.19 Critical Changes among the Competitors before S1.](image)

The Quality category included judgements about what the competitors classified as "good architecture" or "their architecture got worse." Statements that related to buying other architectural firms, increasing their staff, or starting a new office were noted under the categories "Expansion and intensive working," "Computerized," "Marketing and business," "Organization, personnel, and ownership," "Other," and "No changes."

The adopters believed their competitors had expanded and the non-

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\(^1\) P value 0.000.
adopters believed that their competitors had increased marketing activities.\(^1\) About the same portion of adopters and non-adopter had noted that their competitors had computerized, which suggests that some non-adopters considered adopters their competitors.

Before S1, several firms in the industry had increased their business. Some of the judgements about the adaptation were expressed in the questionnaire as "They have been transformed into trend offices" or "They have transformed into industry production." The non-adopters most frequent response, used by about 50% of the respondents, was "Do Not Know." The large number of non-responses among the non-adopters, 42%, may suggest that they do not know the answers or that they did not concern themselves with their competitors. Significantly more adopters than non-adopters responded to the question.\(^2\)

Between S1 and S2 the adopters' competitors lowered their fees and decreased their personnel. Some of them went into bankruptcy. During the same period some of the non-adopters' competitors also lowered their fee and cut down on their personnel. But the most frequent responses from the non-adopters were that their competitors did not make any changes or the respondent was not aware of the changes that the competitors had made\(^3\) (Chart 4.20).

![Chart 4.20 Critical Changes among the Competitors between S1 and S2. The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), "Lower the fee," "Went into bankruptcy," "Doing better jobs than before," "Doing worse jobs than before," "Decreased the personnel," "No affecting changes have occurred," and "Do not know."

The changes that the adopters' competitors had done suggest that the adopters experienced intensive competition. Non-adopters, on the other hand, seem to have had few reasons to worry about their competitors. The competitors went on as usual—"No

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\(^{1}\) P value 0.003.

\(^{2}\) P value 0.026. "Do Not Know" were treated as equivalent to no respond in this analysis.

\(^{3}\) All the changes mentioned here (in this paragraph) were significantly different for the adopters and the non-adopters. P value between 0.000 and 0.029
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Change. The results of the questions suggest that the two groups of firms experienced different kinds of business climates.

Competitive Strategies and CAD

Quality was the primary competitive tool at SI noted by approximately 82% of the firms; however, significantly more adopters than non-adopters used it. Non-adopters, however, used the fee and the total package to a significantly greater extent than the adopters did (Chart 4.21).

"Fast work" was the second most frequent competitive tool for both the adopters and the non-adopters. There was no significant difference between the adopters and the non-adopters regarding their second competitive tool. Significantly more non-adopters than adopters noted only one competitive tool, usually quality. It is possible to interpret the use of only one competitive tool as an indication of difference. The competitive tool quality was enough means for making the firm special from a client perspective.

![Chart 4.21 Ranking of Competitive Tools at SI. The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), “Lower Fee,” “Quality,” “Fast work,” and “Total package.”]

Competitor's competitive tool at SI.

The adopters considered the competition to be significantly more homogenized than the non-adopters did. About 62% of the responding adopters had the opinion that their competitors used the same competitive tool as they used. About 50% of the respondents answered the question, which probably indicates that the competitors competitive tool(s) were not known for several of the firms in the industry. Significantly more adopters

1 Do not know responses were treated as non-responses in this analysis.
2 In the cross tabulation the alternative “Total Package” was excluded because of too few responses, p value 0.009.
3 P value 0.009 respective 0.009.
4 P value 0.303.
5 P value 0.007.
6 “Total package” means the firm managed all the other involved parties in the job.
7 P value 0.002.

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than non-adopters knew.¹ The result supports the idea that the knowledge about the business environment was limited in the non-adopters firms or they did not need to care.

Own competitive tool at S2.

At S2, the situation was altered; the most important competitive tool was contacts, noted by approximately 41% of the firms as their primary competitive tool. There was no significant difference between adopters and non-adopters regarding their primary competitive tool.² Quality was the second most frequent competitive tool noted (about 31%). There was no significant difference between the adopters and the non-adopters.³

Competitor's competitive tool at S2.

About 60% of the firms did not know what competitive tool their competitors used. Significantly more adopters than non-adopters seemed to know⁴ (Chart 4.22).

A conservative interpretation of unawareness responses—"do not know"—suggests that the firms did not know what their competitors offered their clients. Was it fast work or a low fee? About 26% of the adopters used the same competitive tool as their competitors, which might be explained by the alternatives for competitive tool in the question. They were comprehensive and the individual firm could eventually get a unique understanding of their competitive tool even if they used the same ones as their competitors. However, due to the information from the in-depth interviews, initial and intermediate, it is hard to see any major differences in the competitive tool. About 20% of the firms had responded that their competitors have a different set of competitive tool. The most frequent competitive tool according to these respondents was "Low fee."

¹ P value 0.043.
² P value 0.173. Due to few responses the alternatives "Low fee," "Fast work," and "Use of CAD" were excluded in this cross tabulation.
³ P value 0.273. Due to few responses the alternatives "Low Fee," "Negotiable fee," "Total package," and "Use of CAD" were excluded in the cross tabulation.
⁴ P value 0.001.
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CAD as competitive tool.

The adopters ranked CAD as a competitive tool for their own firm significantly higher than the non-adopters did:\(^1\) median value 3 on a ranking "Not at all" (1) and "Very much" (5). The non-adopters, however, had a median value of 2. CAD was also judged as a competitive tool for an architectural firm in general by the respondents. Both the adopters and the non-adopters had a median value of 3 with no significant difference.\(^2\) It is interesting that the non-adopters had ranked technology as a competitive tool very high for their own firm. This may have been due to the fact that some of the non-adopters were about to adopt.

The general perception in the industry was that CAD was a competitive tool for an architectural firm in general but the impact of it as a competitive tool for their own firm varied. It is possible to interpret the result in several ways. As indicated before the perception that their own firm was different from the other ones in the industry was widely spread. A common argument for refusing to respond, especially in the initial questionnaire, was the uniqueness of their firm. Their firm was special to the extent that the responses from this firm would influence the results of the data collection. Their firm was separated from the other firms in the industry.

The different jobs that the adopters and the non-adopters did might be an explanation for the difference in perception of CAD as a competitive tool for their firm and for a firm in general. The advantages of the equipment were greater in a larger job than in smaller ones according to the initial in-depth interviews. The difference in perception of CAD as a competitive tool for their firm and for a firm in general may also be a reflection of different plans for a firm.

The perception of CAD as a competitive tool for their firm was also analyzed for adopters and late-adopters. Both these groups of firms considered the technology to be a competitive tool for their firm.\(^3\)

Competitive Strategies and the Recession

Significantly more adopters (77%) than non-adopters (41%) prepared for the recession that hit the industry by the end of 1990.\(^4\) This situation may be a result of the significant difference in perception between adopters and non-adopters regarding when the recession would start. The adopters thought it would start in February 1991 and the non-adopters believed it would start in February 1995 (mean values). Median values

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\(^1\) P value 0.000.
\(^2\) P value 0.660.
\(^3\) P value 0.112. Adopters 3.4 (SD 1.0) and late adopter 3.1 (SD 1.1) mean values.
\(^4\) P value 0.000.
show that the difference between adopters and non-adopters was not significant. According to the adopters it would arrive in February 1991 and according to the non-adopters it would arrive in March 1991. Probably some of the non-adopters believed that the recession would start much later. Thus, despite that both groups of firms knew that a recession would come, significantly more adopters than non-adopters prepared for it. Answers to the question about preparations for the recession may be a rationalization that the principals of the adopter firms made. These principals may feel greater pressure to be correct in their management behavior due to their larger firms and they want to act in the way prescribed in the management literature.

"Saved money" was the most frequently used strategy by both the adopters and the non-adopters; however, the non-adopters did this action significantly more than the adopters did. Respondents who said that they had prepared for the recession were asked to note the two most important ways in which they had prepared for it (Chart 4.23).

The adopters prepared by buying CAD and training employees in its use. "Established contacts with potential clients" was a strategy that both adopters and non-adopters used. Both types of firms had noted other reasons. The main part of the responses indicated cost reducing activities such as re-locating to "Smaller premises." Most of the non-adopters responded to other reasons without specifying an activity.

1 P value 0.007.
2 P value 0.633.
3 P value 0.930.
Strategies used during the recession.

The adopters reduced their personnel significantly more than the non-adopters did\(^1\) as a way to manage the recession (Chart 4.24). Non-adopter firms were smaller and therefore these firms used the strategies "Reduced the salaries" and "Decreased the working-hours <40 hours/week."\(^2\)

About 50 percent of the respondents did not answer this question. The large number of nonrespondents may be interpreted as several firms did not do anything special for coping with the recession. It was primarily the non-adopters (63%) who did not respond to the question. These firms did business as usual but in a smaller amount. Periods of recession were well known to the architects who had been around in the 1970s. During the severe recession then, the architects worked extra as cab drivers to survive according to the in-depth interviews. Thus, there was an experience in the industry of managing during recessions. The importance of preparing or not preparing for the recession should not be overemphasized; especially for the smaller firms.

![Chart 4.24 Strategies Used for Managing the Recession](image)

Chart 4.24 Strategies Used for Managing the Recession. The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), "Reduced the number of employees," "Reduced the salaries," "Decreased the working-hours <40 hours/week," "Increased the intensity in acquisition," "Took care of existing clients," and "Other."

The adopter firms did not have the possibility to change salary and work hours to the extent that would have been needed to keep all their employees. These firms had more employees and the treatment of these employees is governed by legislation and union agreements. In the small firms, the non-adopters, the situation was more informal and the solutions considered were probably more varied. Perhaps all the people in the firm were partners and there were no personnel responsibilities. A self-evaluation of how their firm managed during the recession compared to the other firms in the industry

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\(^1\) P value 0.000 for both alternatives, including and excluding one-person-firms.

\(^2\) P value 0.000 for both strategies.
showed no significant difference\(^1\) between the adopters and the non-adopters. The two categories “average” and “above average” included about 76% of the adopters and around 69% of the non-adopters. Despite the changes that the firms had to do due to the recession, they seem to have the opinion that they managed the recession well.

### Assessment of Competitive Advantage

Five different indicators were used for assessing the adopters’ and non-adopters’ competitive advantage between S1 and S2.\(^2\) These indicators were survival, change of market share, change of productivity, change of number of employees, and loyalty.

There was no significant difference in survival rate between the firms that had CAD at S1 and firms that did not have it\(^3\) (Table 4.18). The result may seem striking but a closer look explains the situation. Survival during the recession was probably not related to CAD. Actually one of the most progressive firms in the industry went bankrupt during the recession because three of its largest clients went bankrupt. Survival is probably an assessment variable integrated into environmental aspects and should not be used to distinguish the competitive power of CAD.

The result of this question influences the sample of firms included in the processing. For example, a significant result was achieved when the non-respondents to the follow-up questionnaire were included.\(^4\) Significantly more adopters than non-adopters survived. The non-responding firms in the follow-up questionnaire were excluded due to ambiguity of the financial conditions for survivors and their adoption of CAD.

The adopters had a market share\(^5\) of about 82% at S1 and the non-adopters had a market share of about 8%. Between S1 and S2 the total market for the architects decreased by approximately 12%. The adopters decreased their market share by 13% and the non-adopters decreased theirs by 12%. These numbers are on an aggregate level; on the firm level there were great variations. At the firm level there was no significant difference in the decrease between the adopters and the non-adopters.

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\(^1\) P value 0.582. The categories lowest and second lowest grading were collapsed due to few answers in the lowest category.

\(^2\) For an extensive discussion see section 3.4 “Service Quality and Competitive Advantage, and Two Surveys.”

\(^3\) In this processing a specific sample was used. From the sample of firms selected in the follow-up survey those who did not respond were excluded due to ambiguity in the classification. It was not possible to know whether or not these firms had been bankrupt.

\(^4\) P value 0.088.

\(^5\) The market share was estimated using the firm’s revenues. The sum of the revenues in the sample was set to 100% at S1 as a reference basis. This processing was done with weighted cases—industry situation.
The adopters had significantly higher productivity than the non-adopters had at S1 and at S2. Despite a difficult economic period between S1 and S2, the adopters managed to increase their productivity by around 47%. The large difference in productivity between the adopters and the non-adopters may perhaps be explained by the different strategies that the firms used during the recession. Adopters tended to decrease their personnel and the non-adopters decreased their working hours.

Table 4.18 Assessment of Competitive Tool

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival Rate</td>
<td>82% (SD 0.166)</td>
<td>75% (SD 0.191)</td>
<td>.146</td>
<td>N</td>
</tr>
<tr>
<td>Change of Market Share</td>
<td>-2% (SD 49%)</td>
<td>-7% (SD 44%)</td>
<td>.363</td>
<td>N</td>
</tr>
<tr>
<td>Productivity at S1</td>
<td>0.674 (SD 0.312)</td>
<td>0.466 (SD 0.297)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>M. Sw. cr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change of Productivity</td>
<td>47% (SD 73%)</td>
<td>18% (SD 71%)</td>
<td>.003</td>
<td>Y</td>
</tr>
<tr>
<td>Change in the Number of Employees</td>
<td>-19% (SD 91%)</td>
<td>-9 (SD 54%)</td>
<td>.270</td>
<td>N</td>
</tr>
<tr>
<td>Loyal Clients</td>
<td>54% (SD 29%)</td>
<td>46% (SD 32%)</td>
<td>.050</td>
<td>Y</td>
</tr>
</tbody>
</table>

Both the adopters and the non-adopters decreased their personnel between S1 and S2. There was no significant difference between the firms regarding change of the number of employees. To avoid the impact of firm size the change of personnel was computed as a percentage of change.

The adopters had significantly more loyal clients—a client that had done business with the firm four times or more—than the non-adopters. Loyalty was important for the architectural firms during the recession according to the intermediate in-depth interviews. Some firms survived the recession due to a few key clients. Old clients were one of the two most important means for getting new jobs and new clients at S2.

There were significant differences between adopters and non-adopters for some of the variables used for assessing competitive advantage. Significantly more adopters than non-adopters increased their productivity and had significantly more loyal clients. The adopters had higher productivity at S1 and between S1 and S2 they increased productivity significantly more than the non-adopters did. No significant difference between the two groups of firms existed regarding survival, change in market share, and change in the number of employees. For two of the competitive tools, change of productivity and loyalty, the adopters performed better than the non-adopters performed. The findings suggest that CAD was associated with firms that performed better between S1 and S2.
Types of Firms

CAD

A firm used CAD because it was a natural progression of the development in the industry. According to the architects, another frequent reason for using CAD was the possibility to increase productivity. A significant more important reason for the late-adopters' adoption of CAD was "client demand." The use of the equipment was essential both for the adopters, used in 57% of all jobs, and the non-adopters, used in 30% of all jobs. Progressive clients want CAD to be used in all their jobs except extreme ones. The advantages of the technology seemed to outperform the disadvantages. According to both the architects and their clients a fundamental advantage of CAD use was the ease cooperation between the parties involved in the project work.

Adoption of CAD

According to the initial in-depth interviews, adoption of CAD in the architectural industry appeared to be driven by three factors: (1) At S1 production limitations existed among the firms in the industry and the adoption of CAD was influenced by attempts to improve production capacity in the firm. (2) Clients requested their designs to be drawn using CAD, one architects said: "Already today there are clients that require the job to be carried out on CAD because they have an organization for administering the buildings that needs this kind of information." (3) It was apparent to some participants in the industry that a recession was imminent. Almost all of these individuals anticipated that CAD use might assist them during difficult economic times.

The architects in general did not stress these rational arguments for adopting CAD even if they claimed them. The decision to adopt the technology seemed to have been made without much planning. The equipment "floated" into the work place. Adopters among the interviewees seemed to regard the adoption of CAD as an experiment. Because of the uncertainty associated with the adoption of such an innovation, respondents tended to give it a low profile. The situation can be summed up in the following two statements,

For some [firms] it became a marketing argument. [They seemed to be saying] [w]e have got rid of all drawing boards, we are in the future, we came there first. It was like this and for some it still is. It [CAD] became a sign of success and a sign that one was participating in the progress.

and, "It [CAD] is a good supportive system. . . . CAD has come to stay." The adoption of CAD was not an obvious activity for all managers. Several older architects believed they could manage their time in the industry without having to learn to work with CAD. There was resistance among these architects to using and learning new technology.
According to both the initial and the intermediate in-depth interviews there was a common opinion that it was the young architects that were most interested in CAD.

"A natural progression" was the most important reason why both adopters and late-adopters embraced CAD (Chart 4.25). It seems as if an adoption of CAD was an activity along the firm's strategy.

![Chart 4.25 Reasons for Using CAD](image)

The strongest incentive for adopting the technology came from outside the firm. Adopters and late-adopters had similar reasons for adopting CAD. Only the reason "Clients demanded" was graded significantly different by the two groups of firms.¹

Adopters and late-adopters adopted CAD at different business cycles, which may be one explanation to the difference in reasons for adopting the equipment. Demand from clients may be given different dignities during various business cycles. The growing knowledge about the technology in the industry may be another. "Clients demanded" seem to be an increasing reason why the firms adopted CAD. That is, the market for this type of service had increased. There seems to be an increasing awareness among the clients of the advantages of services done with the technology.

It is striking that both the adopters and the late-adopters noted that "Clients demanded" CAD was infrequent. In the interviews, the interviewees usually stressed the close relationship between the adoption of CAD and the need of a suitable job and client, a job in which the technology could be used and the client agreed to the use. One interviewee expressed the situation as follows: "At the moment we have Barnängsviken, Trixin is the client. . . . It was this firm that made our way into computer technology [CAD] possible." Whether CAD was to be used in a job or not was discussed by the architect and the client; the client had to approve its use. The clients in the early stages

¹ P value 0.019.
of the diffusion process of CAD may not have demanded the use of the technology. Instead there was a mutual agreement between the parties that the architect would use it and the parties would evaluate the pros and cons of it.

**Information sources.**

The two most important information sources for obtaining information about CAD were "Architectural colleagues in Sweden" and "Salespeople of the equipment" (Chart 4.26). Probably architectural colleagues provided information about how to work with the equipment and the salespeople provided information about the technical performance of different CAD systems. The information from the latter source was used significantly less by the late-adopters.¹ Architects working with CAD did probably provide the potential adopters with more accurate information than the salespeople could. Clients were not used as information sources very often especially by the late-adopters even though they identified client interest as a reason for using CAD. Perhaps architects were too embarrassed to ask the client for information. Architects who responded to the alternative "Other" noted that they preferred internal knowledge sources, "Hired knowledge," and "Own knowledge."

![Chart 4.26 Information Sources Used when Obtaining CAD.](image_url)

*Chart 4.26 Information Sources Used when Obtaining CAD.* The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), "Architectural colleagues in Sweden," "Colleagues outside the architectural industry," "Architects abroad," "Your clients," "Salespeople of the equipment," "Professional Journals," and "Other."

**CAD adoption year.**

The adoption of CAD in the architectural industry began around 1981.² Since then the adoption had been continuous with variations in the rate of adoption. The adoption

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¹ P value 0.010.
² Only the firms that continued to have CAD, the adopters and the late-adopters are included in the discussion about adoption of CAD. This explains why a deviation from the actual situation might occur.

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rate started fairly constant with an approximate level of 2% and in 1985 it began to increase dramatically (Chart 4.27).

![Chart 4.27 Adoption Year](chart)

**Chart 4.27 Adoption Year**

Most of the adoption was done in 1990; by the end of that year the recession hit the industry and there was a drop in the adoption rate. Thus, the drop in adoption between 1990 and 1991 might be explained by the recession. Between S1 and S2 about 20% of the firms in the industry adopted CAD. The increase in the adoption rate in 1992 and 1993 had no obvious explanations. Despite the recession, some firms decided to adopt CAD, perhaps because their clients demanded it. When competition intensity increased, an adoption of the technology was a way to change a firm's competitive situation (cf. Norton & Bass, 1992). The median adoption year for the adopters was 1988 and the mean adoption date for these firms was in July 1987, which suggest an even distribution. Corresponding figures for the late-adopters were 1991 and in May 1991.

**Buying or leasing the first workstation.**

About 91% of the adopters and about 92% of the late-adopters bought their first workstation. The financing of the firm's first workstation was obviously not related to the prevailing business cycle. Investments in the technology were significant. According to the initial questionnaire, about 60% of the firm's total investments were spent on CAD the year when the firm first bought a workstation. One architect expressed the investment in CAD by giving it the following context: "[B]efore there were salaries, salaries, and rent, now a days it is salaries, CAD, and rent." Regarding the question if there were any other comparable investments the following response was made: "No. Yes people. But there are no other things [that are comparable]. I mean,

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1 1993 is not a complete year. It only includes 8 months and this is why the column for 1993 might have a 33% higher correspondence.
we use ordinary black-lead. Pencils cost nothing, a drawing board costs nothing, some typewriters and PC costs nothing. The other technology [CAD] is demanding [regarding costs]."

A common attitude about the adoption of CAD expressed in the initial in-depth interviews was that the adoption of the technology was an experiment. Because of this attitude, it is interesting that so many of the adopting firms chose to buy the technology. It is also puzzling that some firms were unsure if they would continue to work with CAD. Perhaps they did not want to be obliged to continue to work with it and therefore they considered its adoption to be an experiment because this type of technology was totally new, strange, and unfamiliar. Another impression gained from the in-depth interviews was that the adoption of CAD happened suddenly, without much preparation. The interviewees tended to believe that they secured a job and the client before agreeing to use the technology.

**CAD Use**

In the intermediate in-depth interviews both the architects and their clients were interviewed about their opinions about CAD. The empirical material in this section "CAD Use" comes from these interviews if other is not stated.¹

**The architect's opinion.**

CAD was used on a regular basis in these two architectural firms. Some of the architects had developed working knowledge² about CAD to the extent that they could work easily with it. This meant that there were two groups of people in these firms—one that worked well with CAD and one that did not. The use of CAD could either be because of a client request or because the project group wanted to use it. No significant difference was noticed between the firms in this matter. One interviewee said: "In some cases [the client] prefers the use of CAD." And another interviewee said,"[The use of CAD] is decided in the project group [in which the client is a member]. In some cases the clients have required it." Whether or not an architectural firm used CAD on a job depended on certain constraints. The client had to pay a special CAD fee for the time that the workstation was used. There had to be some CAD experienced people in the firm who were not assigned to any other jobs. There was a restriction from the client that the cost for the job may not be increased because of the use of CAD. The job itself had to have some characteristics that made CAD a suitable design method. One architect expressed it the following way: "Naturally it depends on what the job looks

¹ For more information see "Preparations and Construction of the Follow-Up Questionnaire" in Chapter 3.
² For an elaboration and grounds for classification of working knowledge see Nordenstam (1983, p. 21).
like because all CAD-systems are based on the possibility of using it to perform repetitive work. If that is the case it [CAD] is supremely useful.” The requirements for using CAD were hard to articulate for the architects. Despite all the presented rules and constraints it was not obvious if the technology should be used. One architect put it this way: “What is suitable or not is a question of fingerspitzegefühl [must have the feeling for].” Deciding to use CAD was based on several questions. If a job was to use CAD, it certainly called for repetitive work such as a building with several identical floors.

The client’s opinion.

The clients were convinced that CAD should be used for all jobs except small and simple jobs. Therefore, it was not surprising that one client made the following statement about the adoption of CAD in the architectural industry. “The architects has been very slow in starting to work with CAD.” The clients required the architectural firms working for them to use CAD because the clients wanted the drawings on disk instead of on paper. Architects need a way to protect and store drawings and disks are the best way to do this. One client explained the use of a disk as a storage device the following way: “The University in Solunda was designed on CAD. We requested that the consultants should have CAD because if one gets the same output, if one has drawn a plan all get it very fast by disk, an exact bedding.”

CAD is a supportive tool for an architect that enhances the work. The following story, which was frequently told, identifies the limits of CAD.¹

I once listened to a professor at Chalmers [a technical university for educating civil engineers and architects in Sweden] who formulated it rather well. A bad architect does not draw better houses with CAD, but it is possible that he has time to do more houses.

The story emphasizes that CAD is just another tool available to architects. But, as the findings show, the perceptive clients appeared to be saying that the character of the work changed because of the use of CAD.

Reasons for using CAD.

The job itself was also an important reason for using CAD among the late adopters. The adopters’ clients asked more often for the use of CAD than the late-adopters’ clients did² according to the follow up questionnaire (Chart 4.28). Important reasons for using the technology among the late-adopters were the characteristics of the job and the policy decision that these firms seemed to have about the use of the technology. A large

¹ This story was, with small variations, told in several of the in-depth interviews.
² P value 0.007.
number of late-adopters had identified "Other reasons" for using CAD. Usually they did not specify the reasons; however, the most frequently noted response was the ability to improve the quality of work. Strikingly, the "Clients" was a much more important reason for using CAD among the adopters than among the late-adopters. The former group had noted "Clients" as a significantly more important reason for using the technology.

![Chart 4.28 Reasons for CAD Use. The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), "The job demanded it," "A policy decision," "The clients asked for it," "Employees desired it," "Reduces costs," and "Other."

Use of CAD in jobs.

There were large variations in how much the adopters used CAD in their jobs at S1. The bottom 5% users had the equipment but did not use it at all and the top 5% users used it in 75% of their jobs or more.\(^1\) Mean value for use of the equipment was 25% (Table 4.19).

At S2 the adopters used CAD in about 57% of their jobs (mean value). Between S1 and S2 their use increased by 128%. The bottom 5% of the adopters used the technology in around 5 to 15% of their jobs and the top 5% of the adopters used it in approximately 85% or more of their jobs. The heavy users seem to have a larger demand from their clients to use the technology; the demand for CAD and the use of CAD converged. A comparison between the adopters and the late-adopters showed that the former group used CAD in significantly more jobs. The late-adopters, on the other hand, used it more intensively than the adopters did at S1. The market for these services had probably expanded between S1 and S2. One indication of an increased market is the clients' demand of architectural jobs done with CAD. In about 53% of these jobs\(^2\) in the adopter firms, the customers had explicitly demanded CAD to be used. The corresponding figure for the late-adopters was approximately 60%. One explanation for

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\(^1\) Both adopters and non-adopters were in the sample in this analysis but the firms who had adopted the technology the last financial year were excluded. These firms were excluded because they had not had enough time to start using the technology.

\(^2\) Client's demand of CAD jobs in relation to all jobs done with the technology.
the adopters’ higher voluntary use may be the significantly greater integration of CAD in these firms. The adopters considered it significantly more natural to use CAD in a job compared to the late-adopters. The results suggest that the adoption of CAD is a process; it takes time to integrate the technology into work to the degree that it is a natural supporting tool. The need for time in the integration of CAD in the working process is also shown by the jobs finished with the technology once it was introduced in the working process. The adopters finished their jobs using CAD significantly more than the late-adopters did. This result has to be interpreted along with the type of documents that the firms generated on CAD. There was no significant difference between the adopters and the late-adopters regarding preliminary documents and building permit documents; however, significantly more adopters than non-adopters used CAD for working documents (the last type of document produced in an architectural job).

There was a strong opinion in the industry that the use of CAD was highly correlated with age. According to both in-depth interview surveys, young architects who were trained in the technology during their formal education were very keen on working with it when they began their careers. According to one architect, the eagerness to work with the technology would eventually result in widespread use of CAD when the next generation of architects came to the industry:

I think that in a few years when the TV-games generation is educated and they are around 25 years old, then something really interesting is going to happen in that area [CAD]. Then there will be enough maturity to get something of a breakthrough. There is still a rather large group of people in the industry educated with slide-rules. A generation is still between the slide-rule and 3-D drawing on CAD station.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th>Late-adopters</th>
<th>P Value</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portion of CAD Jobs, S1</td>
<td>25% (SD 25%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portion of CAD Jobs, S2</td>
<td>57% (SD 27%)</td>
<td>33% (SD 32%)</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Clients Demand CAD Jobs in relation to all jobs, S2</td>
<td>30% (SD 30%)</td>
<td>18% (SD 26%)</td>
<td>.034</td>
<td>Y</td>
</tr>
<tr>
<td>Jobs Completely Finished on CAD</td>
<td>54% (SD 43%)</td>
<td>27% (SD 40%)</td>
<td>.001</td>
<td>Y</td>
</tr>
<tr>
<td>Natural to Use CAD, S2 Ranking 1 - 5.</td>
<td>4.2 (SD 1.0)</td>
<td>3.6 (SD 1.2)</td>
<td>.002</td>
<td>Y</td>
</tr>
</tbody>
</table>

1 P value 0.010.  
2 P value 0.947.  
3 P value 0.546.  
4 P value 0.051.
Opinions about CAD

Both the architects and their clients had the opinion that certain advantages were gained when CAD was used. One architect expressed the situation in the following way,

I think that in the long run both [parties benefit]. It [CAD] facilitates work for us. It does. It will give us the possibility to create banks of knowledge that we will use in the future. It is very important to have a bank of knowledge. This helps us search in efficient ways, to try models so to say, and to draw in certain ways; it goes much faster with CAD in certain cases, when it [the designed building] repeats its design. We gain benefits and the client will probably experience benefits as time goes on. . . . I certainly think that it [CAD] is mutually beneficial.

According to this statement CAD would facilitate several parts of the design work for the architect. Creating banks of knowledge means that prior developed design details and knowledge may be reused. These banks will provide uniform design from the architectural firm. Researching and modeling buildings shortens development time. CAD also supports drawing. It gives the architect the ability to use complex geometrical shapes heretofore impossible to draw. The use of CAD makes it possible to reuse efficiently proven designs.

The clients fully agreed that there were advantages of CAD use as well as disadvantages. There was an agreement among the clients that the advantages were greater than the disadvantages. The advantages could be captured in the two words: co-ordination and precision. Co-ordination with other consultants responsible for water, ventilation, sanitation, electricity, and construction was easier and more efficient because of the greater precision CAD drawings provide. Resolution of drawings tends to be much better in CAD drawings. One architect expressed the situation as follows: “When one builds a model of the house in CAD, this model is exact.” “There is better resolution in a CAD drawing. There is room for the switch beside the door. It is possible to measure directly from the drawing.” The clients regarded better resolution and precision in the drawings as quality improvement according to the initial in-depth interviews. They experienced that the cooperation with other consultants was easier because the quality of the drawings had increased. Another advantage of CAD was the possibilities to see the planned building in 3-D format, which was important for some clients. In the intermediate interviews one client said:

During my time as a consultant I had a client that during several years built houses. He often expressed his delight at the blueprints that were presented, but later, when the house was built, he said that he had never understood that it [the house] would look the way it did when it was finished. This is a question of the ability to take in a three dimensional picture.
According to the intermediate in-depth interviews, an experienced CAD user recognizes the limitations of the software. These limitations affected the work process by making it harder (take longer time), but the limitations had no effect on the outcome. The situation was expressed as follows:

It is like this: as one works [with CAD] the demands on the software increase, one never gets completely satisfied. The software is always a step behind. I have been working so much with CAD that I consider that I do not experience any impediment at all working with it.

The interviewed clients experienced advantages of CAD use both in the production process and in the end-result. For example, CAD allowed one client to build a large office building that tenants could customize. Advantage achieved during the design phase was expressed by the interviewed clients as follows:

[C]orrect measurement and co-ordination between the different consultants is much simpler when CAD is used. . . . it [CAD] introduces precision into the drawing process. . . . Co-ordination is also simpler. We copy electricity, telephone, alarm, pipes, air, and refrigerating pipes. Collision points can be seen directly and that is a great advantage. . . .it is a great advantage because one can see on the drawing when things interfere with one another. One does not have to wait until the building stage to see what the problem is. That’s an advantage.

The interviewed clients also saw advantages of using CAD after the construction phase of the building. The quotation below compares drawings made by CAD and manually prepared drawings. “Later, if one has to go in and change things, there are a lot of advantages to correct plans. . . . I believe it [CAD] is a supreme way to produce drawings. Also storage is facilitated.” To conclude, clients appeared to value the advantages so much that they demanded its use, “So we have it [CAD] as a requirement now that only in exceptions are plans allowed to be drawn by hand.” The points of view of architects and the clients are summarized in Table 4.20.

Table 4.20 CAD - Applications and Advantages According to the Interviews

<table>
<thead>
<tr>
<th>Provider</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applications</td>
<td></td>
</tr>
<tr>
<td>To be used in some cases—client must request and pay</td>
<td>To be used in all but extreme cases</td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td></td>
</tr>
<tr>
<td>Correct measurement</td>
<td>Smooth cooperation</td>
</tr>
<tr>
<td>Smooth cooperation</td>
<td>Efficient storing</td>
</tr>
<tr>
<td>More work might be done</td>
<td>Better quality in the building process</td>
</tr>
<tr>
<td>Better resolution</td>
<td>Better overview of the work from different consultants</td>
</tr>
<tr>
<td></td>
<td>Greater flexibility with the end customer</td>
</tr>
</tbody>
</table>
Advantages of CAD use.

"Smooth cooperation with other consultants" was the greatest benefit of CAD use for adopters, late-adopters, and non-adopters (Chart 4.29). There was a tendency in the responses from the adopters and in some cases also in the responses from the late-adopters to stress the benefits of CAD use in ongoing work. For both "More work might be done" and "Correct measurement" there was a significant difference compared to the non-adopters. These firms, on the other hand, had a tendency to stress the visualization benefits of the new technology. CAD "Aids with visualizing and presentations" was the second most frequent advantage noted by the non-adopters. "3-dimensional projection" was an advantage according to both the late-adopters and the non-adopters. Most non-adopters had the opinion that CAD had certain advantages; about 17% of them considered that there were no advantages for using the technology. Some of the firms in all the groups had noted responses in the open alternatives; the two largest categories here were "CAD gives quality" and "Work becomes more rational."

Chart 4.29 Advantages of CAD Use at S2. The abbreviations in the chart were expressed as follows in the questionnaire, (from left to right), "Correct measurement," "Smooth cooperation with other consultants," "More work might be done," "Better resolution, exact depiction," "3-dimensional projection," "Aids with visualization and presentations," and "Other."

Disadvantages of CAD use.

It is possible to interpret the responses regarding disadvantages by the use of CAD, as there were some anticipated disadvantages by the use. A significant number of non-adopters noted that a disadvantage of CAD use was that "The jobs take more time." "Information in CAD is perceived as absolute" was a disadvantage that all groups

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1 P values 0.000 respective 0.003.
2 P value 0.000.
3 P value 0.001.
4 P value 0.003.
shared\(^1\) (Chart 4.30). Remarkably few late-adopters had used the alternative “Other responses.”

Some of the respondents believed there were no disadvantages of CAD use, (about 12\% of the adopters, about 6\% of the late-adopters, and about 6\% of the non-adopters\(^2\)). These 6\% of the non-adopter firms were probably very close to adopting CAD. This distribution may suggest that the disadvantages diminished as the firm gained experience in using CAD. About 36\% did not respond to the question, mainly non-adopters. It was probably hard for them to have any opinion about the disadvantages of CAD use when they had no experience working with it.

**Chart 4.30** Disadvantages of CAD Use. The abbreviations in the chart were expressed as follows in the questionnaire (from left to right), “The job takes more time,” “More difficult to change small details,” “Settings for the job has to be restricted at an early stage,” “Information about CAD is perceived as absolute,” and “Other.”

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1. P value 0.829.
2. P value 0.138.
Chapter 5: CAD—SERVICE QUALITY AND COMPETITIVE ADVANTAGE

This chapter examines the characteristics and impacts of CAD use. Characteristics of the adopters and the non-adopters and the characteristics of CAD are summarized. The impact of CAD regarding service quality and competitive advantage is also discussed.

Differences between the adopters and the non-adopters regarding these issues are only expressed as significant or insignificant in this chapter. Significant has a p value of 0.1 or less; values above this level are insignificant. No detailed information regarding exact levels of significance is presented. For detailed levels of significance see relevant parts of Chapter 4.

Characteristics of Adopters and Non-adopters

Adopters and non-adopters exhibit different characteristics. Adopters can be characterized as progressive firms and non-adopters can be characterized as traditional firms. The adopters developed and explored different business opportunities. Non-adopter firms gave the impression of being satisfied with their present situation and the principals in these firms did not intend to change the firm.

Key Characteristics

The adopters were significantly larger than the non-adopters were. A number of characteristics for the adopters and the non-adopters may be explained by their difference in size. Of course, it is also possible to express the situation the other way around; the characteristics of the two types of firms affected their sizes.

On an industry level, the adopters and the non-adopters may be portrayed by the characteristics in Table 5.1. Each pair of concepts is an aggregate of several individual characteristics for the type of firm. Naturally, these characteristics are not valid to the same degree for all the classified firms. The characteristics should be considered as model of a firm in each of the two categories.

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1 For more information about the choice of the level of significance see chapter 3, section 3.4 entitled "Choice of Significance Level."
Table 5.1 Characteristics of an Adopter and a Non-adopter

<table>
<thead>
<tr>
<th>Adopters</th>
<th>Non-adopters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm’s Lifecycle—Independent</td>
<td>Firm’s Lifecycle—Extension of Founder</td>
</tr>
<tr>
<td>Larger Formal Firm</td>
<td>Smaller Informal Firms</td>
</tr>
<tr>
<td>Various Jobs</td>
<td>Specific Jobs</td>
</tr>
<tr>
<td>Efficient Production</td>
<td>Fragmented Production</td>
</tr>
<tr>
<td>Market Orientation</td>
<td>Professional Orientation</td>
</tr>
<tr>
<td>Progressive Firms</td>
<td>Traditional Firms</td>
</tr>
</tbody>
</table>

Understanding the two types of firms may contribute to the understanding of the impact of CAD in the architectural industry. The principals played a significant role in the decision about an adoption. It is easy to get the impression that the principals in the adopter firms and the principals were opposites. However an adoption is not the opposite of rejection; two different sets of variables explain the two behaviors (Gatignon & Robertson, 1989). When judging the characteristics of the adopter and the non-adopter firms it might ease the understanding to see the principals in these two firms as different but not opposites.

**Independent and Dependent Lifecycle**

Adopter firms had a lifecycle independent of the principal and the non-adopter firms had a lifecycle that was closely related to the founder’s/principal’s involvement with the firm. Several findings support these characteristics. The two firms had significantly different company forms. The founder was active in significantly more non-adopter firms. Frequently the founder was the sole owner of the firm. In the adopter firms, the principal spent significantly more time administering the firm and in the non-adopter firm the principal spent significantly more time participating in jobs. In the non-adopter firms, the focus was on jobs and the firm may be seen as a means for practicing their profession. In the non-adopter firms, the principals were content to have very few collaborators. The founder in the non-adopter firm often worked alone. In the adopter firm, on the other hand, more time was spent managing employees.

There was no difference in the age of the principals in the two types of firms, which suggest that they went to school at the same time. The principal did not get the idea of what type of firms to manage and independent or a dependent one. It was a decision that was made up due to other factors than the education. To some extent, however, may the education have been important in making the decision. There was a significant difference regarding the principals’ education: the adopter principal had a House architectural education and the non-adopter principal had an interior decorator or a landscape architectural education.
An architect's desire to spend more time actually drawing and designing and doing this according to his/her personal and professional values were the most frequent reasons an architectural firm was started. It is possible to see the firm as a way for being able to practice their profession according to their own values, "The firm was not something that came to mind, it was something that came along when going into business." There was no sharp distinction between the firm and its founder; it was an extension of the founder. The firm's lifecycle was a reflection of the founders. The close relationship between the firm and the founder was, for example, reflected in the name of the firm; it frequently carried both the first name and the second name of the founder. Some of the firms managed to break their close relationship to their founder. A critical event in the separation from the founder was when it was time for the founder to cut back or quit working. The usual way to handle the situation was to let the people in the firm go and keep the name of the firm because of its ability to create business.

Through principal change in the adopter firms these firms had broken lose from the founder's influence. The firm continued to exist beyond the present principal's tenure. Significantly more adopter firms than non-adopter firms were members in a group of companies, about 30% of the adopters compared to 3% of the non-adopters. It seems rather unlikely that a branch will follow the founder's lifecycle. There were no indications that the non-adopter firms would break their close relationship to its founders.

**Large Formal Firms and Small Informal Firms**

The adopter firms were significantly larger than the non-adopter firms were, about 26 employees compared to about 3 employees at S1. There was a strong desire among the adopters to be large firms in terms of the industry. About 70% of them had a need for more people at S1, significantly more than among the non-adopter firms. The non-adopter principals usually did not desire to expand their firms; only 30% of these firms had a need of additional people at S1. Adopter firms also needed significantly more people at S1. Between S1 and S2 both the adopter firms and the non-adopter firms decreased its employees. At S2 the average size of an adopter firms was 17 employees and the average size of a non-adopter firm was 2 employees. During difficult economic times the difference in size between the two groups of firms continued. The adopters wanted to achieve their goal to expand the firm at S1 after the recession, i.e., after S2. For example, there was a significant difference between the adopters and the non-adopters regarding plans about the firms market share.
Recruitment Strategies and Organizational Culture

The adopters were formal firms and the non-adopters were informal ones according to the recruitment arguments that the firms used. The adopters and the non-adopter firms had different organizational cultures. Organizational cultures is here used for describing two dichotomies: a formalized culture where situations are managed according to pre-defined patterns: rules and policies govern the employees in the firm, and an informal culture where situations that appear are managed according to individual solutions. There was a formal way for handling new employees in the adopter firms, a pre-determined pattern for career advancement. These people were, according to the initial mailed questionnaire offered “Continuos education” and “Possibilities for career.” The non-adopters stressed the informal working atmosphere in the firm, a good team player. A new employee in these firms was offered ”Partnership” and some specific recruitment argument like ”Nice working environment and good colleagues.” Frequently these firms had used the alternative “Others” and noted something that emphasized the informal atmosphere in the firm. It is important to note that several of the non-adopters were one-person firms that intended to stay the same size. The differences between the adopters and the non-adopters may be blurred by the fact that it was primarily the non-adopters who wanted to expand their firms that responded to recruiting strategy questions. A conservative description of the organizational culture in the non-responding non-adopter firms would be informal. The size of the non-adopter firms and these firms not considering questions about recruiting strategy imply informality. The principals in these firms wanted to keep the size of the firm, which meant that the informal atmosphere in these firms would continue to exist.

Organization of Firms.

The two words formal and informal organizations are also possible to apply to the firms regarding their organizational structure. A significant position was achieved when the architect got responsibility for clients. To be in charge of clients was prestigious and an indication of professional success among people in the industry including clients. Clients of professional service tend to be very sensitive for whom they interact with in the firm (Swartz and Brown, 1992). In the adopter firms, there were significantly fewer people with client responsibility than in the non-adopter firms. This result suggests that the hierarchy had more levels in the adopter firms because responsibility for a client was a sign that the architect had reached a significant high level of the organizational hierarchy in the firm.

The significantly different company forms that the adopters and the non-adopters used also suggest various levels of formality in the firms. A limited company has a high degree of formality built into the company form compared to a private firm. There are
certain requirements on the limited company, e.g., a board and the annual report is more "developed" and publicly available.

New Knowledge and Values.

The significantly different methods for obtaining new knowledge in the firms support the idea of two different organizational cultures. In an adopter firm the employees were offered internal education opportunities indicating a formalized way of "offering new knowledge." In a non-adopter firm the employees were responsible for the own education (self-studies) indicating an informal managing of the process.

Often large firms were known for business excellence and smaller ones were known for outstanding architectural performances. There was no overlap between the two categories—outstanding business behavior and outstanding architectural work. That is, the adopter firms were known for their business values and the non-adopter firms were known for their professional values. The situation was stressed by the fact that the adopters and the non-adopters seem to have different professional values. These groups of firms ranked both the most outstanding Swedish architect and the most outstanding architectural firm regarding architectural performances significantly different. The adopter firms had noted a scattered selection of architectural firms known for their architectural performances, which might be regarded as an uncertainty of professional values in these firms.

Various Jobs and Specific Jobs

Adopter firms were involved in significantly more different types of jobs than the non-adopters were at both S1 and S2. The non-adopters, on the other hand, got a significant larger portion of their revenues from each type of job that the firm did. It seems as is if the individual non-adopter firm had selected to do some types of jobs. These types of jobs were reflected in the firm's knowledge profile. The adopters' knowledge profiles suggest that these firms did all types of jobs.

Education and Jobs.

The adopters usually had knowledge in all types of the architectural areas: house architecture, interior decorating, and landscape architecture. The non-adopters usually had knowledge in one of the three architectural subjects which supports the idea that the adopters did many different types of jobs and the non-adopters did specific jobs, e.g., landscape design. The adopter firms aimed to have house architects, landscape architects, and interior designers in house according to the initial in-depth interviews. The weakest professional competence in the adopter firms was landscape architecture at both S1 and S2. Non-adopters, however, had more knowledge with landscape architecture...
architecture. It is important to note that it was the mean values of the different knowledge areas that were compared between the firms. The non-adopters’ higher ranking of their knowledge in landscape architecture suggest that several of these firms specialized in this area and the adopters had less knowledge in this area.

The two most frequent educations among the non-adopter principals were landscape architecture and interior decorating. In interior decorating the adopters and the non-adopters had about the same level of knowledge. This situation does not undermine the fact that several of the non-adopters were specialized in interior decorating. There were few people in the non-adopter firms (about 2 people at S2) and it is likely that the non-adopters who had a high ranking of their knowledge in landscape architecture had a low level of knowledge in interior decorating. According to the architects it was difficult to be knowledgeable in both landscape architecture and interior decorating for one person. Landscape architecture was considered to be something different by the architects, it was "harder to dabble in."

It is easy to get the impression that a central type of architecture was house architecture and interior decoration, and landscape architecture tasks were beside the main road. The situation is probably to some extent explained by the difference in number of students examined every year; house architecture was the bulk education, which probably is a reflection of the demand of the different types of architectural services in the market. Another explanation to the central position of the house architecture is its volume in a job compared to the two other architectural areas.

There were indications that the adopters would continue to do a large variety of jobs and the non-adopters would do specific jobs. The adopters’ jobs were significantly larger compared to the non-adopters’ jobs at both S1 and S2. A large job probably meant that there was time to obtain new knowledge during the job and eventually enable a firm to try new strategies for producing work, e.g., using CAD. Looking at the number of invoiced clients the mean size of a job was 3 months for an adopter firm and it was 1 month for a non-adopter firm at S2. It was of vital importance that a job offered the possibility of gaining new knowledge because client jobs was the most important source for getting new knowledge among both the adopters and the non-adopters. A large job was perhaps also more interesting and challenging because it was more complicated and forced the architect to stretch her/his knowledge, which was important according the recruitment arguments used by the firms.

Non-architectural business.

About twice as many adopters as non-adopters supplemented their architectural business with non-architectural work at both S1 and S2. The adopters primarily did jobs that were related to construction management, a type of job that is done efficiently with
a computer. Perhaps there was already an application that let the firms integrate the different actors in the job in a computer network, which facilitated supervision. When the non-adopters did work other than architectural business, it was work that reflected the principal’s interest, e.g., illustration. In addition, the adopters were more active than the non-adopters were in jobs that were classified as other than architectural business, which stress that the adopters did significantly more types of jobs than the non-adopters did.

*International jobs.*

Significantly more adopters than non-adopters did international jobs. The adopters increased their international activity between S1 and S2 in terms of number of firms doing these jobs, from about 34% to around 47%. However, the portion of revenues from these jobs was about the same in the individual firm for both adopters and non-adopters. Non-adopters decreased their international activity both in terms of number of firms doing this type of job and the portion of revenues from these jobs. The difference between the adopters and the non-adopters regarding number of firms performing these jobs were about to increase as significantly more adopters than non-adopters had plans to enter a foreign market. About 30% of the adopters that did not seek international jobs had plans to seek such jobs.

*Business volume.*

It seems as if the adopters had the intention to broaden their business to an even larger variety of jobs by increasing the portion of jobs classified as non-architectural business and by starting to offer their services abroad. The non-adopters, on the other hand, do not give any indication that they would increase the variety of their jobs. Actually they will continue to do the specific jobs that they have done before. There was a significantly less intention among the non-adopters to hire additional people. This may explain why the range of competence in these firms regarding different architectural subjects and knowledge related to non-architectural business is fairly constant why the range of competence in these firms regarding different architectural subjects and knowledge related to non-architectural business may in a conservative way be judged as fairly constant. A situation that will preserve the difference in jobs between the firms; the adopters will do a large variety of jobs and the non-adopters will do jobs in some specific areas.

At both S1 and S2, the adopters’ total market share was about 10 times larger than the non-adopters’ was. The difference between the firms’ market share was probably going to increase as significantly more adopters than non-adopters intended to expand.
their market share at S2. At S1 there was no significant difference between the firms regarding this issue. An overall impression was that the adopters had a greater intention to expand than the non-adopters had at S2. Over time the adopters seem to differentiate from the non-adopters regarding the scope of their business.

Efficient and Scattered Production

There were several indications that the adopters had an efficient production and the non-adopters had fragmented production, the firm had several clients and the jobs were small compared to an adopter firm’s production. For example, the adopter jobs were significantly larger than the non-adopters were at both S1 and S2. In an adopter firms there were 4 clients per employee at both S1 and S2, and the corresponding figures for the non-adopters were 8 and 12 clients per employee. Transformed to work time a job in the adopter firm lasted for about 3 months and in a non-adopter firm it lasted for around 1 month. The variations in the size of a job were probably large but this rough estimation of the size of an average job in respective firm gives a hint of the difference.

Job size.

The size of a job was vital for the architects because their most important source for new knowledge were clients’ jobs. A job that lasts for three months compared to one that lasts for one month offers much more possibilities for gaining new knowledge. As a natural consequence of the job size comes also the complexity in the job, which provides even more opportunity to gain new knowledge. There are possibilities for getting deeper into the problems in a larger job, which also will make the jobs more interesting and demanding, in line with used recruitment arguments.

Related to the size of a job was the use of CAD. Some conditions had to be fulfilled before CAD could be used in a job at the time before S1 and the time between S1 and S2. The client had to pay a certain fee for the hours the workstation was used. Usually the client insisted that the cost for the job could not be higher because of the CAD use according to the initial in depth interviews. There should be repetitive parts in the job, e.g., a building with several identical floors. Another way to express the demand of the planned building was to say that the job had to be large. The characteristics of a job seem to have been important. Several of the non-adopters that intended to adopt CAD wanted to wait to a suitable job appeared. According to the initial in-depth interviews, implied in the agreement between the architectural firm and the client to use CAD was that the client had to pay for some of the architect’s training of the new technology.
Client structure.

The significant difference between the adopters and the non-adopters regarding new and loyal clients suggest that the adopters were had to put lesser time into building relationships with clients than the non-adopters had. One way to look at the loyal clients is to see them as a continuous learning process. The architect develops along with the client (cf. Yorke, 1990). Hammarkvist et al. (1982) uses the concept bond when they describe the relation between the provider and the customer. Thus, there is a great deal of investment that needs to be done with a new client. The non-adopters' significantly larger portion of new clients suggests that these firms had to put a substantially larger effort in developing the cooperation between the parties.

The dependence on the three largest clients increased between S1 and S2; all firms were critically dependent on these clients. At S2 the non-adopters got a significantly larger portion of their revenue from these clients compared to the adopters, around 82% compared to about 66%. The large portion of business that the non-adopters did with their three largest clients could mean that these firms had access to several jobs from the same client. It is hard from the collected data to get an understanding of the nature of these clients. For example, they may repeatedly be new ones and demand a substantial time in investments for developing cooperation between the firm and the client. If these three clients are all returning clients, the best possible situation, then there are several of other clients' relationships for the non-adopter architects to develop. The effort that had to be put into building relationships with these other clients may not be as demanding as the jobs with these clients were smaller. At S2 there were nine additional clients for the non-adopter architect to take care of and about three of these clients were new ones. In the adopter firm, approximately three architects had to take care of two new clients per year. The effort that the non-adopters had to put into building relationships with new clients is obvious. A task that probably fragmented their architectural work additionally as the contact with the new clients had to be much more intensive in order to decide about how the service process would proceed.

Market Orientation and Professional Orientation

At S1, the adopters and the non-adopters wanted a client to have the knowledge about architecture—to have the ability to participate in the dialogue with the architect. The recession that hit the industry shortly after S1 affected the architects' opinion of which characteristics a client should have. At S2 the most frequently desired client characteristic was classified in the group relations—a good relation with the client. Significantly more adopters than non-adopter had used their client characteristics for selecting clients at S2. The fact that the adopters did business with significantly more
loyal client supports the adopters’ claim that they selected their clients. Maybe it is all too strong to talk about a selection of clients when business is done with the old stock of clients. These clients were perhaps so good that it was possible to attribute several good characteristics to them.

Bottomlines.

Principals in the adopter firms and in the non-adopter firms seem to have different views about their bottomlines and intentions. They had, for example, different opinions about the most outstanding architect. The adopters and the non-adopters had different professional values indicated by choice of model architect and model architectural firm. When discussing models it is of interest to note that there was a sharp distinction between business model firms and professional model firms. The distinction may be interpreted, as the market wanted different designs than the architects did. Firms that were known for their outstanding business performances were large in terms of number of served clients, and these firms might be described as market-oriented. They were successful in serving a large number of clients. On the other hand, firms known for doing outstanding architectural performance were not the large ones. These firms had a smaller stock of clients. About 87% of the firms were correctly classified as adopters and non-adopters using a logistic regression and size as the explaining variable. The result suggests that the professional values were stronger than the market values in the smaller firms than in the larger firms and in the larger firms it was the other way round—large firms were known for outstanding business performance and small ones were known for outstanding architectural performances.

Adopter firms had significantly more loyal client than the non-adopters had. More than 54% of the adopters’ clients were clients for the fourth time or more at S2. Non-adopters, on the other hand, did business with significantly more new clients at S2. About 22% of the non-adopters’ clients belonged to this group. The non-adopters did not have the ability to keep their clients to the same extent as the adopters had perhaps because they were not market-oriented. An incentive for the clients to change architect might have been CAD. One client said: “As long as one feels that one is having a stimulating cooperation and that they [architects and other involved consultants] carry out that one is aiming for to the costs that one wants there is no need [to change architect].” This statement might suggest that the non-adopters were not able to keep their clients because the clients could get a better value for money somewhere else—from an adopter firm.

At S2, about 49% of the market were not available to the non-adopters because these clients wanted their services done with CAD. Maybe the non-adopters were forced to continuously seek new clients as their present ones started to demand their service done
with CAD. The development of the market using CAD was indicated by several factors. The adopters increased their number of CAD jobs by 128 between S1 and S2: In about 30% of all the jobs in the adopter firms the clients had CAD as a condition. The number of clients who demanded that CAD be used was noted as a significantly more important reason among the late-adopters for getting the technology. These indications suggest that the market for CAD done architectural services was developing fast. Adoption of CAD may be considered as an indication that these firms were market-oriented.

Environmental Awareness.

The adopters seem to be significantly more market-oriented than the non-adopters were; e.g., they were prepared for the arrival of the recession that hit the industry about one year after the initial mailed questionnaire was sent out. The adopters anticipated this change to come within 2 months of its actual arrival; however, the non-adopters predicted that the shift in the business cycle would come around four years later than when it arrived. Perhaps these two types of firms were active in different markets. Arguing this, however, is difficult because the differences in the types of jobs they were contracted for do not support this statement. On the other hand, looking at the education that the principals in the adopter and the non-adopter firms had and regarding this education as a guideline for the nature of jobs that were done may support the idea of different markets. Principals in the non-adopter firms frequently had an interior decorating or a landscape architectural education. The non-adopters ranked their knowledge in landscape architecture significantly than the adopters did. This situation suggests that the non-adopter firms were active in the area reflecting the principals’ education. The large number of one-person firms among the non-adopters stress this situation. Perhaps the competition for these services was different. It is, however, hard to believe that the situation was different for the adopters and the non-adopters to the extent that it makes it possible to talk about different markets. All three types of architectural services are needed when designing a new building that has some land around; they all served the same client.

The non-adopters do not seem to have managed better than the adopters did during the recession; a self-evaluation of how their own firms managed during the period showed no significantly different results between the firms. An argument about different markets, where the non-adopters’ market should have had less competition than the adopters had is hard to make because of the non-difference in managing the recession. Moreover, the adopters managed to increase their productivity significantly more than the non-adopters did between S1 and S2. One explanation of the non-adopters’ belief that they experienced significantly lower competition intensity
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compared to the adopters both at S1 and at S2 might be their significantly larger dependence on the three largest clients. These clients were perhaps exclusive for the non-adopter firm; cooperation over long time had created a firm relationship. Another significant difference was the principals’ plans about the market share for the three coming years at S2. The perception of the competition intensity for the firms was perhaps related to the principal’s plans about the firm’s market share. A want to expand the firm’s market share gave a perception of a more intense competition on the market than a situation when remaining or reducing the market share was present.

As far as competitor activities and competitive advantage, the adopters were systematically significantly more aware about these activities than the non-adopters were. An indication that the adopters were more market-oriented than the non-adopters were. This lack of awareness might eventually be explained by the non-adopters’ dependence on their three largest clients. The relationship between the non-adopters and these clients were probably very close; these clients might be among their returning ones and considered consistent clients for the firms. In such a case, the non-adopters had a limited need to be aware of what the competitors did. Their activities were negligible, as the competitors’ business did not affect the majority of the non-adopter firms’ business. On the other hand, there was intensive competition about the jobs in the industry between S1 and S2, one architect said: “The architects had to vacuum the market for new jobs.” It is probably not possible to talk in terms of a sure business. Every job that appeared on the market was intensely sought after. Another explanation of the non-adopters’ lack of awareness about their market environment might be because of their limited resources. These firms did not have the means to compete for every job or have the means to analyze the market conditions. Everyone in the firm was too busy doing project work. However, frequent strategies for managing the recession among the non-adopters was to cut down on work time and to reduce the number of employees, which to some extent contradicts the need for limited environmental awareness in the non-adopters firms.

Dissimilar mental pictures.

Adopters and non-adopters believed that CAD was a competitive tool for an architectural firm in general. A result that supports von Hippel’s opinion that lead users and non-lead users have very similar product concept preferences (1988, p. 114). However, the adopters and the non-adopters had significantly different opinions about CAD as a competitive tool for their own firm. It seems as if the non-adopters did not identify themselves with the label a general architectural firm. The non-adopters provided different services—landscape architectural—than the adopters and probably
did the principals in the firms have an education that reflected this difference. It would probably be possible to talk about different principal values in the two firms.

The adopters and the non-adopters had significantly different opinions about changes in their own firms. Both at S1 and at S2, the adopter firms implemented change significantly more often than in a non-adopter firms. The changes made in the firms are here seen as a reflection of the principal’s intentions. The management of the firm did probably consider that the firm needed to adapt to the changing market environment. There were constantly changes in the market that offered the firm a possibility to change. It seems as if the non-adopter firms deliberately had chosen to manage without having to change. Perhaps it is possible to regard the non-adopters’ principals to be focused on the professional matters. These principals significantly larger portion of work time spent in jobs and the larger portion of non-adopter firms that had not responded to the question about recruiting strategies suggests this. Changes for these principals were perhaps only related to changes in opinions about architecture.

Perhaps the different opinions about competition intensity in the industry are a reflection of different views about the nature of the competition (cf. Day, 1994, p. 41). The non-adopters lack of awareness of what the other firms in the industry did suggest they were operating using the customer-oriented model or the self-centered model. Whether the non-adopters focused on their clients in order to provide services they demanded is difficult to know. The significantly larger portion of new clients that these firms had at S2 and their focus on professional values suggests that they did not focus on the clients therefore they would be using a self-centered model. The adopters were well aware of their competitors and they had a significantly larger portion of returning clients, which may be interpreted as a better ability to reflect the clients’ demand; therefore these firms probably belong to the market-driven model. These two different ways to view the business environment would probably be reflected in the decisions made in the firm.

**Progressive and Traditional Firms**

The adopters and the non-adopters were two types of firms acting in the same industry in the same market. They were very different from each other, which probably is a reflection of their principals’ intentions. The principals seem to be substantially different. Some of the principal’s characteristics included different education, different “generation” principal (in the adopter firm a principal change had taken place and in the non-adopter firm the founder was still active), the use of work time, perception of the environment, opinions of professional values, attitudes to change, future intentions with the scope of the firm, environmental awareness, and mental pictures. These differences had given the adopter firms and the non-adopter firms certain characteristics why it is
suitable to label the adopters as progressive firms and the non-adopters as traditional firms. Change was a constant state in the adopter firms; at S2 significantly more of these firms compared to the non-adopters planned to: expand their architectural business, expand their non-architectural business, expand their market share, and start doing international business. Thus, the two groups of firms could be labeled labels progressive and traditional firms.

**Embedded IT Strategies**

The adoption of CAD allowed principals in the adopter firms to realize their strategies. These firms had used and were still using a strategy that encouraged the adoption of new technology. These firms had, for example, the right clients to make an adoption useful and possible.

**Strategic Choice**

It is important to emphasize that this discussion is based on the assumption that the differences between the adopters and the non-adopters were systematic in a retrospective way (cf. Mintzberg, 1978, p. 935). Adopting CAD can be viewed as a strategy to improve a firm's competitive position (cf. Porter, 1980). Both adopters and non-adopters made several choices to achieve their goals regarding size. At S2, adopter firms had about 17 employees and non-adopter firms had about 2 employees. In the adopter firms, principals were changed and in the non-adopter firms the founder was still active most likely as the principal. The principal in an adopter firm explored ways to expand the firm such as seeking large jobs, hiring additional people, and seeking international business. A non-adopter firm’s principal had, on the other hand, by and large rejected these possibilities to expand their business. These decisions may be seen as a reflection of the founder’s intentions to secure large jobs or small jobs progression or tradition—progression or tradition. Thus, the situation is more complex than saying that the adopter firms were large and the non-adopter firms were small. Different firm sizes are the result of different management intentions.

At S1 and some years before, the architectural firms seemed to work without any financial limitations. All firms had problems with a lack of production capacity. Production limitations in the firms were a severe problem in the industry; all firms recognized to address this problem according to the initial in-depth interviews. In this situation some of the firms in the industry adopted CAD. In the initial in-depth interviews, the adopters gave the impression that the adoption of the technology was something that happened all of a sudden, e.g., we got a job in which the client
demanded us to use the new technology. According to the results in this book, the adoption did not appear all of a sudden or by chance. A number of both deliberate and implicit choices prepared the way for an adoption. Mintzberg's (1978) argues for this type of technology adoption in his proposal that strategies are formed gradually, and only afterwards it is possible to identify a pattern. CAD is here seen as a means that makes it possible for the principals in the adopter firms to realize their strategy for the firm and for the principals in the non-adopter firms to realize their strategy for the firm by rejecting an adoption.

The most important reason for adopting the new technology was the principals' perception of it, CAD was seen as "A natural progression" by both the adopter and the late-adopter principals. This reason for adopting CAD scored about 4.5 (mean value) for the adopters and around 4.3 (mean value) for the late-adopters at a ranking with max value 5. Thus, the principal's perception of the environment was the strongest reason for a firm to adopt CAD. Included in the perception were the present and future competition in the industry and the competitors' attitudes toward the technology. The adopters opinion of a significantly more intense competition in the industry did probably hasten their adoption.

Reasons for adoption.

It is possible to consider the board as a source of personal information for the principal and individuals with greater access to information are more likely to be adopters (Gatignon & Robertson, 1989, p. 45). A board meeting may be regarded as a personal information exchange activity. Due to the significant larger size of the boards in the adopter firms probably more people from the direct service production had a chair. In the non-adopter firms the principals participated to a significantly larger extent in the project work than the principals in the adopter firms did. Therefore, the portion of business information that came forward at the board meetings in the two firm types may not have been so different. There is, however, a difference between being a principal and doing project work and being a partner doing it. The partner was usually appointed to the board due to her/his professional skills why a need of CAD may have been recognized early in the product life cycle. Another difference between the partner and the principal might be their age. In both the initial in-depth interviews and in the intermediate in-depth interviews it was stressed that using CAD was a question of age. It was the young architects that were most interested in learning about and using CAD (cf. Stevens et al., 1993, p. 21). In the adopter firms more external people were connected to the board than in the non-adopter firms therefore these firms had access to more information from outside the firm, which might have increased the interest for CAD in these firms. Thus, due to the results of the strategies that the adopters had been
using they had created a situation in which an adoption of CAD was done early in terms of the product life cycle of the new technology.

An important difference between the adopters and the non-adopters affecting the adoption of CAD was the culture in the firm. The adopters were used to changes in the firm and the non-adopters were not. Another difference between the two groups of firms that would indicate a different attitude to change is the significantly different size of the firms. Adopters were used to hiring new people; they had procedures for this. Change had been incorporated into their organizational culture. Non-adopters, on the other hand, did not want to change. They wanted to keep on doing business as usual: the most frequent state in these firms was no change. In addition, the difference in organization form for the firms probably affected their attitude to change. The adopters were limited corporations frequently belonging to a group of companies and the non-adopter firms were frequently organized as private firms in which the founder was principal of the firm and the sole owner. In an environment where change has been incorporated into the formal organizational culture an adoption of new technology is probably a natural progression.

A Network of clients.

There was a strong connection between the client and an architectural firm’s first use of CAD according to the initial in-depth interviews. The client had a fundamental role in the adoption by offering the firm a job that was suitable for CAD. Some of the non-adopters had expressed that they intended to adopt the technology when some condition was fulfilled: "When a big job turns up." The client also had to approve the use of the technology in the job. Due to the ways that the firms got their clients it seems to be rather difficult for a non-adopter firm to get a job that would demand CAD in the innovation’s early parts of its life cycle. Most frequently, new jobs as well as new clients were secured through contacts and prior clients according to the follow-up questionnaire and the initial in-depth interviews. The situation suggests that different clients wanted different kinds of jobs regarding the size of a job. A non-adopter’s client mainly offered small jobs and adopter’s clients mainly offered large jobs. The ways used to secure new jobs and clients suggest that a firm was active in a certain network, a defined sphere of actors. The point of time for an adoption was decided by who the actors in the firm’s network were. It was in the network that the architect got referrals for new clients (cf. Coxe, 1990; Day & Barkdale, 1992, p. 89). Probably the actors in the network had certain characteristics in common; e.g., they all had a progressive attitude (cf. Yorke, 1990). There had to be a mutual agreement between the parties to use the new technology because both sides had to do make a lot of effort to make CAD work in the desired manner. Clients were a significantly more important reason for
getting CAD among the late-adopters than it was among the adopters. The importance of belonging to the right network is stressed by the fact that the firm usually had three key clients who stood for the main part of the revenues. It was probably one of these clients who were the first one to demand the use of CAD.

**Perception of CAD.**

Adopters and non-adopters had different perceptions of CAD. The adopters saw it as a tool for increasing productivity and the non-adopters considered it mainly as a means to facilitate presentations. The adopters’ and the non-adopters’ opinions may be described by Löwstedt and Norr’s (1992) concepts solution handling and problem solvers, respectively. The adopters adopted CAD without any clear-cut ideas about the contributions of the technology. The two most frequent reasons why they adopted the technology were “A natural progression” and “A way to raise productivity.”

Productivity and IT are two concepts that ever have been connected by other researchers (cf. Reynolds, 1993).

“Smooth cooperation” and “Increased productivity” were the two most frequent advantages from using CAD among the adopters. At the time when most adopters got CAD there were a boom in the industry and the firms had severe problems with meeting demand because of a shortage of workers. It is possible to describe the adopters’ reason for getting CAD as solution handling due to production limitations. Non-adopters believed that CAD was useful for aiding with visualizing and presentations and 3-dimensional projection. These are typical “problem solving” ways for using new technology (cf. Löwstedt & Norr, 1992, p. 21). Adopters and non-adopters had different opinions about the disadvantages of CAD too. The adopters believed that because the “Settings for the job has to be restricted at an early stage” CAD was a disadvantage. The non-adopters believed that CAD was disadvantage because “The job takes longer time.” The differences in the perception of the advantages and the disadvantages of the technology might have been one reason why some firms adopted CAD and others did not. This conclusion supports the idea of Gatignon and Robertson that adoption and rejection are not opposite; they are two different behaviors (1989, p. 45).

**Comments on CAD Adoption from Adopters and Non-adopters**

Adopters and non-adopters seem to do their business in two different environments. Principals in these firms had two different mental models of the industry. The findings in this book suggest that the mental model is not limited to represent competitive advantage, instead it embraces the principals’ complete perception of the business environment. Depending on how the principals regard their business environment they
emphasize certain aspects and de-emphasize other aspects. The principals also get the information that is relevant for their mental picture from the business environment. Their perception is selective and only information that supports their opinion about the business environment is usually identified.

Adopters and non-adopters significant different perceptions of CAD as a competitive tool for their own firms might be traced back to the different opinions about the advantages and disadvantages of the technology. According to Barras: the first application phase is improving the efficiency and the last application phase is when new technology is used for new service activities such as visualization and 3-dimensional projection (1986, p. 754).

Adoption Is a Process

One way to identify the nature of the adoption process would be through the disadvantages of CAD use. The three most outspoken disadvantages among the adopters were in descending order, “Settings for the job had to be restricted at an early stage,” “More difficult to change small details,” and “Information in CAD is perceived as absolute.” Other disadvantages that the adopters had experienced were expressed in words describing CAD work such as dull, rigid, and stiff. One way to summarize all these disadvantages of the new technology would be by saying that it formalizes the profession, limits artistic freedom, and changes the traditional working process.

The settings had to be restricted at an early stage means that the architect did not have the choice, as when doing manual drawings, of applying the exact measurements for the designed building at a later stage in the work-process. The exact measurements has to be decided on from the beginning of CAD use, e.g., how long is the building going to be, and how high and wide should the windows be. The need of exact measurements at the early point in the work process was a difference and some of the architects experienced it as a disadvantage. To be able to understand the full extent of the disadvantage it is necessary to be familiar with the architects’ perception of their profession and there work process. The architects considered themselves to be artists, “Everyone in this industry considers themselves to be creative types, individualist, therefore, we want to be lone wolfs.” They were doing creative work that preferably was limited by as few restrictions as possible (cf. Coxe, 1980). Especially in the early stages of a job the artistic process is vital. Here the architect creates a concept for the design, a guideline for the design. In the latter phases the concept is transformed to a design with increasing levels of detail and the final stage of the architect’s work process is the design of the working documents. The development of an architectural work process can be described as going from the general idea to the specific design. A client states his/her needs to be fulfilled by the design, but frequently the client only had vague
ideas of the outcome. From these vague ideas the architect started to search for the most appropriate concept for the planned building. At this stage in the work-process the architect wanted to have as few limitations as possible. It is therefore understandable that the architects could experience the need of exact measurements as a disadvantage because it restricts the creativity in the design process.

The disadvantage "Information in CAD is perceived as absolute" also refers to the early stage of the architect's work process. Sketches printed out from the computer were considered too exact which harmed the creative process at the beginning of a job. The work at this point in the process is a series of revisions; sketches are done, changed, and redone. Nothing in the sketches indicates that they are final in any way or that the information in them is absolute. Producing sketches is a way to try to uncover the concept and the design for the planned building. It is natural that the architect would dislike information that appears to be absolute in a process that requires such revision.

In the interviews the architects also pointed out that CAD work producing absolute early-stage plans are also a concern for the client. The client often would consider documents produced using CAD as absolute and final thereby discouraging the client from providing suggestions for the design.

The third most outspoken disadvantage of CAD among the adopters was "More difficult to change small details" compared to a manual situation was more difficult. Depending on the degree of difficulty it might prevent the architect from doing minor changes because of the effort. In such a case the architect's work-process was restricted because there was an increased complexity for changing smaller details.

Two of the disadvantages that the adopters had about CAD might be considered as starting problems. The perception that computer information was absolute produced solutions that would probably change over time both for the architects and for their clients. The more integrated the working with CAD became in the architect's work process the less absolute information would be considered. Eventually it will be natural to consider CAD documents the same as manually produced ones in the aspect of preliminary information. The problem is probably a matter of perception. CAD drawings look as if they are complete irrespective of the stage of the design process they represent.

One way to look at the disadvantages with CAD is to say that the perception of them is related to the improvement of software development. The sooner architects have experience with making small changes using CAD, the sooner the information will be considered as preliminary and changeable. Thus, the experience of absolute information and the difficulty to change small details seems to be related to each other. Time influence the perception of CAD constraints. It was significantly easier for the adopters to work with the technology than it was for the late-adopters to do so.
The architects have for generations done their work manually. Most of the architects in the industry have made their first contact with the new technology just a few years ago. In their formal education all design work was done manually and in their professional career they have also worked with manual design. It is therefore interesting to see that about 12% of the adopter principals had the opinion that there were no disadvantages with CAD according to the follow-up questionnaire.

**CAD—a question of age.**

In the in-depth interviews, the architects repeatedly stated that CAD was experienced differently by the older architects than by the younger architects. The older architects had been trained to work with paper and pencil and they had been working so all their life. It was therefore not surprising to hear statements like, “I want to avoid CAD as long as possible.” As the younger architects had to learn about CAD and get trained on it during their formal architectural education, they more readily accepted it. The new technology would therefore probably be the way they would prefer to design. With the younger architects, CAD had taken some steps on the path of being equivalent with the pencil as a familiar tool for the architect. One architect expressed the differences between the generations the following way:

I think that in a few years when the TV-games generation is educated and they are around 25 years old, then something really interesting is going to happen in that area [CAD]. Then there will be enough maturity to get something of a break through. There is still a rather large group of people in the industry educated with slide-rules. A generation is still between the slide-rule and 3-D drawing on CAD station.

The incorporation of the new technology in the architect’s work process was to some extent reflected by the portion of work completed on CAD; completed means: as soon as the new technology was introduced in the work process the job was managed on the tool for the subsequent phases of the architect’s work process. Adopters completed their jobs significantly more on CAD than the late-adopters did. The late-adopters did especially not prepare working documents on CAD; the difference to the adopters was significant.

**Perceived Service Quality**

A group of the clients wanted their architectural services done with CAD. Their demand may have required a transition from manual design to CAD design because clients perceived CAD use as a way to increase quality. This transition suggests that
service quality is a dynamic concept and it also suggests that the concept of service quality depends on the client's point of view.

**Interests Affecting Service Quality**

In a business-to-business situation service quality becomes a composite concept where the quality perception of each individual client in the values system has to be incorporated into the performed service. The model in Figure 5.1 is very detailed to underline the variety of interests affecting the architect. Each of these interests can according to the initial in-depth interviews have an individual influence on the planned building and these opinions may be hard, if not impossible, to reconcile. According to the definition of service quality used in this book, what the client perceives as quality, results in different expectations about service quality.

![Figure 5.1. Interests Affecting the Output of an Architect](image)

The reason for identifying the large number of clients to an architect is to show the challenging task of design. All the interests in Figure 5.1 can be traced back to the in-depth interviews with the architects. The architect stressed each of the customers as an interest to be considered when making the design of the planned building. Due to their holistic view, the architects were, according to their own opinion, especially skillful in satisfying the various demands of the planned building. One architect said: There are few who have the holistic view as architects have. . . . to simply optimize a project, both from the point of view of the user and from the point of view of the estate administrator.” The statement above is an example of one reason why the architects wanted to be in charge of the project group. There were certainly others but the one quoted here was the most frequently used one.
All the different interests that affect the architect, as noted in Figure 5.1, do not have the same degree of influence. Some of the interests are compulsory, as others are self-assumed. Estate owner, developer, and estate administrator are examples of the compulsory interests. Naturally the combination of compulsory interests depends on the situation; in some jobs there is no estate administrator present and in another job the estate owner and the estate administrator is the same person. Also the group “other consultants” might be classified into this class of interest. Interest coming from the colleagues, values and norms, and models may be classified in the category “self-imposed.” These are interests that the architect considers obligated to fulfil primarily from a professional point of view; e.g., the architect wanted to impress his/her colleagues by making an interesting design. The interest “user” is somewhat special according to the in-depth interviews. Frequently the architects said that they gave voice for the presumptive users when they were not present in the project group, which was rare. According to one architect in the intermediate in-depth interviews there was a market-orientation going on in the Swedish building industry, which stress the importance of representing the users by several interests as done in the model (Figure 5.1).

Estate owner, developer, estate administrator.

The estate owner, the developer, and the estate administrator were central and present interests in all projects. Naturally, there might be exceptions but the focus here is on the typical situation. The estate owner and the estate administrator were usually referred to as the client and the developer was the interest that should realize the architect’s design represented by a number of drawings.

The one who was paying for the architect was usually found among these three interests. Naturally the interest who was paying had priority in preferences about the design, “When we [the architect and the client] have agreed upon and decided that this is something to continue from, then we go to the next phase in the project.”

The user.

The architects frequently referred to the interest labeled “the user.” There seem to have been a certain bond between the architect and the user due to the close attention that the architects gave this interest. If the user was not present in the project group the architects gave voice for the anticipated demands from this group according to the initial in-depth interviews. By doing so the architects probably wanted to stress their capability of having a holistic view of the planned building.

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1 The architects frequently addressed the client with the title the purchaser; the word client is used here to stress the close relationship between the architect and the purchaser.
There seem to be a change going on in the building industry, which would favor the opinions from the user interest. For example, one of the interviewed clients had built a test apartment to which the public was invited to visit and provide comments. Perhaps there was a customer orientation going on in the building industry. One architect interviewed in the intermediate in-depth interviews said so: "I mean that the whole building industry in Sweden is going through a transition from product orientation to customer orientation."

**Colleagues.**

All architectural performances were judged and evaluated by their colleagues in the industry. They were the most demanding and the most present judges. These people were not connected to any particular job; instead they were always present to give comments about architectural design in general.

According to the architects, it was important to stand out as skillful for their colleagues. "It is important to be regarded as a professional among the colleagues, as a capable person. This judgement has its importance in the craft-guild." Due to the nature of architectural work the colleagues were the only ones who could evaluate the architectural performance according to the architects in the initial in-depth interviews; the colleagues were the only ones who had the required knowledge. Also according to these interviews the architects had firm opinions about each other's designs, but these opinions were not shared with the interviewer.

**Value and norms.**

The architect's values and norms about architecture and present trends in architecture affect the quality of an architect's output. Among the architects it was frequent to hear them talk about models. The profession was central for the architect; i.e., there were strong models and norms about what to do and how to do it. The strictness of the norms and of the models was probably accentuated by the relatively small size of the Swedish architectural industry; there were about 5,000 practicing architects in Sweden. The situation was further stressed by the relative homogeneity of the principals regarding sex, age, and education.

**Models.**

The architects used many different sources as inspiration in their work. Architectural journals were frequently mentioned in the in-depth interviews. At S1, when there was money around in the industry, it was usual that the firms made field trips to places with interesting architecture, e.g., New York, London, Paris, and Istanbul. These trips were highly valued events in the firms according to the in-depth interviews. In addition, other
architects in the industry influenced an architect’s work. The professional values between the adopters and the non-adopters were significantly different but homogenous. Within the groups two designers accounted for 47% of the adopters’ opinions about most outstanding architect and around 59% of the non-adopters’ opinions.

**Other consultants.**

The other consultants affected the designing process to some extent because they should realize their parts within the design of the planned building, e.g., the water, electricity, and heat consultant. For example before CAD was used it was very hard to realize curved buildings due to the massive number of calculations needed for this kind of buildings. One consultant more than others affected the architects work, the builder. This person translated the architect’s design into solid materials to be used in the construction of the planned building. The architect’s design had to be understood by all the consultants and contractors on a job, especially the builder.

**Cooperation a way to manage different interests.**

It is easy to get the impression that it would be impossible to satisfy all the different interests involved in the architect’s work. The key to success was the cooperation between the parties because cooperation allows the architect to have the possibility to influence the involved interests and their view of quality (cf. Lundin, 1993; von Matern, 1989; Yorke, 1990). The focus of the cooperation approach is on the members of the project group and the other interests identified in Figure 5.1. Naturally, there was a continuous discussion going on among the architects regarding the three interest groups: models, colleagues, and values and norms. However, the changes in opinions in these interests probably occur slowly. They do not change during one project—one building. In terms of service quality it is one building that is evaluated. The conditions for service quality changes continuously due to the interests present in the project and they who are indirectly represented. In addition, the planned building affects the perception of service quality especially, according to the interviewed clients, since every project was unique.

Regarding cooperation one client said:

[The architect had] had to be able to have a dialogue with the client and make the client do the decisions in the right order. This is quality. He [the client] might then discover that this is not what I wanted, this is what I want instead.

According to the statement above the client wants to be surprised by the architect and to be confronted with unique solutions. To be able to have this type of relationship with the architect and the client there needs to be a lot of confidence between the parties (cf. Huemer, 1998). The social bond in terms of Hammarkvist et al. (1982) needs to be
strong. Partial employee is a concept that has been used for capturing the tight relationship between a service provider and the client (cf. Lovelock & Young, 1979; Mills, 1986) and it seems appropriate to use it for capturing the relationship between an architect and a client. One way to characterize the situation would be by suggesting that the client states his or her needs and the architect designs solutions according to these needs and other interests that the architect considers as appropriate to incorporate as guiding values in his/her work.

**Different levels of knowledge.**

The act of communication with the client was a challenge due to the different levels of knowledge the parties had. Guiding the client is perhaps a better way to describe the dialogue with the client (cf. Lehtinen, 1985a, p. 117). The architect guided the client to a design of the building that would fulfil the clients needs and the architect’s values about architecture (in the extent possible due to the limitations of the present job). Guiding the client was probably difficult when considering the characteristics that the architects wanted a client to have. Various forms of knowledge were the most and the second most important client quality according to the initial questionnaire (cf. Gummesson, 1978, p. 95; Östnäs, 1984, p. 29). One architect expressed the situation in the following words:

If we compare with Finland for example, the mining engineers still order architectural services. . . . there is a long tradition by those who order architectural service, these people have a good education, a good grounding so to say, not only the narrow expert knowledge of mining engineers. Instead they, through their families or through other interests, they have a broader perspective on life. They have a more solid holistic view of what society is about.

Having the model client as a counterpart was rarely the case, if ever, but the differences in knowledge had to be overcome. Confidence seems to be the means for bridging the gap in knowledge between the architect and the client. One architect expressed it as follows: “It is a question about the confidence between the architect and the present client so it is different from time to time.” The use of confidence in the relationship between the parties suggests that there was a rather strong relationship between them.

**Service Quality Perception Is Relative and Dynamic**

Service quality is a relative and a dynamic construct; what is considered to be quality in one setting may be totally different in another one and what is considered to be quality at one time may be different at another time. The architects had to be sensitive to what the involved parties in the job considered quality and what was not appreciated. The relative approach to quality was utterly stressed by the situation that the architects
tended to work with one-of-a-kind jobs. “Every object is normally unique.” There was no predefined solution of the task that the clients wanted the architect to do. The involved parties had their individual ideas about fractions for what the wanted building should be evaluated against. It was the architect’s task to create a homogenous quality perception among the involved parties and it was also the architect’s task to affect each individual’s fractions of quality pieces to correspond to the outcome that the architect wanted to present. One client expressed quality as follows: “It is quality when the architect perceives my level of ambition and he manages to capture this ambition in the right way.” The example presented in this paragraph may be seen as indications of the relative nature of service quality.

An example of the changing nature of service quality is the differences in quality perception between architectural clients; certain clients wanted to have their jobs done on CAD. At S1 the adopters used the new technology in about 25% of all jobs and at S2 in around 57% of all jobs. The single most important reason for using the new technology was client demand, which suggest that the use of the new technology increased the client’s satisfaction. The result is in opposition to Bitran and Hoech’s (1990, p. 89) conclusion that there is no relationship between client satisfaction and technology. There was still, however, a significant part of the jobs in the industry that were done manually, which suggest that the majority of customers did not want their jobs done with CAD. There seemed to be a relationship between technology and satisfaction for some of the clients but not for all. A fast transition from manually done jobs to jobs done with CAD was going on in the industry. The group of late-adopters stresses the transition. Between S1 and S2 these firms went from doing no CAD jobs to doing about 33% of all their jobs with CAD. These arguments suggest that service quality had a dynamic nature in the architectural industry. Over time service quality tended to change evaluation criteria.

\textit{Service Quality and CAD}

As long as the cooperation between the client and the service provider worked out there were no actual needs for the client to change service provider according to the clients in the intermediate in-depth interviews. The service provider has to be sensitive to the client’s needs: how a project should be done and what criteria the final outcome should meet. Both the adopters and the non-adopter had the opinion “That the final outcome corresponds to the expectations” was the second most frequent wanted expectation that a client had on the architectural service according to the follow-up questionnaire. Smooth cooperation was the most frequent expectation from the clients according to the architects. Both these expectations may be easier to achieve when using CAD. Smooth cooperation was the most frequent noted advantage of the
adopters, late adopters, and the non-adopters. In the intermediate in-depth interviews, the three clients noted that architectural services should be done with CAD. These clients seemed to be somewhat frustrated over the pace of the architects' adoption and use of the new technology. "The architects has been very slow in starting to work with CAD." Yorke (1990) has showed that there is a considerable gap between what the clients of professional service want and what the service provider thinks that the clients want, which might explain the clients opinion of a slow adoption of CAD in the architectural industry.

Grönroos (1993) has argued for the need of a new service quality model, one that will reflect the dynamics of service quality. A dynamic service quality model that has an external approach is presented Figure 5.2. The model may be summarized in the following way: introduction of IT might be an incentive for changing perception of service quality. The service provider starts to provide services that are changed in some way, in production or in offer. Here the change was the adoption of CAD. The change may affect the opinion of service quality in the industry. Depending on how the new way to do the service is accepted in the industry and especially by its clients a transition of quality may start. If the industry and its clients accept the change a new quality standard starts to spread in the industry. Services done with CAD are considered to have higher quality than services done manually by more and more clients. The industry norms for quality perception is redefined and the industry has got a new quality standard (Figure 5.2).

![Figure 5.2 Competitive Spiral (Boström & Wilson, 1993, p. 61 modified)](image)

The model in Figure 5.2 starts at a steady state one, SS1—Q1, indicated by the box in the center of the model "Industry @ SS1—Q1." At SS1 there is an accepted definition
of quality in the industry—Q1. The innovation, in this case CAD, which might affect the prevailing service quality because perception has not yet been introduced in the industry.

At the stage "Introduction of Innovation," the new technology is introduced in the industry. At this stage the parties, the firms in the industry and the industry’s clients, are exposed to CAD. Some firms might adopt the new technology and start to use it in selected jobs ("Diffusion and Application to Selected Jobs Interaction"). In some cases there is no one in the industry that wants to adopt the innovation and the process may follow the arrow marked "Exit." According to the results of this book, the progressive clients had a fundamental role in change; they decide the future for the new technology. The role of the clients naturally depends on the nature of the innovation adopted. CAD is adopted on an evaluation basis, if both parties approve the contribution of the new technology a "Redefinition of Quality" occurs. Otherwise, the process will proceed along the arrow marked "Exit." Note that the model in Figure 5.2 depicts an aggregate process for the industry. Some of the firms that adopt the innovation at the "Introduction of Innovation" stage may very well stop working with it (compare for example the behavior of the New non-adopters), which does not mean that the innovation has made an exit from the industry.

At the stage "Redefinition of Quality," it is time for the clients in general to approve the new technology. The process may continue along as anticipated if both parties agree and if not the process will proceed along the "Exit" arrow; i.e., the adoption process and the use of the technology will stop. The innovation path means that the industry proceeds into two stages.

At "Steady Stage 2," the definition of quality has changed and it now incorporates the marketplace’s perception of CAD. The benefits of the technology is now included in the definition of the quality of architectural services. During the transition period when quality is redefined, there will be some vestiges of the "old" quality and the "new" quality in the marketplace. According to the nature of the prevailing definitions of service quality, the clients are of crucial significance for a transition of service quality to occur (cf. Berry et al., 1988, p. 35; Farsad & Elshennawy, 1989; Grönroos, 1983; Gummesson, 1978, p. 93; Gummesson, 1990, p. 7; Lehtinen & Lehtinen, 1991; Murdick et al., 1990; Tierno, 1989; Zeithaml et al., 1990). The clients govern the process depicted in Figure 5.2 by accepting or rejecting the new service. The impact of the clients naturally depends on the type of innovation, how much the innovation affects the offer that the firm presents for the clients. In the case of CAD as the innovation, the clients were the ones deciding if the new technology was to be used; the clients had to agree to the use it and they were charged an extra fee for every hour the workstation was used. The use of the technology meant, according to the clients interviewed in the
intermediate in-depth interviews, that the client got additional features of the architectural service; e.g., better quality in the building process and the drawings were stored on disk.

**Service Quality and Professional Service**

Service quality is somewhat special in professional service, a common perception applied to a situation with one-of-a-kind solution. In the in-depth interviews the architects repeatedly stressed that each job was different than the others (cf. Day & Barkdale, 1992, p. 89; Kelley, Dommelly, & Skinner, 1990, p. 315; Yorke, 1990, p. 349). Naturally, the differences of the services varied, but central are the limited possibilities to satisfy a new client with the solution used for a prior client. In an architectural service situation parts of a prior solution may be usable in a new one but the possibilities to directly apply an old solution to a new setting was limited, according to the in-depth interviews with the architects. To deal with the construct service quality in such a situation is challenging and it has to be related to some broader and average guidelines—how to satisfy the average customer (cf. Liljander, 1995; Parasuraman et al., 1994, p. 122).

"The Perceived Service Quality Model" was used as an indication of a possible relationship between service quality and IT. The model pointed out CAD as a means for affecting service quality. There seems, according to the results in this book, to be a relationship between CAD and architectural services according to the definition of service quality that was used in this book, "Service quality is what clients perceive as quality" (Grönroos, 1992, p. 2). What the clients considered as quality was assessed through their demand.\(^1\) A significant part of the clients in the industry wanted their services done with the technology at S2 and the portion of clients wanting their services done with CAD seemed to increase. Almost 49% of the jobs in the industry were done with CAD at S2.

According to the intermediate in-depth interviews there were several advantages when CAD was used. Both the architects and the clients considered that the cooperation between the parties was eased. The cooperation was the key to a good and successful service situation. It was the foundation for the success of the service design. Architectural clients tended to use the quality of the cooperation as an evaluation characteristic for further business according to the intermediate in-depth interviews with clients. In the service process the architects also considered better resolution as an advantage and CAD increased the productivity. The better resolution eased the

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\(^1\) For more information see headline "Service Quality, Competitive Advantage, and Two Surveys" in section 3.4, chapter 3.
communication with the client. The clients considered that the technology helped them to have a better overlook of the work from the consultants involved in the project. Other advantages of the CAD use were related to the final outcome—the drawings. These could be stored more efficiently on disk. Correct measurement was another advantage expressed by the architects. The clients in the intermediate in-depth interviews said that there was better quality in the building process and there was greater flexibility with the end customers.

There were several indications that the use of CAD would increase in the industry. The clients’ demand of these services was a significantly more important for getting the new technology among the late-adopters than it was among the adopters. Several of the adopters and late-adopters intended to get additional workstations and several non-adopters intended to get CAD in the near future. The degree of use of the new technology in the adopter and late-adopter firms permitted additional use. Among the top 5% of the users the new technology was used in 75% or more of all jobs.

**Competitive Advantage**

Many adopters and non-adopters believed that CAD was a competitive tool for a general architectural firm. The adopters showed a competitive advantage between S1 and S2 compared to the non-adopters. The adopter firms increased their productivity significantly more than the non-adopter firms did and they had more loyal clients at S2.

**Competition and Competitive Tools**

The adopters believed that the competition was significantly more intense in the industry at both S1 and S2 than the non-adopters did. At S1 the adopters considered the competition to be “Relatively Intense” and the non-adopters believed that it was “Low” and at S2 the adopters described the competition to be “Hard” and the adopters said it was “Relatively Intense” (median values). Between S1 and S2, both types of firms had the opinion that the competition increased by “one level” according to the used ranking. It is not obvious why the non-adopters considered the competition less intensive. One explanation might be the non-adopters were significantly less ambitious to expand their business at S2. However, at S1, this difference was not present between the firms. Perhaps the difference was present at S1 too; the adopters wanted to increase their market share more than the non-adopters did assessed in terms of the industry’s business volume. It is probably more difficult to increase a large market-share by 5% than it is to expand a small one by the same number.
Both adopters and non-adopters used quality as their primary competitive tool at S1; however, significantly more adopters than non-adopters used it. Non-adopter firms seem to use the fee and fast work significantly more than the adopters did at S1. At S2 the situation had changed and the most frequently competitive tool for both types of firms was contacts. The contacts made it possible to get new clients and jobs. Another frequent mean for getting new jobs and clients, especially for the non-adopters, were returning clients, which is remarkable as the adopters had significant more loyal clients than the non-adopters had at S2. The competition in the industry had changed from competing with the outcome of the service to competing over the people who were counterparts in the service situation. It is possible to say that there had been a transition from doing the job to getting the job.

Significantly more adopters than non-adopters had the opinion that the competitors used the same competitive advantages as they did themselves at both S1 and S2. There was a homogeneous competition among these firms. Non-adopters, on the other hand, believed that their competitors used different competitive tools or they did not know what competitive tools their competitors used. The majority of both the adopters and the non-adopters did not know what competitive tools their competitors used at S1 and S2. The firms' opinion about their competitors' competitive tools may have affected their judgement of the competition in the industry. Significantly more adopters than non-adopters believed that there was a homogeneous competition in the industry at both S1 and S2.

CAD was of specific interest as competitive tool. Both adopters and non-adopters believed that CAD was a competitive tool for an architectural firm in general and the adopters also had the opinion that it was a competitive tool for their firms too. The non-adopters did not have the opinion that CAD was a competitive tool for their firms. One reason for the different opinions about CAD as a competitive tool for their firms might be the different size that the firms' jobs performed. An average job in and adopter firm was about three times larger than a job in a non-adopter firm.

The impact of the new technology was certainly stressed by the clients interviewed in the intermediate in-depth interviews. These clients want CAD to be used on their jobs and designing manually was the exception. One client said: “So we have it [CAD] as a requirement now that only in exceptions it is allowed to draw by hand.” The potential of CAD as a competitive tool was to some extent related to the types of jobs that the firm did. At the time of survey one, a widespread opinion was that the greatest advantages of CAD were achieved on large jobs with repetitive parts. One architect said: “Naturally it depends on what the job looks like because all CAD-systems are based on the possibility of using it to perform repetitive work. If that is the case it [CAD] is supremely useful.”
Chapter 5

Competitive Advantage and CAD

The purpose of the assessment of competitive advantage in this book is to compare two groups of firms to see if the use of a specific technology may be related to the firms’ performance—competitive advantage. The assessment used five variables: survival, change of market share, change of number of employees, change of productivity, and loyalty.

The result and the discussion in this section may very well be interpreted that some firms were more successful than others were, however, the aim was to assess the impact of CAD. If a firm is successful has to be judged at the individual level and related to the intentions of its; are the principal’s intentions with the firm fulfilled or not?

At S1 there was a similarity between the adopters and the non-adopters regarding plans about the firm’s market share for the coming three years. Approximately 68% of the adopters wanted to remain their market share and around 63% of the non-adopters had the same intention. About 32% of the adopters wanted to expand their market share and around 35% of the non-adopters had the same plan. Due to the similarity regarding plans about the firm’s market share among the adopters and the non-adopters during the period at which competitive advantage was assessed it is possible and relevant to discuss competitive advantage for both these firms in the same way.

Survival of firms.

The most basic mean of competitive advantage is survival (Drucker, 1954); there was no significant difference between the portion of adopters and the portion of non-adopters that survived. About 82% of the adopters survived and around 75% of the non-adopters survived. There seems to be no association between CAD and survival for the adopters and the non-adopters, i.e., the non-adopters who did not survive would probably not have survived even if they had CAD. It is possible to argue that CAD was essential for the adopters’ survival. The portion of CAD jobs that the adopters did was vital for the survival of these firms. In about 30% of all jobs in an adopter firm the client demanded CAD to be used at S2. A decrease in 30% of work in these firms makes it relevant to question their ability to survive during the recession. This decrease would probably have been even larger than 30% due to the characteristics of the CAD jobs. Some of the firms’ three largest clients, if not all of them, probably demand the use of CAD.

It is possible to anticipate that CAD helped the adopter firms to survive. There is no information available about the firms that did not survive. It is, however, likely to assume that having CAD or not having CAD was not related to their survival. The recession that appeared between S1 and S2 hit the whole Swedish industry, especially the building industry. Going out of business was frequent in the building industry. The
architectural firms were severely affected by their customers going out of business or not having money to pay for their architectural work. One of the most famous architectural firms in Sweden did not survive because some of its key clients went bankrupt. The new technology did not prevent some of the adopter firms from going out of business. On the other hand, CAD did probably help some of the adopter firms, if not all of them, to maintain the volume of their business, and perhaps in some cases it enabled the adopters to increase their business volume.

Change in market share.

Regarding change of market share there was no significant difference between the two groups. The adopters decreased theirs by about 2% and non-adopters decreased theirs by around 7% (mean values). Both the adopters and the non-adopters failed in their intentions to remain their market share or to expand it. None of the adopters and about 2 percent of the non-adopters had planned to decrease their market share at S1. There was great awareness of a soon to be change in business cycle among the firms in the industry despite that the firms had these plans about their market share. Between S1 and S2 the total volume of the market for architects decreased by 12%.

Change in productivity.

The adopters increased their productivity significantly more than the non-adopters did between S1 and S2, and at both these occasions the adopters had significantly higher productivity than the non-adopters had. To some extent, the situation may be explained by the different strategies that the two groups of firms used during the recession. Adopters decreased the number of employees and the non-adopters cut down on salaries and work hours. The strategies used by the non-adopters will definitely result in a decrease in productivity. An analysis of the change in number of employees computed as percentile change in the firms showed no significant difference between the adopters and the non-adopters. There was no significant difference affecting the denominator in the calculation of productivity.

Another explanation of the significantly larger productivity for the adopters would be their use of CAD. Productivity was the second most frequent noted reason for getting the new technology and the second most frequent noted advantage of the technology by the adopters. It might be possible to claim that an association between CAD and productivity exist. The difference in productivity may also be attributed to the nature of

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1 The market share was estimated from the firm's revenues. The sum of the total revenues in the sample was set to 100% at S1 as a reference basis. Note the processing was done with cases that were weighted — industry situation.
jobs that were processed on CAD. These jobs were large; perhaps it was easier to obtain a higher productivity on a larger job than on a smaller one and there are more hours billable when doing a large job.

**Loyal clients.**

There was a significant difference between the adopters and the non-adopters regarding how loyal their clients were. Adopters did more business with clients for the fourth time or more and the non-adopters did more business with new clients. It seems as if the adopters were more able to have a continued relationship with their clients than the non-adopters were. The ability may perhaps be attributed to CAD because of the number of clients in the adopter firms who demanded their service done with the new technology.

**Competitive advantage and CAD.**

There seems to be an association between CAD and competitive advantage. The adopter firms had significantly higher productivity and significantly more loyal clients compared to the non-adopters. For the other competitive means—survival, a change in the number of employees, and a change in their market share—there were no significant differences between the two groups of firms. Whether the adopters' better competitive advantage was based on their use of CAD or not may naturally be discussed. There were several indications stressing the importance of CAD for the adopters. It is possible to assume that these firms would not have been able to keep about 30% of their clients if they had not adopted the new technology. The nature of the CAD jobs did probably also contribute to the better competitive advantage. Large jobs offered better opportunities for gaining new knowledge and offer the employees work tasks reflecting the recruitment arguments used.

To attribute the better competitive advantage only to the use of CAD is probably to exaggerate the importance of this technology. Much of the characteristics that the adopters had may have helped them to achieve their performance; e.g., their size was determined by a strategy implemented long before CAD was of interest for the industry. A subtler role of the technology would probably be that CAD helped the adopters to realize their strategy and this strategy gave these firms a better competitive advantage.

**CAD and Sustainable Competitive Advantage**

Competitive advantage has a temporary nature; when the vast majority of architectural firms have adopted CAD the role of the technology as competitive advantage has diminished. However, there are indications noted in this book that the technology might be used as a SCA. Adoption of CAD had to be made carefully if the
full potential of the new technology should be achieved (cf. Magnusson & Johansson, 1993; Wikforss, 1990). There is need for substantial adaptations; the personnel has to be prepared to use and manage the new technology. The situation is more complicated than just buying a computer and a software package.

Another way to stress CAD as a SCA would be to point out the time for the adoption. The most important knowledge source for both the adopters and the non-adopters was client jobs. In this situation the architects learned most about the new technology while working on the job. An adequate expression might be learn-as-you-go (Nehls, 1988). The adopters considered it significantly more natural to work with CAD than the late-adopters did, which suggest that experience from managing CAD was essential for efficient use. Therefore, some firms may stay ahead of the others because they have greater experience in managing the technology. They have a proprietary knowledge about using the technology (Boter & Holmquist, 1996, p. 483; Monger, 1988). Skills regarded as competitive advantage should be proprietary (cf. Porter, 1985, p. 20).

Due to the progress of the CAD adoption, the impact of CAD performed services, as a competitive advantage, will diminish because the vast majority of firms will offer services done with the new technology. CAD performed services are compared to manually performed ones here. The technology will go through a transition from being exclusive (few firms have it) to be common (most firms have it), to almost a necessity for an architectural firm. Clients will by and large require that their jobs to be done with the technology; a firm that wants access to the whole architectural market has to adapt to this demand from the clients. The quality transition according to the competitive spiral, see Figure 5.2, is at this stage in its ending phase. It is important to distinguish between the equipment and the experience from managing it. The impact of the equipment as a competitive advantage will evaporate when firms by and large will have the possibility to offer their services done with the new technology. But the firms with greater experience using CAD will still have a competitive advantage if they are able to still benefit from their greater experience of working with the technology.

**CAD and Image**

The impact of IT may also be regarded in other aspects: actual impact and image impact. Actual impact is as the word suggests the real impact on the service by the use of the technology; e.g., the difference of storage of computer produced drawings and manually produced drawings. Image impact is here related to differences in perception of the corporate image due to the difference in production—architectural services performed on CAD or performed manually. The service is regarded as different due to
how it was delivered—an external perspective. CAD seems to have an improving impact on image. One architect said:

For some [firms] it became a marketing argument. [They seemed to be saying] we have got rid of all drawing boards, we are in the future, we came there first. It was like this and for some it still is. It [CAD] became a sign of success and a sign that one was participating in the progress.

The impact of CAD was not limited to a difference in perception it actually affected the clients buying behavior; firms that had adopted the technology had a significantly higher degree of client retention.

Technology may also have an impact on the corporate image (cf. Stevens, 1991, p. 142). Especially in an industry where the perceptions about outstanding firms were so strong. About 73% of the adopters and around 78% of the non-adopters had noted the same firm as the most outstanding one regarding business behavior, which suggests that there was almost consensus in the industry about the classification. It is most likely to assume that this classification will be familiar for the clients because of their nature, professional and well informed. In an industry with these firm opinions about prototypes a similar ranking system did probably existed in other aspects such as a CAD ranking too. In the in-depth interviews the architects expressed their position about CAD as an indication of the future.

The highest ranked reason for adopting CAD was “A natural progression.” The technology was a mean for indicating that the firm advanced along a path to the future. Grönroos has in his model “The Perceived Service Quality Model” noted image as a filter through which the client strains the impressions and experiences of the service before the provided service is quality evaluated (1983, p. 19). The firm’s image is a way for the client to get some guarantees for the service to be performed. Shostack (1977) stresses the importance of making services tangible, to make the services possible for the client to understand; CAD might be such an attribute in several ways, e.g., working with CAD will make service quality tangible.

**Foundation of Competitive Advantage in Professional Service**

One of the three interviewed clients in the intermediate in-depth interviews placed the costs for the job at the same level as the quality of the cooperation when giving evaluation criteria for an architectural service. The interview was done during the recession, a period when there was a tremendous lack of capital for every activity in the industry. Money was of central interest for all parties during this period. Both the adopters and the non-adopters increased their portion of public clients, adopters form 40% at S1 to 53% at S2 and the corresponding figures for the non-adopters were from 40% at S1 to 48% at S2 (cf. Brown et al., 1993).
During rough economic periods the costs of an architect seems to be just as important as the quality of the cooperation between the architect and the client, which suggest that Porter’s (1985) ideas about competition is also valid for professional service firms. The competition among the architectural firms has the same nature as for other firms. A tool for increasing the productivity may be as important in the architectural industry as in any other. The adopters got CAD during an exceptional boom in the industry, which indicates that a mean for increasing the productivity may be useful during any economic circumstances in the architectural industry.

**CAD—Service Quality and Competitive Advantage**

CAD affects the service quality perception in the architectural industry. According to the demand of services done with the technology several clients have already formulated a new service quality perception. Progressive clients had the opinion that the technology should be used in all but the extreme cases and the top five percent of the adopters used CAD in 75% or more of all their jobs. By and large the adopters used the new technology in a majority of their jobs at S2. Both the architects and their clients had the opinion that several advantages were achieved by using the new technology. The substantial number of clients demanding the use of the technology and the large number of jobs in which it was used suggest that. There seem to be a relationship between CAD and service quality (Figure 5.3); service quality was assessed as clients’ demand in this book.

![Figure 5.3 A Relationship Model](image)

Competitive advantage seems to be related to CAD. According to the follow-up questionnaire the architects considered CAD to be a competitive advantage for a general architectural firm. Firms with the technology showed a better competitive advantage compared to the non-adopters. The adopters’ better performance was probably based on more means than only the use of CAD. However, the technology may not be diminished in its importance, as a competitive means, services done with CAD were vital for the adopters. The revenues from these jobs were in majority in the adopter
firms and in 30% of all jobs in these firms the client had CAD use as a condition. There seem to be a relationship between CAD and competitive advantage (Figure 5.3).

The adopters seemed to have a competitive advantage, as assessed in this book, compared to the non-adopters. These firms had significantly higher increases in their productivity and they had significantly more loyal clients at S2 than the non-adopters had. Regarding the other variables used for assessing competitive advantage—change in number of people, change in market share, and survival—there was no significant difference between the adopters and the non-adopters. Clients increased their demand for services done with CAD and this underlines the impact of it as a competitive advantage.

The relationship between service quality and competitive advantage in Figure 5.3 was partly expressed by the three in-depth interviewed clients who had the opinion that services done with CAD had better quality. According to these clients services done with the technology had features that manually performed services could not offer or did not offer in the same extent. Several of the clients seem to have preferred their services done using the new technology. Another way to stress the relationship between service quality and competitive advantage would be that the better competitive advantage that these firms showed and the opinion that CAD eased the cooperation between the parties in a project according to the follow-up questionnaire. The quality of the cooperation between the client and the service provider was shown to be central for the architects and their clients in this book as it has been shown to been in other studies too (cf. Lundin, 1993; von Matern, 1989; Yorke, 1990).
Chapter 6. CAD AND TRANSFORMATION

In this chapter are the important theoretical conclusions summarized. The results of the surveys are dealt with on an industry level. The interest is on reorganizations, transitions that have occurred, occurs, and may occur in the industry due to introduction of CAD.

CAD and Industry Structure

The introduction of CAD into the Swedish architectural industry divided it into two groups of firms, adopters and non-adopters. The results suggest that these two groups of firms will successively grow apart and the industry will be divided into two parts in which different firms are operating. A mobility barrier will develop between the two groups and this barrier will probably increase over time. The impact of the new technology is discussed in this chapter on an aggregate level—the industry structure. What are the potentials of the firms having the technology?

CAD and Business

By the arrival of CAD a means for differentiation has arrived to the architectural industry. CAD may aid the performance of a firm in different ways. It may provide firms with new ways to compete with non-adopter competitors by lowering costs, improving efficiency, and/or increasing differentiation; it may build switching costs and barriers to entry and in some cases it may completely change the basis of competition; in addition, CAD use may create new businesses (cf. Porter & Millar, 1985, p. 149). Although CAD was available to all firms, it is doubtful that each firm had the same financial ability or interest to adopt it. Important here is that all firms were offered the new technology. This section examines how the adopters and the non-adopters characterize the impact of CAD.

The second most important reason for getting CAD among the adopters was that it was "A way to raise productivity," which indicates that the new technology may be useful in situations of boom. The great potential of CAD as a means for increasing productivity is a fairly common opinion in the literature (cf. Kish, 1991; Reynolds, 1993). CAD allows firms to generate larger resources so that they can be more competitive and it provides a way to deal with changes in the business cycle. CAD may be a means used for giving a lower bid of a job. Cost competitiveness seemed to be an
important in the architectural industry during the recession. The costs were a restriction seen at the "same level" as other aspects of cooperation by the clients in the intermediate in-depth interviews. One architect in the intermediate in-depth interviews claimed that there was no money at all available in the industry. This economic situation is reflected in the qualities that the architects wanted a client to have at S2. Relationships, specifically trusting the client, were the most frequently noted category by both the adopters and the non-adopters. CAD may be an important way to lower costs. CAD maybe a mean for dealing with changes in business cycles.

**Differentiation.**

New and more complex designs, especially curved features, may be designed using the new technology (Reynolds, 1993). In addition, the firm may have a certain design policy that will be facilitated by the new technology, "in this firm we tend to design windows in this way." The designs of these windows are stored on digital media as a module, which may be used in the designs of other buildings (cf. Wikforss, 1990, p. 41).

Late adopters' second most frequent reason for using CAD "A policy decision” might be an indication of such a use.

There were firm professional values in the industry. Outstanding models regarding architecture suggest that the architects want to do architecturally difficult jobs; i.e., jobs that improved their reputation among their colleagues. It was important for the architects to express personal values and beliefs in the design work according to the initial in-depth interviews. It is probably not an overstatement to say that there was a design competition going on continuously among the architects. There was an ambition to make designs that would qualify to be published in an architectural journal, a highly prestigious recognition of the architect’s work regarding contemporary values and the craft guild’s opinion. The architects wanted to differentiate their designs is another way to express the architects’ desire. Their designs should be different but within certain firm norms and values.

The design process was largely a personal process for the architect that allowed the expression of artistic predilections. CAD facilitated the design of certain geometrical shapes according to the architects in the intermediate interviews, which increases the variation in design that is possible to use. Closely related to the larger variation of geometrical forms as a means for the architect, is the use of the increased design possibilities as a means for coping with the increased complexity. According to the architects in the initial in-depth interviews, clients wanted more complex designs and they wanted the work to be processed faster. Both these demands may be easier to manage if CAD is used.
The competitive tools that the architects used also suggest that differentiation was important, especially the competitive tools used at S1. About 82% of the firms in the industry used quality as their primary competitive tool. This could probably be due to the ability to produce several design options.

IT use also creates new businesses. Significantly more adopters than non-adopters intended to expand their business in several ways. About 30% of the firms intended to enter the international market. Being active on several international markets probably makes it possible to deal with fluctuations in the business cycle. About 65% of the adopters intended to expand their non-architectural business at S2. The most frequent type of additional business was construction management at S2. It was probably possible to benefit from the use of CAD and/or related software packages in construction management. There will probably be systems that will support all the different activities in the building process (Jägbäck & Stjernberg, 1990, p. 10).

The third impact of IT was building switching costs, building barriers to entry, and in some cases completely changing the basis of competition (Porter & Millar, 1985, p. 149). The obvious impact of CAD was the creation of two different types of firms the adopters and the non-adopters. Perhaps the new technology also created a barrier to entry as well.

**CAD and a Divided Industry**

Large architectural firm adopted CAD early. These firms had the resources—money and time—to investigate the market about which system would be the most appropriate one for managing, training, and implementing the new technology. In addition, these firms also had the right clients.

At S1, there were 308 ways to combine hardware and software options. Of course, all these combinations are not useful because not all hardware and software are compatible. The number of combinations, however, reflects the difficulty in choosing the best hardware and software and the difficulty in training employees in the technology. The use of information sources, most frequently architectural colleagues, suggest that the adopting firm could get some guidance in their selection of CAD systems. It was probably more difficult for small firms to adopt CAD because the amount of time required to learn it. Usually, small firms closed because they were unable to provide employee training in the use of CAD.

Whether there was any first mover advantage or not in the architectural industry is to be seen (cf. Lambkin, 1992, p. 17). There was no individual firm that could be identified as benefiting from a first mover advantage. Instead, a first mover advantage may be possible to attribute to the adopters as a group. These firms got a significantly larger portion of CAD jobs than any other firms in the industry did. In about 30% of all
jobs in the adopters firm there was a demand to use CAD from the client at S2. The corresponding figures for the late-adopters were around 18%. The adopters had higher productivity than the non-adopters had at both S1 and S2, which indicates that these firms had an ability to continue to be early adopters of most new technologies that the industry would be exposed for.

The adopters and the non-adopters will probably become more dissimilar as time passes. In the analyses there were several indications that the adopters and the non-adopters are different types of firms. These different characteristics were summarized in six overall pairs of statements: firm’s lifecycle independent or founder’s tenure, larger formal firms or smaller informal firms, various jobs or specific jobs, efficient or fragmented production, market or professional orientation, and traditional or progressive firms. These characteristics may suggest that the division of the industry is permanent. There is inevitably a division between the adopters and the non-adopters. The identified characteristics of these firms suggest that they will never be similar.

One obvious difference between the adopters and the non-adopters were their difference in size and all measures associated with size. Between S1 and S2, the non-adopters lost their “fighting spirit” and the adopters kept theirs and to some extent increased it. At S2, the adopters had intended to make changes in their firm more than the non-adopters had. These changes would among other things according to the follow-up questionnaire mean that the adopters would increase their business volume significantly more than the non-adopters would.

All analyses of competitive advantage indicate that the adopters had superior performance compared to the non-adopters. The adopters had significantly higher productivity at S1 and at S2, and they managed to increase their productivity significantly more than the adopters did between S1 and S2. There was no significant difference in change in the number of employees between the adopters and the non-adopters between S1 and S2. A significantly larger portion of the adopters’ clients was returning clients, a client for the fourth time or more, compared to the non-adopters’ clients. Perhaps this latter result was a reflection of the clients’ transition in their perception of service quality—from manually performed services to services done on CAD. Between S1 and S2, the clients who had changed their service quality evaluation criteria to incorporate CAD increased—CAD jobs increased by 128% in the adopter firms.

Industry division.

If a division means that there are two groups of firms, then the architectural industry is divided and the division will last for a long time ahead. There will come a time when another mark of separation will have to be used instead of adopters and non-adopters.
These two groups of firms will still exist in the industry, but the division will no longer be helpful since the number of non-adopters firms will be very small.

A frequent opinion, especially among the older architects, was that they could manage their time in the industry without learning how to use CAD. A group of firms would resist the technology, which was indicated by the growing number of firms that did not have any intentions to adopt CAD. Between S1 and S2, this group of firms among the non-adopters increased from 20% to 35% of these firms. There seems to be an indication of a technological saturation in the industry. Thus, in terms of two groups classified due to the use of CAD, the division will be helpful for some time.

A significant part of the non-adopters will disappear when their principals decide to close their firm. There probably will always be room in the industry for firms that consistently do their drawings manually. The architectural industry is an artistic industry; the architects wanted to identify themselves as artists according to the initial in-depth interviews. In such an industry, the variations in a firm’s characteristics are probably greater than in any another industry. It is always possible that there will be architects who have the professional beliefs that architectural drawings are to be done manually. Thus, there might be non-adopters for a substantial time in the industry.

**Sustainable Division**

The adoption of CAD in the Swedish architectural industry might be regarded as an entrance barrier and a mobility barrier (cf. Porter, 1985; Porter & Millar, 1985). When information about the new technology spreads, the clients experience the benefits of it, and they start to demand the use of it. An entrance barrier and a mobility barrier have emerged when the clients take an architectural firm’s hold of the new technology and knowledge about it for granted (Figure 6.1). The adopters considered it natural to use CAD at S2; they ranked the use of CAD from “not at all” (1) to “completely” (5); the mean value was about 4.2.
When the clients take it for granted that an architectural firm is able to perform the services with CAD, it is more difficult for a firm to adopt it. At this point in the diffusion process and from this point, the possibility to obtain knowledge about CAD during a client job is substantially diminished. The single most important source for getting new knowledge was the clients' jobs because it may be cumbersome for the non-adopters to train on the new technology. At the time when the adopters got the new technology, the adoption was regarded as an experiment, which probably made it easier to start using CAD during the early diffusion process. The client will take it for granted that a firm can provide the services with the new technology and that the architectural firm has sufficient knowledge and experience to do it in an efficient way for the client in latter phases of the diffusion process. That is, the client can not be charged a higher price for the service compared to a firm that had experience working with CAD. If the firm does not offer architectural services done with CAD, then it is possible that a potential client would not consider doing business with the firm. The clients interviewed in the intermediate in-depth interviews had firm opinions of how their work should be done; they wanted CAD to be used in all cases except extreme ones and at a cost that the client found reasonable. Perhaps the adopters' significantly larger portion of returning clients was an indication of a transition among the clients with respect to the use of CAD. A firm that wants to adopt the technology at this latter phase in the diffusion process needs to make a substantial effort to overcome the mobility barrier and as time proceeds the mobility barrier will probably increase. The effort to overcome the barrier increases continuously because a client's expectations of an efficient management of the technology increase. An entrance barrier has been created; firms that wanted to do architectural business need to offer their services done with CAD and they must be able to manage the new technology efficiently.

_Entrance and mobility barriers._

There were several indications that suggest that the entrance and the mobility barriers had emerged in the industry and that this trend would strengthen over time. The clients were especially important in supporting and accenting the impact of these barriers. Clients demanded more and more of their services to be done with CAD. Between S1 and S2, the demand for these services increased by 128% for the adopters. At S2, 57% of all jobs done by adopter firms were done with CAD. It is possible to interpret the volume of demand as an indication of the market's maturity. By the time of this transition, the entrance and mobility barriers were created. The pace of the change helps to maintain the barriers.

Analysis of the late-adopters indicated that these firms seemed to be able to change from being a non-adopter to being an adopter. Perhaps the late-adopters' change
indicates that there was no barrier between the adopters and the non-adopters, and the
division of the industry into two groups would be temporary. But there were other
indications suggesting that the division was not temporary. The adoption of CAD was a
process, which gives evidence to an emerging mobility barrier. Time is needed to adopt
the technology. Adopters considered it significantly more natural to use the new
technology than the late-adopters did. The market's expectations of the knowledge and
experience from CAD in an architectural firm suggest that the mobility barrier was not
temporary. Clients were a significantly more important reason for getting CAD among
the late-adopters than among the adopters. The single most important reason for using
the technology in the adopter firms were the clients' demand for its use. Adopting CAD
is a process and the adopting firm has to adapt if the full potential of the equipment is to
be achieved (cf. Zuboff, 1985). A firm that has spent more time adapting has probably
proceeded further to its full potential use. A mobility barrier seems to be emerging in
the industry. To make the transformation from not having CAD to start to offer this
service feature is probably going to be more difficult than the time proceeds from the
point when the adoption really took off in the industry, about the mid-1980s.

Late-adopters seem to get a quicker start with CAD than the adopters did. At S2 they
used the new technology in more jobs than the adopters did at S1, about 33% compared
to around 25%. The difference is probably a reflection of the development of the
market. At the point of time when the late-adopters got the technology there seems to
be a real need for services done with CAD (cf. Barras, 1986, p. 749). The late-adopters'
high use of the new technology suggest that the time for an adaptation due to the
adoption had decreased. Rather immediately a large portion of the firms' jobs should be
done with the technology.

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had emerged in the industry and that this trend would strengthen over time. The clients
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volume of demand as an indication of the market's maturity. By the time of this
transition, the entrance and mobility barriers were created. The pace of the change helps
to maintain the barriers.

The division of the industry will continue and endure. The adopters will probably
always have more business than the non-adopters have. These firms have certain
characteristics that make it very hard for any other firm to compete with them. The total
business volume for the adopters were at S1 was about 82% of the total volume in the
industry. One way to conceptualize the power of these firms is by saying: volume.
Some of the more important characteristics and factors contribution to the power of the adopters were productivity, and the plans for the coming years. These firms had the key to the fastest growing architectural market. Adopter firms are more productive than the non-adopter firms are.

New Industry Structure

Quinn (1992) suggests a pattern for the changes that occur in an industry of service firms when IT is adopted influence the division of the firms. The large firms are among the first to adopt the technology and this allows the firms to dominate the industry according to the suggested pattern. If the non-adopters do not adopt the new technology they will, according to Quinn (1992), go out of business. The adopters in the architectural industry were significantly larger than the non-adopters were and the adopters had about 82% of the industry's market at S1 and around 81% of it at S2. Thus, the CAD adopters will dominate the industry and the non-adopters will have to adapt to the changes that occur in the industry due to the introduction of CAD.

There was no significant difference between the adopters and the non-adopters regarding survival between S1 and S2. The non-adopters were significantly more skillful than the adopters were in getting new clients. Perhaps their way of adapting to CAD was to get new clients, clients that they could serve without the new technology; maybe the jobs classified into the group planning and investigation jobs were of that type. Thus, Quinn's (1992) pattern does not seem to hold for the Swedish architectural industry up to the stage that the adoption rate has proceeded. The analysis of survival did not suggest any change in industry structure. There were a few large firms, some midsize ones, and several small ones in the industry.

One reason why change takes time in the industry is because of the characteristics of professional service. There are strong professional values guiding the managing of these firms and this is why the structural changes in the industry may take longer time than in other industries. Another explanation would be the nature of these professional service firms. These firms, as they were defined in chapter 2, offer the market complex knowledge because the risk of a firm offering a substitute to the market would be low. There are no outside firms that can come in and take over the business in the industry; instead the industry develops on its own terms. Of course, there is a chance for an outside firm to buy a place in the architectural industry by purchasing one or several architectural firms. This strategy has to be regarded as hazardous because the really valuable assets in the firms—the architect—are only for sale on their own terms. Therefore, it is only firms within the industry that make use of the new technology which probably will affect the adoption of CAD; the clients interviewed in the intermediate in-depth interviews had the opinion that the architectural industry had been
slow to adopt CAD. This slow pace of adoption is probably due to the nature of the industry. The clients have very few possibilities to go elsewhere for buying architectural services. They can only influence services by buying their services from other firms in the industry.

**CAD and Management Bottomlines**

The introduction of CAD into the Swedish architectural industry seems to trigger a change of management bottomlines. Adopter firms will be the vehicles of the quantitative man. These firms have changed from being an extension of the founder to be an independent entity. The new technology supports the creation of larger firms due to its demand of resources. Additional management skills are required of the principal when CAD is used in the firm.

**The Qualitative Man and the Quantitative Man**

There were indications of a change regarding management bottomlines in the architectural industry. The principals were struggling with the values of the qualitative man and the quantitative man. They did this well aware that acting only according to their professional values without considering their clients' values (business values) would result in loss of business (Table 6.1).

<table>
<thead>
<tr>
<th>Type of firm</th>
<th>Adopters</th>
<th>Non-adopters</th>
</tr>
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<tbody>
<tr>
<td>Bottomline</td>
<td>Quantitative Man</td>
<td>Qualitative Man</td>
</tr>
<tr>
<td>Bottomline Foundation</td>
<td>Business Values</td>
<td>Professional Values</td>
</tr>
<tr>
<td>Bottomline Focus</td>
<td>Market</td>
<td>Profession</td>
</tr>
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A transition to business values in the industry was evident (cf. Östnäs, 1984; Gutman, 1988). Professional values guided them resulting in a drawn out process to transition to business values.

An additional factor affecting the transition to managing bottomlines according to business values had entered the industry when CAD was introduced. The technology may be regarded as a manifestation of the differences between the two paradigms. The adopters managed their bottomline according to business values and lead the way in this transition in the industry. Traditionally, the architectural firms have had principals that have acted according to the qualitative man model.

Non-adopters were still using the traditional paradigm for the architectural industry, conducting business according to the professional values. This paradigm has its foundation in professional values and a person acting according to the paradigm focuses
on architectural values. These values override the other values; that is, the present job is the most important assignment (cf. Coxe, 1980). Other tasks have to stand back on the expense of the present job, which in a practical sense means the present job is the mission of the firm. In its extreme, this way of acting, according to one interviewee in the initial in-depth interviews, could result in bankruptcy. Often the best professional solution contradicts a firm’s ability to make a profit (cf. Östnäs, 1984, p. 21). Professional solutions in some cases also mean that the contact with clients is diminished, professional values override all other information.

Adopters used influences from a paradigm founded in business values and their focus was largely on market values. These firms expressed the most important reason for getting CAD as “A natural progression.” Largely these firms were significantly more aware of their business environment, and CAD use addresses this business environment for the industry and the clients. Several other factors indicated a difference in paradigm. The organization and the structure of the firm reflected the principals’ different values. Because the adopter principals chose to build large firms, it might be assumed that business values were highly valued in these firms and not in the non-adopters firms. There was a significant difference between the time that adopter principals and non-adopter principals spent managing the firm. Spending as much time as the adopter principals did on managing suggests that they had an interest in administering the firm.

**Indications of Change**

According to the initial in-depth interviews, there were a number of interests that pushed the architectural firms to act according to business values. One of these interests was the industrial organization SPA that had a firm opinion that the architects had to act more business-like. SPA promulgated this belief in seminaries, a new magazine, newsletters, and courses. The clients also influenced the development of business-like firms. Clients interviewed in the intermediate in-depth interviews wanted firms that acted according to business values.

Firm size has to be seen as a deliberate choice. The most frequent reason for starting an architectural firm was the desire to design. Increasing the size of a firm meant the principal would be doing more managerial duties. Because the firm was allowed to grow, the principal had an interest in questions about firm management. One attitude to the principal role was “I am interested.” The emergence of large firms in the industry suggests a transition in management bottomline. By tradition, the architectural firms had been small, usually one or two architects and a group of collaborators. The large number of small firms suggests that a traditional size of an architectural firm was about five employees. The large firms with 50 people, some times hundreds of people are
definitely a difference. There are other management qualifications required in large firms compared to the traditional architectural firm.

One way to trace a transition in management paradigm might be to look at the adopters’ and the non-adopters’ characteristics as a reflection of their principals’ values. These characteristics may be summarized in the following ways: firm’s lifecycle independent or extension of founder, larger formal firms or smaller informal firms, various or specific jobs, efficient or fragmented production, market or professional orientation, and traditional or progressive firms. The characteristic—independent or dependent—may be seen as an indication of a transition in management bottomlines. An adopter firm is managed with the vision that the firm will continue to exist and when the present principal wants to leave the principal position then a new one will be chosen. A non-adopter firm follows the founder’s life cycle and the firm stopped operating when the founder considered it time to stop drawing has arrived. The impact of firm size on the management bottomline has already been discussed. The summarizing characteristics about the two groups of firms, progressive and traditional firms, may also be attributed to the firms. The qualitative man characterizes traditional firms and the quantitative man characterizes the progressive firms.

The significantly different professional values in the adopter and the non-adopter firms might suggest a departure from traditional professional values in the adopter firms. In these firms new values had emerged, perhaps designs that were not possible to do without CAD was replacing traditional designs. The change may not be as abrupt as it may sound; instead, the transition may be very subtle. For example, curved buildings may become a trend among architects, which would demand CAD to be used.

The changed nature of the jobs suggests a larger focus on administration in the firms. Increased complexity and a shortage of time were two keywords that describe how the jobs had changed character which suggest that there were needs for more specialists in a job—e.g., light, ventilation, audio (cf. Reynolds, 1993). A shortage of time means that there had to be more people involved in the job. The larger group of people and money involved in a job demand more time to manage the projects. More time had to be spent on administering the jobs and the firm.

Management of IT.

It was obvious that CAD had become a permanent tool in the industry. The clients demand for computer performed services were noticeable in several ways; e.g., use of the technology in the adopters firms’ and the late-adopter firms’ jobs, and the number of clients that directly demanded their services to be done with CAD.

IT is a type of technology that continuously needs to be updated and upgraded. The adoption of CAD means that the firm has entered a continuous investment process.
More advanced and diversified equipment will be needed if the firm will continue to develop. This development may depend on the capabilities of CAD—modeling, network connection to the other consultants, network connection to the site, simultaneous work on a drawing by many consultants, assessment facilities from drawings, process planning for the construction on the site, simulation capability, animation capability. CAD must therefore be considered as a technology that continuously develops and demands investment. There is a certain demand of resources for managing the continuous reinvestment because the firm must have a size that is enough for generating the resources.

The adoption of CAD demands new knowledge and skills from management. The development of the new technology needs to be incorporated into the planning of the business in the firm. There is a need for the management to have time, knowledge, information sources, and awareness to do this planning. The situation is additionally complicated by the degree of integration that this technology has with clients, and contractors.

**A Drawn-out Transition**

There were several forces working that influenced the perception of the qualitative paradigm. The architects’ identity will probably retard the incorporation of values from the quantitative model. According to the initial in-depth interviews with the architects they considered themselves to be artists, not good business people and there was a sharp distinction between the firm and the profession for them. One indication of this latter opinion is the situation of no overlap between firms known for doing outstanding business performance and firms known for doing outstanding architectural performances. There are several hurdles in the transition between one paradigm to another. Coxe (1980) notes that being known as a businessperson means that the clients will get the idea that this architect places profitability and self interest ahead of the concern for building quality and the well-being of the client.

The firm was a means for the profession and the managing of it was not central in the architects’ mental picture of being an architect. There was a clear distinction between the firm and the profession, which naturally was a deliberate choice; however, it might be presumed that the choice was made without any considerations due to the paradigm an architect learned during formal education.

Another aspect that will contribute to the preservation of the present paradigm situation in the industry is the homogeneity of the adopters’ and non-adopters’ principals. About 90% of the principals were male principals about the same age, which means that they were educated using the same paradigms. About 86% of the principals
in the industry were trained as house architects, landscape architects, or interior decorators. Due to the homogenous education background the architects had similar values. Because the focus in education was on architecture, it was natural for the principals to concentrate on the profession. About 99% of them participated in the project work. After the formal education was over for the architect usually had several years of apprenticeship. During these years the principal closely evaluated the new architect’s work and the new architect was incorporated into the prevailing values of an architect.

**Coexistence of Bottomlines**

The transition in paradigm will prevail for a long time and during this period the two paradigms will coexist. According to the analyses of industry structure, the structure will probably be as it was before the introduction of CAD: a few large firms, some midsize firms, and a large number of small firms. The two management paradigms will find their basis in the different firm sizes. Small firms will act according to the qualitative man and in the large firms the quantitative man will be active. Of course, it is possible for a small firm to act according to the quantitative man too. Due to the artistic side of the profession both paradigms will probably coexist. In the small firms there will be a large possibility to still act strict according to the qualitative man and in the large firms the quantitative man will be more or less demanded. Of course, it is possible for a small firm to act according to the quantitative man too if wanted. Due to the artistic side of the profession both paradigms will coexist—probably be present forever. The large firms have come to stay and new small firms will always start in which the founder has the ambition to according to the qualitative man.

**CAD and Service Marketing and Management**

The character of client communication will change due to the use of CAD. The architect may work with modules and reuse old solutions easily. It will also be possible to visualize a planned building in 3-D format at a much earlier phase of the job process. The facilitated visualization means that the knowledge between the architect and the client in levered. Possibilities of visualization also means that the quality evaluation of an architectural service has been moved from being done after the service delivery to be possible to do at an early stage in the service process.
Chapter 6

The Service Process

Service marketing and service management are tightly related to each other and it is hard to tell where one starts and the other one ends. These two activities may be seen as two concurring processes where the emphasis varies. The structure in this section builds on the “The Customer Relationship Life Cycle,” which is a three-stage model describing the activities of the service provider and the customer in the service process (Grönroos, 1990, p. 130). The model describes logical structure and flow of the service process. In stage one, the “Initial Stage,” the customer has a need but does not know which firm to use. Stage two, the “Purchasing Process,” embraces the activities for stating the terms for the service. The “Consumption Process” is the third phase during which the service is delivered.

Service Marketing

Service marketing is heavily used in the initial stage of “The Customer Relationship Life Cycle” model. In the purchasing process there is mix between service marketing and service management even if the former one dominates.

Initial stage.

The client becomes aware of eligible service providers in the initial stage. It is not possible to pass the stage today without talking about the Internet. As mentioned in the introduction of this book, AF has started an Internet service where it is possible for potential customers to search for an architect regarding occupation, region, and reference jobs (Arkitektförbundet, 2000-03-31). There is also a presentation of the architectural firms that are members in AF at this Internet address. CAD is to some extent involved in the presentation on the Internet. The CAD working architect’s jobs are already stored electronically why the step to make some of the jobs available on Internet is lower. At the initial stage of the “Customer Relationship Life Cycle,” the perception is that the use of a certain technology may impress potential customers (Keller, 1999). In the initial in-depth interviews, the architects stressed that some firms in the industry had been using the technology as a means for giving their firm an image of being forward looking. The potential customer selects a set of service providers that has given the impression of having a strategic identity, i.e., a set of resources (Kock, 1992) that will satisfy the potential customer’s needs. This leads to the next stage.

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1 For more information about this model see section Character of Professional Service.
2 Arkitektförbundet, the union for Swedish architects. This organization offered also business services, especially for the smaller firms.
Purchasing process.

In the purchasing process stage the final service provider is selected. The service provider and the customer negotiate about the terms of the service offer and its contents (Grönroos, 1990, p. 133). One way to express the aimed outcome of the purchasing process is to say that the potential customer tries to identify the service provider that offers the best terms for satisfying the stated needs, which is critical due to the nature of professional service (cf. Robinson 1992).

In the purchasing process modeling might be useful in the negotiation. The architect may make a suggestion to the planned building from the potential customer's stated needs. At S2 the architects said that the customers frequently arranged competitions—a way to get more elaborated suggestions from the set of firms selected in the initial stage. Due to the use of CAD, prior solutions may easily be found and illustrated according to the interviewed architects in the intermediate in-depth interviews. Modeling with ease means a fundamental change in service marketing. The potential customer may evaluate the planned building beforehand. In the traditional service process the potential customer has no possibility to evaluate the service beforehand. The evaluation of a service was only possible to do during and after the service was consumed. Intangibility is a classic problem in service marketing (cf. Shostack, 1977). By seeing a model of the planned building or a model of a similar building the risks of going into the service process have been substantially reduced. In addition, closely related features such as animation and visualization decrease the risk of buying a service. Visualization means that the proposed building is viewed in a 3-D form of representation and animation means that the planned building is viewed in its final setting. The potential customer gets a good understanding of the planned building. A significant portion of the service quality evaluation has been shifted from being done after the consumption of the service to being placed somewhere between the end of the purchasing process and the initial part of the consumption process.

It is possible to describe the architect's work-process by the following words: from the diffuse to the absolute. The process starts with vague information from a client and successively develops into more and more specific ideas. When the working documents are taken forward every detail of the aimed building is decided and designed. Despite this concrete dimension of the building the information is not accessible to everyone. The information is coded into a two-dimensional representation on paper, which requires knowledge and experience for interpretation into a visual picture of a building. This is a process managed expertly by the architects but there might be some problems for the clients. One client said that one of his colleagues was always surprised when he saw the new building on the site:
During my time as a consultant I had a client that during several years built houses. He often expressed his delight at the blueprints that were presented, but later, when the house was built, he said that he had never understood that it [the house] would look the way it did when it was finished. This is a question of the ability to take in a three dimensional picture.

One way to ease the communication is by using models of the proposed building. There was a strong belief among the architects about the influence of models on the clients according to the initial in-depth interviews. Especially in architectural competitions models were used as a means to ease the communication. In these situations the key to success largely depended on the ability to communicate.

The importance of having the ability to move the quality evaluation to a prior stage in terms of “The Customer Relationship Life Cycle” is clearly stressed by the architects. The second most frequent demand that a client had on the services from an architectural firm was according to the architects the final outcome corresponds to the expectations according to the follow-up questionnaire.

Modeling was probably on the edge of technological frontier in the architectural industry at S2. Considering the advantages of CAD use the adopters had ranked this feature rather low which can mean that they used it rarely or the other benefits of CAD were more influential at this stage of the adoption process. But the high ranking, second and third most frequent, of “Aids with visualization and presentation” and “3-dimensional projection” as benefits of CAD among the non-adopters suggest that it was these capabilities of the technology that were discussed in the industry at S2. Saying the adopters spoke from experience and the non-adopters spoke about expectations may be a good description of the situation.

There was a gap in knowledge between the architect and the customer regarding architectural knowledge. The customer’s lack of knowledge also embraced the problem for the customer to state all the needs up front in the purchasing process (cf. Gummesson, 1978, p. 95). Some of the needs that the customer had were not expressed before the service process according to the architects in the initial in-depth interviews. Architectural services were usually purchased in a business-to-business situation. The clients interviewed in the intermediate in-depth interviews were professional buyers despite this professionalism they wanted to be led to solutions they could not imagine themselves (cf. Coxe 1980).

Service Management

Before the consumption process in the customer relationship life cycle model can start, the customer has to select which firm to purchase from. Therefore, service management rather than service marketing characterize the phase.
Consumption process.

The model of the planned building is developed in the consumption process; details are successively added to the model. Depending on the individual situation the consumption process may start with a development of a new or substantially revised model because the client has identified new needs or the settings have been changed. The customer may change the initial needs to new ones as he/she develops a further understanding for the provided service during the service process. But usually, according to the clients interviewed in the intermediate in-depth interviews, the fundamental part of what Cuff (1982) labeled the negotiation about the outcome is taking place in the initial phase of the consumption process. Due to modeling, visualization, and perhaps animation, the client is able to understand the outcome of the service process. Service quality is affected in two ways by the visualization of the end outcome: (1) a substantial part of the quality evaluation takes place at an early phase in the service process and (2) the client’s quality expectations is governed distinctly by the model of the building. What Lehtinen (1985a, p. 117) calls educating the client, which takes place during the whole consumption process, has moved and can now take place at a very early stage in the consumption process or even before it. The chances for any negative surprises have been diminished due to the client’s understanding of the final outcome.

An important part of the architect’s work-process was the maturing phase, i.e., when the architect tried out different solution alternatives. This process may be more accessible for the client due to the use of CAD, modeling, and visualization techniques; it will be possible to make the client an active part during the whole time of the service process. A change like this will naturally affect the service quality aspect. It will be easier to pay attention to the clients’ points of views at an earlier stage of the process and the client will be better informed about the progression of the project. There is a possibility to give the client a feeling of participation in the work process instead of as a passive consumer of the proposed solutions from the architect. Perhaps it is possible to make the client more committed to the service and its outcome, which will encourage a positive experience of service quality (cf. Cialdini, 1988, p. 68). According to the results in this book the architects wanted a client with as much architectural knowledge as possible. An understandable demand due to the clients’ central role in the service production process. The client governed the pace in the service production process by continuously approving or rejecting designs. Therefore, both parties emphasized the cooperation between them as central.

CAD Affects Cooperation

The most important advantage achieved by working with CAD was that it facilitated cooperation with other consultants and contractors according to the follow-up
questionnaire. Beside the client, there were several other people involved in a job. Due to the development of increased complexity in buildings there were more and more experts on a job such as sound consultants and environmental specialists. The architect usually cooperates with a builder who interprets the architect's design for the new building. There are two other groups of consultants that the architect cooperates with in most projects: the constructor, the vvs consultant (water, heat, and ventilation consultant) and the electricity consultant. Thus, even in a small job there were several parties involved.

Also the interviewed clients tended to stress the importance of eased cooperation with the members in the project group. The nature of architectural services and professional service in general are complex (cf. Hart et al., 1992, p. 122) and customer tailored (cf. Day & Barkdale, 1992, p. 89; Kelley, Dommelly, & Skinner, 1990, p. 315; Yorke, 1990, p. 349). This explains the importance of cooperation between the parties in the project group. According to the architects in the follow-up questionnaire, the most important expectation that a client had of an architectural firm was smooth cooperation.

The cooperation between the parties was going on during the whole service process of making the new building, which was a guarantee that all details were solved in a way that the client currently accepted. The importance of the cooperation between the architect and the client was important beyond the present client. Old clients and contacts were the two most important ways of getting new clients at S2. An architect that was difficult to work with would probably suffer in a system like this one.

Frequently the clients interviewed in the intermediate in-depth interviews expressed the importance of the cooperation in terms of communication (cf. Bitran & Hoech, 1990, p. 92). They seemed to value the architect's ability to communicate with them. The communication between the parties was reflected in the proposed concept for the new building. The use of CAD may have reduced the intensity of the cooperation between the parties, e.g., working with visualized solutions may mean that the client knows what to expected. One of the interviewed clients expressed the benefits of CAD when managing a project in the following way:

[C]orrect measurement and co-ordination between the different consultants is much simpler when CAD is used. . . . it [CAD] introduces precision into the drawing process. . . . Co-ordination is also simpler. We copy electricity, telephone, alarm, pipes, air, and refrigerating pipes. Collision points can be seen directly and that is a great advantage. . . . it is a great advantage because one can see on the drawing when things interfere with one another. One does not have to wait until the building stage to see what the problem is. That’s an advantage.
Client involvement.

It is possible to go as far as talking about the client as a partial employee because of the intensity of the cooperation between the architect and the client (cf. Lovelock & Young, 1979; Mills, 1986; Mills et al., 1983). Naturally, it never comes as far as having the client working as an employee. There are some different characteristics between the client and a potential employee. For example, the client does not need to have the same level of knowledge as an architect; however, in the best situation the client had a substantial portion of architectural knowledge preferably on a level comparable with an architect according to the initial questionnaire. Also for the criteria relationships, especially concerning personality, it does not have to reach the level of an employee but the closer it comes the better the situation is according to the initial questionnaire. Trust in a client has to be at least on the same level as for a potential employee; cooperation with the client is probably more intensive than with some of the employees in the firm.

The relationship between the architect and the client can be applied to the communication model developed by Shannon and Weaver (1949, p. 98). Knowledge is the criteria clients should possess. The client should have the ability to understand the architect. Due to the demand for knowledge, the client will decode and code in a similar way as an architect does and therefore the sender and the receiver in terms of the model will give the words similar meanings (cf. Yorke, 1990).

It was important for the architects to have a client who had knowledge because that made it possible for the client to understand the values of an architect. The architect wanted to see these values reflected in the outcome and to be able to reach a mutual understanding for the outcome architectural knowledge was required. It was important for the architects to be able to realize a job according to their personal values according to the initial in-depth interviews. The possibility to realize these values governed the architects’ perception of a successful job. They established the guidelines for the perception of service quality. Whether it was possible or not to work according to the personal values was decided by the client, because the client decided when to proceed in a job by accepting or rejecting the proposed solution before the next step in the job could start.

Client knowledge.

Successful cooperation over a long time between the professional service provider and the client can be expressed as "meeting of minds" (Yorke, 1990, p. 355). The architects’ perception of client qualities as expressed in the initial questionnaire indicates that the meeting of minds was fundamental. The most important client quality for an architect at S1 was knowledge about architectural work (cf. Gummesson, 1978, p. 95; Östnäs, 1984, p. 29). The second most frequently noted quality for a client,
according to the initial questionnaire, was a good relationship. Ideally, the architect wanted a client with whom he/she could communicate professionally and clearly (cf. Yorke, 1990, p. 355). CAD has the possibility to level the knowledge between the parties and the time before the parties understand each other may be vastly shortened. One impact of CAD leveling the knowledge of the service provider and the client may be that the architects change their sharp opinion of a knowledgeable client.

One way to increase the quality of the architects’ final outcome, according to the architects in the initial in-depth interviews, was to have clients that had knowledge about the architectural work process and architecture. This client quality would ease communication between the architect and the client. The communication between the parties has been labeled a negotiation (Cuff, 1982), which underlines the importance of equality in knowledge level between the parties. CAD may perhaps serve its purpose as a mean to interpret the architect’s work for the client; i.e., the equipment will increase the client’s knowledge level. Instead of interpreting the two-dimensional blueprint the client may look at a model of the building (see it in a 3-D representation). The client will be able to walk around in the modeled building and try out different solutions to see the completed building located on the site and looking at the environment from inside the proposed building.

Model of Industry Transformation

The introduction of CAD in an industry of professional service seems to have affected both the industry structure and the management of bottomlines. Due to the introduction of the new technology, the industry structure was divided into two groups that tended to grow apart. The management bottomline tended to change and a more intensive focus on business values developed. Service marketing and service management was also affected by the introduction of the new technology. But these latter changes are specifically related to the type of new technology adopted. The other two changes in industry structure and management bottomlines seem to be more universal and they are not related to the specific innovation introduced in the industry. Instead, these two changes may be possible to identify in any industry going through an adoption of an innovation. The transition process of the industry structure and management bottomlines is depicted in Figure 6.2. The basis for the transition in the industry structure and the management bottomlines is the relationship between the constructs in the center of the model (Figure 6.2). In chapter 5, the relationship between CAD, service quality, and competitive advantage was examined. Without a stated relationship between these constructs there will probably be no affect on industry structure or management bottomlines, which is symbolized in the model by the location
of CAD, service quality, and competitive advantage in the center of the model. The embracing nature of management bottomlines and industry structure in the model shows the interrelationship between these two constructs and other ones in the model. For example, management bottomlines decides when a firm becomes an adopter and the industry structure affects the adopters’ possibilities to use the potentials of the new technology.

The adopters had several characteristics that indicate that these firms had the ambition to dominate the market. For example, these firms had much more intensive plans to expand their business volume at S2. Between S1 and S2 the spirit of expanding the business volume disappeared in the non-adopter firm and the impression was that these firms wanted to continue to do business as usual. These changes in plans for the non-adopter firms would further emphasize the dominating role the adopter firms had on the market. These firms had more than 80% of the total market share at both S1 and S2.

Over time CAD might be a mobility barrier and there might be problems for the firms to move from being a non-adopter to be an adopter. At S2, about 30% of the clients in an adopter firm demanded their jobs to be done with CAD. In the interviews with clients the rule was stated firmly; their architectural services should be done with CAD in most cases. These clients will probably take the experience from working with the technology for granted. The possibility to train on the new technology during a job has largely evaporated, which will limit the new adopters’ possibilities to be trained on CAD. Client jobs were the most important source for new knowledge. The adopters and the late-adopters had significantly different opinions regarding how natural it was to work with the new technology and this illustrated the amount of training required to work efficiently with CAD. The division of the industry in two groups is stressed by the fact that there seemed to be a technological saturation among the non-adopters.
Between S1 and S2, the portion of firms that had no plans to adopt the equipment increased from 20% to 35% in the non-adopters. CAD may be seen as a means for the adopters to stress their different management of the bottomline compared to the non-adopters.
Chapter 7. ONE STEP FURTHER

This chapter discusses the future impact of IT in the architectural industry. The work done will be used as a basis for some ideas about a possible future in the industry. In focus are the potentials of IT and structural changes in the industry. There will also be a discussion about ideas for further research. Moreover, a model analyzing the impact of an innovation in an industry is presented.

Impact of CAD

CAD offers the possibility of a knowledge transition from individuals in the firm to a database owned by the firm. This tool will also empower the architect and the client. Cooperation will be ease due possibilities of visualization. To some extent variation in demand may be leveled out by CAD. A generic model for industrial transitions due to the introduction of an innovation is developed.

CAD and Architectural Firms

CAD has showed to be a means for quality transition and a means for competitive advantage in the architectural industry. The impact of CAD seems to be large in the architectural industry. Sakr (1991) has labeled the transition from manually performed services to CAD performed services as an epochal shift. When the data collections were done, CAD technology was in its initial phase in the architectural industry. This type of technology was completely new for the architects. There had been no similar equipment ever involved in the design process before.

CAD is a dynamic tool; there is a continuous development going on both concerning the hardware and the software. The studied technology is considered to be in its first stage of the product live cycle (Wikforss, 1990, p. 41); the systems will get more specially designed for specific use (Giertz, 1987, 1989). The software development will include more complex systems, user friendlier systems, systems with communication possibilities—networks, integration of other systems—GPS, integration of new applications such as sketching systems, quantity estimation systems, and virtual reality. There seem to be no limitations of what is possible to do with IT according to people who believe in the technological development in society. Looking in retrospect on the computer systems development means that future systems will be designed for specific
user applications, be more powerful, and they will cost the same as the systems today or even less (Baldwin & Clark, 1997, p. 84).

The development of the hardware and the software that together makes a CAD system is depicted as in Figure 7.1. When looking at the figure it is important to keep in mind that there might be a difference between what is possible to do and what the firms actually do. The depicted development in Figure 7.1 ought to be interpreted from a provider perspective, i.e., what the hardware and software providers offer the market. There is a continuous and fast development of IT equipment among the providers. It is easy to get the impression that it is competitive, e.g., for the speed of the processor. It is possible to regard the release of new products as technology driven with no actual influences from the users. Therefore, the practical use of IT equipment usually differs from its full potential.

![Figure 7.1 Configurations of CAD over Time](image)

The history of CAD and the proposed development of the technology stress its possibilities. There will probably be a system for each firm's resources, money, and computer knowledge. The opinion about CAD in the Swedish architectural industry at S2 was that it had come to stay. Most firms will get some kind of CAD system in the near future.

**Potential uses of CAD.**

CAD will contribute to a significant increase in productivity (Reynolds, 1993). Kish (1991) claims that the goal of using this equipment is to increase productivity. Stevens (1991, p. 141), on the other hand, strongly questions the ability of CAD to increase productivity. Productivity in architectural firms has to be increased because customers tend to ask for much shorter design periods. Building time, measured in years before, now, because of mainly financial reasons, must take place in months (Reynolds, 1993).
The impact of IT in architectural firms may go beyond increased productivity. The working process of an architect has to be changed if the potentials of CAD are to be realized (Reynolds, 1993). For example, CAD has increased the quality of design (see Magnusson & Johansson, 1993; Wikforss, 1990).

There may be changes in the cooperation with the customer due to the ease of communication. Customers have problems interpreting the symbols on a two-dimensional drawing of a three-dimensional building therefore it is natural to communicate with the customer using three-dimensional pictures (Coxe, 1990). Animation and video may further ease the understanding of the project by the customer (Architecture, 1991). The customers may have a better conception of the planned building because IT makes it possible for a customer to walk through the house and make changes in the design (Bock, 1994, p. 91). This possibility might be of increasing importance as the complexity in buildings increase (Reynolds, 1993). It is important to note that the benefits of the new technology presented here are assumptions that these authors have made.

There is a large potential for IT implementation among architects (Hoffer, 1993; Mitchell, 1984; Sakr, 1991; Wikforss, 1992). CAD technology is in its first phase of the product life cycle (Wikforss, 1990, p. 41). Future CAD systems will be more adequately developed for architects (Giertz, 1987). Using this kind of system will offer the ability to easy access to old drawings. The recycling of work will probably increase; that is, a design in one building will be used in another building (Reynolds, 1993). Instead of making blueprints, the architect may "model the new building" (Wikforss, 1990, p. 41). Modeling accesses databases that contain modules, which the architect will use in the design of a new building. A comparison with software firms and their use of models in the configuration of new software systems is interesting. The modules are designed with the intention of recycling them (Johnson, 1993). Working with modules will increase productivity by a factor between three to ten. This will provide the firm with a competitive advantage (Johnson, 1993, p. 28).

An integration of the total flow of information, from the architect's pre-design phase1 to the owner's administration phase, is likely (Björnsson, 1987, p. 25). Furthermore, the building process itself could be managed by computer support. Computer Integrated Building (CIB) covers and supports the complete building process. Today these systems do not exist but the building industry aims to develop such a system (Jägbäck and Stjemberg, 1990, p. 10). The realization of these new systems will be difficult because the use of these systems require changes in the organization's traditional procedures (Kristola et al., 1993); e.g., the definition of what is an original blueprint and what is a

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1 The labeling of the different stages in an architect’s work process has been adopted from Lundin (1993, p. 5).
copy of a computer produced blueprint has to be sorted out. The revisions of a blueprint produced in the computer are invisible. Therefore, it is difficult to tell when a blueprint is revised. The original blueprint has to be signed manually; a digital signature is not valid (Kristola et al., 1993).

Knowledge Transition

The management of knowledge as discussed here takes its basis in knowledge that has already been generated in the firm. This type of knowledge is especially interesting, because, according to Bharadwaj, et al., several service firms "have successfully used IT to capture tacit organizational knowledge and retain property rights over the resulting innovations" (1993, p. 89). Two types of organizational knowledge may be identified when discussing CAD in terms of tacit organizational knowledge, experience knowledge and knowledge from prior solutions. It is the latter type of knowledge that is of special interest in the discussion here. An efficient management of the stock of knowledge in a professional service firm will empower each of the architects in the firm. Of course, there has been a possibility to store old solutions and re-use them in other jobs before CAD was introduced; the change, however, has the facilitated access to the old solutions and how they are adapted to a new setting. There is no need for the architect to go and look for a specific drawing in the storeroom for old drawings; instead the specific drawing is accessed from the workstation. The architect may easily bring up the complete drawing or a specific part of it on the screen where it can be evaluated for use in the present situation.

Managing drawings.

The client is also affected by the efficient handling of drawings that CAD offers. Of course, it is also possible to use CAD when showing the client examples of old buildings. The architect will be able to offer the client instant 3-D views of old buildings that might be of interest. The architect might be able to offer the client a view of a rough adaptation of the buildings to the present setting. Given more time, the architect will be able to do a more detailed adaptation of the old building.

One way to argue, is to consider all drawings done in the name of the firm as owned by the firm, which is the practice today; the firm has the right to process any work that has been done in the firm. An architect that has left the firm might have made the old designs. The adaptation of the old design is independent of who made it initially; however, who owns—architect or firm—the rights to designs has been debated recently. One way to formulate the "problem" is to express it as follows: Is it the estate owner or

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1 Information obtained from the industry organization SPA.
the architectural firm that own the rights to the design of a building? Is the estate owner free to hire any architect for transforming a design of an old building to one of the estate owner’s new sites? This discussion is somewhat different than the one about re-using old solutions within the firm, but it is highly relevant due to the use of CAD and having the drawings of a building stored on disk. Usually an estate owner wants a new building to look very similar to other buildings on a site.

There is a special aspect of image and CAD that may be used by an architectural firm; that is, the image of the buildings designed by the firm. It took several years before a young architect could leave the apprenticeship and was allowed to design according to the initial in-depth interviews. However, there was always the approval of the blueprints by the principal to ensure the design reflected the professional values of the firm. Usually the architects had their individual characteristics in the design of a building. A library of the design features for a firm might be stored in a database and used when designing with CAD. All buildings designed in the name of a firm will have similar characteristics regardless of which architect in the firm designed the feature.

**Empowerment of the architect.**

The possibility to store and access prior solutions is easier in CAD than in any manual system and this will contribute to the empowerment of the architect. An essential part of the education in the architectural firms is feedback from the collaborators about their experiences with jobs. Parts of this experience will be possible to store in a database and by that it will be available for the other architects in the firm in an easier way than before. It will be easy to find how different problems in the design of a building was solved in earlier designed cases who are similar to the present one designed. Instead of having knowledge about the specific solution, e.g., the design of some specific windows, the architect only needs to know that in one of the firm’s jobs there were some windows designed that might be of interest to use in this job too.

CAD offers the possibility to a knowledge transition from the specific knowledge to the general; the architect does not need to know about the details in a design instead there is a need to know about the existence of other similar buildings that have been designed in the firm. Perhaps there will be software that will manage parts of this process too. The CAD system might suggest parts from prior solutions that the system has identified as interesting. The accessibility of prior solutions in the firm’s database will make it possible to instantly retrieve a design feature that is of interest. Because of the simple access, there is a possibility to search for design features and actually apply them to a project for evaluation or as a way to stimulate new ideas. These possibilities for search and try might be important in the phase of a job where the architect is trying to find the rough design of the new building.
Working with modules will be natural when working with CAD (cf. Wikforss, 1990, p. 41). More advanced CAD systems allow the architect to experiment with different modules of design features stored in the system. Supporting the design process in this way will ensure that an architect will produce designs consistent with the firm’s guidelines. Working this way does not mean that all architects are made equivalent. Experienced architects, for example, will more than likely be able to make the choice of the “right” entrance for a building by using this feature. These people have the experience of being able to “translate” the design of the building into any setting and being able to harmonize the building with the setting. Even if the animation comes close to the real setting, there will probably always be differences in some aspects.

The largest benefit of CAD will probably be the increased speed in making drawings. Relating the discussion here to the development of more specific systems suggest that the next generation of CAD systems will have the supportive functions demanded by the architects. One of these functions may be a developed management of modules from old designs made in the firm. An extended version of the system suggesting modules to work with would perhaps make the working process more efficient. The design process will start with entering into the CAD system a number of parameters for a planned building: data about the site (e.g., size, ground conditions, whether conditions, restrictions regarding building permits), data about the planned building (e.g., rental house, office building, wanted space, number of floors), aesthetic aspects (e.g., type of architecture such as Art Nouveau, Functionalism), financial data (e.g., total costs, maintenance costs, lease revenues). Governed by these parameters the software may suggest the design of the planned building. Using a module like this will make it possible to add a floor to the building and see the impact of that on the lease revenues. Another way to work with the model would be to change materials for the façade and see the impact on maintenance costs.

**Empowerment of the firms.**

CAD affects the knowledge in the firm by making all knowledge that are built into drawings previously produced in the firm accessible for all architects in the firm. There is a transformation from individual knowledge to organizational knowledge within the firm. The total knowledge that has been generated by the present architects in the firm and by architects who had previously worked at the firm can be stored easily in a database. The firm’s total body of knowledge will be accessible for all the architects in the firm. Therefore, the knowledge level of an individual architect is not limiting the problem solving in the firm as it might have been before. There is a transition for limitations in individual knowledge to limitations in the firm’s body of knowledge. A schematic picture of the “knowledge library” and its function is shown in Figure 7.2.
The input to the knowledge base comes from prior jobs in the firm. It is possible to obtain knowledge from the database from the other sources shown in the model. Of special interest is the management of knowledge.

The possibility of efficient storage of designs facilitates the use of modules. Parts of the architect's work have been transformed from creating to searching. Of course, there has been parts of searching in the architectural work before; for example, journals and study trips are important for the architects as sources of inspiration and as sources of knowledge. Theoretically it would be possible to change the architect's work by providing the architects with modules prepared for immediate use. The parts of creation in the architectural work will be changed because of the restriction to the modules. This type of discussion was frequent in the 1970s and in the 1980s; the use of computers would mean that the work-contents would erode. Little of the simplification of the work-contents has occurred. Because of this trend, it is possible to assume that it will not occur in the architectural work either. About 66% of the respondents in a survey among textile and fashion designers had the opinion that CAD enhanced their creativity (Gross, 1997, p. 96).

Designing with modules may not negatively influence creativity. The use of modules may facilitate the design of boring and repetitive design features. There might be more time for the creation of the individual concept for the building. It is important to recall a statement made before in this book about the work with computers. The technology does not force us to behave in a certain way. The choice is ours, how do we want to use the technology and to what purposes (cf. Vedin, 1995a, p. 1). Designing with modules may be a question about different generations of architects. A young architect who has been trained to work with CAD in formal education may consider it as the natural way...
to work. Perhaps there will be a competition among the young architects to work with the office that has the best knowledge base.

The possibility to make individual knowledge organizational knowledge has been pointed out. This way of acting may also have importance in identity, a transition from famous individual architects to famous architectural firms. The transition from individual identity to firm identity is accented by the changed character of the jobs, more complex jobs, simultaneous processing of several jobs and shorter times for processing. An individual architect will not have all the knowledge that will be required about the different parts in a job and therefore the job will have to be done using many people. There might even be some architects that are specialized in certain parts of a building e.g., entrances, windows, and stairs.

_Teece (1987, p. 171)_ suggests that each person in an organization should only have knowledge that is usable as an element in a system. Due to the character of architectural work there is probably some limit to what extent it is possible to specialize people in specific areas of knowledge. The architect’s task is to have the overall view of the planned building. They were very firm in their opinion about this mission in their task. Most of the architects who took part in the in-depth interviews stressed their capability of having the overall view and at the same time condemning every other person’s capability of handling this task. One of the arguments used by the architects was that they were trained for this view of a project in their formal architectural education program.

Some degree of specialization is, however, possible to anticipate in an architectural firm despite the need that all the different parts in the planned building must be harmonized. There were three different types of architectural knowledge, house architecture, interior design, and landscape architecture. For example, regarding house architecture an architect may specialize in designing entrances and another one might be specialized in designing windows. They are specialized in designing parts of the planned building. Perhaps the front architect in the firm has developed the concept for the building and other architects develop certain design features that are consistent with the concept. IT will facilitate a specialized production through its possibility to ease communication between the parties involved in a project. Exchanging information of the planned building is done using a computer network.

There are forces working for a specialization among the architects. According to the interviewed clients in the intermediate in-depth interviews they wanted an architect who was knowledgeable about the prices so the architect ensure the cost and final product are compatible for the client and the firm’s profit. This implies that an architect needs to be
On e S t e p F u r t h e r

very well oriented in all different building materials and elements. According to the architects in the initial in-depth interviews, the pace at which new building materials and components were introduced was high. In some firms there were special rooms in which they stored all the books with this type of information. There were literally several tens of meters white shelves filled with these books. Probably there had been some kind of informal specialization done in the firms already. The architects had selected areas of special interest in which they were updated regarding building materials and elements. It seems to be a fairly small step to connect the assumed specialization to a specialization in design too that is facilitated by CAD.

According to the architects there was a strong relationship between their design and the selection of materials. It was not possible to design and without having certain types of materials in mind. The understanding of different materials were firm among the architects. In the initial in-depth interviews, there were several examples of discussions of the impact of certain materials in the design. For example, the aging of a material was important for an architect; one architect expressed in vivid terms the aging of a copper roof.

The architectural firms seem to have been specialized in certain areas according to their self-evaluation of working in niches. According to the evaluation, the firms got the main part of their revenues from their niche business. Between S1 and S2, both the adopters and the non-adopters increased their revenues from their niche business, a possible indication of a transition to a specialization in the industry. As presented in chapter 4, the niches seem to be the same for several firms; for example, at S2 the most frequent niche to work in both among the adopters and among the non-adopters seem to have been public buildings. Within this niche there is room for subdivisions such as libraries, hospitals, schools, and day-care centers.

Empowerment of the client.

The empowerment of the client means leveling the knowledge between the client and the architect. Due to the transition of the design of the planned building by the use of the new facilities—3-D and computer based model simulations—the client will be a more competent contributor to the discussion. Empowering the client also means giving the client greater possibility to govern the design process. What the client considers as good and bad architecture may have a greater impact on the design of the planned building. This transition was perhaps already in process. There was a significant difference between the adopters’ and the non-adopters’ opinions regarding architectural models.

Modeling will empower the client. Animation and modeling means that the client will be given a good understanding of how the planned building will look. The dialogue
between the architect and the client is possible to make on more equal terms regarding knowledge. According to the architects, it was favorable if the client had knowledge about architecture. It is possible to regard the possibilities of animation and 3-D representation as a translation for the client. Due to these forms of representations it is possible for both parties in the dialogue to have similar views of how the planned building will look when it is built. The empowerment of the client probably means that the impact of the client's opinions about the design of the building will be greater. Because the discussion of the design of the planned building has been transferred from an abstract discussion between the architect and the client where mental views of the design was the basis for the discussion to a situation where a 3-D model of the building is the point of departure, eventually supported with animation, it is possible to see the design of the planned building in its real setting via simulation technology. It will probably also be possible to walk around in a computer model of the planned building evaluating different types of windows with respect to a client's lighting needs, evaluating different types of wall materials according to acoustic considerations, and evaluating different façade material due to their aging in the climate. These are only a few examples of how the computer model of the planned building may be used.

The tools used for leveling the clients knowledge may also be used in other ways by the client. These tools will empower the client to extend the group of eligible architects for a job. The experience from having worked together before may be diminished as claimed in section “CAD Affects Service Management and Marketing.” The quality evaluation of the architectural service has been moved from after the performed service to largely being done before the architect is selected for the job. Several of the unknown parts of the design of the planned building will be answered through the computer-based model of it. The client will be offered the possibility to compare architectural firms. In a situation like this it is possible to assume that the client's values about architecture will be more influential.

**Business Cycles**

In this section the impact of the change in business cycle that appeared between S1 and S2 is discussed regarding the inquiry of the book. Moreover, it is possible that CAD could absorb changes in demand.

**The Impact of the Recession**

The overall impact of the recession that started shortly after S1 and prevailed until after S2 did probably slow the adoption rate in the architectural industry down; the "natural progression" in the industry was retarded. Another way to look at the impact of
the recession is to say that it in some ways the recession probably stressed the importance of being an adopter. One architect in the intermediate in-depth interviews described the recession as a consolidation phase regarding education and competence.

Due to the recession, the firms had to compete intensively for new jobs. According to both the adopters and the non-adopters, the competition was more intense at S2 than at S1. The competitive tools that the firms used at S2 suggest intense competition in the industry. At S1, the most frequent competitive tool was quality and at S2, it was contacts. The use of contacts at S2 suggests that quality was not enough for securing a job at S2. One of the clients interviewed in the intermediate in-depth interviews placed price as an overall restriction for the quality of the cooperation with the architect. The architect had to be able to carry out the job within the costs that the client had decided. Thus, at S2 costs had been incorporated in the perception of quality. The importance of contacts for securing new work may suggest that the architect and the client had to know each other beforehand if there were to be a cooperation between the parties. Despite the close relationship between the parties there was a change in client qualities from knowledge as the single most frequent one at S1 to relationships as the single most frequent one at S2. There was a transition from the contents of the service to the terms for the service. In brief, the client quality relationships may be described as the client keeping agreements made according to the architects in the intermediate interviews.

It is possible to argue that the adoption of CAD would have been faster and more intensive in the industry if the good times had prevailed. Due to severe financial restrictions, the firms had to slow the adoption rate down. According to the architects in the intermediate interviews there was no money available for investing in CAD. The shortage of money for CAD may be interpreted in two ways. An architectural firm could not afford to buy any CAD system. The possibility to lease one was probably limited too because the shortage of money may also have included a shortage of clients and the clients were reluctant to pay an extra fee for the use of CAD according to the intermediate in-depth interviews.

The new non-adopters and the short time adopters are extreme examples of how the recession slowed down the pace of the adoption in the industry. These firms stopped adopting CAD because of the recession, e.g., in some of these firms the people who managed CAD left or had to leave.

The slowing down in the adoption rate of CAD between S1 and S2 did probably give the adopters significant advantages compared to the non-adopters. Here are some examples, the non-adopters could see that the market to which they had exclusive rights to grow by 128% during the period. At S2 more than every second job in an adopter firm was done with CAD. According to the characteristics for the jobs processed with the new technology during the period they had certain characteristics of which the most
important one was their size. A comparison of the adopters' and the non-adopters' jobs at S2 showed a difference of a factor of 3. By definition there are larger possibilities for education and for trying new designs in a large job. The size of a job is especially important in the architectural industry because client jobs were the most important source for new knowledge for both the adopters and the non-adopters.

The recession probably slowed down the adoption rate of CAD among the adopters too. These firms increased their number of workstations by 47% during the recession. If there is a difference in adoption rate between the adopters and among the firms at S1 who had plans to adopt, it is hard to tell. At S1 about 40% of the non-adopters had plans to adopt CAD within the coming two years. More than 50% of the firms that had plans to adopt CAD within the coming two years at S1 had to postpone their adoption. The short time adopters and the new non-adopters may be added to the group of firms that had to postpone their adoption of the new technology. Probably all firms in the industry had to slow down or postpone their plans to adopt CAD due the recession. A comparison of the adopters' and the late adopters' density of workstations in the firm showed no significant difference, which show that they had about the same number of architects per workstation. The period of recession may therefore be considered as a time that preserved the situation in the industry. There was a possibility to study the impact of CAD more clearly as the adoption pace was slowed down. If the adoption rate that was prevailing in the industry up to S1 should have been valid also for year S1+1, then about 130 firms should have adopted CAD compared to 9 firms. These figures are hypothetical and may not be interpreted as reflecting a development that should have happened. Instead they should be seen as an indication of how much the adoption rate was affected by the recession.

The increase of workstations among the adopters and the late-adopters is remarkable due to the shortage of money in the industry during the recession. Perhaps these firms were stretching their resources to serve their clients in the way they demanded. The adopters served significantly more returning clients than the non-adopters did at S2. Perhaps increased CAD use between S1 and S2 was not so special. Two frequent strategies to prepare for the recession among the adopters were to train employees for CAD and to buy CAD equipment. There was about one year between S1 and the point of time when the recession hit the industry with intensity. The most frequently used strategy for preparing for the recession was to save money. Some of the saved money may have been used for investing in workstations during the recession. The possibility to generate money in a service firm has traditionally been related to the number of people in the firm, which may explain why the same number of architects shared a workstation in both the adopter and late adopter firms at S2.
If the recession had not come, then the adoption of workstations would probably have been more intensive among all firms in the industry. There would have been more money available to spend on an adoption available. The differences between the adopters and the non-adopters would not have been so distinct and probably some other delimiter must have been used, e.g., adoption year. Due to the recession, the differences between the adopters and the non-adopters were accented. Due to their size, there was a larger possibility for the adopters to adjust the number of employees than for the non-adopters to do so. Non-adopter firms decreased the work-time per week and salary. The recession offered the possibility to study the adopters and non-adopters for a longer period than what would have been the case if the recession had not arrived at S1. Due to the "elucidating" effect that the recession had it was possible to observe the characteristics of the adopters and the non-adopters more clearly. The impact of CAD was made clearer.

*client perspective.*

Looking at the recession from the clients' perspective suggests that it was a time for change. Suddenly there was a surplus of architectural services available. The clients were free to shop around for the best value. During the recession there was a common opinion among the architects that the clients really exploited the architects. There were no rules more or gentleman's agreement and the competition was rampant. In other words, it might be possible to claim that the competition was perfect. The situation really forced the firms to consider client needs. A client could demand CAD. According to the intermediate in-depth, the clients were very firm in their demands on architectural firms. It was up to the clients to demand and the architectural firms to please. The architectural firms were forced to have a complete market orientation. Every single wish from a client had to be noticed and responded. The increase of workstations among the adopters may be seen as an indication of the clients' wishes. At S2, about 33% of the jobs were a CAD job in which the client demanded the use of the new technology. Clients were a significantly more important reason for getting CAD among the late-adopters than they were among the adopters. Between S1 and S2, the market developed their demand of architectural services done with CAD.

**Client Characteristics and Changing Business Cycles**

The importance of the cooperation between the architect and the client seem to diminish in importance during periods of recession. According to the initial questionnaire, the most important client quality was to have architectural knowledge in various forms. It was important for the architect to have a client that had the ability to understand architectural work. In the ultimate case the client would have the same level
knowledge as the architect. In a period when there is a surplus of money it is possible for the architects to put their emphasis on architectural aspects of the design. There is room for stressing artistic design features. The clients probably encouraged the architects to make extravagant designs. The design of the new building should impress and there were resources available, which made it possible for the design to impress all the different interests on the building. About 82% of the firms used quality as their primary competitive tool at S1. Artistic success of the design was the main quality. According to the initial in-depth interviews, the architects were very proud if they were able to have any of their buildings commented in any of the famous architectural journals.

At S2, relationships were the most important client quality. Words like honesty, confidence, and trust were included in this client quality according to the intermediate in-depth interviews and the follow-up questionnaire. It seems as if the content of the work is diminished in importance and the terms for the project are stressed.

Theories about service management seem to have been developed during a stable economic cycle. There seem to be no variation in the relationship between the service provider and the client due to changes in business cycles. The cooperation between the service provider and the client has been pointed out as an aspect that largely determines the perception of service quality (Day & Barkdale, 1992, p. 89; Gummesson, 1978, p. 91; Lundin, 1993, p. 7; Solomon et al., 1985; Wheiler, 1987; von Matern, 1989, p. 26). Norman (1983, 1992) has labeled the meeting between the client and the service provider as the moment of truth. According to the findings in this book, changing business cycles affects the focus from the output of the service process to the terms for the service process. Of course the output was important in periods of recession too according to the architects “That the final outcome corresponds to the expectations” was the second most frequent expectations that the clients had according to the architects. Expectations focus on costs during periods of recession. The clients’ primary expectation was that the cooperation between the parties worked out according to the architects’ opinion. The nature of cooperation changes due to variations in business cycles and effective cooperation may have different meanings for the involved parties. For example, in the initial interviews no one ever mentioned costs for a job; however, in the intermediate in-depth interviews both the architects and the clients focused on costs. For these clients costs were a parameter for evaluating the architect’s work and it was an indication of how well the cooperation between the parties worked out.

**CAD and Changes in Demand of Architectural Services**

The building business cycle is dynamic. Periods of expansion will be succeeded by periods of contraction. The impact of these changes in customer demand might be
different in the future due to the following reasons: the use of CAD, increased size of
the firms, and internationalization. Using CAD means that the architect becomes more
efficient; more drawings can be done in a shorter period of time. The productivity in the
firm increases. According to the results here the adopter firms had significantly higher
productivity at S1 and at S2 than the non-adopter firms had. The adopter firms also
managed to increase their productivity significantly more than the non-adopters did
between S1 and S2. Considering these results a relationship between CAD and
productivity was assumed.

The second most important reason for getting CAD among the adopters was the
possibility to increase productivity and the second largest advantage when using CAD
was according to these firms the increased productivity. Increased productivity seems to
be a vital means for the architectural firms to manage changes in the business cycle.
Saving money was the single most used strategy by both the adopters and non-adopters
for preparing for the recession that hit the industry at S2. Training people on CAD was
the second most used strategy among the adopters, which suggest that effectively using
CAD is important.

Using CAD allows firms to deal with economic changes. One person in an adopter
firm has a larger range of production capacity. The new technology allows architects to
work more efficiently. When a recession comes the adopter firm will have lower costs
for their production capacity than the non-adopters will. According to the follow-up
questionnaire most adopters and late-adopters had bought their first workstation. The
cost for the equipment was only appearing once and at a time when the firm could
manage it, salary payments will appear monthly regardless of business cycle. Also in a
situation of change from recession to boom CAD may be of use. The adopters will have
a better ability to increase their production volume because they use CAD. These firms
will be able to satisfy their present clients in periods of boom without having to hire
additional people in direct proportion to the change in demand. A non-adopter firm has
to build in this flexibility in other ways in the firm.

It is of course not possible to absorb all changes by using CAD. During a recession
such as at S2 the firms that had CAD used other means for managing the situation.
They had to cut down on the number of employees; but smaller changes in demand may
be absorbed by the use of CAD.

Industry Structure

The sustainability of the non-adopters is discussed and a new industry structure is
proposed in this section. A central question for the new industry structure is the starting
of new firms. Moreover, a model for studying business dynamics is presented.
Adopters' and Non-adopters' Range of Firm Characteristics

The adopters may be characterized as progressive firms due to their characteristics and non-adopter may be characterized as traditional firms. Of course, neither adopter firms nor non-adopter firms were homogeneous regarding their characteristics (Figure 7.3). The discussion about the range of firms' characteristics builds on the idea that a combination of characteristics and the point of time for an activity are related (cf. Attewell, 1992). It is possible to segment a market regarding adoption due to certain characteristics (cf. Rangan et al., 1992).

![Figure 7.3 Range of Adopter and Non-adopter Firms](image)

The two lines labeled “Range of Non-adopters’ Characteristics” and “Range of Adopters’ Characteristics” in figure 7.3 represent the diversity within the two groups. The figure shows an aggregate situation for all the different characteristics the firms had. In a situation when representing an individual characteristic the sizes of the ellipses representing the two groups of firms would in most of the cases have different sizes to reflect the proper situation of the reflected characteristic. For example, the size of the range of the adopter ellipse would be larger than the ellipse of the non-adopters.

There was an ongoing adoption in the industry, which means that Figure 7.3 is a snapshot of the adoption process in the industry. At S2, about 53% of the firms were adopters and around 47% were non-adopters, and about 14% of the non-adopters would arrive to the transition area within the coming two years according to the plans that the firms had. These plans are closely related to the development of the business cycle and the number of firms that will adopt probably increases if a boom will develop. The non-adopter firms in the transition area have characteristics similar to an adopter firm located in the proximity to this area. The adoption of CAD, however, does not mean that a non-adopter firm got the characteristics of an adopter firm. Instead the ellipse around the adopters was expanding and the ellipse around the non-adopters was contracting. The adopter firms did now include an additional member’s characteristics, e.g., applied on the single variable firm size it might mean that firms with five people are now in transition to become adopters. Thus, there will be a wider diversity of firm characteristics among the adopters and a narrower diversity of them among the non-
adopters. This concurs with studies that show that at different stages in the adoption process firms exhibit specific characteristics (Bostöm & Wilson, 1993; Löwstedt & Norr, 1992; Mansfield, 1963; Mansfield, 1968).

Some Future Thoughts for the Non-adopters

According to the plans in the firms there will continue to be a portion of firms that are non-adopters, approximately 16%. An impression from the interviews and other occasions of contact with the industry suggest that some of these firms have a principal that has the opinion that he/she will manage the time remaining to their retirement without learning CAD. The opinion in the industry was that there was a strong correlation between age and willingness to learn CAD.

There was no absolute need to have CAD equipment in the Swedish architectural industry at S2. Most of the firms, however, will probably start to use some type of the new technology in the near future. Their adoption is probably in response to the development in the market. There will probably be a large range of CAD systems because each individual firm may find the proper equipment at the right cost.

At S2 the non-adopters had significantly more new clients than the adopters had. There were no indications that these clients would demand new types of services from the non-adopters. Non-adopters did about the same types of jobs at S1 and at S2. It is hard to know exactly were these clients came from. The data suggest that it was new customers demanding traditional architectural services. These new clients in the non-adopter firms may be interpreted as a way for the non-adopters to move away form clients that wanted their services done using CAD.

In an artistic industry there is always a possibility to be famous due to artistic production. In this context it is probably not at all necessary to have CAD. An architect that is famous for her/his buildings is engaged regardless of CAD use. This group of people is probably very small but there is always a possibility for an architect to designs that will make a membership in this group possible.

New Industry Structure

The changes in the industry between S1 and S2 suggest that a new industry structure was emerging. There seem to be some structural changes going on in the industry. Between S1 and S2 the portion of adopter firms that were members in a concern increased from 26% to 30%. Corresponding figures for the non-adopters decreased from 5% to 3%. The number of adopter firms will increase in number and in size. There was no significant difference in mortality between the firm from S1 to S2, which suggest that the number of firms regarding industry structure may be rather stable. It is unclear who engaged the people who had to leave due because of the lack of work.
Perhaps they started a new firm. But it is hard to think that several of them did because of the Swedish legislation regulating the order of laying people off. The most recent employees, usually the younger employees, were laid of first.

According to both the adopters and the non-adopters, contacts were the single most frequent used means for getting new clients between S1 and S2. The people who had to leave a firm may have had an advantage to exploit knowledge about and experience from working with CAD. Architectural services done with CAD was the fastest growing architectural market between S1 and S2. However, one thing lessens the probability of exploiting knowledge about the new technology for the new firm between S1 and S2 and that is the size of CAD jobs. These jobs were large and it is unlikely that a new firm could be able to manage to do such a job when newly started. There are two more questions about this line of development. Where did these new firms get the money from to buy a workstation? In a large job there were probably need for several workstations. The other question is, would the established clients allow a new firm to take a job, especially a CAD job? A conservative conclusion would be that the number of firms established between S1 and S2 was low.

Would the people who had to leave the industry between S1 and S2 come back when the business cycle would change? Some of them would probably do so. In the initial in-depth interviews the architects usually mentioned the difficult economic times in the 1970s. According to their stories, it seems as if several of them had been driving a cab as a way of earning a living. The established firms would probably hire some of the architects that wanted to come back to the industry. Some architects would probably try to start a new firm, which might be hard, before the surplus of architectural services had been absorbed by increased demand. Due to the nature of an artistic industry there will always be possibilities to be recognized by name. These people would have the possibility to start a firm almost during any state in the business cycle. One way to try to be recognized by the name was to participate in competitions.

New firms.

New firms will probably be established in the industry as it was before CAD was introduced soon after S2. Looking in retrospect the two most frequent arguments for starting a new architectural firm was the wish to draw and to do it according to the architect’s personal values. These people would probably come from a position in an established firm where they had client responsibility. According to the initial in-depth interviews, the clients usually followed an employee when the person left a firm. These clients were the ones that the new firm started to serve. Thus, there will be new firms started in the architectural industry mostly because of a changing business cycle. The rate of new firms will to a lesser extent be affected by the need of CAD. The clients
will decide to what extent CAD is needed in a new firm. Of course, it will be needed, but the question is to what degree of sophistication, how advanced must the system be? Depending on the clients’ demand of services from the CAD facility the rate of starting firms will probably be affected.

A large effort has been made in discussing the starting of new firms despite the limited knowledge about this matter. The issue is, however, central when trying to project the industry’s future structure. At SI about half of the firms in the industry had been started within the last 10 years. The architectural industry seems to be a mobile industry concerning new firms. The price development for computer software and hardware suggest that most firms will have the possibility to offer the client CAD services. Whether the clients will prefer to buy their services from these new firms or the other firms who operate CAD may be questioned. However, the probable response is that the established firm will have an advantage. The new firms might have to explore new areas for business, e.g., doing research. However, this is probably not the reason why firms were started.

Contrary to Quinn’s (1992) model that the change of industry structure when IT is introduced, there will probably continue to be a large number of small firms in the Swedish architectural industry especially when considering the establishing of new firms. The artistic aspect of the profession suggests such a structure. Looking at the small portion of the industry’s total business volume that the non-adopters had this volume may correspond to clients that for some reason did not want to do business with a large firm. There was a significant difference in the plans for the firm’s market share between the adopters and the non-adopters. The main part of the non-adopters wanted to remain their market share. About 9% of these firms intended to reduce their market share, which might be interpreted as an indication of plans to cease operating. New firms would probably replace the firms with such plans.

A Generic Model for Industry Transformation

The inquiry for this book is the impact pattern of IT in and industry of professional service. Service quality and competitive advantage were used as indicators of the CAD impact on the firm level. Industry structure and management of bottomlines were used as indicators on the industry level (See Figure 1.1). In chapter 2 the structured model of the studied constructs was developed further. The relationships found in the literature between the constructs were built into the model “A Revised Theoretical Framework” (Figure 2.16). That model suggests that management bottomline decides whether a firm will become an adopter or be a non-adopter. Traditionally the principals in architectural firms have had a qualitative bottomline where professional values of artistic principle override business values and management of the firm. An adoption of new technology
into a service situation that has been done manually for centuries suggests that new values have emerged. Especially as the new technology was an IT application and by and large the use of IT has been associated with increased productivity (Kish, 1991; Reynolds, 1993), which is a main rationale for using the new technology. According to the used service quality model “The Perceived Service Quality Model” (Figure 2.8), there might be a relationship between information technology and service quality. One of the factors in this service quality model is information technology. The relationship between service quality and competitive advantage was mostly shown indirect in the literature. There were several studies suggesting that the use of information technology will give the firm a competitive advantage (cf. Harris, 1985, p. 109; Porter & Millar, 1985, p. 149). Competitive advantage achieved due to the use of information technology has the potential of affecting the industry structure. According to Quinn (1992, p. 23), the structure in the exposed industry will go through a repetitive pattern.

There seemed to be a relationship between service quality and CAD in the architectural industry. Changes in the perception of service quality were assessed as changes in customer demand. Between S1 and S2, the demand of architectural services increased substantially. The transition in service quality that took place in the industry was illustrated in the “Competitive Spiral Model” (Figure 5.2). There seemed to be a relationship between competitive advantage and CAD use as well. Adopter firms had both significantly more loyal clients and significantly higher productivity. In “A Relationship Model” (Figure 5.3), the proximity between the constructs service quality, competitive advantage, and CAD were examined and discovered to be very close.

The introduction of CAD divided the Swedish architectural industry. The new technology created due to the rapid and favorable acceptance of architectural services done with CAD an entrance barrier and a mobility barrier. If an architectural firm wanted access to the fastest growing architectural market the firm had to be able to offer its services using CAD. For most firms this market was especially interesting, as the CAD jobs were in relative terms large.

The relationship between CAD and industry structure is based on the relative changes between the firms. Adopter firms may be described as progressive firms exploring new ways for increasing their business volume and the non-adopter firms may be characterized as traditional firms who wanted to continue as before. The changes in the industry structure due to CAD are an expansion of the adopter firms’ business volume and a status quo volume for the non-adopters.

The adoption of CAD seems to favor a new bottomline. Traditionally a principal governed by professional values has managed the professional service firm, the qualitative man. Experience from practicing the profession was the basis for managing the firm. When CAD was introduced there seemed to be a transition to more business-
A summarizing model.

The Business Dynamic Model (Figure 7.4) illustrates that the innovation is introduced into an industry of professional service and that some firms are labeled innovators (those who adopt the innovation and start to use it).

The ellipse labeled "Innovators" in the Figure 7.4 represents these firms. Due to the use of the innovation the innovators are able to offer the market their services with some added features (including lower prices). The market evaluates these additional features at first by selected clients. Later in the diffusion process by the market on mass evaluates firms. In the model the evaluation is symbolized by the rhomb labeled "Selected Clients' / Market's Perception." The evaluation of the market, may when a positive result is achieved be described the following way, the customers experience a higher service quality and the adopter firms are provided with a competitive advantage. The arrow between service quality and competitive advantage in the model symbolizes a relationship between these two constructs. If the evaluation of the innovation is negative by the market the adoption process will probably stop. No changes will occur according to the model (Figure 7.4).
In the case of CAD as innovation the industry structure was affected. Depending on the impact of the innovation and on the possibility for the innovators to make the knowledge about the innovation proprietary the industry structure will change. The competitive advantage power of new technology is dependent of the firm’s ability to manage it (cf. Boter & Holmquist, 1996, p. 483; Monger, 1988). An innovation may also affect the how managers in the industry thinks about the business and its bottomline.

In a generic model, bottomline may be too specific and too strong a term to use, e.g., the managers in an industry may have a common perception that reflects their thinking which may be classified as according to the quantitative man. An innovation, however, may affect the management’s way of thinking about the business in the industry. Thus, “management vision” might be a more appropriate label for the perception managers have with respect to their business—“Management Vision.” Management vision reflects a process that is related to the learning process about shifting business conditions that appears in an industry and the managers’ opinions of what is desired and what is possible (cf. Mintzberg, 1987). One way to describe the contents of management vision is to use concepts from other authors. Spencer (1987, p. 188) uses the concept industry recipes to refer a broad general common knowledge about how to behave in an industry other authors tend to use the concept industrial wisdom (Boter & Holmquist, 1996; Hellgren & Melin, 1992). Both these latter concepts seem to be similar to industry culture as used by Terpstra and David (1991). These three concepts therefore are incorporated in management vision. One way to be more specific about the contents of management vision is to use the contents of the balanced scorecard, which in itself reflects more than financial considerations. Four main areas are specified in the balanced scorecard, “Financial Measures,” “Customer Perspective,” “Innovation and Learning Perspective,” and “Operation Perspective.” The balanced scorecard is a way to broaden the view on a firm’s performance from solely financial indicators and to incorporate what has been considered as “soft measures” into the management’s base for decisions (Zeithaml & Bitner, 2000, p. 474). Management vision is to a dominating extent based on “soft measures,” but in contradiction to the balanced scorecard there is also anticipation about the future in the construct, it is not only an evaluation of what has happened but contains some idea on vision of what will happen. Due to the impact of the innovation introduced into the industry the management vision in the industry therefore could affect change and be affected by this change.

In Figure 7.4, the arrows around the constructs symbolize their dynamic nature. The introduction of CAD meant that the contents of service quality and competitive advantage were changed. A transition of service quality perception appeared in the industry and the use of CAD developed to be a competitive advantage. Also the
structure of the industry was affected as well as the prevailing management values in the industry.

**Empirical foundation of the model.**

The model is founded in the empirically based results of this book. In this research innovators were labeled adopters. These firms adopted CAD, an innovation. In agreement with the client the firms used CAD. The attitude to the adoption of the new technology was to regard it as an experiment. Both parties considered that architectural services done with the new technology were better than the manually done ones. There were many advantages for using CAD: it was easier to cooperate with the other consultants and contractors in the project and the productivity in the firm was increased. In the intermediate in-depth interviews, the providers stressed correct measurement and smooth cooperation and the clients stressed smooth cooperation and efficient storage of designs. These opinions were shared by several of the actors in the industry. There was a positive evaluation of CAD, which was noted by the rapid increase of services done with the new technology in the industry. Between S1 and S2 the portion of these jobs increased substantially for the adopters and at S2 the majority of jobs in an adopter firm were CAD jobs. In the late-adopters about every third job was one done with CAD. Service quality was assessed as customer demand in this book and there was a strong relationship between CAD performed services and service quality.

The adopters seem to have a competitive advantage compared to the non-adopters. The former firms had significantly higher productivity at both S1 and S2, and these firms increased their productivity significantly more than the non-adopters did during the period. A significantly larger portion of the adopters’ clients were loyal compared to the non-adopters clients. Regarding other indicators of competitive advantage there were no significant difference between these two groups of firms. In the case of CAD there seems to be a relationship between service quality and competitive advantage, thus the arrow between these two constructs in Figure 7.4.

The introduction of CAD seems to have affected the structure in the industry. Not assessed as number of firms, there was no significant difference in number of adopters and non-adopters that survived during the studied period, instead the structural changes in the industry concerned the size of the firms and their business volume. The adopter firms dominated the market by their market share of about 10 times the size of the non-adopters. At S2 there was a significant difference in the adopters’ and the non-adopters’ plans regarding their business volume. The adopters intended to increase theirs and the non-adopters seemed to be satisfied by maintaining theirs at the same level.

Introducing CAD into the architectural industry may be seen as giving a means for some type of management values, the quantitative man. The results in this book suggest
that the adopters and the non-adopters had different characteristics. One way to look at these characteristics is to use Mintzberg's (1978) idea to interpret a development pattern as a strategy. The characteristics of the adopter firms suggest that the principals in these firms managed their firms more according to the quantitative man (business values) than according to the qualitative man (professional values), the traditional values for managing a professional service firm. Thus, the introduction of CAD fueled new ideas about management in the industry, the quantitative man.

The generic nature of the model.

All professional services have some common characteristics. A service provider offers professional knowledge to the market. The professional knowledge is the essence in the service no matter if the professional is an architect, a lawyer, or an accountant. All these professional services emerge with long traditions and this is why it might be assumed that they all carry an individual set of professional values: Values that guide the service provider in the service production. Professional service is defined as complex professional knowledge trading. Architectural firms were selected as study objects for professional service. According to the finding in the book architectural firms seem to be a "neutral" representative of professional service and this is why the suggested model in Figure 7.4 may be regarded as a model possible to apply in other industries of professional service too. Actually there was an aim to make the model to be a proper reflection of the introduction of an innovation in any industry. Due to the general nature of the model there are no restrictions for using it in other situations. The model is not limited to reflect only one type of industry.

In the case of this book, CAD was the innovation; any other innovation may substitute that innovation in the model; however, the studied innovation may be regarded as extreme concerning magnitude of its impact. There were certain advantages in using such an innovation when developing the model. The impact of CAD produced a clear pattern of the possible changing power an innovation may have. Figure 7.4 may be used in any situation when an innovation is introduced in an industry. Innovation has to be interpreted in a broad sense, important is that the studied object or process is new for the exposed industry.

It is naturally possible to find distinctive features in every industry. These characteristics are judged to be of less importance in the context of making the model in Figure 7.4 universal. Of relevance here are also analyses of the respondents, whether the non-respondents were randomly distributed regarding characteristics. The analyses
suggest that they were randomly distributed. Thus, the Swedish architectural industry may serve as a basis for developing a general model.

Research Considerations

Second thoughts about the research design are in focus in this section. Some alternatives to the used research design are presented; their advantages and disadvantages are analyzed. Several methodological issues are addressed. Of central importance are the choices of study object and their affect on the inquiry and the results.

Adopters and Non-adopters as Division

Soon it will not be useful to divide the industry in two different groups due to adoption of CAD. The selection criterion for dividing the firms in the industry in different groups was time sensitive. The firms in the adopter group have probably not become more homogenous due to their adoption of CAD. According to the plans in the adopter firms and in the non-adopters the two groups of firms would be even more differentiated. The adopters firms had plans to expand their business and the non-adopters including the firms that planned to do an adoption within the coming two years did not have plans of expanding their business. A new criterion has to be used to identify the firms that at S1 were incorporated in the group adopters. It is of interest to identify this group because they were the essence of the industry regarding business volume. These firms had a total market share of about 81% of the industry's total volume at S2.

The adopters and the non-adopters were two groups of equal size regarding number of firms, which is of interest as the characteristics of the firms in the two groups, adopters and non-adopters, were studied. Looking at market share the picture is completely altered. In terms of market share the division in the industry was very skewed; the majority belonged to the adopters.

The division of the industry was done to study the impact of IT in an industry of professional service and the study was done with an external approach. Another related question is the use of CAD in the adopter firms. The impact of CAD does come from the use of the technology not merely owning the technology. At the levels of use at S1 and S2 a division of the industry in number of adopters and non-adopters is still useful to do. In the adopter firms the new technology was used in about 25% of the jobs at S1 and between S1 and S2 the use of CAD increased by 128% in the adopter firms. The

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1 The analysis of non-respondents due to location showed a significant difference between the groups. For detailed information see headline “Methodological Considerations” in this chapter.
impact of the technology is probably going to be increasingly noticeable in the industry. An interesting figure here is the number of jobs that were finished with CAD once the technology was introduced in the job it is used until the job was finished. In the adopter firms the figure was about 54% at S2 and for the late-adopters it was approximately 27%. These levels of use suggest that the potential of CAD has not at all been utilized and a division of the firms in adopters and non-adopters is fruitful for the inquiry. If the adopters had used CAD in all their jobs and used this technology in all steps of a job the adoption of CAD had been completed and it would have been impossible to study the impact of CAD. Due to adopters' market share architectural services done with CAD would have a volume assessed in market share of more than 80%. In the future, a new means for division would be more useful when studying the development in the industry.

*A new ground for division.*

A new matter needs to be identified if the future development in the architectural industry is to be studied. It is here important to make a difference of what is the focus of interest, the development of the architectural industry or the impact of CAD. These two issues may not necessarily be the same. The use of a new variable for dividing the industry will be needed in both cases.

If the impact of CAD is of interest it might be fruitful to study heavy users, users who use the new technology in 75% or more of their jobs. Selecting these firms will give a pattern for the development of CAD use. Of larger interest might be to identify the firms that are interested in using additional software packages related to CAD such as simulation, animation, and virtual reality. The use of such features may cause a leap in the development in the architectural industry. Especially as the architects wanted a client with knowledge because that would ease the cooperation. These types of features may level the knowledge between the parties.

Regarding the issue about the development in the architectural industry another approach is needed. Here the large firms might be of interest to study closer. Due to their size, the behavior of these firms had substantial impact in the Swedish architectural industry. When looking for a new ground for dividing the industry regarding the development in the industry it is of interest to recall how the firms for the initial in-depth interview survey were identified. It was the progressive firms that were of interest. Progressive firms were defined as firms that had the image in the industry of stating new behavior1 (cf. Bancroft 1992, p. 1). Progressive firms may not necessarily be the same as large firms. Frequently it is not the large firms that start the new behavior in an industry. Of special interest might the "borderline" firms, firms that do

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1 For more information see section 3.3 "Preparations for the Initial Questionnaire."
not fit in the classic definition of architectural firms. Firms that are stretching the roles for an architectural firm are probably of special interest. When trying to identify these firms it might be fruitful to depart from a client’s view. That is, what other firms can satisfy the clients of an architectural firm?

**The Core of an Industry**

Of central interest is the question of what the core of an industry is. Is it made up by number of firms or is it made up by the size of firms? The definition of industry is important in this book. Porter’s definition of an industry was used, “as the group of firms producing products that are close substitutes for each other” (1980, p. 5). This definition points out the firms as the entities constituting the industry, which might be obvious. According to the situation in the Swedish architectural industry, it is relevant to discuss the magnitude of an industry from two different approaches: number of firms and portion of revenues. There was a large range of revenues in the architectural industry, which comes from the various sizes of the firms. At S2 the adopters had a total market share of about 81% of the industry’s total volume and the non-adopters had a market share of around 8%. The remaining 11% of the market share belonged to the late-adopters. Regarding numbers of firms the division in adopters and non-adopters was fairly equal. At S2 about 53% of the firms (adopter or late-adopter) had CAD and around 47% of the firms were non-adopters. Thus, a division of the industry regarding number of firms is most appropriate. Of interest was the impact pattern of IT in an industry of professional service. Addressing the inquiry in this way makes the number of firms in the industry of interest. Leaving the number of firms approach means that the focus of interest is changed to the possible impact of CAD on an industry.

**Alternative Research Approaches**

At the time when the work in this book was started the used research design was assumed to be the best one. After reconsidering the research design there are of course different approaches that could have been used. A possible alternative would have been to follow a few of the largest firms closely doing in-depth interviews with a number of people in these firms and a number of clients of these firms. The advantages with this approach would have been the achievement of data of a more detailed development of the CAD adoption. Another advantage would have been the greater access to information from the clients. They seemed to be actively participating in the adoption process of CAD therefore more information from them would probably have been fruitful. A disadvantage with this approach is the loss of an industry approach. It would have produced information about the adoption process in some of the firms in the
industry but the industry impact of the adoption process would not be addressed. The inquiry will shift focus from the impact pattern of IT in an industry of professional service to the possible impact of IT in an industry of professional service. Selecting a few firms for study certainly means that the industry approach is lost.

Selecting a few firms for closer study for the time between S1 and S2, about 44 months, could be hazardous. Especially considering the change in business cycle. Perhaps some of the selected firms would not have survived. Of course, the firms that ceased could have been replaced but that would probably have affected the findings.

A possible change of the research design would have been to incorporate more clients in the study. Some of the people in the initial in-depth interviews could have been clients instead. However, this change would have come at the expense of lower certainty of saturation in both the group architectural firms and the clients. The uncertainty would probably have been larger in the client group as the clients were probably more diversified than the architectural firms were. Every change in the research design that is made by adding more activities—for example, more people to be interviewed—means that some other activities have to be decreased or eliminated. It is necessary to always consider the financial restriction for the work in this book and to be aware of the limitations in time when judging the research design and discussing alternative approaches.

A possible alternative approach may have been to follow some firms and a sample of their clients closely for some period of time. For example, during the period between S1 and S2. At S2 the information obtained in these case studies may have been used as input for the construction of a questionnaire that might have been sent out at S2. This research design would give additional in-depth knowledge about the adoption of CAD and the clients' opinion of the matter and it would also have given some information about the situation in the industry. What would have been lost is the development of the industry regarding the impact of CAD. Especially the pace of the development would have been lost.

**Methodological Considerations**

Two paradigms have been dealt with in this book. The research has been done with the eyes of the quantitative man with attention paid to the qualitative man so as to stand outside the paradigm. The question is what would the results have been if the research had been made from a qualitative man's perspective? Would the non-adopters have been the firms who had better competitive advantage compared to the adopters? They could continue to perform the profession in the traditional way despite the introduction of IT.
Selection of empirical objects.

The selection of empirical objects seems to have been fruitful concerning the inquiry. The Swedish architectural industry was an interesting research object as it provided interesting insights into professional service firms. In addition, the architectural industry had an artistic aspect. A feature that certainly stressed the impact of CAD and made the transition of management values more obvious.

CAD was an adequate choice of study object for IT. Largely the choice of study object for IT was determined by the selection of industry. However, the impact of CAD exposed the impact of IT in an industry of professional service clearly (cf. Sakr, 1991). Every technology that falls into the IT category will naturally not have the same impact as CAD had. The benefit of selecting CAD was that it unmasked most of the potential changes that IT might have in an industry of professional service.

Service quality was assessed by the customers' demand of a specific service. The prevailing way of assessing service quality is to monitor the clients' opinion (cf. Berry et al. (1988, p. 35), Farsad & Elshennawy (1989), Grönroos (1983), Gummesson (1978, p. 93), Gummesson (1990, p. 7), Lehtinen & Lehtinen (1991), Murdick et al. (1990), Tierno (1989), and Zeithaml, et al. (1990)). Here the transition in the clients' opinions was observed as changes in demand of a type of service. An indirect way of assessing. In the best case every one of all the selected firms' clients should have been addressed. Due to financial limitations, time restrictions, and assumptions made about the access to the firms' client directories, addressing the individual clients directly was not practical. The loss of not addressing them directly was considered to be negligible compared to the effort of such an approach and the tight relation between the architect and the client suggest that addressing the architectural firms was enough.

Competitive advantage was assessed by the following variables: survival, change of market share, change of productivity, change in number of employees, and loyalty. As indicated before the variable survival showed to be difficult to use as an indicator of competitive advantage. All architectural firms got the main part of their revenues from the three largest clients at both S1 and S2 and if any of these three firms went bankrupt the architectural firm probably also went bankrupt. Whether the tight relationship between the firm and its clients should be an indication of competitive advantage may be questioned. As the situation turned out there was no significant difference in survival between the adopters and the non-adopters. There is another aspect of the variables used for assessing competitive advantage that is of universal methodological interest. Is it possible to find any way in which large and small firms can be compared? In this book percentages were used as the best approximation.
Sample and respondents.

The used sample was a closed sample; no new subjects were added between S1 and S2. There were no resources available for including new firms into the work. The impact of these firms regarding the inquiry was considered to be very limited. During the period of study there was a severe recession in the industry and this is why it might be possible to assume that few new firms were started, which utterly diminish the impact of this group.

A critical question is how to deal with the firms that did not respond. About 35% of the firms in initial survey did not respond the questionnaire. The analyses of first half and second half suggested that the non-respondents were randomly distributed. The last reminder of the initial mailed questionnaire was made by telephone; information from these telephone calls supports the argument that the non-respondents had no affect on the results. All contacts with the non-responding firms suggest that they would be randomly distributed regarding characteristics, opinions, et cetera.

The analysis of respondents and non-respondents regarding their location turned out to be significant, p value 0.088. There were more non-respondents among the firms in central locations than among the firms in non-central location. Information obtained from these non-respondents, at the follow-up made by telephone, suggests that they were similar to the responding firms. Their non-participation did not affect the results.

Due to the design of the research there are by necessity certain areas that are overlooked. Other areas of interest emerge as results of the work were analyzed. Interesting questions to address in new studies are, for example, did any new firms start between S1 and S2 and what were the characteristics of these firms. Another area of interest is the gender aspect in the industry.

Areas for Further Research

Several areas for further research are identified as a result of the research done in this book. The findings in this book do not support the ideas of a repetitive pattern in an industry exposed to IT. How will the pattern of the Swedish architectural industry look like? Changing business cycles is another area addressed: where did the people who had to leave the industry between S1 and S2 go? Do these people come back when times change? Finally, there are the different inquiries related to "The Business Dynamic Model" presented. Future research should be designed in a way that makes it possible to evaluate the model.
Industry structure approaches.

There are several ways in which it would be of great interest to continue this research. What has happened in the industry? Two major data collections were done for reflecting the studied process. Due to the character of social science it would certainly be of interest to do an additional data collection especially as the results suggest that the development pattern of the Swedish architectural industry would deviate from the Quinn (1992) suggests.

During the recession between S1 and S2 about 20% of the people in the industry had to leave their employment. When there are difficult economic times in the Swedish architectural industry where do the people who have to leave their employment go? An architectural education is a focused education. Where is it possible to get employment as an architect if there is a surplus of educated labor in the industry? It would be of interest to make a broad approach in this survey and try to capture what happened with these people. An interesting question is to see if there are any pre-designed patterns for architects during these circumstances. For example, do Swedish architects go to Norway or become teachers?

Changing business cycles.

Over the years the architectural industry has been exposed for periods of economic fluctuations, booms, recessions, and recovery. Changing business cycles seems to be constantly present in the architectural industry according to the architects in the initial in-depth interviews. The impression was that there were ways for coping with this problem among the principals. However, according to the follow-up questionnaire the strategies that the firms had used for preparing for the recession and the strategies they had used during the recession does not suggest a way to cope with changing business cycles. A close look at how the firms manage the changes with changing business cycles would be of interest. Especially since the Common Market has broaden the market substantially for the architects. An area for further study is the relationship between changes in business cycles and international business. According to the results in this book the large firms expanded their international activity during the recession and the small firms behaved the opposite way. Is this a common pattern during different business cycles?

Each of the recessions that have hit the Swedish architectural industry has probably meant that several architects have had to leave the industry at least temporarily. Was their leave temporary? Did they really come back? In what other positions have the architects been able to benefit from their education? For example, how many of the architects that finished their formal education in 1960 and who have not retired are still practicing as architects?
Despite the difficult times between S1 and S2 some new architectural firms may have started. If there were any such firms, then they are especially interesting as the bulk of firms were busy managing to be able to survive. Why did these new firms start? How did they manage to start? Which ideas did these people have for anticipating that they would manage to start their business during such a period in the business cycle?

The results of the conducted research suggest that the cooperation of the service provider and the architect is sensitive to the prevailing business cycle. This finding alters the traditional focus on the importance of the cooperation between the parties. In times of severe competition the conditions for competition in a service firm may be the same as in other industries. How does the cooperation between the architect and the client change due to changes in the business cycle?

**Gender issues.**

Between S1 and S2 significantly more female principals than male principals quit. Why did they choose to stop being principals? Male principals succeeded these female principals, why? Is there any connection between the recession and this development? Will these female principals be principals again when the economic climate improves? Is there any connection between gender and business cycle?

A closely related question is the unique behavior of the female principals. In a significantly large number of firms with female principals they were classified as late-adopter firms. Why is the behavior in these firms so homogeneous? Is a female principal's behavior so distinctly different compared to a male one? Is it fruitful to have a discussion in terms of gender? Would it be more fruitful to do some other type of classification?

**Business issues.**

About 47% of the adopters were active in a foreign market and about 30% of the firms not active had plans to enter a foreign market. In the in-depth interviews the ways for entering a foreign market seemed to be a fortuitous: for example, a person from a foreign country comes to Sweden for some reason and works as an architect in the firm. Now this person goes home and starts a branch of the firm. Another way for entering the international market was due to a special driving force of the question in the firm. At S2, approximately 50% of the adopter firms had international business. Had they all started fortuitously? Was there a pattern for establishing business in a foreign country? What was the idea of going abroad? Were these businesses profitable? How were cultural problems overcome?

The results suggest that the use of CAD changes the nature of service marketing and service management. Due to the possibilities of visualization the evaluation of a service has changed from being done after the service delivery to be done before the service
delivery. This possibility may have a large impact in the architectural industry. Are the firms using the possibility of visualization? How are they using it? Are the clients demanding it? How has it affected the competition? It is possible to assume that the possibility of visualization has broaden the clients set of eligible architectural firms and by that increased the competition among the architectural firms.

The business dynamic model.

It is of certain interest to design an additional survey in a way that would make it possible to test the developed model “The Business Dynamic Model” (Figure 7.4). There are two different approaches for the design of a new survey. The survey could approach the Swedish architectural industry or it could approach another industry of professional service for evaluating the model. In the best case both of these approaches are allowed. It is of absolute priority to conduct a follow-up study of the Swedish architectural industry with a similar approach as survey one and two. As far as this author knows, it is unique to have made a study of longitudinal character of the impact of IT in professional service. An additional survey would only add to the unique nature of the study.
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Appendix A. Members in the Reference Group
Members in the Reference Group

During the first survey, a reference group was put together. People with various knowledge and experience from the Swedish architectural industry were selected for the group. These people represented different perspectives on the industry. Beside the author, the following people were members of the group (listed in alphabetic order):

Marja-Leena Agri, Åke Larsson Byggare AB, Stockholm

Svante Berg, Berg Arkitektkontor AB, Stockholm

Staffan Carenholm, Arkitektförbundet, Stockholm

Mikaela Eckered, ARKUS, Stockholm

Lars Hallin, SPA, Stockholm

Bo Kjessel, Bo Kjessel Arkitektkontor, Stockholm

Rolf A. Lundin, Institutionen för företagsekonomi, Handelshögskolan i Umeå, Umeå Universitet

Ragnar Östlund, Contekton Arkitekter, Falun
Appendix  B.  People Interviewed in the Initial In-depth Interviews
People Interviewed in the Initial In-depth Interviews

This list is of the people that were interviewed in data collection one, before the initial mailed questionnaire was sent out. The list is sorted by location (alphabetic order), and when the interview was conducted. All interviews, except one, were done at the firm in which the interviewee worked.

**GÖTEBORG**

7 June 1989 Pelle Frenning, Erceus, Frenning, Sjögren arkitekter AB.
7 June 1989 Leif Blomkvist, Liljewall arkitekter ab.
8 June 1989 Ingemar Mattsson, Arkitektlaget AL AB.
8 June 1989 Nils Palm, FFNS Gruppen AB.
9 June 1989 Magnus Månsson, Semrén Arkitektkontor AB.

**HALMSTAD**

29 June 1989 Ann Charlott Castler, Fredblad Arkitekter AB.
3 July 1989 Stellan Eriksson, White arkitekter AB.

**LUND**

26 June 1989 Jonas af Klercker, Datorstudion.
27 June 1989 Bengt Persson, Landskapsarkitektarna i LUND AB.
28 June 1989 Bo Johansson, Fojab
28 June 1989 Lennart Welin, ARCON Arkitektkontor AB.

**MÅLÖ**

26 June 1989 Hans Rendahl, Lundquist & Rendahl Arkitekter AB.
27 June 1989 Janne Svensson, Arkitektura AB.

**STENUNGSUND**

9 June 1989 Tommy Strandberg, Arkitektgruppen i Stenungsund AB
STOCKHOLM
15 March 1989 Jan Ericson, Ericson, Gynnerstedt, Ågren Arkitektkontor AB.
15 March 1989 Anders Hamrin, Brygghuset Arkitekter AB.
16 March 1989 Monica Wallin, Nyréns Arkitektkontor AB.
16 March 1989 Anders Pyk, Nyréns Arkitektkontor AB.
16 March 1989 Joe Lindström, VBB, Linnégatan 2
3 July 1989 Peter Ohrstedt, AGORA Arkitekter AB.
4 July 1989 Ben Stenmark, S. Koinberg AB Landskapsarkitektkontor.
4 July 1989 Ingemar Ståhl, HJS Arkitektkontor AB.
5 July 1989 Gunnar Nordström, FFNS Gruppen AB.

UMEÅ
5 March 1989 Laila Björnham, FFNS Arkitekter i Umeå.

ÖRNSKÖLDSVIK
15 June 1989 Per-Eddie Bjuggstam, Bjuggstam Arkitektkontor AB.
15 June 1989 Mårten Johannessen, Arking AB.

People not associated with an architectural firm.
5 July 1989 Mikaela Eckered, Stiftelsen ARKUS och ARKUS-föreningen.
6 July 1989 Lars Hallin, SPA, Sveriges Praktiserande Arkitekter.
6 July 1989 Staffan Carenholm, Arkitektförbundet.
23 November 1989 Leon Nordin.
Appendix C. Topics Discussed in the Initial In-depth Interviews
ARCHITECTURAL FIRMS—STUDIES OF AN INDUSTRY IN CHANGE
TOPICS TO BE DISCUSSED, 6/19/89

The Firm
History, possessing, management, sales, financial management of job budgets?
Number ongoing jobs? Extent of contracted work?
Advantages with fix sum and running sum?
Your division of working time between jobs and management? Amount of time possible to invoice?
Overtime?
Number of employees, number of people in each profession group, areas of business?
Connection to other business?
Business mission, goals, strategic planning?
Recent strategic changes?
Clients, distribution private, public, and international
  International contacts and international cooperation?
How is contact with potential clients obtained? Marketing activities?
What does your geographical distribution of clients look like?
How do you get new jobs?
Competitors, cooperation with other firms?
What makes your firm special?

Recruitment
How do you recruit new employees?
Personnel situation, lack of personnel?
Salary for a 40 year old architect?
Contacts and connections with architectural schools?
Personnel turnover, comments?

Picking Up Knowledge
Managing of the employee education?
Internal education: scope—numbers of hours, direction, competitions, trips abroad, information meetings—scope?
External education?
Diffusion of knowledge within the firm?
Development Work

R&D activities in the firm?
Involvement in any public research jobs?
Development jobs, innovations?
CAD, year of adoption, number of workstations, type of system, competence,
professional groups knowledge, progression, who is in charge?
How does the clients affect your progression?
Relations to the building sector, the architect’s role in the building sector, progression?
The craft-guild?

Work Situation

How do you decide your prices?
Has the will to pay for architectural work changed?
What is the role of an architect in a job, actual, ideal?
What do you do for being able to play this role?
How restricted is the architect in his work regarding time, solutions, and money?
Would it be possible to rationalize architectural jobs in a way that would make the architect unnecessary?
Is it possible that this situation will occur?
In which ways has the architect contributed to the progression regarding the outcome of the architectural work and regarding the organization of the external parties involved in architectural jobs?

The Industry

What constitutes the industry?
Progression concerning new firms, computerization, specialization, and concentration?
What is going on concerning tendencies, state of the market, external factors affecting clients, competitors, ways of how to work (total contracts)?
Opportunities and threats for the industry, the firm?
Do you have any suggestions of other firms that might be of interest to include in this in-depth interview survey?
Appendix D. Initial Questionnaire
QUESTIONNAIRE

to

the management

REPORTED DATA IS CONFIDENTIAL.
I Management and Ownership

1. Your sex:
   - Male
   - Female

2. Your age: ............. years.

3. What is your education?
   - Architect
   - Engineer
   - Business administration
   - Others

4. How much of your working time is spent on:
   - job work: ........% 
   - administrative work: ........% 
   (If this does not add up to 100%, then please write down the type of work you do for the rest of your time: ...............................................................)

5. Have there been any plans about changing the ownership of the firm in the coming three years?
   - Yes
     - Selling stocks to employees
     - Stocks traded within the owner family
     - Introduction to the stock market
     - Selling the firm to another firm
     - Other: ........................................................................................

   If you are planning a change in the ownership in the next three years what is the main reason for this?
   - Succession
   - Capital is needed
   - Tie up key people
   - Other: ........................................................................................

   - No
II  Goals and Critical Recourses

6. Please rank the firm’s goals for the present financial year. (Please note the most important goal first.)

..............................................................................................................................................................
..............................................................................................................................................................
..............................................................................................................................................................

7. To reach the most important goal please estimate in decreasing order, how restricting the following factors are: 1 most restricting, 2 second most restricting, and so on.

.... Knowledge
.... Personnel
.... Capital
.... Projects

8. Please estimate the total competence in the firm in the following areas.

<table>
<thead>
<tr>
<th>none</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
<td>House architecture</td>
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<td>Interior design</td>
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<tr>
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<tr>
<td>Other: .........................</td>
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</tbody>
</table>
9. Please estimate to what extent the following alternatives increase the knowledge in the firm.

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<tr>
<th>none</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>Architectural comp.</td>
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<tr>
<td>External education</td>
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<tr>
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<tr>
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<tr>
<td>Other:</td>
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</tbody>
</table>

III Organization and Personnel

10. Is your firm organized into fixed smaller groups?
   ☐ Yes
   ☐ No

11. Does your firm have a recent need for more architects?
   ☐ Yes
      If yes, how many house-architects? ..........numbers
      interior designers? ..........numbers
      landscape architects? ..........numbers
      planning-architects? ..........numbers
      town-architects? ..........numbers
   ☐ No

12. Does your firm have a recent need for more engineers?
   ☐ Yes
      If yes, how many with an academic exam? ..........numbers
      without an academic exam? ..........numbers
   ☐ No
13. Please mark the three most important arguments used for recruiting new employees:

- Higher salary
- Partnership
- Stimulating work and challenging tasks
- Transfer sum
- Work abroad
- Continuous education
- Possibilities for career
- Possibilities to start a branch
- Fringe benefits e.g. leased car
- Other: .................................................................

14. Do you believe that your colleagues receive training to the extent they wish?

- Yes, go to question 15
- No

If no, which is the main reason for this situation?

1. Lack of time
2. Lack of capital
3. Their wishes exceed available resources
4. Others: .................................................................

IV Business and Market

15. How big was the firm’s increase in profit (last year’s figures) compared to other firms in the industry?

- Lower
- Same
- Higher

16. Note the most important changes that your firm has gone through the last three years.

........................................................................................................
........................................................................................................
........................................................................................................
17. Is it your opinion that the architect is the person who should be wholly responsible (financial, time, functional, and so on) for the total job towards the client.

- Yes
  If yes, what is needed in order to succeed in this role?

- No
  If no, why not?

18. Does your firm have any niches?

- Yes
  If yes, which: Proportions in SEK or % of revenues.

- No

19. What is your plan for your market size in the coming three years?

- Reduce
- Remain
- Expand

20. Do you have any plans to concentrate your business to any particular niches in the coming three years?

- Yes
- No
21. Do you have any plans to expand your business in the coming three years by expanding it within what is considered to be architectural business to day?  
☐ Yes  
☐ No  

outside what is considered to be architectural business to day?  
☐ Yes  
☐ No

22. Did you have any assignments abroad last financial year?  
☐ Yes  
If yes, how did you mainly get these assignments?  
☐ Through Swedish subcontractors  
☐ Own initiative  
☐ Others: .................................................................  
☐ No

23. Do you have any plans for entering a foreign market during the next three years?  
☐ Yes  
If yes, when: ........................................  
where: ........................................  
In what way will this be done  
☐ Opening an office  
☐ Cooperation with a firm in the foreign market  
☐ Other: ........................................  
☐ No
24. What would happen with the volume of your billing if you: (Note the change in percent with a + or - sign)
   1 Decreased your fee with 10%: ........%
   2 Increased your fee with 10%: ........%
   3 Increased your fee with 20%: ........%
   4 Increased your fee with 30%: ........%
   5 Increased your fee with 40%: ........%

25. Note the most important changes that have occurred with your clients in the last three years:

26. What do you value most from a client?

V Competitors and Competitive Advantage

27. How do you experience the competition for your firm?
   1 □ None
   2 □ Low
   3 □ Relatively intense
   4 □ Intense
   5 □ Very intense

28. Please rank the importance of the following competitive advantages, (you may skip alternatives that are not relevant).
   ..... Fee
   ..... Quality
   ..... Fast work
   ..... Total package
   ..... Other: ........................................
29. Do your competitors rank their competitive advantage in the same way as you?
   - Yes
   - No, please rank their alternatives used
     - Fee
     - Quality
     - Fast work
     - Total package
     - Other: .................................................................

30. Note what has been characteristic for your competitors during the last three years.
    ........................................................................................................
    ........................................................................................................
    ........................................................................................................

VI Future

31. The building sector is experiencing a boom at the moment. Is it your opinion that there is a boom at your location?
   - Yes
     If yes, for how long will it last? ......................................................
   - No
     If no, when did it end? .................................................................

32. When will the architectural industry work in a normal business cycle?
    ........................................................................................................

Architectural firms - studies of an industry in change
VII Market View

33. Note the three currently most outstanding Swedish architectural firms regarding business management. (Do not list your own firm.)

.................................................................
.................................................................
.................................................................

34. Note the three currently most outstanding Swedish architectural firms regarding architectural work. (Do not list your own firm.)

.................................................................
.................................................................
.................................................................

35. Note the three currently most outstanding Swedish architects. (Do not list any person employed in the own firm.)

.................................................................
.................................................................
.................................................................

36. Note the three Swedish architectural firms that you currently consider to have the most potential. (Do not list your own firm.)

.................................................................
.................................................................
.................................................................

THANK YOU FOR YOUR PARTICIPATION

The following part of the questionnaire asks for financial statements about your firm and should preferably be answered by the accounting manager.
QUESTIONNAIRE
for the Financial Office

REPORTED DATA IS CONFIDENTIAL.
I  Start, Company Form, and Ownership

1. Which year did the firm start? ..............

2. If architectural business was not done from the start of the firm, what year did it start? ..............

3. Are any of the founders still active in the firm?
   - Yes
   - No

4. In which type of company is the business done?
   1. Private firm. Go to question 5.
   2. Trading company. Go to question 5.
   3. Limited partnership. Go to question 5.
   4. Is a part of a limited company. Go to question 5.
   5. Limited company
   6. Other: ........................................................................................................

   If a limited company, how many people are members of the company's board? ..........numbers

   If a limited company, how many of the people in the company's board are mainly dealing with businesses outside the architectural industry? ..........numbers

5. Is the firm part in a concern?
   - Yes
   - No

6. How large portion of the firm is owned by the founder/s (include family members) respective the principal/s? (If these groups are the same people just mark one set of figures, please)

   Founder/s? ..........%
   Principal/s? ..........%
7. How large portion of the personnel, (please exclude people mentioned above) own stocks in the firm? ...........% 

8. How large portion does the personnel own together? ........% 

9. How large portion of the firm is owned by external investors? ........% 

II Employees 

10. How many people were employed in each one of the personnel categories by the end of last financial year?

<table>
<thead>
<tr>
<th>category</th>
<th>full time</th>
<th>part time</th>
</tr>
</thead>
<tbody>
<tr>
<td>house architects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>interior designers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>landscape architects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>engineers with acad. exam.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>engineers without acad. exam.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td></td>
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</tbody>
</table>

11. During the last financial year, how many of the firms architects and engineers:

<table>
<thead>
<tr>
<th>quitted</th>
<th>were noticed</th>
<th>were employed</th>
<th>were hired.</th>
</tr>
</thead>
<tbody>
<tr>
<td>arc</td>
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<td>arc</td>
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<tr>
<td>engi</td>
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<td>engi</td>
<td>engi</td>
</tr>
</tbody>
</table>

12. Note the number of architects and engineers that were in charge of jobs (financial responsible towards a client) by the end of last financial year: 

   Architects: ...........number 
   Engineers: ...........number
III Financial Issues

13. Note revenues (revenues + other incomes + the financial year's portion of ongoing jobs) for the following years:
   - 1989: .......................... crowns
   - 1988: .......................... crowns
   - 1987: .......................... crowns

14. Note the costs for the following years (please exclude financial, exceptional and depreciation costs):
   - 1989: .......................... crowns
   - 1988: .......................... crowns
   - 1987: .......................... crowns

Issues for question 15 to 19 concerns last financial year.

15. When did your last financial year end? 198......-........-........

16. Did this year comprise twelve months?
   - Yes
   - No

17. How big a portion of your revenues was from work abroad? ..........%  

18. What portion of all work-hours (excluding holiday) were billable? ..........%  

19. What are your figures for?

   Own capital (50% of untaxed resources + own capital):
   ........................................crowns

   Total capital, figures from balance sheet: ............................crowns

   Current assets, stock-in-trade excluded: ..............................crowns

   Short term debts: ...............................crowns

Architectural firms - studies of an industry in change
IV Clients

Issues for questions 20 to 24 concerns last financial year.

20. Note the total number of invoiced clients: ..........numbers

21. Note the invoiced sum for a normal client: ..........crowns

22. What did your mixture of clients look like? Note total revenue in crowns or % of revenues.
   Private ........................................... □ crowns □ %
   Municipals ...........................................
   Government ...........................................
   County council ....................................
   Industry ............................................
   Others: ..............................................
   Others: ..............................................

23. Note the firm's revenues that came from each of the three largest clients (either in crowns or as % of revenues):
   Client 1: ................................. □ crowns □%
   Client 2: .................................
   Client 3: .................................

24. What kind of jobs did you have? Total revenues in cr. or % of revenues.
   Private houses ........................................... □ crowns □%
   Apartment houses ....................................
   Industries .............................................
   Offices ................................................
   Hotels ............................................... 
   Shops ................................................
   Hospitals / laboratories ............................
   Others: ..............................................

Architectural firms - studies of an industry in change
25. Did your firm do work other than architectural work?
   • Yes
     If yes, note type
     Sum or % of revenues.
     ...........................................................................  .........................  cr.  %
     ...........................................................................  .........................
     ...........................................................................  .........................
   • No

V Education

Issues for question 26 to 28 regards last financial year.

26. Note the sum of money put into education, excluding field trips.
    ...........................................crowns

27. How many of the employees used education money? ...........% 

28. Note the sum of money that corresponds to the work you have put in to architectural competitions: ............................crowns

VI CAD

29. Do you have CAD equipment in the firm?
   • Yes
   • No, go to question 41.

30. When did you get your first CAD system? 19...........

31. How many CAD workstations did you have by the end of last financial year? ............numbers
32. Which software do you use?
   - Medusa
   - CAD Point
   - Auto CAD
   - Others: ............................

33. What brand of hardware do you use? Note the earliest obtained equipment first and so on.
   ........................................................................................................................................
   ........................................................................................................................................

34. What percent of jobs was CAD used last financial year? ..........% 

35. Note the number of people participating in CAD training last financial year: ............

36. What was the total number of hours of this training? ...........hours

37. How many architects and engineers will be given CAD training during this financial year
   Architects: ...........
   Engineers: ...........

38. How many hours in total will the training comprise for each one of the professions?
   Architects: ..........hours
   Engineers: ..........hours

39. What percent of your total investments was in CAD equipment and CAD training
    for the following financial years?
   1989: ...........% 
   1988: ...........% 
   1987: ...........%
40. Did you lease any CAD equipment for the years listed below?
   1989  □ Yes  □ No Number of workstations? ...........
   1988  □ Yes  □ No Number of workstations? ...........
   1987  □ Yes  □ No Number of workstations? ...........

41. If you do not use CAD in your firm, do you intend to start using it?
   □ Yes
   If yes, when will you start: ...........
   Which software will be used?
   □ Medusa
   □ CAD Point
   □ Others: .........................
   Which hardware?.................................................................
   □ Do not know
   □ No

42. What is your estimate of how many architects and engineers in your firm will have their own CAD workstation within three years?
   Architects: .........%
   Engineers: .........%

THANK YOU FOR YOUR PARTICIPATION!
Appendix E. Introduction Letter Initial Questionnaire
To the principal

Information about the architectural industry and its change.

Changes are taking place in the architectural industry. New offices are established, practices change owner(s), Swedish architectural firms are entering markets abroad—the signs of change are everywhere. A powerful tool to handle this dynamic situation is information, information about the occurring changes. "Arkitektföretag - studier av en bransch i förändring" (Architectural Firms - Studies of an Industry in Change) is a study about the progression in the architectural industry. The study is conducted at the department of Business Administration, Umeå Business School. Financial support for the study is provided from ARKUS, Byggforskningsrådet, and SPA.

Your practice is interesting due to the changes occurring in the industry. Within a few days you will receive a questionnaire. Your participation is needed. I depend on your participation to make the results from the study reliable and interesting.

All collected information will be processed confidentially. The presentation of the collected information will only be made in aggregate forms. Thus, it will not be possible to trace any individual respondent.

Results from the study will be put together in a report published by ARKUS. If you respond the enclosed questionnaire you will automatically get the report.

Please call me if you have any questions about the study. My phone number is 090-16 69 51.

Sincerely,

Gert-Olof Boström
Ph.D. Student

Department of Business Administration, Umeå Business School, 901 87 UMEÅ
Phone 090-16 69 51
Appendix F. Enclosed Letter Initial Questionnaire
To the principal
Information about the architectural industry and its change.

You have now received the questionnaire that was announced in an earlier letter. The aim of the questionnaire is to get more information about the changes taking place in the industry, and your firm is interesting regarding these changes. The questionnaire is part of a larger study: "Arkitektföretagen – studier av en bransch i förändring" (Architectural Firms - Studies of an Industry in Change) done at the department of Business Administration, Umeå Business School. Financial support for the study is provided from ARKUS, Byggforskningsrådet, and SPA.

Your participation is needed. I depend on it to make the results from the study reliable and interesting. There are two parts in the questionnaire. The first part is about strategy and management of an architectural firm. It is important that you, the principal, answer this part. The second part of the questionnaire is about background information of the firm. The person in charge of the bookkeeping should answer this part. The questionnaire is long because of all the questions with fixed response alternatives. It will probably only take about 10 to 15 minutes to process each part of the questionnaire.

All information from the questionnaires will be confidential. The collected data will be presented in ways that makes it impossible to trace any individual firm. The identification number in the upper right corner on the second page of the questionnaire is needed for administrating a follow-up letter if necessary.

Results from the study will be documented in a "småskrift," an ARKUS publication. If you answer the questionnaire and return it, you will automatically and free of charge get the publication.

To be able to keep the time schedule, I would appreciate it if you answer the questionnaire and return it before the 25 January 1990.

If you have any questions at all concerning the study do not hesitate to call me. My phone number is 090 - 16 69 51.

Yours sincerely

Gert-Olof Boström
Ph.D. Student

Department of Business Administration, Umeå Business School, 901 87 UMEÅ
Phone 090-16 69 51
Appendix G. First Reminder Initial Questionnaire
To the principal

Information about the architectural industry and its change.

A large questionnaire study is being conducted in the architectural industry. A questionnaire was sent to your practice around 17 January. According to my notes, the questionnaire have not been returned. Please respond to the questionnaire and return it. Your questionnaire is needed. The quality of the results depends on the response rate. If you have not received the questionnaire or if you have any questions about the study please do not hesitate to call me. My phone number is 090-16 69 51.

The aim of the questionnaire study is to get more information about the changes taking place in the industry. The questionnaire is part of a larger study: "Arkitektföretagen - studier av en bransch i förändring" (Architectural firm - Studies of an Industry in Change). The study is conducted at the department of Business Administration, Umeå Business School. Financial support for the job is provided from ARKUS, Byggforskningsrådet, and SPA.

All information from the questionnaires will be kept confidential. The presentation of the collected data will be done in ways that will make it impossible to trace the individual firm. The identification number in the upper right corner on the second page of the questionnaire is needed for administrating follow-up letters if necessary.

Results from the study will be documented in a "småskrift," an ARKUS publication. If you respond the questionnaire and return it, you will automatically and free of charge get the publication.

To be able to keep the time schedule, I would appreciate it if you answer the questionnaire and return it as soon as possible.

Yours sincerely

Gert-Olof Boström
Ph.D. Student

Department of Business Administration, Umeå Business School, 901 87 UMEÅ
Phone 090-16 69 51
Appendix H. Second Reminder Initial Questionnaire
To the principal

Information about the architectural industry and its change.

A large questionnaire study is being conducted in the architectural industry. A questionnaire was sent to your practice around 17 January. According to my notes, that questionnaire has not been returned. Please respond to questionnaire and return it. Your questionnaire is needed. The quality of the results depends on the response rate. If you have any comments or questions about the questionnaire or the study please do not hesitate to call me. My phone number is 090-16 69 51.

The aim of the questionnaire study is get more information about the changes taking place in the industry. The questionnaire is part of a larger study: "Arkitektföretagen - studier av en bransch i förändring" (Architectural firms - studies of an industry in change). The study is conducted at the department of Business Administration, Umeå Business School. Financial support for the job is provided from ARKUS, Byggforskningsrådet, and SPA.

All information from the questionnaires is confidential. The presentation of the collected data will be done in ways that will make it impossible to trace the individual firm. The identification number in the upper right corner on the second page of the questionnaire is needed for administrating follow-up letters if necessary.

Results from the study will be documented in a "småskrift," an ARKUS publication. If you answer the questionnaire and return it, you will automatically and free of charge receive a copy of the publication.

To avoid further delay of the study, please answer the questionnaire and return it as soon as possible. Maybe you will have a chance to answer it today?

Yours sincerely

Gert-Olof Boström
Ph.D. Student

Department of Business Administration, Umeå Business School, 901 87 UMEÅ
Phone 090-16 69 51
Appendix  I. People Interviewed in the Intermediate In-depth Interviews
List of People Interviewed in the Intermediate In-depth Interviews

This is a list of the people that were interviewed in the intermediate in-depth interviews. These interviews were conducted to highlight the situation with CAD in the industry. The interviews were done in the firms at which the interviewee worked, all of which were located in Gothenburg.

7 December 1992, Magnus Månsson, Semrén Arkitektkontor AB
7 December 1992, Anders Svensson, Arkitektlaget AL AB
7 December 1992, Yngve Karlsson, Arkitektlaget AL AB
8 December 1992, Bengt Brandeby, Platzer Bygg AB
8 December 1992, Lennart Edgren, Bostadsbolaget
8 December 1992, Olle Lindquist, Eriksbergs Förvaltnings AB
Appendix J. Follow-up Questionnaire
QUESTIONNAIRE
to
the management

REPORTED DATA IS CONFIDENTIAL.
I. Enterprise Changes

Question 1 - 5 is concerns the period January 1, 1990 to September 1, 1993.

1. Has the name of the firm been changed during this period?
   - No
   - Yes, why?
     - Changed business
     - Bankruptcy
     - Other: .................................................................

2. Has the firm been reconstituted during the period in such a way that it has changed identification number
   - No
   - Yes, reason?
     - Private firm reconstituted to limited company
     - Limited company reconstituted to private firm
     - Bankruptcy
     - Other: .................................................................

3. Has the ownership of the firm changed during the period?
   - No
   - Yes, reason?
     - Number of employees has changed
     - The firm has merged
     - The firm has been sold
     - Other: .................................................................

   In what way has the ownership changed?
   - Fewer partners
   - More partners
   - Completely new owners
   - Other: .................................................................

4. Has the firm changed premises during the period?
   - No
   - Yes, reason?
     - Too big
     - Too expensive
     - Too small
     - Other: .................................................................

---

1 The identification number is the number assigned to the firm by the Patent and Registration Authority when the firm was registered.
5. This question concerns parent companies.
Has the number of branches changed from the January 1, 1990 to September 1, 1993?
- No
- Yes, how?
  - Fewer, decreased by: ............numbers
  - More, increased by: ............numbers
  - Other: .................................................................

II. Background Information

6. Which year did the firm start? ..............

7. Is the firm part of a corporate group?
- No
- Yes

The concept firm is used in the questionnaire. When the firm is a parent company, the question is valid for the entire group.

8. How many people were employed in each of the personnel categories by the September 1, 1993 (If the specific numbers are missing, an estimate is better than no answer.)

<table>
<thead>
<tr>
<th>Category</th>
<th>full time</th>
<th>part time</th>
</tr>
</thead>
<tbody>
<tr>
<td>House architects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior designers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landscape architects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineers with univ. degrees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineers without univ. degrees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. What is your estimate of the number of employees as of January 1, 1992? .............. numbers

10. Question 10 only concerns parent companies.
How many firms are included in the concern? ............ numbers
How many of these firms mainly deal with the architectural business?
.......... numbers
11. How do you estimate the firm’s recent need for architects? Please note that both alternatives increase - decrease can be present.

<table>
<thead>
<tr>
<th></th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>House architects?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior designers?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landscape architects?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning architects?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

☐ No change is needed. Please mark here.

12. How do you estimate the firm’s recent need for engineers? Please note that both alternatives increase - decrease can be present.

<table>
<thead>
<tr>
<th></th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>With a university degree?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without a university degree?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

☐ No change is needed. Please mark here.

13. Disregarding your actual need, please mark the most important arguments used in recruiting new employees. *Mark at most three.*

☐ Stimulating and challenging tasks
☐ Continuous training
☐ Possibilities for career advancement
☐ Work abroad
☐ Higher salary
☐ Security such as redundancy payment, insurance, etc.
☐ Other benefits
☐ Partnership
☐ Other: ........................................................................................................

14. Estimate the firm’s competence concerning CAD for the different age groups and personnel categories. If there are no employees corresponding a label, mark the right most square.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 30 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 - 40 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 - 50 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 and older</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service providers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. Please mark to what extent the following sources of information gives added knowledge to the firm.

<table>
<thead>
<tr>
<th>Source</th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Swedish Council for Building Research</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>ARKUS</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Colleges</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Other:</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

16. Please estimate the total expertise in the firm for the following subjects.

<table>
<thead>
<tr>
<th>Subject</th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Law</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Personnel management</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>ADP, CAD excluded</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>CAD</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Job management</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>House architecture</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Interior design</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Physical planning</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Other:</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

17. Please estimate the extent to which the following alternatives give increased knowledge to your firm.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>None</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-studies</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>External training</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Internal training</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Internal research projects</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>External research projects</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Client jobs</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Architectural competitions</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>New employees</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Other:</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Architect firms - studies of an industry in change

Note that estimates are fine for the purposes of this survey. Detailed information is not required.

18. What is your estimate of your firm's revenues for the previous financial year? SEK ..................................................

   If the financial year did not comprise twelve months, note the number: ......

19. Estimate the total workforce in the number of full time employees (temporarily hired personnel included) during previous financial year. (A rough estimate is better than no answer): ....... employees

   How many of these were temporary employees? ....... employees

III. Goals and Critical Resources

20. Do you have any plans to focus your business to any particular niches in the coming three years (e.g. some specific client groups that you would serve)?
   - No
   - Yes

21. Please mark the dominant category for the two most important goals for the firm for the current year.

   Most important goal  Second most important goal

   NOTE only one X per column.

   - Financial
   - Personnel
   - The firm's internal business
   - Forms of working/contents
   - Computerization
   - Development work
   - Market, areas of business
   - Acquisition, booking, marketing.
   - Other: ..............................................................
   - Other: ..............................................................

22. What of the following are the most limiting factors in reaching the most important goal for your firm. 1 most limiting, 2 second most limiting, and so on.

   ..... Knowledge
   ..... Personnel
   ..... Capital
   ..... Projects
23. In what direction do you want your market size to develop in the coming three years?
   - Reduce
   - Maintain
   - Expand

24. Do you have any plans to expand your business in the coming three years by broadening it within what is considered to be the architectural business today?
   - No
   - Yes

   outside what is considered to be the architectural business today?
   - No
   - Yes

IV. Market

25. To what extent do you agree with this statement: The architect is the person who should be utterly responsible for the total job towards the client?

   Never                      Always
   □  □  □  □  □  □

26. Does your firm have any niches? (e.g. special groups of clients that you serve)?
   - No
   - Yes, which?

   Estimates of revenues
   ..........................................................  %
   ..........................................................  %
   ..........................................................  %

27. Mark the two most frequent ways of obtaining new jobs.
   - Bid competition
   - Through contacts, existing
   - Through old clients
   - Participate in competitions
   - Other: .................................................................
   - Other: .................................................................
28. Within the architectural industry the term "work for free" is used for work that a client wants but does not pay for. Do you do this kind of work?

- No
- Yes

What is your estimate of your volume in percent of hours for this type of work: ........... %

How has the amount of this work changed for you during the recession?

- Increased
- Unchanged
- Decreased

29. Did you have any assignments abroad last year?

- No
- Yes, what was the main way you got these assignments?
  - Through a Swedish subcontractor
  - Own initiative
  - Swedish client
  - Contacts
  - Other: ...........................................................................................................

Please estimate the percent of last year's revenues that came from jobs done abroad? ........ %

30. Do you have any plans to enter a foreign market over the next three years?

- No
- Yes, where:
  - The Nordic countries
  - Western Europe, the Nordic countries excluded
  - Eastern Europe
  - Asia
  - America
  - Africa
  - Other: ...........................................................................................................

How will you do this?

- Open an office
- Cooperation with a firm in the foreign market
- Cooperation with a Swedish contractor
- Cooperation with a Swedish client
- Other: ...........................................................................................................
V. Clients

31. Which two qualities do you value most from a client?

*Most important*  *Second most important*

**NOTE just one X per column**

- [ ] Have knowledge of and interest in architecture
- [ ] Have an understanding for architecture
- [ ] Give the architect free hands
- [ ] Able to cooperate, confident, honest
- [ ] Have ability to decide and give straight answers
- [ ] Have ability and willing to pay
- [ ] Other: .........................................................
- [ ] Other: .........................................................

32. Have you in any conscious way selected your clients based on these criteria?

Not at all  Completely

- [ ]

33. Please mark the **two** most frequent ways of getting *new clients* today.

- [ ] Bid competition
- [ ] Through contacts
- [ ] Through old clients
- [ ] Participate in competition
- [ ] Other: ..........................................................
- [ ] Other: ..........................................................

34. In your opinion, which **two** characteristics do clients value most from an architectural firm *today*?

- [ ] Easy to work with
- [ ] No questions or demands from the architect
- [ ] An architect with firm points of view
- [ ] A quality system
- [ ] Fast work
- [ ] Well developed proposals
- [ ] That the final outcome corresponds to expectations
- [ ] Low prices, fees
- [ ] Other: ..........................................................
- [ ] Other: ..........................................................

In the questionnaire, the concept firm is used. When the firm is a parent company the question is valid for the whole corporate group.

35. Please estimate the number of invoiced clients previous financial year: .........
36. Estimate of the percent of clients for each category for the previous financial year.
   First time client: ................ %
   Second or third time client: ............... %
   Fourth time or more client: ............... %

37. *Estimate* the mixture of your clients during the previous financial year.

   Percent of revenues
   - Local government and their companies: ........... %
   - Government and their companies: .............. %
   - County council and their companies: ............ %
   - Other: ........................................ %

38. *Estimate* the revenues from each of your three largest clients from the previous financial year. Percent of revenues.

   Client 1: ................ %
   Client 2: ............... %
   Client 3: ............... %

39. *Estimate* the size of the jobs you had during the previous financial year.

   Estimate of revenues
   - Places to live: ............... %
   - Industries: ................ %
   - Offices: ................ %
   - Hotels, restaurants: ............ %
   - Shops, banks: ................ %
   - Hospitals, laboratories: ........... %
   - Education premises, day-care center: ........ %
   - Interior design: ................ %
   - Churches: ................ %
   - Planning, studies: ............... %
   - Ground and landscape planning: ........ %
   - Infrastructure: ................ %
   - Other: ........................................ %

40. Please estimate the percent of the previous financial year's revenues that was from dealing with new buildings: ............... %
VI. Competitors and Competitive Advantage

42. Please rank the most important competitive advantage for your firm. Limit to three. 
   ..... Low fee
   ..... Negotiable fee
   ..... Quality
   ..... Fast work
   ..... Total package
   ..... Use of CAD
   ..... Contacts, cooperation, personal chemistry
   ..... Expertise
   ..... Other: ........................................................................................................

43. Do you think that the most of your competitors rank their competitive advantages in the same way?
   q Yes
   q Do not know
   q No, mark, if possible rank, their most important competitive advantage. Limit three.
      ..... Low fee
      ..... Negotiable fee
      ..... Quality
      ..... Fast work
      ..... Total package
      ..... Use of CAD
      ..... Contacts, co-operation, personal chemistry
      ..... Expertise
      ..... Other: ........................................................................................................
44. Which changes by competitors over the last three years have affected you most? 
   Limit to two.
   - Reduced their fees
   - Went into bankruptcy
   - Doing better work than before
   - Doing worse work than before
   - Decreasing personnel
   - Other: .................................................................
   - Other: .................................................................
   - No changes have occurred that affect us
   - Do not know

45. How do you experience the competition for your firm?
   - None
   - Little
   - Relatively intense
   - Hard
   - Very intense

VII. CAD

46. Please mark whether you have CAD equipment in the firm or not?
   - Yes, go to question 47.
   - No, have you had it?
     - Yes, why did you stop? ......................................................
     - No

   If you do not have CAD in your firm, will you adopt it?
     - Yes, when? ............
     - No
     - Do not know

   Go to question 58, please.

47. What year did you get your first CAD equipment? 19........

48. Did you buy or rent it?
   - Bought
   - Rented
49. Please mark and, if possible, rank the most important sources of information you used when you acquired your first CAD equipment? Limit to two.

- Architectural colleagues in Sweden
- Colleagues outside the architectural industry
- Architects abroad
- Your clients
- Equipment resellers
- Professional journals
- Other: .................................................................

☐ I do not remember.

50. Please mark the importance of the following reasons for acquiring CAD.

<table>
<thead>
<tr>
<th>Reason</th>
<th>None</th>
<th>Dominating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had a lot of money</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A natural progression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others did it</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clients demanded it</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employees demanded it</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Way to rise productivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


52. How natural is it to use CAD in the jobs in your firm?

<table>
<thead>
<tr>
<th>Naturality</th>
<th>Not at all</th>
<th>Completely</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

53. Estimate the percent of CAD jobs during previous financial year:.......... %

54. Put an X in front of the documents below if they were produced using CAD for any jobs during previous financial year. Please also try to estimate the extent. 100% = this document was always done on CAD.

☐ Proposals, estimated: .......... %
☐ Building permit documentation, estimated: .......... %
☐ Working documents, estimated: .......... %
☐ Do not know.
55. Estimate the percent of CAD jobs that were completely finished using CAD, i.e. when CAD was introduced in the job, it was continuously used until the job was completed: .............. %

56. In how many of the CAD jobs did clients require that CAD be used: ............. %

57. Mark the most important reasons for the use of CAD in jobs. Limit to two.
   - The job demanded it
   - A policy decision
   - The clients asked for it
   - Employees wished it
   - Reduced costs
   - Other: .................................................................
   - Other: .................................................................

58. Mark the greatest advantages with CAD. Limit to two. If you are not using CAD today, assume that you were using it.
   - Correct measurements
   - Smooth co-operation with other consultants
   - More work might be done
   - Better resolution, exact depiction
   - 3-dimensional projection
   - Aids with visualizing and presentations
   - Other: .................................................................
   - Other: .................................................................
   - There are no advantages

59. Mark the greatest disadvantages due to the use of CAD. Limit to two. If you are not using CAD today, please assume that you were using it.
   - The job takes longer time
   - More difficult to change small details
   - Settings for the job have to be restricted at an early stage
   - Information in CAD is perceived as absolute
   - Other: .................................................................
   - Other: .................................................................
   - There are no disadvantages

60. To what extent do you consider CAD to be a competitive tool for:

   Your firm (assume hold)  Not at all Very much
   - .........................................................

   A general architectural firm  Not at all Very much
   - .........................................................
VIII. Recession

61. Did you make any preparations in the firm for the recession that began at the end of 1990?
   □ No
   □ Yes, which? Please mark the most important ones. Limit to two.
      □ Trained employees for CAD
      □ Bought CAD equipment
      □ Saved money
      □ Tried to earn as much money as possible
      □ Established contacts with potential clients
      □ Did not replace vacancies in the firm
      □ Other: ...............................................................
      □ Other: ...............................................................

62. Compared to other firms in the architectural industry, how has your firm managed during the recession?
    Worse Better
    □ □ □ □ □

63. Mark the most important ways your firm coped with the recession. Limit to two.
    □ Reduced the number of employees
    □ Reduced salaries
    □ Decreased working time <40 hours/week
    □ Increased the intensity in acquisitions
    □ Took care of existing clients
    □ Other: ...............................................................
    □ Other: ...............................................................

64. There are many unemployed architects now that receive unemployment compensation. It might that they are doing some architectural work on the side, thus creating a "gray market". To your knowledge, do you feel that this is occurring?
   □ No, not to a noticeable extent
   □ Do not know
   □ Yes
       What is your estimate of the revenues for this market, compared to the total revenues for the architectural industry?
       0 ————+———+———+———+———+———+———+———+———+———+———1
       0 50 100 %
   □ Do not know
IX. Managing and Ownership

65. Are the person or persons with the role of the president male or female?
   □ Man Number: ..........  
   □ Female Number: ..........  

66. Note the age of the president or the mean age of the people who have the president's role: .........

67. What type of education does the person or people who serve(s) as president have?
   □ House architect
   □ Interior designer
   □ Landscape architect
   □ Engineer
   □ Other: ..............................................................................................

68. Estimate the percent of the working time used by the president or persons with the president's role on:
   job work: .........%
   administrative work: .........%
   (If this does not add up to 100%, please write the type of work done for the rest of the time: ........................................)

69. Are there any plans for changing the ownership of the firm in the next three years?
   □ No
   □ Yes, how?
      □ Selling stocks to employees
      □ Stocks traded within the owner's family
      □ Introduction to the stock market
      □ Selling the firm to another firm
      □ Other: ..............................................................

      If you are planning a change in the ownership in the next three years, what is the main reason for this?
      □ Succession
      □ Capital is needed
      □ Tie up key people
      □ Other: ..............................................................

Thank you for taking the time to complete this questionnaire.
Appendix K. Enclosed Letter Follow-up Questionnaire
To the principal,

The enclosed questionnaire is a follow-up to a study done in spring 1990. As with as last time, the questionnaire is directed to the principal. The results from the prior survey have been presented in a report from ARKUS (no. 11) “Arkitektbranschen och Företagandet” (The Architectural Industry and Its Business). The results from this survey will also be presented in a book and seminars are planned. If at all possible, please complete this questionnaire as soon as possible, preferably within two weeks.

Most of the questions in the questionnaire have response alternatives to shorten the time it takes to complete it. Please note that the questionnaire asks for estimations and opinions – there is no need to check your accounting records for information.

ARKUS, SPA, and AF support the study. In addition to these organizations’ interest in the study, I also have a personal interest in it. I will be using the information from the questionnaires to finish my dissertation. Please help me – I really need your answer. My dissertation is entitle “The Impact of New Technology in Service Firms – The Swedish Architectural Industry an Example.”

If you have any questions please do not hesitate to call me.

Yours sincerely,

Gert-Olof Boström
Ph.D. Student
Appendix L. First Reminder Follow-up Questionnaire
To the principal,

This letter is a reminder to you to complete a mailed questionnaire that you have not responded to yet. The questionnaire is part in a follow-up study to the questionnaire study that was done in the spring 1990. The last time the questionnaire was directed to the principal. The results form the prior questionnaire have been presented in a report from ARKUS (no. 11) "Arkitektbranschen och Företagandet” (The Architectural Industry and Its Business). Also the results from this survey will be presented in a book and seminars are planned. It would be very kind of you if you would process the questionnaire as soon as possible, please.

Most of the questions in the questionnaire have suggested responding alternatives to cut down the process time. Please note that the questionnaire asks for estimations and opinions—no research is needed.

ARKUS, SPA, and AF support the study. Beside these organizations' interest in the study I also have a personal interest in it. I need the information from the questionnaires to be able to finish my dissertation. Please help me—I really need your answer. My dissertation is the entitled "The Impact of New Technology in Service Firms—The Swedish Architectural Industry an Example."

If you have any questions please do not hesitate to call me.

Yours sincerely,

Gert-Olof Boström
Ph.D. Student
Appendix M. Second Reminder Follow-up Questionnaire
To the principal,

This letter is the second reminder requesting that you complete a mailed questionnaire. The questionnaire is part of a follow-up study to the questionnaire study that was done in spring 1990. Last time the questionnaire was directed to the principal. The results form the prior questionnaire have been presented in a report from ARKUS (no. 11) "Arkitektbranschen och Företagandet" (The Architectural Industry and Its Business). Also the results from this survey will be presented in a book and seminars are planned. It would be very kind if you would complete the questionnaire as soon as possible, please.

Most of the questions in the questionnaire have suggested responding alternatives to cut down the process time. Please note that the questionnaire asks for estimations and opinions—no research is needed.

ARKUS, SPA, and AF support the study. Besides these organizations' interest in the study I also have a personal interest in it. I need the information from the questionnaires to be able to finish my dissertation. Please help me—I really need your answer. My dissertation is entitled "The Impact of New Technology in Service Firms - The Swedish Architectural Industry an Example."

If you have any questions please do not hesitate to call me.

If you for any reason do not consider it possible to process the questionnaire please notify that by responding to the question below and returning this paper in the enclosed postage paid envelop:

- The questionnaire is already processed and returned
- It is not possible for me to process the questionnaire
- Other: ........................................................................................

Sincerely,

Gert-Olof Boström
Ph.D. Student

Gert-Olof Boström, Department of Business Administration, Umeå Business School, Umeå University, 901 87 Umeå. Telephone 090-16 69 51
Appendix N. Analyses of Short Time Adopters and New Non-adopters
Characteristics of Short Time Adopters and New Non-adopters

The reasons why the short time adopters (n=5) had given up CAD were: "The demand was to little," "Changed owner situation," "People that managed (CAD, authors note) have left," "No time to educate oneself," and "My son who helped me has moved to Norway." According to these reasons there was a domination of internal explanations. Between S1 and S2, the size in number of people in these firms decreased substantially, almost by 50% (Table 3.9).

Table 3.9. Changes in Number of People among Short Time Adopters.

<table>
<thead>
<tr>
<th>Case</th>
<th>No. of People, S1</th>
<th>No. of People, S2</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-50%</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>4</td>
<td>-56%</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>8</td>
<td>-27%</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>6</td>
<td>-62%</td>
</tr>
</tbody>
</table>

The decrease in personnel among the short time adopters might be interpreted as these firms were especially affected by the recession. Even if their reasons for giving up CAD to a dominating extent were internal, they were probably not self-selected. These firms might therefore be considered as firms that wanted to have the technology but did not have the possibility to continue to use it. These firms were not possible to classify in as adopters or non-adopters.

New non-adopters (n=4) were the firms that had the new technology at S1 but did not have it at S2 due to the following reasons: "Had to let the CAD-trained personnel go due to the lack of work," "Too expensive," and "Too early adopter, no good systems" (one firm did not give any reason). Some more characteristics for these firms are found in Table 3.10.

Table 3.10. Some Characteristics for New Nonadopters.

<table>
<thead>
<tr>
<th>Case</th>
<th>Adoption. Year</th>
<th>No. Work- Stations</th>
<th>Usage of CAD</th>
<th>No. of People, S1</th>
<th>No. of People, S2</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1989</td>
<td>-</td>
<td>0%</td>
<td>4</td>
<td>1</td>
<td>-75%</td>
</tr>
<tr>
<td>2</td>
<td>1989</td>
<td>1</td>
<td>2%</td>
<td>1</td>
<td>3</td>
<td>+200%</td>
</tr>
<tr>
<td>3</td>
<td>1988</td>
<td>2</td>
<td>80%</td>
<td>6</td>
<td>5</td>
<td>-17%</td>
</tr>
<tr>
<td>4</td>
<td>1989</td>
<td>1</td>
<td>0%</td>
<td>7</td>
<td>2</td>
<td>-71%</td>
</tr>
</tbody>
</table>

These firms had to give up having the equipment due to circumstances that they did not control: had to let the CAD-trained people go, too expensive, and no good systems.
This group of firms wanted to have the equipment but they did not manage to continue to do so. They were CAD firms without the new technology, which made it impossible to classify them as either non-adopters or adopters.
Appendix O. Types of Jobs
Types of Jobs

In this appendix the types of jobs that the adopters and the non-adopters did at S1 and at S2 is detailed.

Table o.1 Types of Jobs at S1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Industry</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>sign lev</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwellings No. of firms</td>
<td>75%</td>
<td>78%</td>
<td>64%</td>
<td>.023</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues12</td>
<td>38% (SD 24%)</td>
<td>37% (SD 24%)</td>
<td>35% (SD 25%)</td>
<td>.619</td>
<td>N</td>
</tr>
<tr>
<td>Offices No. of firms</td>
<td>75%</td>
<td>86%</td>
<td>64%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>27% (SD 21%)</td>
<td>25% (SD 15%)</td>
<td>30% (SD 23%)</td>
<td>.071</td>
<td>Y</td>
</tr>
<tr>
<td>Industries No. of firms</td>
<td>53%</td>
<td>69%</td>
<td>42%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>16% (SD 11%)</td>
<td>16% (SD 11%)</td>
<td>17% (SD 12%)</td>
<td>.509</td>
<td>N</td>
</tr>
<tr>
<td>Shops and Banks No. of firms</td>
<td>35%</td>
<td>52%</td>
<td>19%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>15% (SD 15%)</td>
<td>12% (SD 8%)</td>
<td>25% (SD 25%)</td>
<td>.001</td>
<td>Y</td>
</tr>
<tr>
<td>Hospitals and Laboratories No. of firms</td>
<td>30%</td>
<td>41%</td>
<td>19%</td>
<td>.001</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>25% (SD 24%)</td>
<td>26% (SD 25%)</td>
<td>28% (SD 25%)</td>
<td>.753</td>
<td>N</td>
</tr>
<tr>
<td>Hotels and Restaurants No. of firms</td>
<td>23%</td>
<td>34%</td>
<td>16%</td>
<td>.002</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>15% (SD 13%)</td>
<td>11% (SD 9%)</td>
<td>19% (SD 11%)</td>
<td>.011</td>
<td>Y</td>
</tr>
<tr>
<td>Education Premises and Day Care Centers No. of firms</td>
<td>16%</td>
<td>20%</td>
<td>16%</td>
<td>.385</td>
<td>N</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>25% (SD 19%)</td>
<td>21% (SD 13%)</td>
<td>23% (SD 13%)</td>
<td>.698</td>
<td>N</td>
</tr>
<tr>
<td>Planning and Investigations No. of firms</td>
<td>12%</td>
<td>11%</td>
<td>14%</td>
<td>.458</td>
<td>N</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>48% (SD 36%)</td>
<td>16% (SD 12%)</td>
<td>73% (SD 31%)</td>
<td>.000</td>
<td>Y</td>
</tr>
</tbody>
</table>

1 Please note that only the firms that did this type of job were included in the t-test. This way of computing portion of revenues was used for all types of jobs.

2 The respondents who had only marked that they did certain types of jobs and not given any degree of involvement in this type of job were processed in a special way. A conservative estimate was done for these firms' involvement in jobs. It was anticipated that these firms had an equal involvement in all the noted types of jobs. This information embraces all types of jobs.
<table>
<thead>
<tr>
<th>Variable at S2</th>
<th>Industry</th>
<th>Adopters</th>
<th>Non-adopters</th>
<th>Sign level</th>
<th>Sign Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwellings No. of firms</td>
<td>69%</td>
<td>84%</td>
<td>51%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>(SD 26%)</td>
<td>26%</td>
<td>20%</td>
<td>(SD 28%)</td>
<td>.085</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>57%</td>
<td>72%</td>
<td>46%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Offices No. of firms</td>
<td>12%</td>
<td>(SD 18%)</td>
<td>25%</td>
<td>(SD 15%)</td>
<td>.071</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>3%</td>
<td>(SD 14%)</td>
<td>11%</td>
<td>(SD 19%)</td>
<td>.000</td>
</tr>
<tr>
<td>Industries No. of firms</td>
<td>35%</td>
<td>51%</td>
<td>16%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>4%</td>
<td>3%</td>
<td>5%</td>
<td>(SD 5%)</td>
<td>.001</td>
</tr>
<tr>
<td>Shops and Banks No. of firms</td>
<td>22%</td>
<td>36%</td>
<td>9%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>15%</td>
<td>18%</td>
<td>14%</td>
<td>.466</td>
<td>N</td>
</tr>
<tr>
<td>Hospitals and Laboratories No. of firms</td>
<td>38%</td>
<td>59%</td>
<td>28%</td>
<td>.000</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>11%</td>
<td>15%</td>
<td>10%</td>
<td>(SD 19%)</td>
<td>.050</td>
</tr>
<tr>
<td>Hotels and Restaurants No. of firms</td>
<td>38%</td>
<td>45%</td>
<td>33%</td>
<td>.052</td>
<td>Y</td>
</tr>
<tr>
<td>Portion of Revenues</td>
<td>7%</td>
<td>8%</td>
<td>7%</td>
<td>(SD 16%)</td>
<td>.795</td>
</tr>
</tbody>
</table>

Please note that only the firms that did this type of job were included in the t-test. This way of computing portion of revenues was used for all types of jobs.

The respondents who had only marked that they did certain types of jobs and not given any degree of involvement in this type of job were processed in a special way. A conservative estimate was done for these firms' involvement in jobs. It was anticipated that these firms had an equal involvement in all the noted types of jobs. This information embraces all types of jobs.
Information technology (IT) is used in more and more versatile applications. Especially the service firms seem to be adopting this technology and managers in the adopting firms are convinced that there is an urgent need for IT. This book focuses on the impact of IT in professional service firms. These firms are special because their assets are their human capital and this is why IT may affect the nature of the business in these firms. IT might empower the professional service worker both in terms of productivity and in terms of extending the service offer.

In specific this book is about the impact of CAD in the Swedish architectural industry. A longitudinal research design built around two surveys with both in-depth interviews and mailed questionnaires provided the data. Of special interest were the characteristics of the adopters firms and the non-adopter firms. The results suggest that CAD affect the business in the industry regarding perception of service quality, competitive advantage, industry structure, and management visions.

The book may be of interest for both practitioners and academic people. Two models—"The Competitive Spiral" and "The Business Dynamic model"—are presented to inspire other people in their work. Other readers may be more interested in the change in industry structure or the possibilities a transition from individual knowledge to organizational knowledge that IT offers.

_Gert-Olof Boström_

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