MANAGING MISSION-CRITICAL IT IN THE FINANCIAL INDUSTRY

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MANAGING MISSION-CRITICAL IT IN THE FINANCIAL INDUSTRY

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PREFACE

This report is the result of a research project carried out at the Department of Information Management at the Economic Research Institute (EFI) at the Stockholm School of Economics.

This volume is submitted as a doctoral dissertation at the Stockholm School of Economics. As usual at the Economic Research Institute, the author has been entirely free to conduct and present his research in his own ways as an expression of his own ideas.

The institute is grateful for the financial support provided by the Lars Erik Lundberg Foundation for Research and Education and The Swedish Transport and Communications Research Board.

Stockholm, April 2003

Bo Sellstedt

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Mats Lundeberg

Professor, Head of the Department of Information Management

ACKNOWLEDGMENTS

Some people say that the acknowledgments are the only thing that the average reader of a dissertation actually reads. Dear reader, even if you never make it through the rest of this book, or do not even try, let me assure you that I owe a great deal to a great number of people for helping me put all these pages together.

To all the people at Delta, Gamma, Lambda and Tau: Thank you so much! Without you, there would be no dissertation. Anonymity prohibits me from naming you, but you know who you are!

Someone I am glad to be able to name, however, is my main supervisor, Professor Mats Lundeberg, whose support and guidance have been invaluable. His ability to ask insightful questions to help me see things I have not seen before never ceases to amaze me. Thank you, Mats!

Professors Peter Jennergren and Lars A Samuelson have also contributed profoundly as co-supervisors, always willing to lend a helping hand when needed. With unfailing precision, they have identified topics for discussion and suggested improvements. Your diligent comments and helpful advice are greatly appreciated!

Over the years, my research has benefited from a vast number of discussions at the Department of Information Management, sometimes in formal seminars and sometimes in informal chats. Thanks to long-time discussion partners Björn, Christofer, Magnus M, Martin and Pablo V. All the other members of the Department of Information Management are of course also important contributors: Bo, David, Frank, Gösta, Lasse, Magnus B, Niklas, Susanne, Tina! Others may have left the department but are still valued for past and present discussions, especially Alf, Anders G, Ann-Sofie and Ragnvald.

Drawing on his experience from the financial industry, Professor Karl-Olof Hammarkvist provided important input early on in the research.

Another form of important input has been generously provided by the Lars Erik Lundberg Foundation for Research and Education and The Swedish Transport and Communications Research Board. Their financial support of this research is gratefully acknowledged.

I am also very grateful, as you should be dear reader, for the meticulous work of Thomas Lavelle in helping me improve the readability of this book. Thomas, working with you has really been a joy!

Apart from being a joy, spending time at the Stockholm Stock Exchange, and later OM, has helped me a great deal to keep alive the practitioner perspective on what I am doing. Special thanks goes to Christer for introducing me to the design of marketplace software, Göran for so many times helping me understand why a marketplace system technically works the way it works, Jan for all the joint excursions into the wonderful world of order matching and Lars-Ivar for fruitful discussions on the intricacies of various forms of financial markets. Also at OM, thanks to Pablo L for interesting discussions on literally any topic.

I am also indebted to the people at Pantor Engineering, so thank you Rolf for guiding me towards the financial industry many years ago and your unfailing presence as a discussion partner and thank you Anders F for having such patience in explaining technical details in laymen's terms. Special thanks also to you Ola for your insightful and detailed feedback on various drafts of this book.

Finally, the time has come to thank my brother, Pär. Professionally, your input during endless discussions and careful comments on an uncountable number of drafts have been invaluable. Socially, having such a great friend means a whole lot to me.

So dear reader, having seen all the people I owe so much (and let me assure you that this list is by no means complete) you may wonder if I have done anything myself! I grant that this may be a valid concern, but let me assure you that I have at least done enough to be able to rightfully claim responsibility for any shortcomings in the pages to come!

Stockholm, April 2003

Anders Mårtensson

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

Early in 1947, Sidney Weinberg[1] *found himself seated on the dais at a charity dinner next to one Thomas Watson, Sr., the founder of IBM. During the course of the evening, Watson convinced the investment banker of the merits of using a computer to run his complex business. Weinberg had little idea of what a computer was, but Watson assured him that it was the key to the modern age. Weinberg could not resist; anything this revolutionary was worth a try; by the end of the evening Watson had made a sale. Shortly thereafter an extremely large box, five or six feet across and four feet high, arrived at the firm's New York office. [...]*

"What do you think it does?" Weinberg asked, but no one knew. Weinberg parroted Watson's words: "This is going to do great things. It will change everything." Still the crowd stared. Sidney Weinberg, a man inclined to action, said, "Well, plug the damn thing in. Let's give it a try." The prehistoric computer was plugged in, and instantly the firm was plunged into total darkness. The telephones went dead, the elevator stopped, and the confused staff stood motionless. [...]

Sidney ran down the stairs to the ground floor, out into the summer sunshine, and down the street to the closest pay phone in a local bar. When Watson came to the phone Weinberg started cursing, "Damn it, you sold me this thing and all it did was blow out everything. The thing doesn't work; what does it do anyway? You get down here and get this thing working again." Watson knew the value of a client, and the chairman of IBM came down to the Goldman Sachs offices himself. Although power was not restored immediately, the gesture was appreciated, and the firm continued to use IBM systems for the rest of the century.

Endlich (1999, p. 216)

[1] Legendary chairman of financial industry giant Goldman Sachs between 1930 and 1969.

1.1 SETTING THE STAGE

Apart from illustrating one vivid consequence of using new technology, the interaction between Goldman Sachs and IBM gives an example of a long term relationship between a company and its IT provider. Despite the fact that a lot of things have changed during the last half-decade or so, some things remain more or less the same. For example, the consequences of adopting a new, partly unknown, technology can be quite surprising in terms of both what actually happens when it is adopted and how it is perceived by existing and potential customers. Also, in some cases the expected benefits from IT investments still seem to be almost as vaguely defined as Mr. Weinberg's statement above "This is going to do great things. It will change everything."

Since the story, 1947, both companies have managed to remain industry giants in their respective industries. IBM's industry, the computer or IT industry, has changed probably beyond what anyone, including Thomas Watson, Sr., could imagine. Goldman Sachs' home turf, the financial industry, has also changed dramatically in terms of size and global impact to name just two areas. The financial industry, along with many other industries, has also become very dependent on IT.

This research is devoted to looking into IT in the financial industry. How do companies in the financial industry embrace IT? How is it used in their business operations? How is it managed?

1.1.1 Managing IT

Managing IT is important to companies since IT plays a key role in the operations of most companies. Management of IT has been addressed in a number of different ways, each contributing in its own way to the understanding of the practical challenges facing managers in companies. Focus can be on different activities such as IT implementation issues or managing IT projects. Other activities include the more generic question how companies can manage IT in general in order to support the business operations (Earl, 1989; Keen, 1991b; Rockart et al, 1996; Falk & Olve, 1996).

Managing IT can also be studied by scrutinizing specific phenomena such as enterprise systems (e.g. Davenport, 2000), IT infrastructure (Weill & Broadbent, 1998; Weill et al, 2002), end-user computing (cf. Powell & Moore, 2002) or organizational capabilities (Feeny & Willcocks, 1998). Strategic approaches are common, where the goal is to achieve IT-based competitive advantages (e.g. Feeny & Ives, 1997) through strategic IT planning (e.g. Ward & Peppard, 2002) and strategic use of IT (e.g. Neumann, 1994). Closely related to this are studies of IT investments and how they can be evaluated (e.g. Willcocks, 1994, 1996). Making IT investments typically leads to change projects, which is also a topic of interest within the research area (e.g. Lundeberg, 1993).

A different approach is to ask IS professionals what they find to be the key issues in information systems management. A series of such studies from the early 1980s to the mid 1990s (Dickson et al, 1984; Brancheau & Wetherbe, 1987; Niederman et al, 1991; Brancheau et al, 1996) found the top concerns to be surprisingly stable during the period studied. IS planning was a top concern during the 1980s only to later succumb to infrastructure and architectural issues.

This study takes its starting point in the challenges facing companies today. The increased complexity of companies' IT support, combined with the fact that IT development shows no sign of slowing down lead to interesting management challenges. New technologies and standards are presented very rapidly. How can IT be managed successfully under such circumstances? Companies have to keep up with the rapid development, but while doing so they might make long-term commitments. Is it possible to survive in the long run without surrendering in the short term?

The present study is devoted to the generic issue of managing IT, rather than any one specific activity. It focuses on *what* is being managed by applying an IT portfolio perspective and singling out mission-critical IT as the subject matter of interest.

1.1.2 IT as a Portfolio

In today's world applications are tightly interwoven. From a time when most companies had but a few specialized stand-alone applications that did not communicate with each other, most companies have since long moved into a world where applications are interconnected (e.g. McKenney & McFarlan, 1982; McFarlan et al, 1983). Companies manage large sets of interacting applications dating from different ages and often demanding different technical production environments. In later years this interconnectedness has even reached outside the company itself as many companies link their applications with those of other companies, such as suppliers or customers (cf. Konsynski, 1993).

In the information intensive financial industry most, if not all, companies interact extensively with external parties. It may be banks settling deposits with other banks or stock brokerages interacting with marketplaces such as stock exchanges. In this sense, the financial industry is a truly global web of companies interacting (electronically) with each other.

This increased linking between applications has invited approaches that not only study applications in splendid isolation (cf. Ward, 1988). In the same way as interaction with other existing applications is a necessary part of IS development and implementation efforts, portfolio approaches can be fruitful when studying IT management (McFarlan, 1981, 1984; Ward, 1990; Weill & Vitale, 1999). Such approaches can help explain issues dealing with the interaction between applications rather than the applications themselves (cf. Ward & Peppard, 2002; Swanson & Dans, 2000). Axelsson & Goldkuhl (1998) argue that the structuring of the interaction between applications usually is not done on the basis of strategic considerations, but will end up having strategic consequences.

This research uses a portfolio approach to the management of IT, i.e. the IT resources of a company are viewed as a portfolio. One benefit from this approach is that it helps bring all the company's IT resources into consideration. The purpose is not to divide resources into either being part of the portfolio or not. Some applications are crucial to the operation of the company or central in some other sense, while others are more peripheral. They are all part of the IT portfolio, but their importance to the company differs. Weill & Broadbent (1998) define a company's IT portfolio broadly as "*its entire investment in information technology, including all the people dedicated to providing information technology services, whether centralized, decentralized, distributed, or outsourced*" (p. 24).

In this research the notion of an IT portfolio is a variation of this, based on an application perspective where the applications are the starting point. Thus, the IT portfolio is taken to *include the applications of the company together with the prerequisites and resources needed to develop, maintain, operate and use these applications and any and all IT related infrastructure not necessarily related to any specific application*. In contrast to Weill & Broadbent (1998) people are excluded from the IT portfolio.

A potentially useful analogy to the IT portfolio approach is the investment portfolio, which is the set of different investments of a person or a fund. The idea behind the investment portfolio is that the value of a single investment depends on the rest of the portfolio (cf. Huang & Litzenberger, 1988; Ingersoll, 1987). In the same sense the "value" of an application depends on the company's other applications.

1.1.3 Mission-Critical IT

What Does Mission-Critical IT Mean?
Of special interest in this research is mission-critical IT, i.e. IT which is critical for the company's execution of its mission or business strategy (cf. Davenport, 2000). It would be valid to argue that IT that is not important to the company should not be there at all. On the other hand, it is quite persuasive to argue that the importance of different applications within a company varies. Hence, studying the management of mission-critical IT means focusing on those applications that are most important to the company. Lacity et al (1996a, pp. 406-410) consider the business contribution of IT activities and label the end-points of this continuum *critical* and *useful*. IT activities will be classified as critical when "*the basic operations of the business are now highly dependent upon them*" (ibid., p. 408).

In this research mission-critical IT is interpreted in a similar fashion, namely as *IT that either is, or is intended in the future to be, necessary for the execution of those business processes needed in order to accomplish the firm's business strategy or for gaining competitive advantages in some other manner*. Typically, mission-critical IT will be used to describe different applications. An application is interpreted as an information system or computer program, including necessary hardware and documentation, that is designed and conceived of as an entity in itself. This means that different parts or sub-processes of a computer program will not be considered to be applications. It also means that applications typically are characterized by having more or less well-know interfaces to other entities.

What is Interesting to Know about it?
Acknowledging that some IT plays important roles in companies, and more so than other IT, it becomes interesting to know where companies get such IT. Do you build it yourself? Why? Do you buy it from a vendor? If so, can you still use it to gain competitive advantages?

When managing IT and the acquisition of new capabilities, deciding what to do in-house and what to acquire from other companies is a central question. Determining what activities to carry out in the company and what not to is an important task in general (cf. Coase, 1937; Williamson, 1975) and has garnered quite some interest regarding IT activities (e.g. Lacity & Hirschheim, 1993a; Lacity & Willcocks, 2001). It has even been argued that IT strategy is mainly an issue of sourcing (Keen, 1993, p. 19). In order to gain an understanding of how mission-critical IT is managed, in this study it will be addressed from a sourcing perspective.

Given the rapid development in the IT area over the last decades, new technical opportunities abound (e.g. Weill & Vitale, 2001). At the same time, existing solutions tend to grow old more rapidly than is usually desirable. This leads to another set of questions of relevance for IT that plays important roles. *When* do you get new solutions? Is being innovative and using new technological solutions worthwhile? What technologies should be adopted for internal use? What should we have our customers adopt?

Deciding on how to develop the existing IT portfolio in the company given new opportunities is one example of the ever-lasting challenge of managing new technology and innovations (cf. Christensen, 1997a; Utterback, 1994; Rogers, 1995). In this study the management of IT is analyzed and interpreted from a technology adoption perspective.

Regardless of the actual answers to questions such as the ones posed above, it is interesting to explore the relation between mission-critical IT and the business operations of the company. Or, in other words, to examine how the management of (mission-critical) IT relates to the business operations?

Strategies can serve as useful tools when working with long-term issues in general (Mintzberg, 1978) and managing IT portfolios specifically (Earl, 1993). The IT strategy supposedly provides long term guidelines for various IT related issues, such as ensuring adequate business support. If strategies play an important role for any kind of IT, they are definitely likely to do so for mission-critical IT. In this study, the relation between mission-critical IT and business operations will be studied with IT strategies as a point of departure.

1.2 Purpose of the Study

The overall question dealt with in this research falls within the wide area of how companies manage IT. Even though most companies can be assumed to try to make what they consider to be the best possible use of IT, companies do approach the problem in quite different ways. To operationalize the concept of managing IT, this study focuses on what companies actually do and what choices they make regarding their mission-critical IT.

An overall research question guiding this research can be stated as:

How is mission-critical IT managed in companies?

To gain a better understanding for this research question, what companies actually do will be analyzed from both a sourcing perspective and a technology adoption perspective. This way multiple theoretical areas are used, each helping to provide parts of an answer.

The first thing to do however is to scrutinize what is being managed, namely the mission-critical parts of the IT portfolio. Next, attention can be turned to how it is managed, which is described and analyzed from sourcing and technology adoption perspectives. Finally, the relation between mission-critical IT and the business operations of the companies will be explored.

Thus, the purpose of this study is to contribute to the understanding of management of mission-critical IT by:

1. *describing and analyzing IT portfolios with focus on mission-critical IT*
2. *investigating the management of mission-critical IT from sourcing and technology adoption perspectives*
3. *exploring the relation between mission-critical IT and business operations.*

1.3 CENTRAL DELIMITATIONS

To shape and focus this research several delimitations have been made. The main delimitations are the following.

The focus is on mission-critical IT, which is a way of focusing on IT that is of vital importance to the company. This is a somewhat soft delimitation, but it serves to exclude for example applications that neither are nor will be vital in the short run to deliver the intended service to the customer.

The cases are all confined to one industry, the financial industry. Even though this significantly increases the opportunity for cross-case analysis it can be problematic from a generalization perspective, as will be discussed in chapter 2.

For purposes of delimitation, the sourcing and technology adoption perspectives are in focus in this study. It is, however, acknowledged that many other perspectives, such as a power perspective, could complement them and perhaps help provide a fuller understanding of how mission-critical IT is managed in companies.

1.4 EMPIRICAL SETTING: THE FINANCIAL INDUSTRY

This subchapter starts out with a brief introduction to the financial industry followed by a description of the actors involved when securities, or more specifically stocks, are bought and sold.

1.4.1 The Financial Industry

A first question one may ask is what is the financial industry? Crane et al (1995) discuss financial systems and claim that "*the primary function of any financial system is to facilitate the allocation and deployment of economic resources, both across borders and across time, in an uncertain environment*" (p. 12). In other words, one interpretation of the financial industry is that it is made up of companies facilitating the "allocation and deployment" of economic resources. Typically such companies are banks, insurance companies and other companies that are active on capital markets.

Over the years, the financial industry has gone through a rapid and on-going change. An example of this is the increased globalization of financial services where not only companies, but also financial centers (such as Stockholm[2], London, and Frankfurt) compete against each other (cf. Seifert et al, 2000). Another example is the rapid development of new securities (cf. Finnerty, 1988, 1992; Finnerty & Emery, 2002). Advances in computer and telecommunications technology have had a significant effect on how securities are traded (Domowitz & Steil, 2002) and on retail banking in general (Channon, 1998) and its distribution choices specifically (Byers & Lederer, 2001). The Internet has had a profound impact on the stockbroker industry (Evans & Wurster, 1999) and perhaps primarily retail brokerages (Wilhelm & Downing, 2001).

> *The impact of information technology thus far is most profound in functions involving little more than information dissemination. Retail securities brokerage provides a particularly striking example (ibid., p. 74)*

It is however important to note that the change is not driven by technology improvements alone. New rules governing competition and other political and regulatory changes also play major roles (Calomiris, 2002).

[2] The Stockholm financial center is described by Andersson (1998) and Boman (1999).

On the other hand, even though there are a lot of changes, some things remain more or less the same, such as banks organizationally and culturally tending to be conservative, bureaucratic and security-oriented (Sippel, 1989). All in all, the financial industry is undergoing change, which is often unpredictable (Crane & Bodie, 1996).

The financial industry has been dependent on IT for a long time (Garbade & Silber, 1978) and IT has served as a source for competitive advantage (McKenney, 1995; McKenney et al, 1997). It is reported that securities trading firms spend some 20 percent of their total outlays on information systems, and trading desks as much as half of their revenue on IT (Dewan & Mendelson, 1998). The use of IT has allowed companies in the financial industry, not least stock brokerages, to automate and standardize business processes, which is an important way to improve efficiency in service industries (Levitt, 1972, 1976). Many of the services provided in the IT industry follow the typical characteristics of services: they are for example perishable and produced at the time of consumption (Normann, 1992, p. 31). Unfortunately, technological improvements are hard to measure since inputs and outputs are not easily defined within the financial industry (Calomiris, 2002).

1.4.2 Different Actors in the Transaction Chain

When a customer decides to buy or sell a stock, a number of actors are involved, see Figure 1.1 below. A member firm is an intermediary that helps the customer to execute the order on the marketplace (exchange). There is also an organization (or in some cases more than one) taking care of clearing and settlement. Finally, there is a central securities depository keeping track of who owns how many shares in a specific company. A similar presentation, albeit with a focus on performance improvements, is available in Toppen et al (1998).

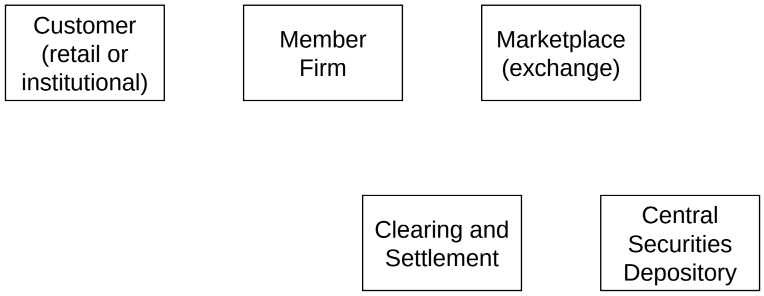

Figure 1.1: Actors Involved When Buying or Selling Securities

Retail Customers

Retail customers are individual investors investing their own money. Historically, retail customers have usually interacted with their broker either over the telephone or, if the broker was a bank, by visiting a branch office. Today, these ways of interacting are of course still available, but the Internet has opened up a new way of interacting where orders can be entered from a computer without any human interaction between the customer and the broker.

Institutional Customers

Institutional customers are for example mutual funds or insurance companies managing portfolios of securities. Typically, institutional customers trade larger quantities than retail customers. Institutional customers are attractive customers since the fee structure of most brokers is value based, i.e. a fraction of the value of trades is charged. Most brokers have research departments producing research and analysis reports advising companies to buy or sell. This advice is provided to larger customers “free-or-charge” (meaning that transactions fees pay also for these reports).

Member Firms

A number of companies have access to the exchange, such as banks and stock brokerages. Companies may use this access in different ways. Some accept orders from customers, execute them on the exchanges, and charge a fee for this service. Market makers are always willing to trade an instrument and make money on the spread, i.e. they buy at a slightly lower price than they are willing to sell for. Proprietary traders take on positions that deliberately try to exploit arbitrage opportunities or that represent well-grounded bets on where the market is going. Most, but not all, member firms combine these different usages, as they may, for example, both accept end customer orders and do some proprietary trading.

At member firms a distinction is often made between front-office applications and back-office applications. Simply put, front-office applications are applications that help the broker or trader to place orders on the exchange, get information on what is going on, do risk analysis etc. Back-office applications keep track of what customer owns what instruments. In a sense, they are bookkeeping applications.

Marketplaces

The marketplace, or exchange, is a place where buyers and sellers meet. It may be physical place, much like a traditional marketplace for, say, groceries, or it may be a virtual place, i.e. a computer system.

Historically, stock exchanges have used floor trading in open outcry markets. This means that the brokers come together at the physical exchange and interact audibly or by using hand signals. Today, IT plays an important role by supporting the trading at most exchanges, even though some exchanges still use a trading floor (e.g. the New York Stock Exchange and the American Stock Exchange), while others trade completely electronically (e.g. the Stockholm Stock Exchange and the London Stock Exchange).

Some markets do not have a central exchange or marketplace where trades are created. Instead brokers and dealers post price information on various information systems and stay in touch using other means, such as phones, to create trades.

Clearing and Settlement Institutes

When a trade has occurred at the exchange, it is merely an agreement between two parties to exchange a certain amount of a financial instrument, such as a stock, for a certain amount of money at a specific point in time. The trade then has to be cleared and settled, which usually takes place a well-defined number of days after the trade. The settlement date is commonly expressed as "T+n", where for example "T+3" indicates that settlement occurs on the third banking day after the trade. Likewise, "T+1" means settling the day after the trade and "T+0" means same day settlement. There is a trend within the financial industry towards shorter settlement times where markets have gone from maybe "T+5" to currently "T+3" and have in some instances been looking at "T+1".

Clearing and settlement are often lumped together but consists of two separate, albeit related, activities. *Clearing* means clearing of obligations, where it is made sure that the parties can actually deliver what they are supposed to deliver. The clearing activity thus serves to prepare the settlement so that basically nothing goes wrong. The *settlement* refers to actually exchanging payment for delivery of securities.

Central Securities Depository

A central securities depository keeps a register of who owns how many shares in a company. This register is typically updated when trade are settled. The central securities depository also manages corporate actions, such as a company performing a split for instance where each "old" share entitles the owner to two "new" ones.

Putting the Pieces Together

The actors just described all interact when a customer trades at a stock exchange. When a customer buys or sells shares the seven steps that are typically executed are illustrated in Figure 1.2.

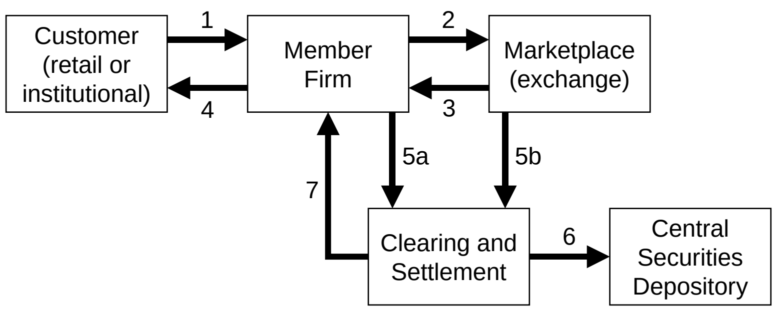

Figure 1.2: Transaction Chain When Buying or Selling Securities

Everything starts with a customer's intent to trade. If and when this intent leads to action, the following will occur[3]:

1. The Customer enters the order to the Member firm.
2. The Member Firm enters the order to the Marketplace and a trade is created.
3. The trade is reported back to the Member firm.
4. The Member Firm reports the trade back to the Customer.
5. Depending on the conventions of the specific market, either the Member Firm or the Marketplace reports the trade to the Clearing and settlement organization.
6. When the trade is settled, the Central Securities Depository is updated.
7. The settlement is also reported back to the Member Firm.

[3] Note that these steps are not strictly chronological beyond some obvious constraints, i.e. Step 1 always comes first and Step 2 always comes second. Step 4 must come after Step 3, and Steps 6 and 7 must come after Step 5.

1.5 A ROAD MAP OF THE STUDY

This subchapter concludes chapter 1, which serves as a general introduction to the study. It also includes the purpose of the study, some central delimitations and a brief introduction to the empirical setting.

In chapter 2, the research approach of the study is discussed. Even though a reader with a practitioner perspective may choose to skim this chapter, a quick glance at section 2.2.6 Which Case Companies? on p. 24 is recommended.

Chapter 3 discusses the theoretical foundations of the study. Subchapter 3.1 concerns IT infrastructures and IT portfolios, while subchapters 3.2 and 3.3 discuss sourcing strategies and technology adoption, respectively. Finally, subchapter 3.4 deals with the relation between mission-critical IT and business operations.

Chapters 4-7 present the empirical findings from the four case companies of this study, i.e. Lambda, Delta, Tau and Gamma.

Chapter 8 discusses the empirical findings in the light of the theoretical foundations on IT infrastructures and IT portfolios presented in subchapter 3.1. In the same manner, chapter 9 applies a sourcing strategy perspective (presented in subchapter 3.2) to the empirical findings while in chapter 10 a technology adoption perspective (presented in subchapter 3.3) is used. In chapter 11 theories from subchapter 3.4 are applied to the empirical findings.

Chapter 12, finally, contains some concluding remarks concerning the main findings of the study and their implications. Figure 1.3 provides an overview of the dissertation.

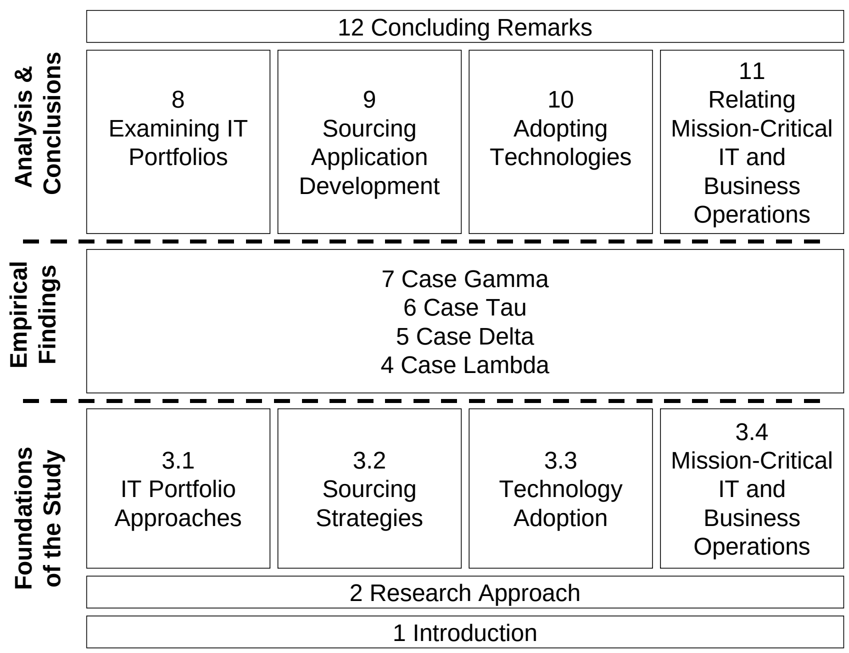

Figure 1.3: Dissertation Overview

2 RESEARCH APPROACH

The chapter is divided into four main parts. First, I will present some philosophical assumptions underlying the study, followed by a subchapter on research strategy, which discusses some central choices in the design of the study. This is followed by a description of the research execution, i.e. how the research was actually carried out, and finally, the chapter concludes with a discussion of research quality.

2.1 APPROACHING RESEARCH

In approaching research there are a number of questions to be clarified, such as one's view on ontology and epistemology. In fact, "approaching research" can in itself spur some discussion. Is there something called "research" out there that can be approached (indicating a more positivist belief) or is "research" socially constructed (indicating a belief in social constructionism).

While epistemological assumptions concern the grounds of knowledge and what forms of knowledge that can be obtained (Burrell & Morgan, 1979), ontology concerns whether "*social and physical worlds are objective and exist independently of humans, or subjective and exist only through human action*" (Orlikowski & Baroudi, 1991, p. 8). Put differently, the question is whether there is a true objective world out there to be observed or if the reality is socially constructed (cf. Berger & Luckmann, 1966). Personally, I find myself taking on different views depending on what is being discussed. Do I believe Ayer's Rock in inland Australia is socially constructed? No. I believe the rock just lies there, plain and simple, regardless of whether it is called Ayer's Rock or its aboriginal name Uluru. Do I believe the spiritual significance attached to the rock to be socially constructed? Yes. I believe such traditions exist through human action.

Chua (1986) suggests three different philosophical perspectives underlying research studies, positivist, interpretive and critical, which was later discussed in an IS setting by Myers (1997). In the *positivist* approach it is assumed that the reality is objectively given and can be described by properties independent of the researcher (Myers, 1997). Another centerpiece of this approach is the empirical testability of scientific theories (Chua, 1986). The *interpretive* approach on the other hand assumes that the reality is accessed only through social constructions (Myers, 1997; Klein & Myers, 1999). The *critical* approach finally, assumes that social reality is historically constituted and is constantly being produced by people. People's ability to change their circumstances is constrained by various forms of domination (e.g. social, cultural) (Myers, 1997).

Orlikowski & Baroudi (1991) apply Chua's different sets of assumptions to the IS research domain by examining published research and find the positivist approach to be the most common. A similar study a few years later shows an increase in interpretive research (Walsham, 1995). Despite the apparent fundamental differences between positivist and interpretive perspectives, it has been argued that they can be integrated in organizational research (Lee, 1991).

One distinction sometimes made between interpretive and positivist worldviews is that the former relies on social constructionism as "*Interpretivism asserts that reality, as well as our knowledge thereof, are social products*" (Orlikowski & Baroudi, 1991, p. 13). The linkage between one's ontology and epistemology is emphasized by Morgan & Smircich (1980), who argue that one's ontology more or less implies a certain epistemology, i.e. an objective ontology would lead to a similar epistemology and so on.

Walsham (1995), on the other hand, means that "*Interpretive methods of research adopt the position that our knowledge of reality is a social construction by human actors*" (p. 376), i.e. there is no explicit assumption regarding reality itself, only knowledge of it. This is in line with Myers' (1997) view above, that reality can be given or socially constructed. Susman (1983) does make an assumption regarding reality itself, namely that there is a real world, as he states:

> *I believe there is a real world that exists independently of me and of which I will always have imperfect and incomplete knowledge. I come closest to experiencing it directly when I try to minimize interpreting it and concentrate on nothing but "pure" qualities like colors, sounds, smells, and the like. If I make any pretense to knowing something about that world (e.g., how it works), that knowledge will be limited by the language and conceptual frameworks I have learned as a product of the time and place I occupy historically and culturally. (Susman, 1983, p. 96)*

Using Susman's stance, my own view can be expressed as follows. I tend to believe that there is a world independent of me; a world which is partly objective (like Ayer's Rock) and partly subjective (like people's beliefs concerning Ayer's Rock). My understanding and knowledge of this world is, and will continue to be, incomplete, and it is the result of my own interpretation. My ability to understand the world will vary with what phenomenon I choose to study, but also with the social constructions of the world I live in. Thus, I would characterize my own underlying philosophical perspective as an interpretive one in Myers' (1997) sense.

In general, I concur with Galliers who argue that:

> *A particular approach is likely to have its adherents who, all too frequently, argue (often, most cogently) for its* universal *applicability. (Galliers, 1991, p. 327) [*emphasis *in original]*

Galliers' (1991) concern is that he finds that the research approach adopted is not so much affected by the object of the research as by the location of the research, i.e. he identifies a tendency among researcher to apply a certain research approach (more or less) regardless of what is being studied. As indicated above my own view is that ontologically, I find it useful to consider some parts of the world as objective and other parts as subjective. Similarly, epistemologically I believe knowledge to be interpretations but depending on the subject matter of the knowledge the amount of interpretation will vary.

2.2 RESEARCH STRATEGY

The design of a research study can be seen as consisting of five components interacting as depicted in Figure 2.1 (Maxwell, 1996).

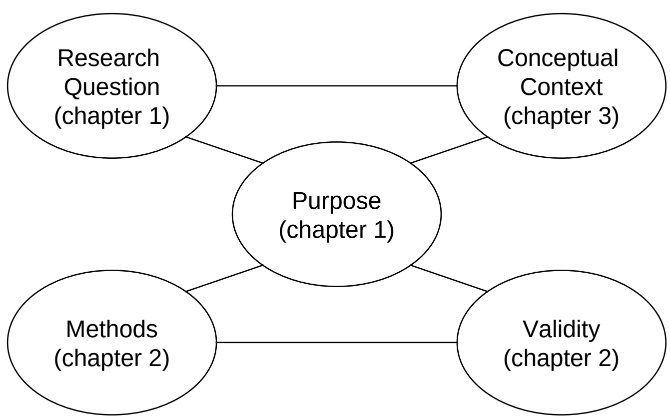

Figure 2.1: Model of Research Design (adapted[4] from Maxwell, 1996)

[4] The adaptation comes from the fact that Maxwell (1996) characterizes purpose as "What are the ultimate goals of this study?" (p. 4) and research questions as "What, specifically, do you want to understand by doing this study?" (p. 4). As described in chapter 1, this study

The Research Question and Purposes have been discussed in chapter 1. The Conceptual Context will be dealt with in more detail in chapter 3. By Methods Maxwell refers to research relationship with the people in the study, site selection and sampling decisions, data collection methods, and data analysis techniques. Validity finally, refers to the question whether the research can be wrong in some sense. The remainder of this chapter will cover the last two components, methods and validity.

The upper half of the model, Research Question, Conceptual Context, and their interaction with the Purpose, covers mainly external aspects of the study. What is the study trying to accomplish in relation to previous work? The lower half, discussed in this chapter, correspondingly covers aspects mainly internal to the study. How will the study be performed?

The remainder of this subchapter deals with some of the methodological choices made in this study.

2.2.1 Choosing a Case Strategy?

Determining the overall research strategy is quite fundamental when designing a research study. This research uses a case-study research design to get a detailed view of the questions at hand. The case study strategy has a distinct advantage when "*a 'how' or 'why' question is being asked about a contemporary set of events over which the investigator has little or no control*" (Yin, 1994, p. 9). Generally, case studies are well suited for studying complex phenomena that are little understood and exist in specific settings (Benbasat et al, 1987; Hartley, 1994). Eisenhardt (1989) describes how a case-based research strategy can be deployed to generate theories. Her description has later been operationalized by Paré & Elam (1997). Not all case studies seek to arrive at *general conclusions*, however. Some instead attempts to reach *specific conclusions* (Gummesson, 1991, p. 74) regarding a specific case of special interest.

An important clarification is what a case study really is. Yin defines it as:

> *an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and context are not clearly evident. (Yin, 1994, p. 13)*

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uses these concepts inversely to the way Maxwell uses them. Thus, in Maxwell's original figure, the research questions are located in the middle ellipse.

An important aspect of the research design is determining the unit of analysis (Yin, 1994). What is the case really about? In this research, the unit of analysis is the overall approach to management of mission-critical IT, i.e. how a company's IT resources or applications are managed. A possible alternative unit of analysis would be how a specific application is managed over time. As discussed above, the portfolio perspective of this research makes that a less suitable approach.

The case studies are snapshot studies and are not longitudinal in nature[5]. However, in terms of Markus and Robey's dichotomy between variance theories and process theories (Markus & Robey, 1988) this study does take on a process perspective. This perspective recognizes causality uncertainties, which are prevalent in the research area. The relationship between causes and consequences are not as deterministic as the variance theory approach demands, at least in its purest form. Furthermore, since IT legacy issues are important, a process approach is more desirable.

2.2.2 Single or Multiple Cases?

Given a case study approach, the question remains how many cases the study should involve. An overview based on multiple cases was preferred to a deep understanding of a single case. Since comparison between different IT portfolios is one important part of the analysis, a single case study was not considered suitable. The understanding of how mission-critical IT is managed is deemed more valuable if it is based on a number of instances rather than a deep understanding of one case, even though Lee (1989) shows that a strong case can be made for the viability of single case studies, as is exemplified by e.g. Mårtensson (2001) and Mähring (2002).

The study encompasses four cases. Having multiple cases allows for a comparison between cases, an inter-case analysis, which more than makes up for the fact that multiple cases reduces the depth of the cases. It is not feasible to achieve the same level of depth of a specific case when four cases are collected as when fewer cases are used. Acknowledging the importance of inter-case analysis is in line with the argument made above between the difference of analyzing a single application and a portfolio. The understanding of one out of four cases is enhanced in itself by the three other cases.

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[5] In one case, Delta, data was collected in two phases with a 16-month gap. This was not in order to investigate longitudinal aspects, but due to specific circumstances at the company.

2.2.3 How To Collect Data?

In qualitative research it can be argued that most data are not collected but rather generated (Mason, 1996, pp. 35-36). The main idea behind this argument is that from a qualitative perspective it is reasonable to "*reject the idea that a research can be a completely neutral collector of information about the social world*" (ibid., p. 36). Acknowledging the view that data does not lie around waiting to be collected, the term data collection is still valid in my mind. Rather, the important issue is to be aware that collecting qualitative data has a slightly different meaning, or at least is operationalized differently, than collecting quantitative data. In the same vein, a weakness of the term generating data is its connotations in regards to quantitative data where is seems to suggest some sort of "data fabrication".

Yin (1994) identifies six sources for collecting data in case studies: archival records, documents, participant-observation, physical artifacts, direct observation, and interviews.

Archival records are mainly used for classifying the case companies as described in section 2.2.6 Which Case Companies? below. The records used are typically company external, i.e. kept by a third party.

Written *documents* have supplemented interviews when possible. The documents are mainly official information, such as annual reports, but also include some internal documents, such as investment evaluations.

Participant observation was not used. To participate in the management of mission-critical IT would call for a long-term and intense relationship with the company. As discussed above in section 2.2.2 Single or Multiple Cases? collecting data from multiple companies was prioritized.

Physical artifacts and direct observation have a somewhat troublesome relationship because Yin (1994) states that a physical artifact can "*be collected or observed as part of a field visit*" (p. 90). It is therefore difficult to distinguish direct observations and physical artifacts. For the purposes of this study, a physical artifact is considered to be something that is collected rather than observed. Given this definition, which differs slightly from Yin's, physical artifacts have not been used in this study.

Direct observation was used in a very limited sense. All interviews took place at the respective case company; sometimes in the interviewee's office and sometimes in a conference room. Often the interview started out, or was concluded, with a short improvised tour of, for example, the IT department or the trading room. This was not used as a systematic way of collecting data, but still served as an important tool for a deepened contextual understanding. In general, the actual management of mission-critical IT is hard to observe directly as the activities it entails are not prone to observation.

The main data collection tool in this study is *interviews*. Qualitative research interviews are characterized by a limited degree of structure imposed by the interviewer, mostly open questions and a starting point in real life stories, or specific situations, rather than abstractions and general opinions (King, 1994). King also acknowledges that the relationship between the interviewer and the interviewee constitutes part of the research process. The qualitative research interview is contrasted with the structured interview, which is based on a predefined set of ordered questions, most of which are closed. The interviews in this study are close to the qualitative research interview. The nature of the interviews in this research can be characterized as semi-structured (cf. Rubin & Rubin, 1995).

Basing the case studies on interviews gives room for a multiple case study, but the understanding of the rather complex phenomenon under study will not be as deep as in a longitudinal case study based on a clinical approach (cf. Schein, 1987). For the purposes of this research, the chosen design is deemed more suitable. If the focus of the study was instead a deep understanding of decision-making processes per se, other designs would be preferable.

2.2.4 Whom to Interview?

Given a multiple case study based largely on interviews, the question remains who should be interviewed. Generically, three company internal perspectives can be identified as playing a role when allocating IT resources, the top management, the IT function and the business function (see Figure 2.2 below). These perspectives correspond closely with the generic change process perspectives put forward by Checkland (1981), owner (management), actor (IT function), and customer (business function). There are also a number of perspectives external to the company, such as suppliers and customers, which have not been covered.

Two of the internal stakeholders come naturally. The IT function can be seen as a company within the company, whose business idea is to provide, or sell, IT services to its customers (Earl, 1989). The business function is the end customer of the IT function, at least within the company. The purpose of the company’s IT activities is to support the business processes residing in the business function.

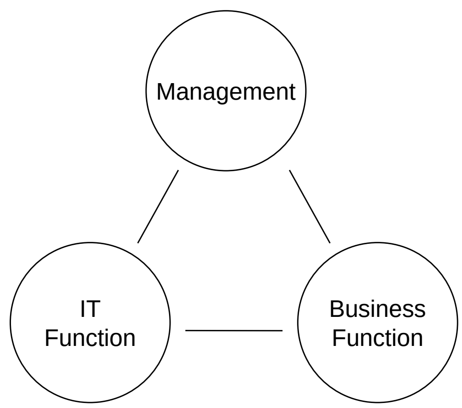

Figure 2.2: Three Perspectives

That management is also a stakeholder is today no longer controversial. The impact of IT on the business in most companies is more than enough to put IT and its evaluation on the management agenda. Farbey et al (1993) provide four reasons for senior executive involvement in IT evaluation:

- IT affects strategic issues. IT is a question of competitive advantage or disadvantage.
- IT is at the core of the business processes. Many organizations are basically IT based, i.e. they can no longer function without proper IT support.
- IT accounts for large expenditures. The fact that IT accounts for a large portion of capital investments makes it an executive management concern.
- IT is complex. IT issues often cross functional and organizational boundaries, which makes senior management involvement important.

Allowing for possible differences in perspective between managers and workers, one finds five different perspectives to be covered in each company as described in Table 2.1 below. For smaller companies it is quite conceivable that the difference between the manager role and the worker role is so blurred that different interviewees are neither feasible nor necessary, i.e. the same interviewee might represent both roles or perspectives.

Perspective	Reason, Purpose
Top management	Overall perspective, relate activities to business strategy
Line manager	Line/business perspective
Line worker/user	User perspective
IT manager	Overall IT perspective
IT worker	Hands-on IT perspective

Table 2.1: Perspectives Represented by the Interviewees

2.2.5 What Industry?

It is now time to turn to the question of what industry, or industries, the case companies should represent. To enhance the possibility of relevant inter-case analysis, all cases are collected from the same industry, namely the financial industry. In this industry, IT is tightly intertwined with the business, and IT support is extremely important for the business, which is very sensitive to system breakdowns. Furthermore, business development efforts are usually dependent on adequate IT support.

This industry is operationalized, or further narrowed down, by the selection criterion that the case companies were all members of the Stockholm Stock Exchange (SSE) at the time of data collection. Given this definition the industry consisted of a number of companies (as of 1999-12-31 there were 59 SSE members (Stockholmsbörsen, 2000)) exhibiting a number of similarities. Buying and selling stocks is part of the business for all members, and at the SSE they all trade with each other.

Since the Swedish equity market is fully electronic, there are some common external requirements on their respective IT portfolios, and from time to time they are all forced to adapt their systems to changes in these external requirements. In some companies the IT portfolios are also fairly complex, as they are part of global real-time based networks.

Yet another reason for choosing the financial industry is my affiliation with the SSE (later OM) where I have spent time on and off since 1996 working in various information system development projects. This means that my pre-understanding of the industry is relatively high. It also reflects a personal preference since I think this industry is interesting (cf. Strauss & Corbin, 1990, pp. 42-43). When discussing researcher's challenges, Gummesson (1991) notes that "*Traditionally, academic researchers' preunderstanding takes the form of theories, models, and techniques; generally they lack institutional knowledge such as knowledge of conditions in a specific* *company, industry, or market.*" (p. 12). Hopefully, my experience of the industry remedied this at least in part.

A concept related to preunderstanding is theoretical sensitivity, which is usually associated with grounded theory (Strauss & Corbin, 1990). Theoretical sensitivity "*refers to a personal quality of the researcher. It indicates an awareness of the subtleties of meaning of data.*" (ibid., p. 41). Several sources are identified for theoretical sensitivity, such as literature and professional experience. The latter stems from an understanding of how things work based on personal experience from working in the industry.

However, there are some possible drawbacks with the financial industry as an empirical area. The industry can be considered fairly extreme compared to other industries. The type of business carried out differs from most industries, which could reduce the relevance of the study for other industries. However, even though few industries have the same conditions as the financial industry today, conditions in other industries are changing, and furthermore, they are changing in the direction of the conditions existing in the financial industry today (cf. Wilhelm & Downing, 2001). The argument would be the same as Lawrence & Lorsch's on behalf of the plastics industry during the 1960's, namely that "*this industry is characterized by rapidly changing technological and market conditions, and the organizational issues for firms in it may be typical of those to be faced in the future by firms in other industries*" (Lawrence & Lorsch, 1969, p. 21). In that sense, studying the financial industry might actually provide some results of value to other industries in a prognostic way.

2.2.6 Which Case Companies?

This section deals with how the case companies are chosen from within the financial industry. First, different possible criteria are discussed followed by the actual choice of criteria. Finally, the operationalization of the chosen criteria is described.

Possible Criteria

Given the delimitation of studying brokerages, or more formally, members of the SSE, the list of possible case companies was narrowed down to some 59 companies. In line with Eisenhardt's (1989) reasoning, the case companies were chosen so that the variation will help the understanding of the cases. In this sense, the aim is to cover different ends of the spectrum in some important dimensions. Mason (1996, pp. 91-92) calls this theoretical, or purposive, sampling drawing on Glaser & Strauss' concept of theoretical sampling (Glaser & Strauss, 1967, pp. 45-77).

There are many differences between the member companies, which create different conditions for their respective IT portfolios. Examples of such differences are company size, services offered, targeted market segment and type of trading. These differences are not independent.

Size is an obvious difference between the companies. The members range from small, specialized brokerage firms with 10-15 employees to the four large Swedish banks and large international investment banks.

Services offered differ a lot since some offer trade-execution services and nothing else, while others offer analysis and services such as corporate finance services to the market.

The *targeted market segment* varies, where some companies target large institutional customers, while others target individuals with fairly limited investment portfolios.

The *type of trading* goes from members doing only proprietary trading, i.e. trading on their own behalf instead of on behalf of customers, to companies doing no proprietary trading whatsoever. Many, if not most, companies do both some proprietary trading and some handling of customer orders.

Thus, the members of the stock exchange can be grouped in a number of different ways using different dimensions. There are other pertinent dimensions such as electronic or manual trading, where some companies use online trading and others use traditional telephone based customer communication.

Chosen Criteria

The two primary dimensions chosen were company complexity and targeted markets segment. Company complexity was used as a composite measure consisting of the two dimensions, sheer size and scope of services offered (e.g. analysis, asset management, corporate finance, trading), as illustrated in Figure 2.3. Even though these dimensions usually are correlated, small full-service companies are quite conceivable.

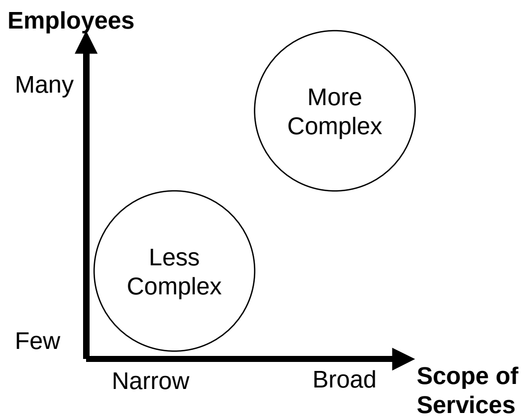

Figure 2.3: Company Complexity

The targeted market segment basically refers to whether the company predominantly aims at serving private investors or institutions. It is possible to study both dimensions based on public information. The degree of proprietary trading, for example, is considered a business secret in almost every case except for the extreme cases where companies either do no proprietary trading at all or only trade in their own books. When it comes to type of customer communication, the distinction becomes more and more blurred as more companies offer both online trading and manual phone based communications.

Operationalization of Criteria

The sheer size of the company is measured in number of employees, while services offered are not measured quantitatively. The variation goes from the smallest specialized companies with some 10 employees offering trade execution only, to large international banks offering every conceivable type of services.

The targeted market segment is operationalized by comparing the relative sizes of trades. The turnover of trades made divided by the number of trades provides the average size per trade. The companies can then be divided into two groups, “large trades” and “small trades”, where the difference is whether the average size of the company’s trades is larger or smaller than the overall average size of the trades at the exchange. If this trade ratio is larger than 1 the company is considered to belong to the “large trade” group, while companies where this measure is less than 1 belongs to the “small trades” group. This distinction is crude and the exact line between the two groups is fairly arbitrary. Based on the trades made during 1999, this leads to a "large trade" group of 32 companies with trade ratios ranging from 4.65 down to 1 and a "small trade" group of 25 companies stretching down to .06 (cf. Appendix B). Since the overall average size during this period was about 294,000 SEK, this means that the companies' average trade sizes vary from about 1.4 million SEK down to about 18,000 SEK.

This leads to Figure 2.4 where the case-company structure is presented.

Market Segment	Complexity: **Less (small, narrow services)**	Complexity: **More (large, broad services)**
Institutional	Small companies serving large investors *Example: Niched, upscale brokerages*	Large companies with mostly institutional customers *Example: Full scale brokerages*
Retail	Small companies targeting the retail sector *Example: Internet brokerages*	Large companies with retail customers. *Example: Retail banks*

Figure 2.4: Case Company Structure

2.3 RESEARCH EXECUTION

2.3.1 Accessing Case Companies

When carrying out this kind of research study, gaining access to case companies is of course an absolutely crucial aspect (cf. Brown et al, 1976; Gummesson, 1991). In the process of getting access to four case companies (covering the four different cells in Figure 2.4 above) a total of eight possible case companies were contacted. Three companies were "cold-called", i.e. no reference was made to a sponsor, while in the five other companies, some reference was made to a sponsor who would vouch for the project. As is evident from Table 2.2 below having a sponsor turned out to be quite crucial as all "cold-called" companies declined participation. Thus, the experience from this study certainly supports Hartley (1994) who points out the benefits of being "*introduced through a third party*" (p. 216).

Company	Vouching Sponsor	Result
1	Yes	Lambda
2	Yes	Delta
3	No	No
4	No	No
5	No	No
6	Yes	Tau
7	Yes[6]	No
8	Yes	Gamma

Table 2.2: Case Company Access

The reason espoused for declining to participate was in three of the cases lack of time due to the current workload. In the fourth case (company 7 in Table 2.2 above) the reason was an ongoing major re-organization. It is hard to tell to what extent these were also the true reasons and to what extent they were merely used as excuses to avoid participating in the study for some other reason.

In terms of Figure 2.4: Case Company Structure, the four cases of the study are structured according to Figure 2.5.

	Less Complex	**More Complex**
Institutional	Lambda	Delta
Retail	Tau	Gamma

Figure 2.5: Actual Case Companies

[6] It is worthwhile to note that the vouching sponsor in company 7 (working in that very company) was instrumental as a sponsor when company 8 was contacted.

2.3.2 The Interviewing Phase

Once the four case companies agreed to participate, the primary contact person served as a mean for gaining access to interviewees. The primary contact person was interviewed in all the cases. The position of the contact person varied in the different cases as described in Table 2.3. This variation had no discernable effect.

Company	Position
Lambda	Head of Business Development
Delta	Head of IT Department (later replaced by CEO)
Tau	CEO
Gamma	Head of Operations

Table 2.3: Contact Persons

As qualitative interviewing design is flexible, iterative, and continuous (Rubin & Rubin, 1995, pp. 42-48), the interviewees were not chosen at the outset of the interviewing since that would have made the interviewee selection very dependent on the view of the contact person. The results of prior interviews instead guided later interviews both in terms of interviewee selection and, to some extent, interview content. This meant that the interviews in each case company came to span a longer period of time. The process of getting suggestions from an interviewee, checking the suggestion with the contact person[7] and then booking a new interview made data collection a somewhat slow process.

In general interviewing started with people from the IT organization suggested by the contact person. These interviewees then in turn suggested other people to interview. The focus of the interviews then switched over to the line organization. Usually, some management representative was interviewed late in the process.

Interviewing continued until the marginal revenue in terms of new data was deemed too small to justify further interviewing. Rubin & Rubin (1995, pp. 72-76) call this the *completeness principle*, which they compare to the saturation point (Glaser & Strauss, 1967, pp. 61-62). Thus, depending on the size and the complexity of the specific case anywhere from five to 15

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[7] In no case did the contact person refuse or oppose such suggestions made by prior interviewees. Thus, access to research settings (i.e. companies) proved to be more restricted than access to individuals (cf. Brown et al, 1976, p. 19).

interviews were performed in each case. A list of the interviews and the positions held by the interviewees at the time of the interview is presented in Appendix A.

2.3.3 The Interviews

In various forms a distinction is usually made between different levels of structuration of qualitative interviews. Patton (1990, pp. 280-290) talks about three types of interviews.

The informal conversational interview relies on spontaneously generated questions where "*the persons being talked with may not even realize they are being interviewed*" (ibid., p. 280). Typically, this kind of interview occurs as part of participant observation studies.

The general interview guide approach outlines a set of issues to be resolved (in no particular order) during the interview. The interview guide serves mostly as a checklist to make sure that all issues have been covered during the interview.

The standardized open-ended interview walks through a set of predefined questions ensuring that the same questions are asked (in the same way) to all respondents.

Yin (1994, pp. 84-86) discusses three different types of interviews, open-ended, focused and survey, basically mapping onto Patton's three types. Mason (1996) considers qualitative interviewing to refer to "*in-depth, semi-structured or loosely structured forms of interviewing*" (p. 38). She describes qualitative interviews as:

- having an informal style and being more of a conversation or discussion than a question and answer session,
- being thematic, topic-centered, and relying on a range of topics to cover rather than a set of predefined questions to ask,
- generating data rather the interviewer collecting data, due to the interaction between interviewer and interviewee.

Qualitative interviews are built by three kinds of questions; main questions, probes and follow-up questions (Rubin & Rubin, 1995, pp. 145-146). Main questions guide the interview, and three important concerns are whether they cover the overall subject, have a natural flow from one to the other, and match the research design, i.e. cover emerging subjects from the iterative design (ibid., pp. 146-147). Probes on the other hand serve to specify the desired level of depth, to avoid incomplete answers, and finally, to signal that the interviewer is paying attention (ibid., pp. 148-150). Follow-up questions serve to deepen the interview by "*pursuing themes that are discovered, elaborating the context of answers, and exploring the implications of what has been said*" (ibid., p. 151).

In this study the interviews have followed the general interview guide approach and also measured up to Mason's characteristics of qualitative interviews, with the caveat indicated above concerning whether data is collected or generated.

In line with Yin's (1994) recommendations, a case study database was created. The idea put forward by Yin is to distinguish between the data collected in the case and the different reports of the research. In this piece of research this was done by each interview being documented immediately after the interview and saved in a specific document. The same document was also used for keeping data collected by direct observations done at that specific company visit. Thus, the document contains all data collected on the visit to the company. In this way, all data in a case is kept in a set of documents. These documents were then used for writing up the case studies.

2.3.4 Anonymizing the Companies and the People

The case studies are anonymized, i.e. the company names are not disclosed and reasonable efforts have been made to hamper the possibility of identifying the companies. Anonymizing the cases leads to a loss of information in order to avoid revealing the company name. No pre-knowledge the reader might have of the companies can be used. However, to anonymize companies totally beyond recognition is probably not feasible without making the case descriptions either trivial or misleading. The industry chosen is a small industry in terms of the number of competitors, and companies are fairly well aware of what their competitors are doing.

One important reason for anonymizing the cases is the non-trivial access problem described above. In fact, not revealing the company name is seen more or less as a hygiene factor. Harsh competition, few competitive advantages, and the small number of competitors make companies very wary of revealing information about themselves. There is also a very strong culture of secrecy within the industry. Being secretive is important in many aspects of the business and this seems to carry over into how the companies themselves act.

An advantage of not naming the company is the reduced incentive to "glorify" your own company. The study is not seen as a way of sending a message regarding the company, which increases the likelihood of obtaining candid and honest information.

Maintaining a chain of evidence so that a reader is able to track the conclusions back to the original data leading up to the conclusion is a principle suggested by Yin (1994) for maximizing the use of the data. The existence of such chains of evidence is obviously not affected by the potential anonymity of the cases, but the possibility to show them is. In this research however, this was seen as a minor drawback compared to the benefits of anonymizing the cases.

2.4 RESEARCH QUALITY

This subchapter discusses triangulation as a tool for *achieving* research quality, as well as different dimensions for *evaluating* research quality.

2.4.1 Triangulation

Triangulation is often recommended as a tool for enhancing the quality of qualitative research (Yin, 1994; Maxwell, 1996). Denzin (1989), who is a strong advocate of triangulation, distinguishes between four different types of triangulation (pp. 234-244). *Data triangulation* refers to the use of multiple data sources (and not multiple methods of collecting or generating data). *Investigator triangulation* means that several observers are active in the research. *Theory triangulation* would mean that multiple theories are brought to bear on the question at hand. *Methodological triangulation*, finally, calls for several distinct methods to be used in the study.

There are however authors that question the use of triangulation. Mason (1996) advocates the use of multiple methods in the research design but claims that:

> *at its worst, the logic of triangulation says that you can use different methods, or data sources, to investigate the same phenomena, and that in the process you can judge the efficacy or validity of the different methods and sources by comparing the products." (Mason, 1996, p. 148)*

She goes on to argue that "*it implies a view of the social world which says that there is one, objective, and knowable social reality*" (ibid., p. 149). This is not necessarily true as Fielding & Fielding (1986) point out that:

> *We should combine theories and methods carefully and purposefully with the intention of adding breadth or depth to our analysis, but not for the purpose of pursuing "objective" truth. (Fielding & Fielding, 1986, p. 33)*

In this research data triangulation has been used by interviewing different people representing different perspectives. Theory triangulation has also been applied to some extent by drawing on different strands of research in an effort to better understand the management of IT. Neither investigator nor methodological triangulation has been applied.

2.4.2 Evaluation Dimensions

Research can be evaluated using a multitude of dimensions (Gummesson, 1991; Mason, 1996; Rubin & Rubin, 1995; Maxwell, 1996; Keen, 1991a), where different suggested sets of dimensions often are overlapping in different ways. Some focus their discussion on evaluation criteria for some specific kind of research, such as Klein & Myers (1999) who present a set of principles "*addressing the quality standards of only one type of interpretive research, namely, the interpretive field study*" (p. 69). Others argue that different dimensions are better suited to certain kinds of research than others; for instance Rubin & Rubin (1995) argue that validity and reliability are better suited to quantitative research and that they do not fit qualitative research.

The remainder of this section will discuss various evaluative dimensions by grouping them into dimensions primarily concerning the *Credibility*, *Contributions*, and *Communicability* of the research. These dimensions are an extension of Håkangård & Nilsson (2001) who discuss evaluating research by judging whether it is credible, original, and communicable.

Credible

Most authors discussing research evaluation discuss the credibility of the research in some sense. Based on Shipman (1982), Gummesson (1991, p. 159) suggests some questions when evaluating research. *Reliability*: had someone else carried out the investigation, would the same results have been obtained? *Validity*: does the evidence reflect what is really under study? *Credibility*: is the research process transparent enough for the consumer to assess the credibility of the research?

Mason (1996, p. 145) follows the same lines as Gummesson, when she discusses the first two concepts in terms of the reliability and accuracy of the method and the validity of the data.

Reliability and accuracy of the method carry notions from quantitative research and deals with quality of the research tools or instruments and the measurements they provide. In qualitative research the concept of "tools" is more complex, as the researcher is more actively involved.

Validity of the data deals with what is actually measured or explained. "*Judgements of validity are, in effect, judgements about whether you are 'measuring', or explaining, what you claim to be measuring or explaining*" (ibid., p. 146). Mason points to two different aspects of validity, namely data generation methods and interpretation. Maxwell (1996, pp. 89-90) adds theoretical validity in a discussion of three different kinds of validity: Description, Interpretation, and Theory (see Table 2.4).

Perspective	**Major Threats**
Description	Inaccuracy or incompleteness of data.
Interpretation	Research imposing its own framework, rather than understanding interviewees.
Theory	Not collecting or paying attention to discrepant data. Not considering alternative explanations.

Table 2.4: Validity Threats (Maxwell, 1996)

Two important validity threats are researcher bias and reactivity (Maxwell, 1996). Research bias deals with the risk of the researcher selecting data that either seems exotic in some sense or fits existing theories or preconceptions, which are quite likely to exist (Fielding & Fielding, 1986, p. 32). Thus, "*validity in qualitative research is not the result of indifference, but of integrity*" (Maxwell, 1996, p. 91). Reactivity deals with the influence of the researcher on the setting or interviewee (Miles & Huberman, 1994, pp. 265-266).

As noted above, Rubin & Rubin (1995) do not consider validity and reliability to be fruitful concepts when evaluating qualitative research and even state that "*Trying to apply these indicators to qualitative work distracts more than it clarifies*" (p. 85). Instead they suggest transparency and consistency-coherence.

"*Transparency means that a reader of a qualitative research report is able to see the basic processes of data collection*" (ibid., p. 85). This is very much in line with Gummesson's credibility concept despite their apparent disagreement on other criteria.

Consistency-coherence deals with the extent to which inconsistencies in the empirical data are understood (rather than eliminated). Rubin & Rubin (1995) claim that "*A credible final report should show that the researcher checked out ideas and responses that appeared to be inconsistent*" (p. 87). The goal is not to eliminate inconsistencies but to understand why they occur (ibid.).

In discussing the rigor of research, Keen (1991a, p. 44) brings a slightly different perspective, which deals with placing the study in an intellectual context in addition to its reliability and internal validity. This is supported by Maxwell (1996), who includes conceptual context as a vital component of research study design (see Figure 2.1 above). The intellectual context criteria means that research in some fashion must relate to existing knowledge, i.e. it is not enough to have reliability and being internally valid.

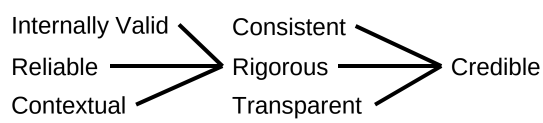

Figure 2.6: Dimensions Building Up Credible Research

As illustrated in Figure 2.6, to be *Credible*, research must be rigorous (Keen, 1991a), by being internally valid (Miles & Huberman, 1994; Mason, 1996), reliable (Gummesson, 1991; Mason, 1996) and placed in an intellectual context (Keen, 1991a, p. 44; Maxwell, 1996). Finally, transparency and consistency also contribute to its credibility (Rubin & Rubin, 1995).

Contributory

Traditionally, the focus has been on the rigor of the research rather than its relevance (Benbasat & Weber, 1996; Robey & Markus, 1998), or in other words on credibility rather than contribution. Keen (1991a) is very clear as he states that "*Until Relevance is established, Rigor is irrelevant. When relevance is clear, rigor enhances it.*" (p. 47). As argued by Robey & Markus (1998), there is no inherent conflict between the concepts of rigor and relevance, i.e. there is no need for a trade-off to be made.

In order to increase the relevance of research Keen claims that one has to add the questions "why?" and "for whom?" to the more traditional "what?" and "how?" (Keen, 1991a, p. 30). Relevance has been further specified by Benbasat & Zmud (1999) into the dimensions described in Table 2.5 below, where the first three dimensions are content-related and deal with the nature of the contribution, while the fourth rather deals with style.

Dimension	Description
Interesting	Does the research address problems or challenges that are important to IS professionals?
Applicable	Can the results (i.e. knowledge and prescriptions) be utilized by practitioners?
Current	Does the research address current (at the time of publication) technology and business issues?
Accessible	Is the research presented in an understandable way for IS professionals?

Table 2.5: Dimensions of Relevance (Benbasat & Zmud, 1999)

Another important aspect of research aspiring to contribute is generalizability (Gummesson 1991, p. 159). Mason (1996, p. 145) suggests two ways of thinking about generalization, empirically and theoretically. Empirical generalization extends findings from one empirical population (the studied sample) to a wider population based on the argument that the sample in some sense was representative of the wider population. Theoretical generalization on the other hand extends findings to theoretical propositions rather than to populations (Yin, 1994, p. 10).

Sometimes generalizability is referred to as *external* validity, dealing with the populations or settings to which observations can be generalized, while *internal* validity refers to the effects of the observations on the findings (Miles & Huberman, 1994, pp. 278-279).

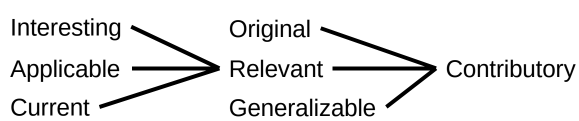

Figure 2.7: Dimensions Building Up Contributory Research

Thus, as indicated in Figure 2.7, research is *Contributory* if it brings some original contribution (Håkangård & Nilsson, 2001), which is generalizable (Gummesson, 1991; Mason, 1996; Yin, 1994) in some sense. To be contributory it must also be relevant in the dimensions put forward by Benbasat & Zmud (1999), see Table 2.5 above.

Communicable

One aspect of being communicable is the accessibility addressed in Table 2.5 above (cf. Benbasat & Zmud, 1999), i.e. is the research presented in a way that IS professionals understand and would enjoy reading. Rubin & Rubin (1995) discuss the communicability of research and emphasize that

“*The portrait of the research arena that you present should feel real to the participants and to readers of your research report*” (p. 91).

The research should also be consumable in Robey & Markus’ (1998) sense. They advocate practitioner sponsorship, new models of research, producing consumable research reports, and supporting non-traditional publication outlets as tools for producing consumable research. All these tools serve to decrease the gap between traditional rigorous academic research and research that is consumable for, and consumed by, practitioners.

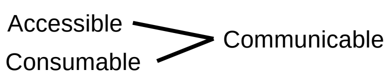

Figure 2.8: Dimensions Building Up Communicable Research

Thus, *Communicable*, as described in Figure 2.8, means that the research must be accessible (Benbasat & Zmud, 1999) and consumable (Robey & Markus, 1998), which includes reaching the consumer and feeling real (Rubin & Rubin, 1995).

Summing Up

Putting together the three pieces discussed above, produces a model for describing “Credible Contributory Communicable research”, see Figure 2.9.

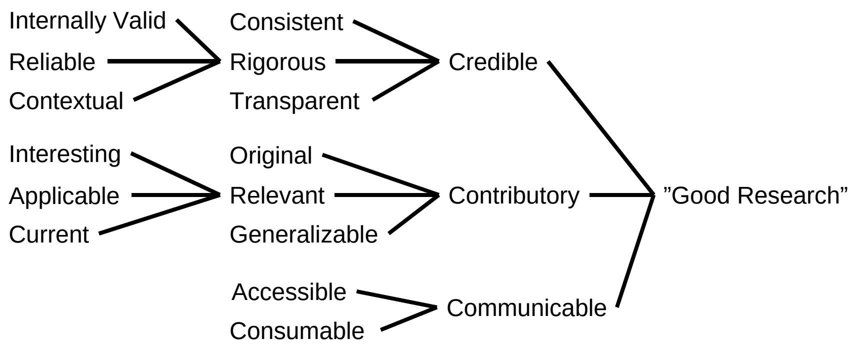

Figure 2.9: Aggregated Research Evaluation Dimensions

Research that is satisfactory along these dimensions makes up what this author considers to be “good research”.

2.5 EVALUATING RESEARCH

Evaluating one's own research is obviously a difficult, but necessary, thing to do. The present research will be evaluated using Figure 2.9. Note that this is a retrospective evaluation and as such may well be read after chapters 3 through 12.

2.5.1 Credible

The first question to be addressed is whether the research is credible, which entails asking whether it is consistent, transparent and rigorous, which in turn entails asking whether it is internally valid, reliable and contextual.

Internal validity deals with whether the results of the study make sense. Are the descriptions in the empirical data authentic? One example of how the internal validity of the study has been increased is by having people in the case companies read and comment on case descriptions. The two major validity threats are researcher bias (cf. Fielding & Fielding, 1986, p. 32) and reactivity (cf. Miles & Huberman, 1994, pp. 265-266), and they have been consistently considered during the study. It is not possible for a researcher to guarantee that there has been no researcher bias. Instead by being aware of the risk of such bias and the importance of integrity (Maxwell, 1996, p. 91), it is argued that researcher bias has been reasonably well combated in this research. Regarding reactivity, I believe my preunderstanding of the industry has been helpful in understanding and communicating with the interviewees without influencing them by, for example, using a different vocabulary than their own.

The *reliability* of a research study is high if the same results would have been obtained by another researcher. When answering this question it is important to be specific about what type of research has been performed. In this piece of research it is highly likely that the results would have been different to some degree had the researcher been replaced. Compared to experiments in natural science, this would give the research low reliability. Compared to other qualitative research studies, a different judgment may be called for. Given the empirical area chosen and the theories applied, the results are still likely to be dependent on the researcher but maybe less so.

Regarding *context*, the research does relate to existing knowledge within different areas, mainly theories on IT portfolios, sourcing, technology adoption and IT strategies, and it tries to build on the cumulative knowledge within these areas. As discussed in subchapter 12.1 there are a number of main findings building on existing theory and extending it in various ways.

Thus, it could be argued that the research is rigorous in the sense of relating to and building upon existing knowledge.

The *consistency* aspect calls for checking out ideas and responses that appears to be inconsistent and making sure that they are understood (rather than eliminated). In this study, the empirical data has not contained inconsistencies to any substantial degree. Contradictory statements have usually either been on a factual level making them possible to check, or served as examples of different people having different perspectives on the matters at hand.

Measures have been taken to increase the *transparency* of the study, such as describing in some detail the data collection process from industry selection, via company selection to the interview process itself.

2.5.2 Contributory

The question of whether the research is contributory depends upon its originality, generalizability and relevance.

The research is *original* in the sense that it addresses questions on the management of mission-critical IT not usually addressed specifically. It also joins together and applies different strands of research usually not applied in a single research study. As presented in subchapter 12.1, the main findings of the study provide original contributions in terms of new additions to existing bodies of knowledge.

To be *relevant* the research should be interesting, applicable and current. Whether or not it is *interesting* is obviously quite subjective, but practitioners in general would hopefully find the issue of managing mission-critical IT to be of some interest. Moving on to *applicability*, the study can shed light on different approaches to managing mission-critical IT, and furthermore, the main findings do have practical implications (see subchapter 12.1). Practical settings of course imply so many contingencies that providing easy step-by-step rules is not feasible. Regarding being *current*, the research problems the study addresses are certainly still important even though, as may be noticed, some specific choices discussed in the cases are more or less obsolete today. Obviously, what is important is the discussion as such and the pros and cons of new vs. proven technologies and not the specific technologies as such. Thus, it can be argued that the research deals with issues and challenges that are definitely current.

The *generalizability* of the research can be questioned in a statistical sense. In terms of analytical generalization it is easier to argue that the results of the present study are indeed generalizable, i.e. generalizable to theoretical propositions rather than some population of companies (Yin, 1994, p. 10). It is quite conceivable that the propositions and concepts brought forward in this research can also be applied in other cases under different circumstances.

2.5.3 Communicable

When it comes to research being communicable, there is an important distinction to be made between the research study and a specific report or book. A research study can become communicable by using a variety of different types of publication channels. However, focusing on the *accessibility* (Benbasat & Zmud, 1999) of the present volume the intent of the research is that it should be accessible to both researchers and to IS professionals, and effort has been put into increasing the readability of the text. Living up to Rubin & Rubin's (1995) demand that the portrait of the research arena should feel real to the reader has been a priority. Efforts to meet this demand have included having people from the case companies read and give feedback on their respective case studies and by having other people active in the industry read and give feedback on the text.

Robey & Markus' (1998) prescriptions for *consumable* research have been partly met in terms of, hopefully, a consumable research report. Reports in other formats, such as articles, can however serve as important complements in order to reach a wider audience. Other activities aimed at reducing the gap between academicians and practitioners such as finding new models of research and seeking practitioner sponsorship have not been attempted.

3 THEORETICAL FOUNDATIONS

This chapter will lay the conceptual foundation of the study by presenting and discussing existing theories. It is divided into four subchapters. First, IT portfolios will be discussed followed by different aspects of sourcing strategies. After dealing with technology adoption, the chapter closes with a discussion of strategies.

3.1 IT PORTFOLIO APPROACHES

The discussion of IT portfolios begins with a discussion of IT infrastructure. The importance of the IT infrastructure to the competitive strength of companies is well established (Keen, 1991b; Clemons & Row, 1991; Byrd & Turner, 2001) as is the role of flexibility (Duncan, 1995). Even though there is no universal definition of the concept of IT infrastructure, most authors agree that the IT resources making up the infrastructure should be shared between different parts of the organization (e.g. Earl, 1989; Keen, 1991b).

Then the focus turns towards the concept of application portfolios. Application portfolios were introduced by McFarlan (1984) who positioned companies according to the overall expected contribution of information systems to business success. Later, it was pointed out that companies are likely to have different systems with different strategic importance (e.g. Ward et al, 1990[8]).

Finally, there is a discussion of the relationship between the concepts of IT portfolios, IT infrastructure and application portfolios.

3.1.1 IT Infrastructure

Different Types of Definitions

In this section, two questions will be discussed: “What is an IT infrastructure?” and “Why is it important?”.

It can easily be established that a common definition of the concept IT infrastructure is yet to be agreed upon[9]. Not only are there different answers

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[8] Later, new editions of this work have been published (Ward & Griffiths, 1996; Ward & Peppard, 2002) presenting the same ideas.

[9] Merriam-Webster (2002) defines infrastructure as ”1 : the *underlying foundation or basic framework* (as of a system or organization) 2 : the permanent installations required for military purposes 3 : the system of public works of a country, state, or region; also*: the resources (as personnel, buildings, or equipment) required for an activity*” [emphasis added].

to the question, there are even a number of different ways to go about answering it. One approach is to discuss a content definition; another is to follow a usage definition approach. Yet another way is to rebut the question and instead answer a quite different question "when is an IT infrastructure?" This subchapter covers these different approaches to the question in turn.

Common to all content definitions is that the IT resources that make up the infrastructure should be shared between different parts of the organization or business units (e.g. Broadbent & Weill, 1997; Earl, 1989; Keen, 1991b; Weill, 1993). Most existing content definitions also include the basic technology components and some add resource planning and management (Duncan, 1995).

Broadbent et al (1999) define IT infrastructure explicitly as "*the base foundation of budgeted-for IT capability (both technical and human), shared throughout the firm in the form of reliable services, and centrally coordinated*" (p. 160).

This definition is representative of definitions focusing on what an IT infrastructure is and what it is not, i.e. content definitions. Some definitions are more explicit, such as Earl (1989) whose operational definition consists of the four elements described in Table 3.1.

Element	**Description**
Computing	Hardware and operating system software
Communications	Networks for interlinking and interworking
Data	Data assets and the requirements of use, access, control and storage
Applications	Main application systems, their functions and relations and development methods

Table 3.1: Infrastructure Elements (Earl, 1989)

Definitions that go beyond the technical issues, by for example relating to IS planning and management of IT, usually have three common factors: alignment, architecture and skills (Duncan, 1995). Alignment deals with the alignment between the business and the IT support. Architecture, in Duncan's terminology, relates to the IT strategy of the company. An architecture provides a "*framework for analysis, design and construction of IT infrastructure which guides an organization over time*" (Earl, 1989, p. 97). Skills, finally, pertain to the expertise of people of the company.

Another way of defining a phenomenon is to look at its use, i.e. a usage definition. There is a fairly wide consensus regarding the purpose of an IT infrastructure. Most existing definitions state in some way or another that the purpose is to "*provide a foundation to enable present and future business applications*" (Duncan, 1995, pp. 39-40). Weill et al (1994) state this similarly, namely that it provides "*the base technical and managerial foundation for application systems that support business processes*" (p. 3).

Keen (1991b) defines the business functionality of the IT infrastructure in terms of two characteristics, reach and range. *Reach* refers to the linking capability of the platform - "Who is Accessible Through Our IT Platform?" Maximum reach means the ability to connect to anyone, anywhere. *Range* refers to the degree to which information can be shared across systems - "What Services Can We Automatically and Directly Share Across the Platform?" As simple as the concepts of reach and range might seem, they sum up much of the role of the IT platform of a company, i.e. providing capabilities throughout the organization.

The almost mechanical view of infrastructure embedded in both content and usage definitions is challenged by some authors. A slightly different way of approaching the problem is presented by Weill & Broadbent (1998) who, in addition to defining the concept, also focus on how management views firm-wide infrastructure and how investments are analyzed. This is similar to a usage definition, but it is more of a purpose definition as the usage concept applies more abstractly, what purpose the infrastructure is supposed to fulfill. They identify four different views of the role of the infrastructure, which are described in Table 3.2.

View	**Description**
None	No infrastructural view of IT exists.
Utility	IT infrastructure is seen as a way of saving costs through economies of scale.
Dependent	Investments in IT infrastructure are made to meet the needs of the current business strategy.
Enabling	Investments are related to long-term requirements for flexibility. The IT infrastructure is used proactively to drive business initiatives.

Table 3.2: Different Views of IT Infrastructure (Weill & Broadbent, 1998)

Yet another approach is taken by Star & Ruhleder (1996) who reject the question "What is an IT infrastructure?" Instead they claim that a tool cannot be studied in isolation; the infrastructure is something that emerges. Thus, the relevant question is “When is an IT infrastructure?” As an answer to this question they consider an infrastructure to occur *“when the tension between local and global is resolved*” (ibid., p. 114). By this they focus on situations where local practices or actions are enabled by larger-scale technology. They do not focus on the physical perspective on infrastructure, instead they take on a relational perspective choosing to view infrastructure as something that emerges in relation to organized practices.

The different types of IT infrastructure definitions are summarized in Table 3.3.

Definition	**Description**
Content	Defined by what belongs to it
Usage	Defined by what it is used for and what it provides
Emerging	Emerges when local - global tensions are resolved

Table 3.3: Different Kinds of IT Infrastructure Definitions

It is important to note that the different approaches to defining IT infrastructures are not contradictory. Nor are they different answers to the same question. Instead they ask and answer different questions that all pertain to IT infrastructures.

Infrastructure and Flexibility

The importance of the IT infrastructure to the competitive strength of companies has been pointed out on many occasions (e.g. Keen, 1991b; Clemons & Row, 1991; Weill et al, 2002). One of the main tasks of the IT platform is to provide flexibility for the business (Allen & Boynton, 1991). The essence of such flexibility is to be able to respond to events instead of having to obey policies fixed at the beginning of the life cycle (Taudes, 1998). According to Keen:

> *The firm’s IT platform is a major determinant of its ‘business degrees of freedom’ for the 1990s [...] The platform enables or disables future business options. (Keen, 1991b, p. 39)*

Duncan (1995) uses connectivity, compatibility and modularity to operationalize technical IT infrastructure flexibility. *Connectivity* refers to components’ ability to connect to other components inside or outside of the company. *Compatibility* deals with the ability to share information across components. *Modularity*, finally, is the degree to which components can be easily added, removed, or updated. Based on a literature study, Byrd & Turner (2002) performed an empirical investigation directed towards both technical and human IT infrastructure flexibility. Based on their survey they were able to reduce eight factors derived from the literature to just three: integration, modularity, and IT personnel flexibility.

Duncan (1995) identifies two ways in which the company's business capability is affected by the IT infrastructure's flexibility. The cost and feasibility of IT-based business innovation depend on the flexibility of the infrastructure. Second, it affects the ability to enhance business systems.

The information systems' ability to absorb change is extremely important, especially given the large investments being made in information systems (Gunton, 1989). Being forced to make major investments because of lack of flexibility of existing systems is not compatible with staying competitive. Of course, flexibility does not come for free, as it usually adds near-term cost and complexity (Weill et al, 1994).

3.1.2 Application Portfolios

On a different level, with less focus on the technology per se and more focus on the applications, the concept of application portfolios is pertinent. The portfolio approach was introduced by McFarlan who first used it as a tool for managing a set of IS development projects (McFarlan, 1981) and later (McFarlan et al, 1983; McFarlan, 1984) for positioning companies according to the overall expected contribution of information systems to business success. The two variables used by McFarlan were *Strategic impact of existing operating systems*[10] and *Strategic impact of application development portfolio* (see Figure 3.1 below).

The usefulness of matrix analysis approaches is supported by Ward & Peppard (2002) who note that such approaches are "*attractive because they reduce an apparently infinite continuum of alternatives to a manageable, pertinent number of discrete options from which high-level directions can be determined*" (p. 303). Ward also illustrates this when evaluating investments (Ward, 1990)[11].

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[10] Note that McFarlan uses "operating systems" to refer to generic "systems that are operating" and not to operating systems specifically such as e.g. Windows, Linux, Unix or MacOS.

[11] It is important to note that matrices and "matrix analysis" in this respect serve illustrative purposes and are typically qualitative tools in contrast with formal matrix algebra.

		Strategic Impact of Application Development Portfolio	
		Low	**High**
Strategic Impact of Existing Operating Systems	**High**	Factory	Strategic
	Low	Support	Turnaround

Figure 3.1: Positioning Companies Based on IS Impact (McFarlan, 1984)

Vitale uses a similar matrix but instead considered the "*future competitive importance of IS to industry*" (Vitale, 1986, p. 332), thus indicating that not everything is up to the individual company. Instead, its future is significantly shaped by its environment. Parsons (1983) noted that different applications within a company play different roles as they support different business strategies.

Parson's idea was later supported by studies that showed that individual companies were likely to have different applications with different strategic importance (Hirschheim et al, 1988). Later on, Ward & Peppard[12] (2002) embraced this fact and proposed the matrix illustrated in Figure 3.2 for structuring the application portfolio, where they refer to an application as "*the use of IT to address a business activity or process*" (Ward & Peppard, 2002, p. 4)[13].

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[12] The matrix was originally presented in Ward et al (1990), which is an earlier edition of Ward & Peppard (2002).

[13] It is noteworthy that this formulation of the concept is an addition compared with the previous edition (Ward & Griffiths, 1996). In the first edition, the current application portfolio is described as "*the portfolio of current systems that supports the business*" (Ward et al, 1990, p. 100). There seems to be a shift in the interpretation of "application", where the latest edition defines it differently than earlier editions adding the usage aspect. The impact on the presentation as such from the new definition seems limited.

Degree of Dependence of the Business on Application in Achieving Overall Business Performance

Potential Contribution of Application to Achieving Future Business Goals	**Low**	**High**
High	*High potential* May be important in achieving future success	*Strategic* Critical to sustaining future business strategy
Low	*Support* Valuable but not critical to success	*Key operational* Currently depended on by the organization for success

Figure 3.2: Applications and Business Contribution (Ward & Peppard, 2002)

Strategic systems might help the company to gain competitive advantages in the future. Often, time is very important since windows of opportunity tend not to remain open very long in a competitive market. Strategic systems often use fairly new technologies since they are pushing forward and trying to enable new business initiatives.

High potential systems are not usually used in the business but can rather be seen as "insurance policies". Ward & Peppard (2002) compare these systems with ordinary research and development efforts and predict different outcomes depending on the result of the research. High potential systems can turn into, or enhance existing, strategic systems or enhance the quality of key operational systems. A third possibility is that they increase the efficiency of existing support systems.

Key operational applications are vital for running the business. If they fail, parts of the business come to a complete standstill. The quality of the system is extremely important since it must always function well. Examples of this kind of systems are the reservation system of an airline and the electronic trading system of a stock exchange.

Support applications are important in order to run the business, but not critical for the success of the business. The business could go on for quite a while even if the system were to break down. Examples of this kind of systems are general ledger systems. When developing support applications, cost is considered the only way to gain a competitive advantage (Ward & Peppard, 2002).

While Ward & Peppard focus on what the different applications are used for, Lacity et al (1996a) instead take on a contribution perspective in their business factor matrix, which will be further discussed below (see section 3.2.3 Deciding What to Outsource on p. 55). The matrix is used for suggesting suitable sourcing strategies for different applications. The two dimensions used are *Contribution to competitive or business positioning* and *Contribution to business operations*. The former deals with whether the IT activity distinguishes the company from its competitors, i.e. whether it is a *Commodity* or a *Differentiator*. The latter does not deal with the type of contribution, but rather the extent of the contribution. This spectrum goes from *Useful* to *Critical*. Even though this matrix is developed primarily to discuss IT sourcing, it is a useful tool for describing and analyzing application portfolios in general.

Based on Earl (1989), Weill & Vitale (1999) use a portfolio approach to discuss the "health" of the application portfolio. It is based on an assessment of five related attributes: importance to the business unit, investment, technical quality, level of use and perceived management value. They use the dimensions technical quality and management value in the matrix shown in Figure 3.3. Individual applications are then placed in this matrix, where Weill & Vitale (ibid.) suggest using size and color to describe importance and investment.

		Technical Quality	
		Low	**High**
Management Value	**High**	Upgrade	Nurture
	Low	Consolidate or eliminate	Question

Figure 3.3: IS Application Health (Weill & Vitale, 1999)

Different managers are quite likely to judge the health of an application portfolio differently because of their different perspectives and experience. In fact, the assessment itself provides a "*vehicle for dialogue between IS managers and line managers*" (Weill & Vitale, 1999, p. 602).

Another distinction made for information systems is between directive and operational systems (Sundgren, 1992). Directive systems are used when making strategic long-term decisions, while operational information systems are used for making decisions concerning the daily operations of the company. A similar dichotomy can be found in Samuelson (1990), who distinguishes between using accounting information for control or for operational purposes.

3.1.3 IT Portfolios

Turning attention to IT portfolios, the work of Weill & Broadbent (1998) is used. They identify four different types of objectives that can be achieved by investing in IT: infrastructure, transactional, informational, and strategic. The objectives are not mutually exclusive, i.e. a new investment can have more than one objective. Different objectives then lead to systems of the four types indicated in Figure 3.4, which together make up what Weill & Broadbent call the IT portfolio.

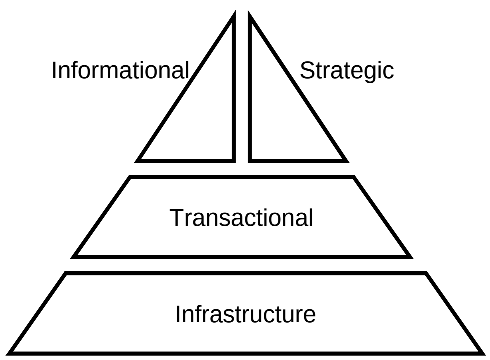

Figure 3.4: Management Objectives for IT Portfolios (Weill & Broadbent, 1998)

Infrastructure is largely what was discussed in section 3.1.1 IT Infrastructure. Weill & Broadbent (1998) assign centrally coordinated, reliable, shared services to this objective. They also conclude that the "*information technology investment, which uses and sits on top of this infrastructure, is made up of the applications that actually perform the business processes*" (ibid., p. 26).

Transactional IT automates basic repetitive transactions, be it order processing or accounts payable. These systems depend on the infrastructure, and the cost of building them is reduced if the necessary infrastructure is in place. Similarly, the transactional systems are usually a necessary precondition for informational or strategic systems.

Informational IT provides information for managing and controlling the company. Different kinds of management support systems belong to this category. They typically use the data created in the transactional systems, and assist the users who bring this data to bear on decision-making at different levels in the company.

Strategic IT differs from the other three, as the explicit purpose is to gain competitive advantage. This objective is the same as the strategic systems discussed by Ward & Peppard (2002). As Weill & Broadbent (1998) point out, strategic systems tend over time to lose their strategic importance and become transactional or infrastructural.

3.1.4 Summary

IT Infrastructures, Application Portfolios and IT Portfolios

The three topics discussed in this subchapter, IT infrastructures, application portfolios, and IT portfolios, are closely related. The infrastructure provides the foundation on which the application portfolio resides, as depicted in Figure 3.5. Taken together they make up the company's IT portfolio.

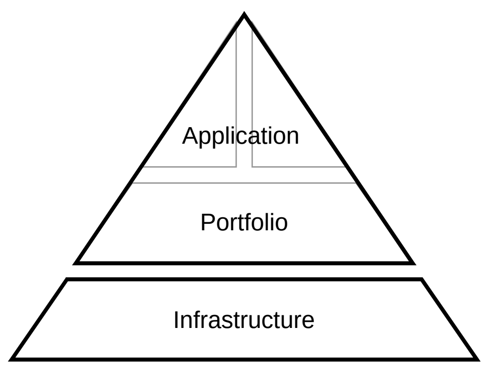

Figure 3.5: Summary IT Portfolio

Going into finer detail, Weill & Broadbent's transactional, informational and strategic objectives for an IT portfolio can be related to Ward & Peppard's four different types of business contributions making up the application portfolio. It is important to note that Table 3.4 is a way of relating the main ideas behind the two different classification schemes, and not a strict one-to-one mapping of the concepts.

Ward & Peppard (2002)	Weill & Broadbent (1998)
Key Operational	Transactional or Strategic
Support	Transactional or Informational
Strategic	Strategic
High Potential	Strategic

Table 3.4: Relating Different Classifications

Mission-Critical IT

As stated in chapter 1, in this research mission-critical IT is interpreted as *IT that either is, or is intended in the future to be, necessary for the execution of those business processes needed in order to accomplish the firm's business strategy or for gaining competitive advantages in some other manner*.

In application-portfolio terms (Ward & Peppard, 2002), mission-critical IT typically would refer to strategic and key operational applications, i.e. applications upon which the business is highly dependent in achieving overall business performance (see Figure 3.2 above). As indicated in chapter 1, the notion of mission-critical IT is closely related to Lacity et al's (1996a) concept of contribution to business operations ranging from useful to critical. Using Weill & Broadbent's (1998) view of the IT portfolio the mapping is not quite as close, but mission-critical IT would typically relate to strategic and transactional objectives (see Figure 3.4 above).

Mähring (2002) talks about projects called mission-critical "*meaning that business operations are dependent on the functioning of the information system in question*" (p. 12). The attribute "mission-critical" in this case refers to the project and not the information system, but the basic idea is the same as in the interpretation presented above.

The business process dimension is used to emphasize the fact that what is mission-critical is determined by the company's business operations. Davenport (1993) discusses some processes being central to "*the execution of the firm's business strategy*" (p. 32) and to "*accomplishing the organization's strategy*" (p. 32).

3.2 SOURCING STRATEGIES

This subchapter deals with the sourcing of IT activities, i.e. the issue of whether IT activities are kept in-house or if they are outsourced to external, or possibly semi-external, providers. The focus is on application acquisition itself, rather than operational issues such as the operation of existing applications or help desk activities.

3.2.1 Some Basic Questions

The concept of sourcing strategies is quite a wide area. It basically deals with the issue of how to carry out the activities necessary for the company in focus to deliver its business proposition to the market. In "The Nature of the Firm", Coase (1937) asked two seemingly quite innocent questions: Why are firms created at all? If it is such a good idea, why isn't there one firm doing everything? Coase's own answer to these questions is that increased efficiency can be achieved by organizing activities in firms, but there are also increasing coordination costs as the organization (or firm) grows. The second presupposition is that a market does not come for free, i.e. there is a cost of using the price mechanism of the marketplace. The answer to the two basic questions then simply is that the "equilibrium firm size" is where any increased (decreased) efficiency by increasing (decreasing) the size of the firm is exactly balanced by increased (decreased) coordination costs and decreased (increased) price mechanism costs.

Williamson later developed these arguments into the transaction cost theory (Williamson, 1975, 1985), which is commonly used as an underlying theory for outsourcing discussions (Lacity & Hirschheim, 1993a; Jurison, 1995; Scarbrough, 1998) and also for discussions of make-or-buy decision (Walker & Weber, 1984; Park et al, 2000).

There is a danger, pointed out by Willcocks & Lacity (1998, p. 10), that theories are brought in uncritically from other disciplines without taking into account current debates around the theory in its original discipline. They argue that this has happened frequently with transaction cost theory (cf. Lacity & Willcocks, 1996), which in itself has been questioned (Slater & Spencer, 2000). Thus, transaction theory should be applied with some caution. It does however provide a relevant perspective based on the notion that "*If firms and markets are* alternative *modes of organizations, then the boundary of the firm needs to be derived rather than taken as given" [*emphasis *in original]* (Williamson, 1996, p. 133).

The basic question of how to source activities is dealt with in many different ways. In this subchapter the question is dealt with mainly from an outsourcing perspective. The typical questions asked in this strand of research are “should we really be doing this? Isn’t someone else better suited to do it?” Vertical integration is mentioned briefly, where the question is “should we extend the boundaries of our organization to include more parts of the value chain?” Software make-or-buy issues conclude the subchapter and present the perspective “given that we have to acquire this [application, product, etc], should we build it ourselves or should we buy it from someone else?”

3.2.2 Outsourcing: Some Definitions

Outsourcing is not a new concept. As early as 1963, Electronic Data Systems took care of data processing services for other companies (Lacity & Hirschheim, 1993b). Since Eastman Kodak’s decision in 1989 to outsource its IT activities, the drivers for outsourcing have primarily been cost-effectiveness, avoiding building in-house skills, and access to special functional capabilities (McFarlan & Nolan, 1995). Eastman Kodak being the first major company to outsource its IT department, and being successful at that, created quite an interest in outsourcing (ibid.; Lacity & Hirschheim, 1993b).

Since then, the outsourcing industry has grown tremendously, and it now encompasses all types of IT services. McFarlan & Nolan (1995, p. 11) suggest two factors that have affected this growth, namely “acceptance of strategic alliances” and “IT’s changing environment”. By the strategic alliance factor, they refer to companies needing long-term relationships with other organizations that have complementary sets of skills. The second factor means that the rapid IT development has made outsourcing a viable way of getting access to current skills and to cope with technology shifts. Production cost advantages offered by vendors also remain a very important impetus for outsourcing (Ang & Straub, 1998).

To exactly define outsourcing is no trivial matter. Lacity & Hirschheim (1993a) define it as “*the use of external agents to perform one or more organizational activities*“ (p. 2). The same authors also use a similar definition “*Outsourcing, in its most basic form, can be conceived of as the purchase of a good or service that was previously provided internally*“ (Lacity & Hirschheim, 1993b, p. 74). Willcocks et al (1995) even start their paper with a definition: “*In this paper IT outsourcing means handing over the management of some or all of an organization’s information technology (IT), systems (IS) and related services to a third party*” (p. 59).

Willcocks & Lacity (1998) talk of a working definition as (note the inclusion of result in the definition) “*the handing over to third party management of IT/IS assets, resources and/or activities for required result*” (p. 3).

Grover et al (1998) define outsourcing as "*the organizational decision to turn over part or all of an organization's IS functions to external service provider(s)*" (p. 80). Keen (1995) states that *"Outsourcing is the practice of contracting with an outside firm that can afford to hire top technical specialists by spreading their time over a number of contracts"* (p. 211) while Patane & Jurison (1994) use the term to mean *"the practice of subcontracting some or all of a company's information systems services to another firm"* (p. 6).

de Looff (1995) agrees with Ang's (1994) claim that there is both a lack of consensus in defining outsourcing and also many definitions that are neither complete nor mutually exclusive. He chooses a broad definition of IS outsourcing, "*the situation in which part or all of the IS activities an organization needs are performed by one or more external suppliers*" (de Looff, 1995, p. 282).

The directional aspect is very salient in many of the different definitions. Some activity is first performed within the organization and is then later outsourced, or moved, to an outside party. Within the outsourcing strand of research the reversal of outsourcing is also discussed, albeit without the same coherence in vocabulary.

Ang (1994) also subscribes to the notion of outsourcing as moving something across the boundaries of the organization. She distinguishes between three different criteria for determining these boundaries: geographic criteria, legal ownership criteria and control criteria (see Table 3.5).

Criteria	**Description**
Geographic	An activity is performed away from (physically) the organization.
Legal ownership	The focal organization has neither legal ownership of physical assets used nor employs the people involved.
Control	The focal organization relinquishes behavioral control and relies primarily on outcome control (cf. Eisenhardt, 1985).

Table 3.5: Organizational boundaries (Ang, 1994)

Lacity & Hirschheim (1995) deal with the concept of *insourcing*, which they define as "*an outsourcing evaluation outcome which results in the selection of the internal IS department's bid over external vendor bids*" (p. 7). Insourcing in other words means that the activity *stays* within the organization, but only after having been compared to outside alternatives. Lacity & Willcocks (2001) later introduce the concept of backsourcing in a discussion on future sourcing. Backsourcing "*involves taking back in-house what* *was previously outsourced*" (ibid., p. 320), i.e. backsourcing is the reversal of outsourcing. A survey performed 1999-2000 found that almost one third of outsourcing contracts that were cancelled were brought in-house, i.e. backsourced (ibid.).

3.2.3 Deciding What to Outsource

Willcocks & Lacity (1998, pp. 7-8) suggest four main drivers for companies to outsource at all:

- Bandwagon effect ("Everyone else is doing it so why don't we outsource?")
- Cost reduction or containment
- New forms of organization and management
- The IS "Money Sink", i.e. get rid of a troublesome function that finds it difficult to demonstrate its business value (ibid, p. 8; Fowler & Jeffs, 1998).

McFarlan & Norton (1995) apply the strategic grid model (see Figure 3.1 on p. 46) and come to the conclusion that factory and support companies are outsourcing candidates, while turnaround and strategic companies are less so. Note that this overall recommendation relates to the company as such and not to individual applications, thus the criticism that a company has applications of varying importance is still valid (cf. Hirschheim et al, 1988; Ward & Peppard, 2002).

The different arguments for outsourcing can be summarized into three dimensions, *business*, *economic* and *technological*, which leads to three factor matrices (Lacity et al, 1996a; Lacity & Willcocks, 2001).

The business factor matrix (see Figure 3.6) differentiates between the IT activity's contribution to the competitive or business positioning and to the business operations. The contribution to competitive positioning ranges from commodity, when the IT activity does not distinguish the company from its competitors, to differentiator, when the IT activity is expected to lead to competitive advantages. This dimension deals with the type of contribution made by the activity, while the business operations deal with the extent of the contribution (Lacity et al, 1996a, p. 408). The business operations contribution ranges from critical, when the operations of the business are highly dependent on it, to useful, when the business operates better due to their existence (ibid.).

		Contribution to Competitive or Business Positioning	
		Commodity	**Differentiator**
Contribution to Business Operations	**Critical**	Best-source	In-source
	Useful	Outsource	Eliminate

Figure 3.6: The Business Factors Matrix (Lacity et al, 1996a, p. 407)

The economic factor matrix (see Figure 3.7) differentiates between managerial practices and in-house scale. Managerial practices range from leading to lagging while the in-house scale ranges from sub critical to critical mass (Lacity et al, 1996a, pp. 419-420).

		In-house scale	
		Sub critical	**Critical mass**
Managerial practices	**Leading**	In-source	In-house
	Lagging	Out-house	Compete

Figure 3.7: The Economic Factors Matrix (Lacity et al, 1996a, p. 420)

Note that Lacity et al (1996a) use the term *in-source* to mean bringing others' IT activities in-house, i.e. act as an outsource provider to others in order to achieve critical mass, even though the concept is not explicitly defined. In Lacity & Willcocks (2001) the same matrix is presented but with *best-source* substituted for *in-source*. Best-sourcing is then defined as *"test the market to determine the economic validity of outsourcing"* (ibid., p. 193.).

The technical matrix (see Figure 3.8) uses the degree of technology maturity and technology integration.

		Technology Maturity	
		Low	**High**
Degree of Integration	**High**	Preferred supplier	Preferred contractor
	Low	Buy-in	Contract-out

Figure 3.8: The Technical Factors Matrix (Lacity et al, 1996a, p. 416)

Once again, the same matrix is presented elsewhere (Lacity & Willcocks, 2001, p. 200) but with *strategic alliance* substituted for *preferred contractor* and *fee-for-service contract* substituted for *contract out*.

All in all, these matrices present a rough guideline for how to deal with a specific IT activity.

Another approach to outsourcing decisions is to rely on the risk and return concept of financial economics. Jurison (1995) looks at the possible outsourcing of an activity and discusses what risks would be created by outsourcing it. Some of the risks of outsourcing applications development are loss of control over critical strategic applications, inability to control vendor's cost, schedule, and technical quality (ibid, p. 244). In practice, Jurison suggests plotting activities in a chart with cost savings (return) on the y-axis, and risk level on the x-axis. By drawing a straight line originating from no cost savings at no risk, outsourcing and insourcing candidates can then be identified (ibid, pp. 244-245). However interesting, this approach unfortunately mixes a quantitative underlying model[14], quantitative estimates (cost savings), and a qualitative measure of risk, without discussing the viability of such a mix.

In a similar fashion (albeit without the quantitative approach), Quinn & Hilmer (1994, p. 52-54) point out that the main strategic concerns associated with outsourcing are:

- loss of cross-functional skills,
- loss of control over a supplier,
- loss of critical skills or developing the wrong skills.

This last point can be called into question because the crucial issue is "*whether the necessary expertise can be acquired on reasonably competitive terms when it is required*" (Domberger, 1998, p. 69).

A common adage concerning outsourcing is "Keep the core competences in-house and outsource the rest!" On one level it seems like a natural thing to do. A competence, or knowledge, perspective is also commonly applied to outsourcing issues, especially in studies focusing on the decision-making process regarding whether to outsource and what to outsource. Scarbrough (1998) actually provides one approach to extending Williamson's transaction cost theory with a knowledge perspective, and frameworks have been

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[14] The Capital Asset Pricing Model (cf. Huang & Litzenberger, 1988; Ingersoll, 1987).

presented based on a competence perspective (e.g. Cronk & Sharp, 1995). Quinn & Hilmer (1994) focus on core competencies (cf. Prahalad & Hamel, 1990), which should be kept in-house, and other activities, "*for which the firm has neither a critical strategic need nor special capabilities*" (Quinn & Hilmer, 1994, p. 43).

Lacity & Willcocks (2001, p. 186) argue against the adage "outsource commodity, keep strategic in-house". First, they argue that what is a commodity and what is strategic is not self-evident. They claim that what may seem like a commodity, such as a payroll system, very well can be a strategic application for some companies. Secondly, if IT activities are not salient, top management may be led to believe that there are no strategic IT activities in the company. Scrutinizing these two arguments, it is possible to make the counter-argument that the adage is still true but making the distinction is harder than one might think.

A study of outsourcing within the banking sector confirms that financial motivations and unresponsive IT departments are driving forces for outsourcing, but that study rejects the conventional wisdom that strategic activities should be kept in-house (McLellan et al, 1995). The banks studied considered IS activities to be strategic, but still chose to outsource. Another illustration of this is Huber's (1993) description of Continental Bank's outsourcing. One alleged reason for this is the trend towards strategic alliances with outsourcing partners. Institutional factors have been shown to play an important role for banks' outsourcing decisions (Ang & Cummings, 1997).

Applying Williamson's (1975) perspective, outsourcing, or rather a market solution, is preferable when the benefits in terms of lower production costs (due to economies of scale) outweigh the increased coordination cost of the market solution. Included in this cost is also a monitoring cost (Domberger, 1998). Transaction-cost theory uses three critical dimensions for characterizing transactions: uncertainty, frequency and asset specificity (Williamson, 1985). Focusing on the two latter, where frequency may be occasional or recurrent, and the asset specificity may range from nonspecific via mixed to idiosyncratic, Figure 3.9 describes the resulting six ideal types of transactions.

	Investment Characteristics: Nonspecific	Mixed	Idiosyncratic
Occasional	Purchasing standard equipment	Purchasing customized equipment	Constructing a plant
Recurrent	Purchasing standard material	Purchasing customized material	Site-specific transfer of intermediate product across successive stages

Figure 3.9: Illustrative Transactions (Williamson, 1985, p. 73)

Asset specificity can be divided into different kinds of specificity (Williamson, 1985). *Site specificity* denotes geographical idiosyncrasy, such as co-location of immobile assets. *Physical asset specificity* refers to mobile assets, which are still idiosyncratic such as specialized tools. *Human asset specificity* relates to specialized knowledge in terms of, for example, learning-by-doing. *Dedicated assets*, finally, addresses cases where, for example, an existing plant is expanded on behalf of a specific customer. From an IT perspective the most prominent types are physical asset specificity in terms of tailor made applications and human asset specificity in terms of industry or application expertise. Sometimes asset specificity in general is interpreted as referring to the uniqueness of hardware and software architecture and the skills of the IS employees, without making use of the different kinds of specificity (cf. Cheon et al, 1995).

Williamson (1985) moves on to note that "*where firms are observed both to make and to buy an identical good or service, the internal technology will be characterized by greater asset specificity than will the external technology, ceteris paribus*" (p. 96). This would imply that an application developed in-house would have a higher degree of asset specificity than a similar standard package. This seems plausible as the standard package (hopefully) is designed to be flexible enough to meet the needs of different customers, many of which may not even identified during the systems development.

For the different types of transactions Williamson (1985, pp. 72-79) suggests matching governance structures according to Figure 3.10.

	Investment Characteristics		
	Nonspecific	**Mixed**	**Idiosyncratic**
Occasional	Market governance	Trilateral governance	
Recurrent		Bilateral governance	Unified governance

Figure 3.10: Efficient Governance (Williamson, 1985, p. 79)

Market governance suggests that market solutions are preferable for transactions involving nonspecific investments. Dealing with a commodity increases the potential for economies of scale and decreases the risk for lock-in effects, thus a commodity is more easily acquired on a market.

Trilateral governance is recommended for occasional transactions when idiosyncrasy increases. The third party implied is some arbitration assistance included in the contractual agreement enabling contractual fulfillment in case of differences of opinion.

Bilateral governance is more suited as the frequency increases since the incentive for both parties to continue cooperating increases.

Unified governance, finally, is what Williamson suggests for frequent transaction involving highly idiosyncratic investments as the incentives for both acquiring and providing such products or services diminishes as the idiosyncrasy increases.

Linking this reasoning to the outsourcing literature suggests outsourcing anything demanding nonspecific investments commonly labeled commodity in outsourcing literature (e.g. helpdesk functions). Furthermore, it would suggest a transaction purchasing style (see Figure 3.11 below) for such activities. It would also suggest keeping in-house (Unified governance) recurrent transactions demanding idiosyncratic investments (firm-specific investments). Whether this translates into "strategic IT" is doubtful; on the other hand, the notion of not outsourcing strategic IT is also rather doubtful (McLellan et al, 1995). The higher the asset specificity the more suitable it is for keeping in-house.

Some operations and maintenance activities are likely to be recurrent transactions involving mixed investment characteristics, which suggests Bilateral governance. Applications development activities are likely to be less frequent, i.e. occasional, which would suggest Trilateral governance.

3.2.4 Different Types of Outsourcing

There are two extreme answers to the question what to outsource: everything or nothing. In the more interesting spectrum between these extremes (what could be called selective sourcing) the traditional wisdom is to keep strategic IT in-house and outsource commodities (Willcocks et al, 1995). It has been argued that using a strategic approach to outsourcing means not to ask whether to outsource or not, but rather *"how do we use, if at all, the opportunity of what is available on the IT and services market to leverage business advantage?"* (ibid., p. 61).

By taking into account that the world is not black or white, Lacity et al (1996b) introduce the concept of *selective sourcing,* which they define in quantitative terms based on shares of total resources:

- *Total outsourcing,* where at least 80% of the IT budget is outsourced.
- *Total insourcing,* where at least 80% of the IT budget is retained in-house after outsourcing alternatives have been evaluated.
- *Selective outsourcing,* where some IT functions are outsourced and some are insourced but neither accounts for 80% of the budget.
- *De facto insourcing,* where the internal IT department is used without evaluating outsourcing alternatives.

The concept of *transitional* outsourcing has been introduced, meaning "*the practice of temporarily outsourcing during a major transition to a new technology*" (Willcocks & Lacity, 1998, p. 22). This is however troublesome since companies usually lack the ability to negotiate sound contracts and also to evaluate the vendor's performance (ibid.).

A different take on selectivity is presented by Lacity & Hirschheim (1993a), who present three different types of outsourcing. Here, share of resources is mixed with what type of resources is outsourced.

- *Body shop* means that short-term demand is met by hiring contract programmers managed by company personnel.
- *Project management* is the outsourcing of a specific project or portion of work. The difference from the body shop is that the vendor is responsible for completing the work.
- *Total outsourcing* is used rather as a quantitative measure as it relates to cases where a *significant piece* of IS work is outsourced.

Body shop and project management differ in terms of what is bought from the outside vendor: man hours or results? Willcocks & Lacity (1998) emphasize the purchasing focus, which can be on resources or result, coinciding closely with the body shop vs. project management distinction. They also look at purchasing style, which can be transaction or relationship oriented, providing the four external sourcing options in Figure 3.11. Buy-in means a transaction-based acquisition of resources, while preferred supplier mean a longer-term relationship with an external provider of resources. Such relationships can be seen as a form of vertical quasi-integration (cf. Blois, 1972). The same distinction in purchasing style between transaction and long-term relationship can be made for the buying of results rather than resources. This produces the alternatives contract-out and preferred contractor.

		Purchasing Focus	
		Resource	**Result**
Purchasing Style	**Relationship**	Preferred supplier	Preferred contractor
	Transaction	Buy-in	Contract-out

Figure 3.11: Sourcing Options (adapted from Lacity et al, 1996b)

3.2.5 Outsourcing Experiences

A common thread in most literature is the sound skepticism towards total outsourcing (see Willcocks & Lacity, 1998, pp. 24-25 for a list of renegotiated or terminated contracts). Instead, generally positive effects can be found in cases of selective outsourcing (Lacity & Willcocks, 2001, pp. 5-11). They find that most companies are successful with selective outsourcing strategies and that infrastructure and support activities are most often outsourced (and in general successfully so). There are of course success stories of total outsourcing deals where the outsourcing company is more than happy with the consequences (e.g. Huber, 1993).

Transitional outsourcing in itself seems to be harder, and it has turned out to be troublesome since companies usually lack the ability to negotiate sound contracts and to evaluate the vendor's performance (Willcocks & Lacity, 1998, p. 22). However, Lacity & Willcocks (2001) find positive results from transitional outsourcing despite their earlier skepticism.

Another often cited problem is caused by the longevity of outsourcing deals, where ten years is a common contractual length. There are several reasons why shorter deals are preferable, for example the difficulty of predicting technology and business conditions, the reduced lock-in effect since the vendor will be up for review in a shorter time and the increased possibility of learning from prior mistakes (Willcocks & Lacity, 1998, pp. 21-22). However, often a long contract is necessary for the vendor to recoup initial spending when taking on the contract.

An interesting aspect is the "small world effect". When asked about an outsourcer's keys to success, the president of a major outsourcing provider answered:

> *First and foremost is maintaining your reputation. Outsourcing is a very small town. CEOs are the most important references, and a failed relationship has an overwhelming negative impact. (McFarlan & Nolan, 1995, p. 21)*

So from a vendor perspective reputation is an important factor as it leads to increased trust in the vendor. In that sense the success of Kodak's highly publicized outsourcing deal may not be representative since vendors are likely to behave less opportunistically in such a public deal (Lacity & Hirschheim, 1993b, p. 76). In that sense, being an early mover and attracting a lot of press can be one way of increasing the likelihood of success in an outsourcing deal!

3.2.6 Comparing Outsourcing of IT and Other Activities

An important issue is if IT really is any different. Huber states:

> *Our [Continental Bank] decision to outsource management of the bank's employee cafeteria and other peripheral services, including even legal services, caused little stir in the banking community. However, our decision to outsource almost all of our information technology – the first money-center bank to do so – was something of a revolution. (Huber, 1993, p. 121)*

Huber's perspective is that there really was not that big of a difference for the bank. The opposite opinion is quite common (Lacity & Willcocks, 2001). Issues distinguishing IT outsourcing from the outsourcing of other activities include (ibid., pp. 183-185):

- *Ubiquity*. IT comprises a wide variety of activities and often spans functional boundaries.
- *Development*. It is hard to predict future IT needs due to the rapid development.

- *Economics*. It is hard to measure price/performance ratios for IT activities and they change quickly.
- *Practices*. Efficiency has more to do with IT practices than economies of scale.
- *Switching costs*. The costs of switching outsource providers are extremely high.

These issues seem to suggest that there is something generically different when outsourcing IT compared to for example the employee cafeteria used as an example by Huber. It can of course be argued that "everything is different", i.e. regardless of what activity is outsourced it will have properties that distinguishes it from most other activities. Thus, Lacity & Willcocks' (2001) distinctive issues above are issues that typically make outsourcing IT different from outsourcing other activities.

3.2.7 Vertical Integration: Variation on a Theme

The basic question of what should be done in-house and what should be contracted out has also been discussed from the perspective of vertical integration for quite some time (for a discussion on vertical integration see Porter, 1980, chapter 14). Vertical integration has been defined as "*the combination of technologically distinct production, distribution, selling, and/or other economic processes within the confines of a single firm*" (ibid, p. 300). It is typically considered to be "*a means of coordinating the different stages of an industry chain when bilateral trading is not beneficial*" (Stuckey & White, 1993, p. 71).

For a brokerage, vertical integration of the industry chain would mean for example entering the marketplace business, which is done when order flow is internalized, or integrating towards the customer, which is done, for instance, by providing asset management services.

Application development and IT operations on the other hand, are activities contributing to the company's ability to produce its market offering, if not part of the offering itself. This means that it is not a traditional form of vertical integration, even though sometimes outsourcing is equated with vertical integration (e.g. de Looff, 1998). The perspective used in vertical integration discussions may still be useful though. This perspective is usually diametrically opposed to the perspective found in the outsourcing literature, i.e. the question is what activities currently being performed by others could be brought in-house? Of course some researchers, such as Walker & Weber (1984), do include the possibility of vertical *de*integration.

Motives for vertical integration include cost reductions and increased control of the environment (Scherer & Ross, 1990, pp. 94-95). The importance of both these motives is increased if there is no competitive market for the service or good (Anderson & Weitz, 1986). In fact the failure of a market is perhaps the most important reason to integrate vertically, i.e. no viable market exists where the service of good can be acquired (Stuckey & White, 1993). From an outsourcing perspective, a competitive market would make it more attractive to outsource an activity. Other potential benefits of integrating vertically include increased familiarity with technologies (Porter, 1980, p. 305).

There are drawbacks with vertical integration such as entry costs and reduced flexibility (ibid., pp. 309-315). Actually, Stuckey & White's (1993) recommendation is "Do not vertically integrate unless absolutely necessary. *This strategy is too expensive, risky, and difficult to reverse.*" *[*emphasis *in original]* (p. 76). They identify two reasons for what they consider to be "*excessive integration*" (ibid, p. 76). First, decisions are based on weak, or even invalid, reasoning, such as reducing cyclicality and assuring market access. Second, managers fail to consider different forms of quasi integration, such as strategic alliances and long-term contracts.

3.2.8 Software Make-or-Buy Decisions

Yet another approach to the basic question of what to do in-house and what to let others do is to focus on specific software acquisition situations, for instance the development of a new application of some sort. This question can be seen as closely related to the vertical integration approach. The issue of make or buy becomes interesting partly because the production resource (mainly programmers) needed to "make" instead of "buy" is quite flexible.

After performing a literature review, Rands (1993) drew the conclusion that there was little research on the topic of software make-or-buy. Furthermore, he concluded that the existing research, dealing primarily with standard application packages, either dealt with purchasing patterns (Lees & Lees, 1987; DeLone, 1988) or with creating models for decision support (Bryce & Bryce, 1987; Martin & McClure, 1983). Thus, there was a shortage both of research models for determining software make-or-buy policies and research studies of the procedures managers actually use when approaching the decision. Drawing on Walker (1988), Rands (1993) creates a framework for managing software make or buy. The key aspects are the skills of the company relative to others and the strategic importance of the application, see Figure 3.12 below.

		Company's Skills Relative to Best External Source		
		Low	**Equal**	**High**
Strategic Importance	**High**	Strategic alliances	Tend to make	Make
	Low	Buy	Make or buy	Tend to make

Figure 3.12: Different Strategies for IT Sourcing (Rands, 1993)

Make or buy in Rands' (1993) framework refers to whether "*a firm should provide its own software development resources, or use external sources*" (p. 279). External resources in this context mean that "*suppliers may market specialized software packages for the area concerned […] or undertake bespoke applications projects*" (ibid, p. 280). It is important to note that no distinction is made between software packages and bespoke application projects as external resources, i.e. the focus is on the location of the resource rather than its type.

Rands does acknowledge the somewhat unclear interpretation of the alternatives by suggesting a continuum ranging from "Make Totally" to "Buy Totally" with four different points:

- Internal design and development
- Install adapted package
- Install unadapted package
- Turnkey package

Rands' (1993) two dimensions in Figure 3.12 above partly overlap with Saarinen & Vepsalainen (1994), who identify system specificity and requirements uncertainty as major decision criteria. System specificity varies from systems "common in many organizations" to "highly specific and contingent to one organization". Uncertainty of requirements varies from certain and simple requirements to risky and complex. Coupled to these criteria are the developers' knowledge of the supported business and their ability to specify requirements. These dimensions serve as means to meet the demands stemming from the first two dimensions. If, for example, the developers' ability to specify requirements is low and the uncertainty is high, it is a sign that outside help might be called for.

The wisdom of treating every acquisition separately can of course also be contested. Rands & Kambhato (1996) claim that researchers have concentrated on make-or-buy decisions for individual projects rather than developing strategy models. Ford & Farmer (1986) identify three approaches as operational/cost based, business and policy. An operational/cost-based approach is characterized by individual decisions based on operational costs or cost savings in each case. A business approach is more proactive and is based on a business evaluation and broader criteria than short-term cost and operations. A policy approach is the result of an overview of the company and a pre-meditated choice about what should be carried out in-house and what should be done externally. In the same vein Rands (1993) proposes a combined approach consisting of choices on two levels, strategic and tactical/operational level. The strategic level deals with long-term policies, such as what abilities should be kept within the company. The tactical level deals with the specific occasion and might depend on available capacity. Clearly, the strategic level calls for a policy approach while the tactical level calls for an operational approach.

3.2.9 Towards a Framework for Selective Sourcing

As has been discussed above, different strands of research ask the same fundamental question in different ways as illustrated in Table 3.6. The strong contextual path dependency leads to a lack of acknowledgement of Williamson's point (1996) that organizational boundaries should be derived rather than take for granted.

Body of Literature	Focus	Question
Outsourcing	Move activities out of organization	Should we really be doing this? Isn't someone else better suited to do it?
Vertical integration	Integrate outside activities	Should we extend the boundaries of our organization to include more parts of the value chain?
Make-or-buy	Specific occasion or effort	Given that we have to acquire this [application etc], should we build ourselves or should we buy it?

Table 3.6: Summary of Different Foci in Different Bodies of Literature

The discussion in the literature on make or buy often focuses on where the resources belong. The buy (alt. outsourcing) scenario includes both buying a standard application package and choosing a tailor made application but having it developed by an external vendor. Make or buy is in that sense comparable to internal or external. In an IT setting, a more fundamental issue for the business activities of a company is whether the application should be bought as a standard application package or developed as a tailor made proprietary application.

In the case where a tailor made solution is chosen, important issues regarding the sourcing of coding and project management arise. From a practical perspective the difference between outsourcing project management and development efforts is significant. Lacity & Hirschheim (1993a) distinguish between body shop outsourcing and project management outsourcing, or on a more abstract level, acquiring development resources (code development) and results (project management) (e.g. Lacity et al, 1996b; Willcocks & Lacity, 1998). By extending Ang's (1994) notion of the possible outsourcing of control from the original behavioral control to the control of the application, a more extensive framework can be constructed. It is important to bear in mind that the control of an application is very tightly linked to the responsibility for that application.

This leads up to a framework for selective sourcing (see Table 3.7) distinguishing between four types of development solutions, where the first three are variations on tailor made proprietary solutions. In practice, the types are not likely to be as clear-cut as presented below since, for example, many projects use both in-house developers and external consultants. Moreover, acquiring a standard package is likely to entail modifications of some sort, which would have to be sourced in some fashion.

Type of Solution	**Code Development**	**Project Management**	**Control and Responsibility**
In-house solution	In-house	In-house	In-house
Outside developers	External	In-house	In-house
Turnkey solution	External	External	In-house
Standard package	External	External	External

Table 3.7: Framework for Selective Sourcing

In-house solution means that everything is done in-house with no use of external resources. *Outside developers* means that the company makes use of outside developers, but retains the project management and responsibility for the project, i.e. resources and not results are acquired. *Turnkey solution* means that the company acquires a tailor made application from an external party, which delivers a result (the application) rather than resources (man hours). This type of solutions is sometimes called customized software (George, 2000). *Standard package* means that the company buys a standard package from a software provider that retains the control and responsibility for the application in terms of for example future updates. Control and responsibility for actually using the specific application instance of course lies with the acquiring company.

The important distinction between rows three and four (turnkey solution and standard package) is that a company buying a turnkey solution from, say, a major consultancy company, still owns and controls the solution. For example, they have the right to sell it to others, or turn to others to maintain the application. In the standard package case the company buys a license for the package and controls its use, but not the application itself. Normally, the buyer in such relationships has no right to sell the application to a third party.

As has been discussed above, the proposed framework extends the traditional discussion on outsourcing and make-or-buy decisions by adding the control and responsibility dimension. This creates the distinction between standard packages and turnkey solutions apparent and emphasizes the difference between the two alternatives.

It also contributes to the concept of selective sourcing, which can carry different albeit related meanings. It can be interpreted as outsourcing certain *IT functions* such as operations, applications development or helpdesk services. It can also refer to choosing what applications to outsource. In this case, outsourcing an (existing) application usually means outsourcing its operations and maintenance. In yet other cases it can refer to the outsourcing portion of the overall IT budget (e.g. Lacity et al, 1996b). The present framework provides a vocabulary for defining different sourcing options for application development. This increases precision, both when following the former interpretation, by detailing the application-development concept, and following the latter, by supporting a more nuanced discussion of the different forms the outsourcing of a specific application may take.

3.3 TECHNOLOGY ADOPTION

3.3.1 Innovation and Adoption

> *Perhaps the most general formula for effective innovation is: "An idea; initiative; and a few friends." (Shepard, 1967, p. 471)*

Applying an Organizational Perspective

A lot of research studies how individuals adopt innovations or new technologies (e.g. Davis, 1989; Davis et al, 1989; Agarwal & Prasad, 1999), typically resulting in the S-shaped curve of diffusion (Rogers, 1995). Fichman (1992) introduces the concept of *locus of adoption* (individual vs. organizational). It could be argued that level of adoption is a more suitable term since the term locus may bring in issues of *where* in an organization adoption occurs. In this case the important issue is at what level, individual or organizational, innovation occurs. An in-depth study of innovation in organizations is presented by Zaltman et al (1973).

Studying technology adoption at the organizational level becomes a bit more complicated than studying individuals since:

> *Once a decision to adopt has been made in an organization, implementation does not always follow directly. Compared to the innovation-decision process by individuals, the innovation process in organizations is much more complex. (Rogers, 1995, pp. 371-372)*

Management considerations are also added to the question of adoption (Van de Ven, 1986). A specific complication when moving to an organizational level is the lack of a unitary decision-maker (Fichman, 1992), i.e. an organization's adoption decision is less well defined.

Shepard (1967) describes how some organizations become *innovation resisting* when ideas, which are typically generated locally, are not properly reported to the top, where power resides. In practice, this forces innovation to "*take the form of local conspiracies*" (Shepard, 1967, p. 471). *Innovation-producing* organizations on the other hand, he argues, are continuously learning and embracing change.

Technology Providers and Technology Consumers

A fundamental question is the relation between innovation and adoption. A first approximation of an answer may be to consider the company coming up with a new technology to be an innovator and the company making use of the innovation the adopter. The latter will however be an innovator in the business where the technology is deployed.

Robey (1986) describes three different types of innovations:

- *New products*, meaning the development of new products offered to external customers.
- *Administrative innovations*, including changes to an organization's structure or processes.
- *Technical innovations*, involving changes to the organization's technology work process.

A distinction can be made between the first, new products, and the two latter, administrative and technical innovations. The first targets innovations provided by a company *for its customers*. The latter two target innovation aimed at internal use, which of course in the end hopefully will benefit the customer in terms of lower prices and higher quality.

Abernathy & Utterback (1978) discuss and highlight the difference between *Product Innovation* and *Process Innovation*, i.e. the difference between the new product and technology per se, and how it can be used in some business process. Typically, product innovation is done by a technology provider and process innovation by a technology consumer. In contrast to product innovation, process innovation brings with it issues such as implementation and organizational change. IT applications do not fall easily into either category. In a sense it is a Product Innovation, but its usage typically leads to Process Innovation.

In a similar vein, Klein & Sorra (1996) separate source-based stage models *"based on the perspective of the innovation developer or source"* (p. 1057) and user-based stage models, which are *"based on the perspective of the user"* (p. 1057). In source-based models, an innovation is viewed as a new product or service created for a market. In user-based models on the other hand, innovation is viewed as a technology used for the first time by an organization.

Thus, a distinction can be made between acting as a *technology provider* and as a *technology consumer*, see Figure 3.13. "Acting as" are key words, as naturally a company can act both as a technology provider and a technology consumer. A similar approach is suggested by Balcer & Lippman (1984), who use the terms adoption (demand) and creation (supply).

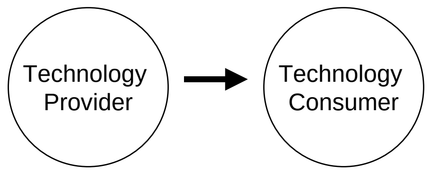

Figure 3.13: Technology Transfer between Provider and Consumer

The innovator – adopter, or provider – consumer, relationship is tied to the technology. The consumer will always be the adopter of the technology, but can also be an innovator in how the technology is deployed.

Different Views on Innovation

The concept of innovation can be interpreted in different ways.

Industry Innovation can denote innovations, where the first organization within some group of organizations starts doing something new. *"We suggest defining innovation as the first or early use of an idea by one of a set of organizations with similar goals."* (Becker & Whisler, 1967, p. 463).

Organizational Innovation can be used when looking only to a specific organization. Daft (1978) defines organizational innovation as *"the adoption of a new idea or behavior by an organization"* (p. 197), which is quite similar to Shepard's (1967) definition *"When an organization learns to do something it did not know how to do before, and then proceeds to do it in a sustained way, a process of innovation has occurred."* (p. 470).

Robey (1986, p. 462) uses the following hierarchy:

- *Change*, referring to any alternation in structure, process, inputs or outputs.
- *Innovation*, referring to change that is new to the adopting organization.
- *Invention*, referring to change that is new to all organizations.

Rogers (1995) in his study of diffusion of innovations takes a more individual approach, defining an innovation as:

> *an idea, practice, or object that is perceived as new by an individual or other unit of adoption. It matters little, so far as human behavior is concerned, whether or not an idea is objectively new as measured by the lapse of time since its*

> *first use or discovery. The perceived newness of the idea for the individual determines his or her reaction to it. If the idea seems new to the individual, it is an innovation. (ibid., p. 11)*

Even though he opens up for “other unit of adoptions”, his focus is on how individuals perceive the idea.

A problem is that “organization” is not always as well defined as one may hope. Individual departments within a large company may for instance have a closer relationship with outside organizations than with other parts of its own organization.

Different Types of Innovations

From a consumer company perspective, or micro perspective, there are several different types of innovation or new technologies. Daft (1978) studies organizational innovation in general, and focuses on idea proposal and adoption decision, consciously leaving out the idea conception phase as well as the implementation of the idea. He presents a dual-core model, consisting of the technological core and the administrative core, explaining from where innovation ideas stem. He concludes that a low degree of formalization, decentralization and high complexity facilitates innovation in the technical core while the opposite facilitates administrative core innovation. Thus, technological innovations tend to be well suited for a bottom-up approach, while administrative innovations often follow more of a top-down approach.

Swanson extends Daft’s model with his tri-core model, claiming that *“IS permeates both the technical and administrative cores”* (Swanson, 1994, p. 1075). Hence, Swanson presents three cores: Technical Core, Information System Core and Administrative Core.

Based on these he presents three primary types of innovations:

- *Type I* innovations are process innovations restricted to the IS core.
- *Type II* innovations are innovations that applies IS products and services to the administrative core.
- *Type III* innovations are innovations that integrate IS products and services with core business technology and typically also affect the general business administration.

An empirical test of Swanson’s model is presented in Grover et al (1997), whose overall results support the model. They do point to some factors blurring the lines between the different innovation types, such as infrastructural innovations, which may enable different types of innovation and may thus call for a separate (fourth) innovation type.

When is the Right Time to Adopt an Innovation?

> *All advantages erode. As competitors copy an advantage, it is no longer an advantage. It is a cost of doing business. (D'Aveni, 1994, p. 233)*

The question of when to adopt a new technology has been studied for quite some time (e.g. Scherer, 1967), and it can be shown that diffusion in terms of different adoption dates follows even in the case of ex-ante identical companies and no uncertainty (Reinganum, 1981). Reinganum equated adoption with successful implementation, which is unfortunately not always true. In fact, there is an important distinction to be made between successful innovations and successful implementation of innovations. It is not only the willingness to adopt that is important, but also the ability to do so (Fichman, 1992). A successful innovation that is not implemented successfully will still not contribute to the organization (Klein & Sorra, 1996).

Reinganum's analysis has been extended to deal with different payoff structures for adoption (Götz, 2000) and deal with the possibility of preemption, i.e. no assumption is made that the firms precommit to adoption dates (Fudenberg & Tirole, 1985). Hoppe (2000) extends this thinking and shows that fairly small increases in the probability of success can switch adoption strategies from a waiting game to a preemption game, which typically reduces the payoff for the companies.

In reality, most technologies do not come as packaged deals, instead they are subsequently enhanced in such a way that it is more plausible to talk about sequences of innovations. This leads to wait-and-see behavior as *"a firm may be unwilling to introduce the new technology if it seems highly probable that further technological improvements will shortly be forthcoming"* (Rosenberg, 1976, p. 525). This is further elaborated by Balcer & Lippman (1984), who shows that postponing the adoption of an innovation becomes more attractive if the pace of innovation increases. More surprisingly, perhaps, they also show that increased uncertainty as to when the improved technology will appear may hasten the adoption. Reduced expectations of future enhancements of the technology can also make it profitable for a firm to adopt a technology that had been rejected earlier (ibid.). A real options perspective has also been applied to the problem of timing investments, both in general (Dixit & Pindyck, 1994; Copeland & Antikarov,

2001) and concerning IS specific investments (Benaroch & Kauffman, 2000; Taudes et al, 2000).

Another aspect of the adoption timing is the (potential) existence of first mover advantages (cf. Lieberman & Montgomery, 1988). The optimal adoption timing depends on the existence of such advantages. Lieberman & Montgomery (1998) identify three primary sources for first mover advantages: *technological leadership, preemption of assets* and *buyer switching costs*.

Mueller (1997) explicates the distinction between demand side and supply side advantages, which is only implicit in Lieberman & Montgomery (1998). On the demand side, Mueller (1997) identifies four types of first mover advantages, where the first three map quite closely to Lieberman & Montgomery's *Buyer Switching Costs*.

Set-up and switching costs arise if, for example, the customers grow accustomed to the new product or if costs are incurred when switching to a different product, thus creating a lock-in effect (cf. Shapiro & Varian, 1998).

Both *Buyer inertia due to uncertainty over quality* and *Buyer inertia due to habit formation* prevent customers from switching to other products or services and both in a sense imply a switching cost albeit not a monetary one.

Network externalities may arise if a customer benefits more as the number of other customers increases, typically leading to bandwagon effects (cf. Rohlfs, 2001).

On the supply side, Mueller (1997) identify four first mover advantages, where the first two relate to *Technological Leadership,* and the last two to *Preemption of Assets*.

Scale economies will benefit the larger player, which will typically be a company already present on the market.

Learning-by-doing cost reductions will also typically benefit the early movers, as they will have more experience than the potential entrant.

Set-up and sunk cost lead to the incumbent (i.e. the company that moved first) facing lower (marginal) costs than the potential entrant.

Network externalities and economies mean that the potential entrant must develop contractual agreements with, for example, input providers, which the early mover will already have in place.

Based on a study of a number of failing first movers, Tellis & Golder (1996) identify five lessons for first movers in order to continue to dominate their respective markets: *Envisioning the Mass Market*, *Managerial Persistence*, *Financial Commitment*, *Relentless Innovation* and *Asset Leverage* (meaning the ability to make use of assets in other, but similar, industries or market niches). Hoppe (2000) supports the "successful second" strategy as her models predict followers to be better off, on average, than first movers.

The result of first mover advantages can be measured in many different ways. It turns out that market share as a performance measure is more likely to find first mover advantages than other measures, such as profit level or survival rate (VanderWerf & Mahon, 1997). The positive effects of early entrance on market share are supported by Hoppe's (2002) identification of preemption and business stealing as reasons for early adoption.

On the other hand, it is not certain that being the first mover is advantageous at all, and investigations into first mover disadvantages have been called for (cf. Lieberman & Montgomery, 1998). Commercializing an emerging technology is of course an inherently risky business. By leaping too far or too soon, companies can deter consumers (Dhebar, 1996). Some studies indicate that the cost of imitating someone else's innovation is significantly less than coming up with it in the first place (e.g. Mansfield et al, 1981). The "Fast Second Strategy" aims at reverse engineering innovations, as detailed early on by Baldwin & Childs (1969). It should be noted, however, that this is not always a successful strategy as imitation cost may well be higher than the innovator's cost, due to factors such as the initial innovator's technological edge. Mansfield et al (1981) note that innovators continue to innovate even though they can be imitated at a lower cost because doing so may well remain profitable by creating repeated temporary advantages. Lee et al (2000) find empirical evidence for the existence of first mover advantages, but also, unsurprisingly, that competitors' actions may reduce the durability of these advantages.

Investing early is usually more expensive than investing late since new technology tends to be more costly than old. On the other hand, if the technology turns out to be successful it might be a source of competitive advantage in terms of first mover advantages. Unfortunately, investing early increases the risk (Keen, 1991b, p. 62). The risk of the project failing is large since the technology has not been tested in similar projects, and it is not as well known as old technologies. This is in line with the project risk notion put forward by Applegate et al (1999, pp. 282-289) singling out project size, technology experience and project structure as dimensions influencing inherent project risk. These dimensions have been extended by Gogan et al (1999), who propose time constraint and system interdependence as additional key influences. Specifically, they compared a traditional high-risk project deploying leading edge technology with a traditional Y2K-project involving older technology and found that the fixed deadline of theY2K-project (namely December 31st, 1999) increased project risk significantly compared to the leading edge project where deadlines were more lax. In a sense, Gogan et al's findings are consistent with Applegate et al (1999), who consider risk to imply the exposure to such consequences as longer-than-expected implementation time. A fixed deadline only implies that these consequences will be significantly more sever, i.e. the project entails a higher risk also from Applegate et al's (ibid.) point of view.

Regardless of whether a company invests early or late, achieving business benefits quickly is paramount. The ability to integrate technology calls for three different capabilities: *knowledge creation*, *knowledge retention* and *knowledge application* (Iansiti, 1998). An ability to shorten lead times gives the company a competitive edge based on the opportunity either to reap the benefits of new technologies earlier than competitors do, or to let the technology mature slightly before trying it.

Adoption of an Innovation Takes Time

The fact that it takes time for an innovation to be universally adopted was established quite some time ago (e.g. Mansfield, 1961) and it can be noted that in fact *"The central feature of most discussions of technology diffusion is the apparently slow speed at which firms adopt new technologies"* (Geroski, 2000, p. 604). In a study of administrative innovation (a particular kind of multidivisional administrative structure), Teece (1980) found that such innovations diffuse more slowly than technology innovations, which is supported by Damanpour & Evan (1984).

Griliches (1957) provides an illustrative example of how a technology innovation (in this case hybrid corn) spreads (geographically) over time. In addition to the normal acceptance problems for innovations, Griliches also adds the availability problem. Given a rapid adoption it is not certain that the technology provider(s) can provide the necessary quantities (in Griliches study a lack of corn slowed down the adoption process). For IT related innovations, lack of expertise and experience is probably more likely than other shortages, such as physical shortage of certain hardware.

There are two commonly observed empirical regularities regarding the adoption of new technologies (Hoppe, 2002). *"First, the adoption of new technology is in general anything but instantaneous. [...] Second, once initial adoption occurs, the inter-firm diffusion path tends to be S-shaped"* (ibid., pp. 56-57). Rogers (1995) provides ample support for Hoppe's argument.

Adoption of New Information Technology

In 1974, Gibson & Nolan's (1974) published an influential article on stages in electronic data processing growth suggesting four stages of growth: *initiation*, *contagion*, *control* and *maturity*. The control stage was later divided into control, integration and data administration for a total of six stages (Nolan, 1979). However, it turned out to be very difficult to operationalize these stages in order to validate them empirically (cf. Drury, 1983).

A slightly different approach was used by McFarlan et al (1983) who identified four phases for technology assimilation, i.e. instead of studying the electronic data processing of the whole company (as Gibson & Nolan did), they studied the assimilation of a specific technology. The four phases are *Identification and initial investment*, *Experimentation and learning*, *Control* and finally *Widespread technology transfer*. With minor adaptations this model is still in use (Applegate et al, 1999).

It is noteworthy that the abandonment phase is not included, or considered, in the model. In Gibson & Nolan's (1974) case this is to be expected since they are studying the company use of information technology, which is likely to be an on-going process up until the company itself is closed down. In McFarlan et al's case one interpretation is that the model is focused on *assimilation* of new technology. The decision not to deal with the abandonment of the technology is not however made explicit. Other studies, such as Nilsson (1991), present a life cycle model for information systems consisting of the three phases development, *operations* and *maintenance* and *decommissioning*.

3.3.2 Different Types of Technology Shifts

Sometimes when there is a new technology there is a period of flux or uncertainty before a dominant design emerges (Utterback & Abernathy, 1975; Abernathy, 1978; Tushman & O'Reilly, 1996; Anderson & Tushman, 1990). Other times there is no such flux or uncertainty. The new solution or technology basically builds on the prior solution. Thus, there are different kinds of shifts from one technology to another.

Radical vs. Incremental

A traditional distinction between different technology shifts is between radical and incremental shifts (e.g. Utterback, 1994; Henderson, 1993). Radical innovation means *"change that sweeps away much of a firm's existing investment in technical skills and knowledge, designs, production technique, plant, and equipment"* (Utterback, 1994, p. 200). Henderson & Clark (1990) argue that the distinction between incremental and radical innovation is incomplete. Instead, they stress the importance of the degree of architectural innovation, which deals with reconfiguration of established systems, where the existing components are linked together in new ways, see Figure 3.14.

		Core Concepts	
		Reinforced	**Overturned**
Linkages between Core Concepts and Components	**Changed**	Architectural	Radical
	Unchanged	Incremental	Modular

Figure 3.14: A Framework for Defining Innovation (Henderson & Clark, 1990)

Chandy & Tellis (1998), on the other hand, provide a wider perspective on a product level as they identify the two dimensions technology and markets, see Figure 3.15. Technology determines to what extent the technology used in the product differs from prior technologies. Market determines whether the new product fulfills key customer needs better than prior products.

		Customer Need Fulfillment per Dollar	
		Low	**High**
Newness of Technology	**High**	Technological breakthrough	Radical innovation
	Low	Incremental innovation	Market breakthrough

Figure 3.15: Types of Product Innovations (Chandy & Tellis, 1998)

Tushman & Anderson (1986) bring a competence perspective on discontinuities, as they distinguish between competence-enhancing and competence-destroying discontinuities. By competence-enhancing discontinuity they mean an order-of-magnitude improvement in price/performance building on existing technologies and existing knowledge. A competence-destroying discontinuity on the other hand, either creates a new product class or replaces an existing product. They are characterized by being so different from existing dominant designs that there is a shift in the skills and competences needed. Thus, existing competences are “destroyed”, or rather rendered more or less useless. The competence-destroying perspective is important when replacing legacy systems (cf. Heygate & Spokes, 1997).

Cohen & Levinthal (1990) use the term *absorptive capacity* for an organization's ability to "*recognize the value of new information, assimilate it, and apply it to commercial ends*" (p. 128). It is important to note that the concept is not confined to acquisition and assimilation of information, but instead includes exploiting the information as well.

Absorptive capacity stems from related knowledge within the company and depends on the absorptive capacities of its individuals. More specifically, Cohen & Levinthal (ibid., p. 132) point to the individuals at the interface between either the firm and the external environment, or between different subunits within the organization. Such individuals are often called boundary spanning (Aldrich & Herker, 1977; Tushman & Scanlan, 1981a, 1981b). Cohen & Levinthal (1990) argue that absorptive capacity is cumulative, which leads to companies to retain familiar technology or solutions.

Thus, when competence-destroying discontinuities appear, companies may face a catch 22. In order to understand that the new technology or solution calls for building up absorptive capacity, i.e. acquiring knowledge and an understanding of it, an absorptive capacity, albeit minimal, is needed.

Sustaining and Disruptive Technologies

The concepts of sustaining and disruptive technologies are introduced by Bower & Christensen (1995) and are discussed in greater detail by Christensen (1997a). Sustaining technologies are characterized by improving "*the performance of established products, along the dimensions of performance that mainstream customers in major markets have historically valued*" (ibid., p. xv). Thus, they tend to provide the customer with "more-of-the-same" regardless of how radical changes they may introduce.

Disruptive technologies, on the other hand, have a different value proposition, offering new features that are compelling to a new group of customers. Often such technologies are weaker in other, traditionally valued, dimensions. Typically, products based disruptive technologies are "*cheaper, simpler, smaller and, frequently, more convenient to use*" (ibid., p. xv). Andy Grove states the key point of disruptive technologies as "*It does not matter how inferior the new approach is. What matters is, is the new approach good enough for the market?*" (Puffer, 1999, p. 18)

It is important to note that sustaining technologies can be either radical or incremental in nature. Thus, there is no direct mapping between sustaining and incremental technology shifts as one may be led to believe. The important difference between the sustaining and the disruptive technology lies in their value propositions, and not, as in the case with radical and incremental shifts, in how something is achieved.

A common trait for disruptive technologies is that the mainstream customers on a market often do not adopt them. Instead the technologies appeal to small special segments, or even completely new sets of customers, which were not attracted enough by the sustaining technology to bother to enter the market.

Disruptive technologies are also often developed and used by start-ups rather than incumbents. Existing companies try to satisfy their existing customers, who usually ask for "more-of-the-same", i.e. are geared towards sustaining technologies.

Yet another aspect of disruptive technologies is that they commonly improve faster than the customers' demands increase. This means that even if the technology is under-performing compared to the established sustaining technology, it catches up sooner or later by undergoing rapid development.

Market Impact of Technology Shifts: Incumbents and Start-ups

Technological development can also provide new entrants with a competitive advantage, thus increasing the contestability (Baumol et al, 1982) of the market. Clemons et al (1996) use the concept of "cream-skimming" to denote entrants that target market niches where incumbents have traditionally over-charged in relation to the product or service delivered.

History has numerous examples (Cooper & Schendel, 1976; Christensen, 1999; Rosenbloom & Christensen, 1998; Clemons et al, 1996) of dominant companies losing their position when a new technology arrives. In every technology shift, two distinct perspectives can be discerned, that of the inventor, or early adaptor, and that of established companies, the incumbent. In technology shifts that bring an end to the prevailing technology, established companies have shown a striking inability to survive. Christensen & Rosenbloom (1995) claim that most studies explain incumbents' problems in terms of the magnitude of the technological change and existing organizational dynamics. In their study, Christensen & Rosenbloom (1995) add the value network of the incumbents where value network refers to *"the context within which the firm identifies and responds to customers' needs, procures inputs and reacts to competitors"* (ibid., p. 234). In fact, listening too much to existing customers and their needs is a key factor when it comes explaining why disruptive technologies are difficult to handle for incumbents (Christensen & Bower, 1996).

The prevalent opinion is that *"established firms are likely to dominate incremental innovation, while entrants are likely to dominate radical innovation"* (Henderson, 1993, p. 252). Channon (1998) argues that in the financial services industry, IT induced change often has been "*pioneered by either new entrants or by maverick operators within the industries concerned*" (p. 197). He goes on to note that "*strategic advantage has often been attained by first movers who have gained positions of competitive advantage whilst scarcely being observed by traditionalists.*" (ibid., p. 197). On the other hand, Pennings & Harianto (1992) argue that accumulation of technological experiences is conducive to innovation, after having studied the propensity of organizations in the financial services industry to adopt technological innovations. Their finding speaks in favor of established firms.

Rosenbloom & Christensen (1998) investigate this further by studying where existing companies usually go wrong. Their conclusion is that it is not primarily an inability to adopt new technology, but rather an inability to change business strategy. Companies comfortable in a value network with existing relations to suppliers and customers rather naturally run into problems when new technologies force them to question this network. Contrary to mainstream research they claim that the *"intrinsic technological difficulty or riskiness"* (ibid., p. 233) does not affect the existing company's ability to survive the shift.

Cooper & Schendel (1976) explicitly adopt the viewpoint of the established company and identify several response strategies ranging from "do nothing" to "seek leadership in new technology". They also include strategies as trying to hold back the new technology, or just monitoring it for possible future action.

Somewhat to their surprise Cooper & Schendel (ibid.) find that incumbents make substantial commitments to old technology, even when sales has already started to decline because of new technology. They refer this back to the decision makers, as they note that not only the existing technology grows old, but also the skills and positions of influence. Adoption tends to be delayed because managers lack the background to comprehend new technologies (Morgan & Daniels, 2001). Of course, that it is not optimal for incumbents to lag behind new entrants is not self evident (cf. Ghemawat, 1991).

Christensen (1997a) claims that the "incumbent's curse", i.e. the notion that incumbents are in trouble when there is a technology shift, comes into play for disruptive technologies. When it comes to sustaining technologies, however radical, Christensen's view is that they often are best mastered by existing companies. Chandy & Tellis (2000) support this since they find no evidence of an "incumbent's curse" in their study on radical, but sustaining, consumer product innovations.

Day & Schoemaker (2000a) contrast incremental innovations with emerging technologies. The latter denotes technologies that *"have the potential to create a new industry or transform an existing one"* (ibid., p. 2) or more precisely technologies where *"(1) the knowledge base is expanding, (2) the application to existing markets is undergoing innovation, or (3) new markets are being tapped or created."* (ibid., p. 2).

Four more or less sequential traps for incumbent companies when facing such emerging technologies can be identified (Day & Schoemaker, 2000b):

- *Delayed Participation*. To watch and wait when something unfamiliar is encountered is both normal and, according to Day & Schoemaker, perhaps rational. What does not fit the current mental models of people are filtered out or distorted. Ghemawat (1991, p. 164) introduces the concept of *efficient underinvestment* for incumbents that (under some conditions rightfully) underinvest in product development and new technologies compared to new entrants.

- *Sticking with the Familiar*. Incumbents tend to stay with the familiar too long. Day & Schoemaker (2000b) bring this back to risk aversion, both political (commission is more "dangerous" than omission) and in the sense of Kahneman & Tversky (1979), i.e. preferring certainty (of the familiar) to the possibly higher, but uncertain, return (of the emerging technology).

- *Reluctance to Fully Commit*. A major concern is profit prospects, which are often unclear. Often developing emerging technologies is less cost effective than relying on incumbent technologies (Morgan & Daniels, 2001). Risk aversion also comes into play, and focusing on existing customers reduces the interest in new products for new customers (Christensen, 1997a).

- *Lack of Persistence*. Giving up too soon if the new technology does not seem to pay off is the fourth and final trap. If the core business is struggling, possible because the emerging technology has increased competition, reducing an upstart effort can be a natural thing to do, at least when applying a short term perspective.

The successful incumbent has to be able to manage new and existing technologies alongside each other. This ability is sometimes called ambidexterity (Day & Schoemaker, 2000b; Duncan, 1976).

Another aspect of new technologies is that they also compete with the incumbent's existing offerings. Copulsky (1976) identifies this as cannibalism, which is framed as a problem to be avoided and *"the lesson to be learned is that cannibalism results from too close identification of a new product with the launching company's older products and established markets"* (p. 105). Mason & Milne (1994) on the other hand focus on identifying cannibalization but they *"do not address if the effects of cannibalization have positive or negative effects on performance"* (p. 164). Cannibalization of existing products is a major concern (Chandy & Tellis, 1998), even though some authors argue that it is optimal in the long run (Nault & Vandenbosch, 1996, 2000).

New technologies can also be a tool for affecting market structure. While being market-driven means taking market structure and behavior as given, driving markets mean shaping or affecting market structure and behavior (Jaworski et al, 2000). There is an important distinction to be made between meeting existing demands and pursuing new business opportunities (cf. Slater & Narver, 1998). Listening to existing customers and providing even better sustaining solutions is an example of being market-driven while disruptive technologies are associated with driving markets. Combining this with Christensen & Rosenbloom (1995) and Christensen & Bower (1996) would suggest that new entrants (being more likely to make use of disruptive technologies) are more likely to drive markets than incumbents, who are instead more likely to be market-driven, listening to their existing customer base.

Surviving Technology Shifts

Tripsas (2000) argues that it is not the technology per se that determines the incumbents' ability to survive a technological shift. Instead, it is the fact that the technology changes other factors, namely relevant complementary assets, relevant competitors and relevant customers, all of which make it hard for the incumbent, see Figure 3.16 below. If these factors are not changed significantly by the new technology, the challenge for the incumbent is much smaller. This is in line with what Christensen & Rosenbloom (1995) call value network.

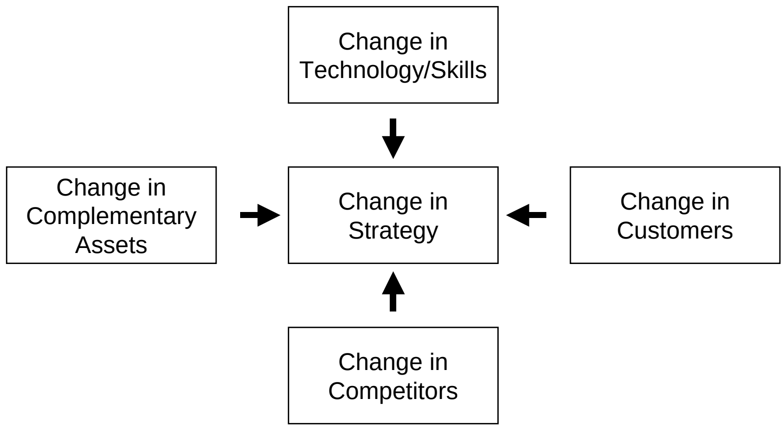

Figure 3.16: Forces Shaping Commercialization Strategy (Tripsas, 2000)

Rothaermel (2000) takes on a more peaceful approach identifying extensive cooperation between incumbents and new entrants in "creative cooperation". This cooperation is related to a shift in not only technology, but also industry structure labeled "complementary innovation". Such an innovation:

> *destroys the existing industry structure, but instead of destroying the incumbent firms with it as in the Schumpeterian model, it results in an industry structure of extensive cooperation between incumbents and new entrant firms that allows for a symbiotic coexistence in an newly defined industry" (ibid., p. 150).*

The value network discussed by Christensen (1997a) pertains primarily to customers, and possibly complementary assets in Tripsas' model. The customer part of Tripsas' model relates to Grove's (1997) extension of Porters five forces, see Figure 3.17 (Porter, 1980).

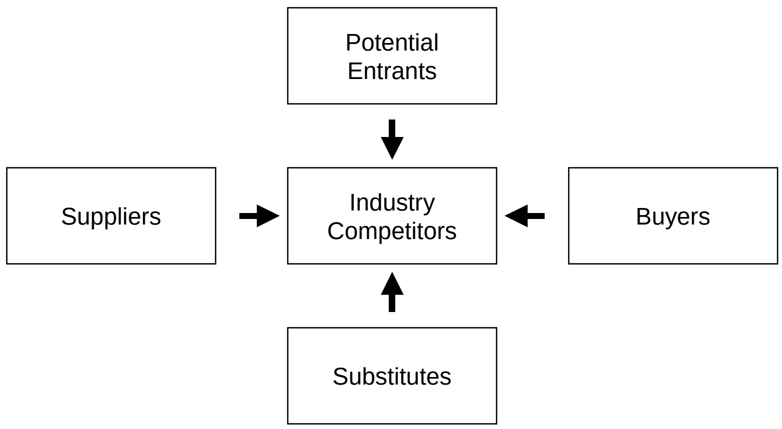

Figure 3.17: Porter's Five Forces (Porter, 1980)

Grove (1997) makes two adjustments to Porters model. He adds the concept of Complementors, and he shifts the perspective from a market or industry perspective to a company perspective. By doing so, he ends up with the model in Figure 3.18.

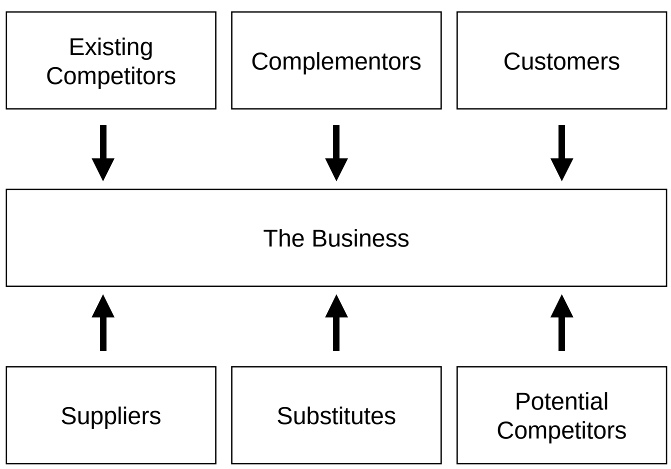

Figure 3.18: Grove's Adjusted Model (Grove, 1997)

Grove (ibid.) argues that during some periods of time, one of these forces is much stronger than the others and that this causes the framework of the business to change dramatically as *"the whole business gets re-invented in a very different way and ends up as a completely different structure"* (ibid., p. 12). He calls this period the Strategic Inflection Point. He even presents a mental "silver bullet test" for recognizing such an inflection point. The test basically asks, *"imagine you have a silver bullet, a single bullet that you* *can shoot one competitor with. Who are you going to shoot with it?"* (ibid., p. 15). When the answer to this question changes, Grove argues, it is likely that you are experiencing a strategic inflection point.

Instead of strategic inflection points, Strebel (1995) uses the term "industry breakpoints" to describe *"a new offering to the market that is so much superior in terms of the value perceived by the customer/consumer and the delivered cost of the offering that it changes the rules of the competitive game"* (p. 11). He distinguishes between divergent and convergent breakpoints, where divergent breakpoints increase the variety of product offerings. Convergent breakpoints, on the other hand, tend to standardize the offerings available on the market. Such breakpoints, be they divergent or convergent, are typically the consequence of new offerings. This subchapter will now conclude with a discussion of existing solutions with which such new offerings must coexist.

3.3.3 Postponing Technology Shifts

> *For as far ahead as any of us can see, today's systems will have to coexist with yesterday's. (Gunton, 1990, p. 193)*

IT Legacy

The delicate task of balancing commitment and flexibility (cf. Ghemawat & del Sol, 1998) poses quite a challenge for managers in information intensive industries. There is a constant need both to respond to what the business needs today and to build a platform for making it easier to do just that in the future. Too many managers have realized that their degrees of freedom today are severely constrained by what was done earlier, i.e. by their IT legacy.

Due to the rapid development of information technology, the timing of adopting a technology is crucial. There are a number of reasons for this, such as the intrinsic uncertainty regarding new technologies, the intangibility of expected benefits and the long-term perspective of committing to a technology (Scarso, 1996). The latter is especially true for infrastructure investments (Weill & Broadbent, 1998).

Legacy systems can be defined as:

> *a large system delivering significant business value today from a substantial pre-investment in hardware and software that may be many years old. [...] It is a business-critical system which has an architecture which makes it insuffi-*

> *ciently flexible to meet the challenges of anticipated future change requirements (O'Callaghan, 1999, p. 6)*

Legacy systems also tend to contain implicit business models, i.e. to prevent changes in business operations (Kelly et al, 1999; an example from the financial industry is provided in Randall et al, 1999). To circumvent this, legacy systems are often embedded in more modern bolt-on systems (Lobaugh & Deshmukh, 2000).

Viewpoint	**What Makes It a Legacy?**
Strategic	Costs more (incl. opportunity cost) than it contributes.
Organizational	Constrains rather than supports changes and responses to new challenges.
Operational	Is in operation but based on obsolete technology compared to what is now deployed by the company.
Developmental	Code that has left development, i.e. anything that is being maintained.

Table 3.8: Viewpoints on Legacy Systems (Alderson & Shah, 1999)

An application can of course be considered to be a legacy from different perspectives. Based on Alderson & Shah (1999), Table 3.8 illustrates four different viewpoints that can be identified when applications are coined legacy applications.

From a *strategic* viewpoint, systems become legacy systems when their financial contribution is less than the cost of operating and maintaining them. Apart from the apparent measurement problem, which is left untouched by Alderson & Shah (ibid.), this is conceptually a straightforward definition.

The *organizational* viewpoint concerns itself with the business processes needed to support the business strategy of the company. Legacy systems are those systems that "*constrain rather than support the ability of the organization to respond to changing environment conditions or to adopt new strategies*" (ibid., p. 115). This viewpoint allows for a positive interpretation of legacy systems as they, even if old and inflexible, support core business process.

The *operational* viewpoint takes its stand in systems operations and the need to provide an efficient service to the business. Legacy systems are systems using hardware and software that the company no longer deploys and for which there may even exist removal plans.

The *developmental* viewpoint focuses on the development of applications and considers anything that is moved into operations a legacy system, which is to be maintained. This viewpoint also notes the need for information and skills when systems are handed over from experts to non-experts for long-term maintenance.

Software Maintenance

Maintaining existing software solutions is an important task for any company and it has been reported that the cost for doing this comprise from 50% to 80% of IS department budgets (Banker et al, 1991, p. 1). It has also been argued that given the amount of resources put into software maintenance research on the topic is scarce (ibid.; Swanson & Dans, 2000).

Gode et al (1990) develop a theoretical model of the maintenance vs. replacement problem and argue that "*there may exist a time when it is optimal (in an economic sense) to rewrite the system*" (p. 160). By extending this model by allowing for, among other things, non-immediate execution of replacement projects, Chan et al (1994) conclude that if the number of change requests is growing rapidly, replacement should be delayed. They also propose that the replacement, or rewriting, project should be staffed with highly skilled people. The argument for this is to minimize the length of the project, and thus to minimize the number of change requests that must be solved in both the old and the new application. Their third and final conclusion is that the maintenance team should be trained with the new technology.

Swanson & Dans (2000) stress the importance of balancing the allocation of maintenance effort with the estimate of the remaining life of the system. A larger maintenance effort may allow for a longer remaining lifetime and vice versa. The causality goes both ways as a projected shorter remaining lifetime may allow for a decreased maintenance effort and vice versa. The independent variables used in their study are system size, age and portfolio complexity, which deals mainly with coordination with other applications in the company IT portfolio.

3.4 MISSION-CRITICAL IT AND BUSINESS OPERATIONS

In this final subchapter the relationship between mission-critical IT and business operations will be covered mainly by a discussion of IT and business strategies. Traditionally, the purpose of IT is to support the business, i.e. business operations have some needs, which are supposed to be met by IT. Thus, it comes as no surprise that different contingency approaches are quite common in IS research, where IS solutions are contingent either on business needs directly or on other factors. In fact, one study showed that over 70 percent of the empirical studies published in two leading IS journals from 1982 to 1988 applied some sort of contingency model (Weill & Olson, 1989).

The contingency theory approach focuses on how organizations must vary in order to cope with changing environments. Lawrence & Lorsch (1969) argue that the traditional question at the time was to find "*the one best way to organize in all situations*" (p. 3). Burns & Stalker (1961) use technology and market changes as contingency factors, finding that a dynamic environment calls for an organic management system, while a more stable environment calls for a mechanistic approach. Lawrence & Lorsch (1967, 1969) studied how the environment influences organizational integration and differentiation. Woodward (1965), in a similar fashion, studied how technology affected the suitability of different organizational structures.

Despite some criticism (e.g. Schoonhoven, 1981; Weill & Olson, 1989) contingency theory approaches have become widely used. Examples of such studies include how IT activities are organized within companies (e.g. Blanton et al, 1992; Brown, 1997; Sambamurthy & Zmud, 1999) and studies of IS planning quality and effectiveness (e.g. Premkumar & King, 1994).

In the remainder of this subchapter, strategies will be discussed as a tool for managing mission-critical IT and dealing with the trade-offs between short and long term issues (cf. Abell, 1993, 1999). Business strategies in general will be covered briefly, followed by a discussion of IT strategies. Alignment issues conclude the subchapter.

3.4.1 Business Strategies

> *[A]ll strategies are abstractions which exist only in the minds of interested parties [...] It is important to remember that no-one has ever seen a strategy or touched one; every strategy is an invention, a figment of someone's imagination, whether conceived of as intentions to regulate behavior before it takes place or inferred as patterns to describe behavior that has already occurred. (Mintzberg, 1987, p. 16)*

What is Strategy?

The area of strategic management is filled with different schools with different views on the world in general and on strategies in particular[15] (cf. Mintzberg et al, 1998).

Chandler (1962) defines strategy as "*the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of actions and the allocation of resources necessary for carrying out these goals*" (p. 13). Thus, he includes in his definition of strategy both goal setting and implementation in terms of "courses of action" and "allocation of resources". This is in line with Chaffee's claim that the general consensus among researchers is that the study of strategy includes both strategy content and its implementation (Chaffee, 1985, p. 89).

Porter (1980) describes competitive strategy as *"taking offensive or defensive actions to create a defendable position in an industry"* (p. 34). Later on, his answer to the question "what is strategy?" is "*Strategy is the creation of a unique and valuable position, involving a different set of activities [than your competitors].*" (Porter, 1996, p. 68).

Mintzberg (1987) presents five different definitions of strategy, Plan, Ploy, Pattern, Position, and Perspective, which are described briefly in Table 3.9.

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[15] Examples of different, but related, schools are the Design School (e.g. Andrews, 1971), the Planning School (e.g. Ansoff, 1965) and the Positioning School (e.g. Porter, 1980). Mintzberg et al (1998) provide a categorization of different strategy schools. An example of the debate between different schools is provided by Mintzberg (1990, 1991) and Ansoff (1991).

Definition	**Description**
Plan	Maybe the most common notion of a strategy. Mintzberg defines this as "some sort of *consciously intended* course of action" [italics in original] (Mintzberg, 1987, p. 11).
Ploy	A Plan that is intended to throw off competitors.
Pattern	Focuses on "*consistency* in behavior, *whether or not* intended" [italics in original] (Mintzberg, 1987, p. 12).
Position	Focuses on identifying and pursuing some market niche (which can be done through a Plan, Ploy or a Pattern (ibid., p. 15). This is close to Porter's (1996) definition (see above).
Perspective	Relates to how an organization perceives the world. Some organizations *"are aggressive pacesetters, creating new technologies and exploiting new markets; others perceive the world as set and stable"* (Mintzberg, 1987, p. 16).

Table 3.9: Different Definitions of Strategy (Mintzberg, 1987)

The different definitions are not exclusive as, for instance, both a plan and a pattern can be used to attain a certain coveted position. Furthermore, Ploy may be somewhat questionable as it is merely an instantiation of a Plan.

Christensen (1997b) argues that developing and implementing strategies is usually not a core managerial competence, and identifies two major challenges. The first challenge is to avoid creating a new strategy that only reflects "*the biases (and possibly ignorance) of the management team*" (ibid., p. 142). The second is to actually allocate resources according to the new strategy. This indicates his view of strategy as a plan to get to some position (by actually allocating resources in order to do so).

Deliberate vs. Emergent

The successful implementation of a plan is not a given. According to Mintzberg (1978) *"strategic change can be viewed as the organization's response to environmental change, constrained by the momentum of the bureaucracy and accelerated or dampened by the leadership"* (p. 941). Such potential implementation difficulties support the distinction between deliberate and emergent strategies, see Figure 3.19 below (Mintzberg, 1978; Mintzberg & Waters, 1982, 1985).

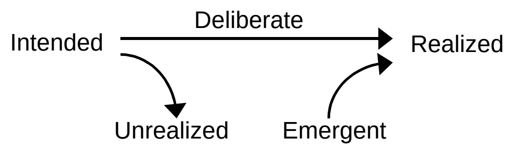

Figure 3.19: Types of Strategies (Mintzberg & Waters, 1985)

When studying realized strategies, Mintzberg (1978) focuses on patterns in decisions as he states that: "*Strategy in general, and* realized *strategy in particular, will be defined as a* pattern in a stream of decisions" *[*emphasis *in original]* (p. 935), where a decision is defined as a commitment to action (usually by committing resources) (cf. Mintzberg et al, 1976). As discussed above, pattern relates to "consistency *in behavior,* whether or not *intended*" *[*emphasis *in original]* (Mintzberg, 1987, p. 12); this is an important distinction as patterns in general can take on any shape whatsoever.

The Plan perspective on strategies, described in Table 3.9 above, focuses on the Intended strategy, maximizing the correlation between Intended and Deliberate strategies, and minimizing the Emergent aspect. The Pattern perspective, on the other hand, looks at the Realized strategy. Another example of a Realized focus is provided by Pettigrew (1985), as he takes strategy to mean "*that which is realised in practice through consistency in a stream of actions and decisions over time*" (p. 438). Thus, he is not concerned with what is intended but instead what is realized.

The emergent aspect can be the consequence of various contingencies in the company. Strong and coherent norms (Eriksson & Mattsson, 1996) can be one contributing factor. Eisenhardt (1985) discusses how organizational control can be achieved by "*[employing] people whose preference coincide with those of management*" (p. 148).

Simons (1994, 1995) describes four levers of control that can be used to guide the process of going from an intended strategy to a realized one, some parts of which emerge:

- *Belief systems* define the basic values, purpose, and direction for the organization. "*Analysis of core values influences the design of belief systems*" (Simons, 1994, p. 170).
- *Boundary systems* establish limits and rules to be respected. "*Analysis of risks to be avoided influences the design of boundary systems*" (ibid., p. 170).
- *Diagnostic control systems* provide formal feedback used to monitor outcomes and correct deviations. "*Analysis of critical perform-*

ance variables influences the design of diagnostic systems" (ibid., p. 171).

- *Interactive control systems* are formal systems used by top managers to involve themselves in their subordinates' decision processes. "*Analysis of strategic uncertainties influences the design of interactive systems*" (ibid., p. 171)

Simons (1995) argues that belief systems affect both intended and emergent strategies by defining the overall mission of the firm. In the same vein, boundary systems help rule out what is not to be done. Diagnostic control systems support the implementation of intended strategies through coordination and monitoring. Interactive control systems on the other hand primarily facilitate the emergence of new strategies.

Furthermore, Simons (ibid.) links the different control systems to different kinds of strategies (cf. Table 3.9 above) according to Table 3.10.

Control System	**Strategy as**	**Description**
Belief systems	Perspective	Obtaining commitment to the grand purpose
Boundary systems	Position	Staking out the territory
Diagnostic control systems	Plan	Getting the job done
Interactive control systems	Patterns in action	Positioning for tomorrow

Table 3.10: Linking Control Systems and Strategies (Simons, 1995, p. 159)

3.4.2 Turning to IT Strategies

Different Kinds of IT Strategies

IT strategy is a broad concept and Earl (1989) distinguishes between three different levels of strategies: IS strategy, IT strategy and IM (Information Management) strategy. The IS strategy deals with aligning IS development with business needs and seeking strategic advantage from IT with a focus on *what* should be done. The IT strategy is concerned with technology policies with a focus on *how* things are done. IM strategy, finally, is "*the management framework which guides how the organization should run IS/IT activities*" (Earl, 1989, p. 117). Earl's definition of IM strategy has since been operationalized further and measured along the following dimensions: Aggressive promotion of IS, Analysis-based Development of IS, Defensive

Management of IS, Future-oriented Development of IS, Proactive management of IS, Conservative Management of IS (Ragu-Nathan et al, 2001). In the following discussion, the overarching use of IT strategy is used and not Earl's narrower definition above.

The Need for Planning

The need to plan the use of IT has long been established (McFarlan, 1971; King, 1978; Boynton & Zmud, 1987). The process of Strategic Information Systems Planning (SISP) has been defined as "*the process of deciding the objectives for organizational computing and identifying potential computer applications which the organization should implement*" (Lederer & Sethi, 1988, p. 445). To an organization SISP normally means carrying out a major, intensive study (Lederer & Sethi, 1996), and it should not come as a surprise that a major problem with SISP reported by Lederer & Sethi (1988) is lack of resources. Note that this does not refer to lack of resources for strategic IS but for strategic IS *planning*. Doherty et al (1999) establish a more continuous perspective as they define SISP as *"an exercise or on-going activity that enables organisations to develop priorities for information systems development."* (p. 263).

Earl (1993) identifies five different approaches to SISP, which are illustrated in Table 3.11.

Approach	**Emphasis**
Business-led	Business planning driving SISP
Method-driven	SISP depends on formal technique or method
Administrative	Resource planning
Technological	Analytical modeling leading to IS-oriented results
Organizational	No well-defined task but based on IS decisions being made through integration between IS and line

Table 3.11: Approaches to SISP (Earl, 1993)

There has been a plethora of research studies focusing on how to actually carry out SISP (e.g. Lederer & Sethi, 1988, 1992, 1996; Henderson & Sifonis, 1988; Doherty et al, 1999), and different methods have been prescribed (e.g. Kovacevic & Majluf, 1993). There have also been attempts to present new methodologies (Min et al, 1999) or to create a theory of SISP[16]

[16] Suggesting that more stable external environments, simpler intern environment and more extensive and higher quality planning resources lead to more effective and efficient planning processes. The same authors also argue that a more comprehensive planning process leads to

(Lederer & Salmela, 1996). Efforts have also gone into evaluating the planning process (King, 1988). There has been significantly less research studying IT strategy content, i.e. the result of the process of developing an IT strategy, than the process itself (Sabherwal & Chan, 2001).

In a study of information strategies at six information-intensive companies, all with a turnover ranging from $100 million to about $5 billion, Smits & van der Poel (1996) found that most of them, but not all, had written information strategies. Pyburn (1983) identified three different approaches to linking IS planning to corporate planning:

- *Written formal* is a structured approach primarily based on the interpretation of written business plans usually resulting in written documents.
- *Personal formal* is a partially structured approach relying on personal communication in formal settings such as steering groups. Plans and documents are seen mainly as documentation of meetings.
- The *Personal informal* approach relies on informal discussions and formal documents are, if they exist, perceived as a "*paper shuffling burden*" (ibid., p. 5).

Linking IT Strategies and Business Strategies

Earl (1989) points to the mutual dependency between business strategy and IT strategy as IT can support the business strategy, but it can also create strategic options. Hence, he continues "*we can state that no business strategy is complete without reference to IT strategy. Conversely, no IT strategic planning is robust unless it is connected to business strategy.*" (ibid., p. 62). On an organization level, the existence of a gap between the IT organization and the line organization has been discussed and analyzed (Ward & Peppard, 1996; Peppard & Ward, 1999).

The importance of linking or aligning IT strategies to business strategies, see Figure 3.20, was identified early on (King, 1978; Hartog & Herbert, 1986; Ward, 1987). Research on this linkage has largely been based upon questionnaires and quantitative analyses (e.g. Pavri & Ang, 1995. Teo et al., 1997, Teo & King, 1996, 1997; Baets, 1996). There are also examples of

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a more useful information plan, which in turn leads to greater plan implementation, which in turn leads to better alignment with organizational goals.

case studies from banking environments (Dutta & Doz, 1995) and the airline industry (Copeland & McKenney, 1988).

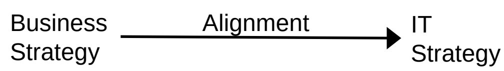

Figure 3.20: Rational View of Business and IT Strategy

As a rather unique approach in this strand of research, Reich & Benbasat (1996) identify two dimensions of the linkage: intellectual and social. The intellectual dimension concerns itself with the content of the IT and business plans and their consistency. The social dimension deals with whether IS and business executives understand each other's objectives and plans. They define the social dimension as "*the level of mutual understanding of and commitment to the business and IT mission, objectives, and plans*" (ibid., p. 58). Instead of only discussing the written documents, they also include the "minds of executives" when determining the linkage between the two types of strategies. Segars & Grover (1999) found five distinct schools of thought representing managerial attitudes, beliefs, and experiences regarding SISP. The schools – design, planning, position, learning and political – are as the authors note strikingly similar to those describing perspectives on the formulation of corporate strategy (cf. Mintzberg et al, 1998).

There have also been (somewhat unanswered) calls for linking *the research* on strategic use of IT to existing bodies of theory. Bakos & Treacy claim that:

> *Much of the current work on the strategic impacts of information technology, despite dramatic references to "strategic tools" and "competitive weapons" makes little or no use of bodies of theory related to either strategy or competition. [...] Approaches drawing on appropriate reference disciplines can avoid idiosyncratic, private theories of the strategic use of information systems. (Bakos & Treacy, 1986, p. 117)*

Too Much Focus on Intended Strategies?

In a study on SISP methodologies it was found that 38% of all projects initiated after the SISP study were not part of the plan and that only 50% of the changes in the IS department recommended by the SISP were carried out (Lederer & Sethi, 1988, p. 455). Cerpa & Verner note that:

> *[Strategic Information Systems Planning] often result in very satisfactory plans, but a lack of management commitment and the absence of the control mechanisms necessary to ensure the success of the plans can impede its implementation" (Cerpa & Verner, 1998, p. 200).*

The IT strategy literature often focuses on the strategy per se rather than discussing how the strategy is communicated within the company. There is a distinction to be made between strategy documents and strategic behavior. There seems to be a common underlying assumption that a strategy document leads to strategic behavior (barring bad management), while the lack of a document leads to the absence of strategic behavior. At the same time it can be observed that even though many organizations do have strategic IT plans, these plans are not implemented very extensively (Gottschalk, 1999).

Despite Mintzberg's impact on strategy research in general, IS strategy research seldom draws on his body of work (Burn, 1993). In the light of Figure 3.19, the focus on intended strategies in the works cited above on IT strategies is striking, especially since it has been argued that the "*notion of realized strategy is very pertinent to the information systems area where developments in the information industry might make it inappropriate to pursue some intended strategies while others emerge*" (Broadbent & Weill, 1993, p. 164).

The focus usually is on the intended IT strategy and its linkage to the intended business strategy. Even if Reich & Benbasat (1996), as an exception, explicitly take the "mind of the executive" into account it still concerns the intended strategy. This is somewhat troublesome as Mintzberg & Waters claim that:

> *conceiving strategy in terms of intentions means restricting research to the study of perceptions of what those who, it is believed, make strategy intend to do. And that kind of research–of intentions devoid of behavior–simply is not very interesting or productive (Mintzberg & Waters, 1982, p. 465).*

One exception is Ciborra (1994), who argues that "tinkering" leads to strategic information systems in the form of "bricolages" and thus opens the door for more incremental approaches. A more recent article by Salmela & Spil (2002) suggests a method for how traditional planning can be combined with more incremental planning, thus allowing for IT strategies of a more emergent character.

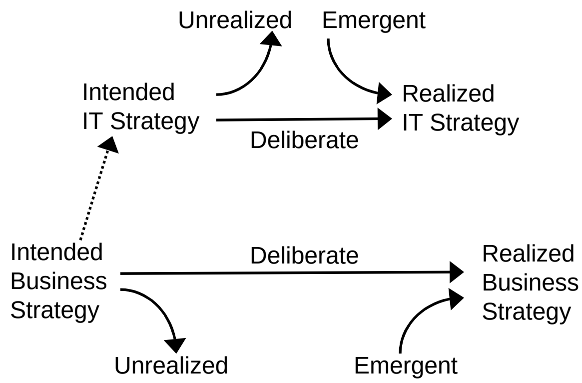

Figure 3.21: What Is Being Aligned?

In light of Mintzberg & Waters' (1985) model (see Figure 3.19), it can be discussed what is really being aligned. Typically, SISP deals with aligning an intended IT strategy with the intended business strategy (Lederer & Mendelow, 1989; Teo & Ang, 1999). Earl (1993) serves as a potential exception as he discusses aligning IT with business needs, without explicating whether this concern needs to be expressed in business plans or realized business needs. As illustrated in Figure 3.21, subscribing to Mintzberg & Waters' view means that alignment efforts do not focus on realized strategies. Explicit discussions of the effect of aligning intended strategies on the alignment of realized strategies seem to be quite rare.

Chan et al (1997a, 1997b) are an exception to the fallacy of focusing on intended strategies, as they explicitly set out to assess the realized information systems strategy which refers to a "*strategy evident in IS investment decisions and IS deployments, as contrasted with vocalized or documented IS strategy*" (Chan et al, 1997a, p. 126). This is in line with Venkatraman's (1989) study of strategic orientation (in general and not IT specific), where strategy is viewed as a pattern of critical decisions.

The fairly strong belief in organizations' ability to put plans into action goes back to at least McFarlan (1971) who states that "*The most significant factors differentiating the companies that are effective CBIS [computer-based information system] users from those that are not are the quality and content of their written plans*" (p. 82). Thus, the leap from the written plan to reality was downplayed somewhat. A more recent example is Teo & Ang (1999), who study critical success factors for aligning IS plans with business plans. Although this is important, it is studied seemingly without consideration of the potential difference between planned and realized strategies.

This belief seems to be planted more firmly in the research on IT strategies as discussed above than in the research on business strategies (e.g. Mintzberg, 1978; Mintzberg & Waters, 1985; Pettigrew, 1985). Overall, the perspective on IT strategy formulation as a rational formal process is omnipresent (cf. Bryson & Currie, 1995) even if there is a second view emphasizing the ad hoc nature of the strategy process (ibid.). In terms of the different schools of strategic management, SISP seems firmly planted in the planning school stemming from Ansoff (1965), characterized by focusing on the planning process, which is seen as decomposable into distinct steps and carried out by planners rather than top executives.

Strategic Alignment Model

When constructing their Strategic Alignment Model, Henderson & Venkatraman (1993) view strategy as involving both formulation, i.e. "*decisions pertaining to competitive, product-market choices*" (p. 4), and implementation, i.e. "*choices that pertain to the structure and capabilities of the firm to execute its product-market choices*" (p. 4).

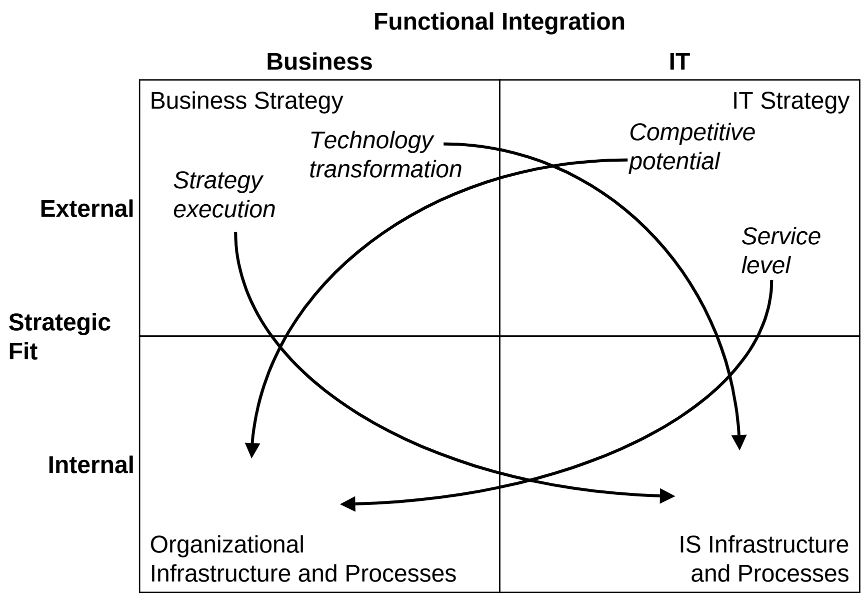

Figure 3.22: Strategic Alignment Model (Henderson & Venkatraman, 1993)

The two main building blocks in the Strategic Alignment Model are strategic fit and functional integration (see Figure 3.22). Strategic fit concerns the fit between external positioning and the internal capabilities to execute the chosen market-positioning strategy. Functional integration deals instead with the capability of the IT strategy to shape and support the business strategy (strategic integration) and the link between organizational and IS structure and processes (operational integration) (cf. Henderson & Venkatraman, 1993).

As described in Figure 3.22, the model acknowledges four dominant alignment perspectives:

- *Strategy execution*, where business strategy drives organizational infrastructure, which in turn drives the design of the IS infrastructure.
- *Technology transformation*, where business strategy drives the IT strategy, which then determines IS infrastructure.
- *Competitive potential*, where the IT strategy drives the business strategy, which then drives the organizational infrastructure.
- *Service level*, where IT strategy drives IS infrastructure, which in turn drives organizational infrastructure.

The Strategic Alignment Model was strongly questioned by Ciborra (1997), mostly for being a top-down abstract model not rooted in empirically observable everyday activities. Sääksjärvi (1997) and Simonsen (1999) both acknowledge some benefits in Ciborra's perspective including the concepts of care, hospitality and cultivation, but while doing so they are not in complete agreement with Ciborra's proposed shortcomings of the model.

It is noteworthy that the Strategic Alignment Model rules out the business strategy directly affecting the internal IS infrastructure. This has later been questioned as the concept of fusion between IT and business strategies has been proposed to further emphasize the tight intertwining of the two (Smaczny, 2001).

An important insight underlying the model is that alignment is *"a journey and not an event"* (Henderson & Venkatraman, 1993, p. 14). The passage of time is explicitly treated in other models as well such as Itami & Numagami (1992). By explicitly bringing in the passage of time, three different modes of dynamic interaction between business strategy and technology can be identified (ibid.):

- *Strategy capitalizes on technology*, where there is a contemporaneous match where the existing technology can act as a weapon to be used, a constraint to be met, or a threat to be dealt with.

- *Strategy cultivates technology*, where the current strategy cultivates future technology, i.e. business strategy choices lead to technology capability accumulation and drive technical development.
- *Technology drives cognition of strategy*, where the is a focus on the effect of current technology on future business strategy.

Thus, both Henderson & Venkatraman (1993) and Itami & Numagami (1992) identify scenarios where the business drives IT and vice versa.

On this note, the chapter on the theoretical foundations of the study is concluded. The four case companies, Lambda, Delta, Tau and Gamma, will now be visited in turn.

4 CASE LAMBDA

4.1 THE COMPANY

4.1.1 History and Background

Lambda[17] was founded in the mid 1990s by Luc Langdon, Frederick Long, and Jim Lee. They are all still working with the company. After the business idea of discount brokerage had been formed, it was a fairly quick process taking some four months from the formal decision to start the business to the first trade on the Stockholm Stock Exchange (SSE).

At this time electronic routing of end customer orders was not yet allowed at the SSE and to CEO Luc Langdon the electronic part was crucial.

> *Being an "ordinary" discount broker might have been worthwhile, but it wouldn't have been interesting enough for me to actually start Lambda. (Luc Langdon, CEO)*

From the very beginning a fourth person joined Lambda, Edgar Lucas, who took charge of developing the trading system, EdbTrade. Lambda started to trade on the SSE about 6 months before EdbTrade was ready, using the standard client application provided by the SSE, Saxess Trade.

4.1.2 Business Vision

Lambda has a very clear business vision consisting of two parts. They want to provide a trading floor feeling[18] for their customers and act as a transaction factory.

> *Access and low price are the cornerstones of what we are doing. [...] You want to give the customer what you have yourself as a SAX[19] broker when you trade. Basically it is*

---

[17] A list of interviewees can be found in Appendix A. The interviews were conducted between January 1998 and March 1998.

[18] "Trading floor feeling" is a voice from the past as there no longer is a physical trading floor at the Stockholm Stock Exchange. What Lambda refers to is the feeling for the market that is usually only available to the stock brokers.

[19] SAX refers to the electronic trading system of the Stockholm Stock Exchange. SAX broker refers to a professional stock broker connected directly to SAX and certified by the exchange.

> *like a SAX broker sitting at the customer's trading desk. (Frederick Long, Head Broker)*

Lambda wants to provide the trading floor feeling by increasing the market transparency for the customer. By using Lambda, customers are on level terms with all other actors on the market. Luc Langdon likes the phrase ”Lambda as transaction factory”, which reflects the initial idea of the company, to act like a factory. Frederick Long supports this view:

> *Really, it [working as a stockbroker] is nothing but a factory work, albeit clean. (Frederick Long)*

These two visions are captured in the concept of "electronic discount" brokerage, where the electronic part is necessary for providing the trading floor feeling and the discount part, i.e. very low prices, are enabled by the transactional, or factory, approach. Lambda's strength emanates from the combination of the two visions. As mentioned above, Luc Langdon thinks that one of these would have been enough but having both gives Lambda an even stronger position. Frederick Long believes that the access to the exchange is even more important than the low prices, which are continuously lowered.

4.1.3 Business Strategy

In line with its dual business vision, Lambda offers no analysis or corporate financial services. They do not have an opinion on which stock a customer should buy or sell, i.e. what trade to make. Furthermore, they never trade in their own book[20]. Thus, Lambda's only source of income is the trades they carry out. They do not make money on anything else, and they see themselves as extremely streamlined compared to the traditional stockbroker. Of course there are drawbacks with not having, for instance a corporate finance department, as Lambda can never offer their customers initial public offerings.

An underlying idea behind the business concept is that low prices make the customers increase their trading. True to the factory metaphor, Lambda prefers to earn a little on a lot of trades rather than a lot on a few trades. A lot of trades create liquidity, which leads to more trades, which creates more liquidity etc. Lambda's most important customers are the institutional investors, i.e. customers that continuously trade large positions. Fast and reliable access gives the customer better control over her orders, for exam-

[20] This guarantees customers that the broker will never piggyback on customer orders or use information on customer orders to benefit himself.

ple making it possibly to quickly withdraw orders if something unforeseen happens. In manual phone based trading, the brokers become a scarce resource in turbulent times.

To Luc Langdon, the electronic trading system, EdbTrade, is a key competitive advantage. It makes it harder to copy Lambda's business concept. Furthermore, it is necessary in order to provide the factory element of the business. He wants Lambda to grow in traded volume without having to increase the personnel, which is perfectly possible if the increased trading is electronic. He guesses that other members with the same trading volume probably have some 20-50 brokers and maybe 100-150 employees (granted that they might do things that Lambda does not do) compared to Lambda's five brokers and a total of 13 employees.

In Luc Langdon's eyes, it is very hard to start a traditional brokerage and create a valuable company since one is too dependent on the staff, especially if the company is small. If key personnel leave, there is nothing left of the company. A driving idea behind Lambda is to be less dependent on key people, at least in the long run. This goal has been partially achieved according to Edgar Lucas , head of IT development:

> *Since Lambda is a small company many things are person dependent, at least in the short run. In the long run, Lambda would cope even if, for example, I left. (Edgar Lucas)*

Frederick Long points out that time is on Lambda's side.

> *It is important that we do not screw up. (Frederick Long)*

Within Lambda's customer segment there will shortly be complete acceptance of electronic trading and discount brokerage. This is a long-term process and Frederick Long thinks that they might be halfway there. It is important for Lambda to deploy EdbTrade clients so the customers can start trading in the new way and get used to it as soon as possible. Frederick Long feels that the value of being first is large when it comes to electronic trading because of switching costs. The matter of habit, rather than their respective functionality, makes brokers prefer one client application to others.

Lambda's basic business idea is stable over time but its implementation changes. The long-term strategy is to take one step at the time and aim for a northern European market. An example of Lambda's implementation of this strategy is their membership in the Helsinki stock exchange and their viewing the Nordic countries as an aggregated market. Today, Lambda aims at linking the markets (primarily stock markets) of Sweden, Finland, Norway and Denmark. Frederick Long thinks that the volume traded on the Finnish market very well might increase when Lambda establishes itself. Their pricing will force other actors to adjust (i.e. lower) their prices which will increase trading, as will the increased access to the market.

> *As Lambda offers more exchanges the customer benefits increase even further. (Luc Langdon)*

Lambda has only institutional customers, i.e. there are no private customers. Other discount brokers target private customer and thus have a lot of possible customers and are closer to retail marketing in their marketing efforts than Lambda, who has only a page and a half of promotional material presenting the company. Since Lambda's potential customers are both fewer and more knowledgeable than a retail broker's, the sales process is less dependent on sales material such as brochures.

Frederick Long actually thinks it is already too late to make money on retail trading on the Internet. It does, however, attract customers you can make money on via other services, net interest etc. When it comes to institutions though in his mind, ”the sky is the limit...”.

4.1.4 Business Activities

Lambda's business activities can be summarized in a single sentence; they help their customers to trade on an exchange. Everything they do is focused on some aspect of this.

Customers can trade either electronically or manually (over the phone) via Lambda, so there is a trading room albeit a small one. If a customer calls Lambda, a broker will enter the order for the customer. The fee is slightly higher if the order is entered manually than if entered electronically, which of course corresponds to the related costs.

There is an implicit distinction between easy trades and harder ones where there is a market impact risk. Trades of the latter kind are sometimes within the industry called block trading or ”up-stairs trading”[21]. Easy trades are typically performed by the customer electronically via the EdbTrade client (buy 10,000 Ericsson, sell 1,000 AstraZeneca). Harder trades are more often done manually over the phone. For such trades the brokers can add value by their knowledge of the market and different actors' positions. Brokers are

[21] The expression ”up-stairs” comes from floor trading where larger orders were not traded on the floor but instead by the head traders located (physically) up-stairs.

basically good at reading the market and thus know what large players do. They also know where there is liquidity, which means that they can manage large blocks of stocks.

The value added based on these strengths resides in how the trades are implemented, for example should the customer wait until the afternoon to buy the stock. To Lambda, the underlying company is not really interesting. They have no opinion on how Volvo is doing and whether it is a good buy in the short or long run. They are however good at buying and selling Volvo stock.

Lambda has a very reactive approach in its customer relations. Since they do not offer advice or analyses, customers are usually not interested in being called by Lambda, unless they have explicitly asked to be called if something specific happens.

4.1.5 Lambda Organization and People

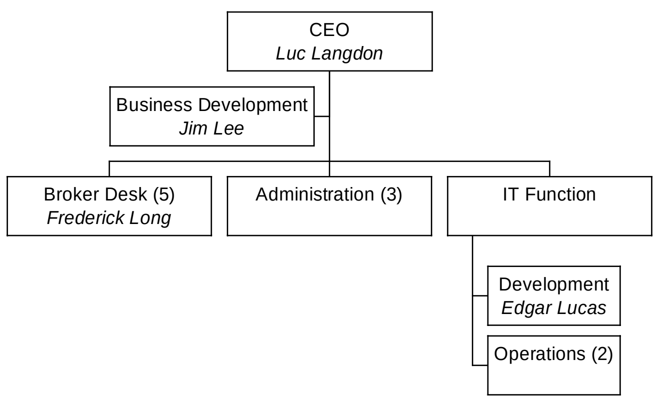

Figure 4.1: Lambda Organization Chart *(Interviewees Included)*

Lambda has 13 employees and the personnel situation has been very stable over time after the initial period of hiring. There are five brokers who take care of the trading desk with manual trading and trading supervision. Three people manage company internal administration and the parts of the back office that have not been outsourced. Even though Lambda has outsourced most of its back office they are sure to retain competence in-house for special circumstances, for example customers calling and making inquiries. If a customer calls or if any problem arises they need back-office expertise even though it may not be necessary in daily operations. Lambda feels that their outsourcing provider has received some criticism, which has been uncalled for, just because some members have lacked the necessary internal competence.

It is between the brokers and the administrators that the two people working with IT operations are located. The CEO, Luc Langdon, occupies one ”glass room” and Edgar Lucas and Jim Lee, head of business development, share another. Luc Langdon has a background as a futures trader and also has a history as an entrepreneur.

Jim Lee has customer responsibilities both when it comes to manual and electronic trading. Prior to joining Lambda he worked for another company in the financial industry, working with introducing electronic trading from a marketplace perspective. He then moved on to long term IT strategy issues like ”How much should we spend on the system platform? How much is it worth to expand the lifetime of an application with a year in five years time when the technology development is so quick?” He has no technical background and is not a programmer even though he is technically competent. He has traditionally worked as a middleman between systems and users, for instance by managing administration and money.

Frederick Long is the head broker at Lambda. He is relatively uninterested in IT per se, but not in what you can do with IT. The brokers at Lambda are homogenous. They all have access to the same information and they all focus on speed and effectiveness. The brokers also know who wants what information and thus whom they should call regarding a specific newsflash.

Edgar Lucas is head of IT development and is responsible for updates and further developments of EdbTrade. He is appreciated throughout Lambda as he can talk with laymen about very technical issues. Luc Langdon thinks of Edgar Lucas as a key to EdbTrade and, thus, Lambda’s success; an opinion shared by Frederick Long.

> *Without Edgar Lucas we wouldn’t be where we are. He is AAA+ on technology and since he has worked as a dealer/broker he understands the business side. (Frederick Long)*

4.1.6 IT and the Business

> *The IT-systems mirror the company at large. It is less surprising when a company with a low quality profile has IT-problems than when a high quality company experiences problems. Given a low cost low quality business strategy, if the IT-systems do not work, so what? It is not that surprising because it is in harmony with the overall image. If on*

> *the other hand say SAX crashes, you get upset because the image of the Stockholm Stock Exchange makes you think that the systems should work. (Jim Lee)*

In Jim Lee's eyes the coupling between the systems and the image of the company is tight. The systems are a part of the company and must be characterized by the company at the same time that they may characterize the company. The strength of this coupling increases as the size of the company decreases.

Lambda is not positioning itself as an IT company even though large portions of its core competence lies in the development and maintenance of EdbTrade. There is a huge difference between positioning IT as an aid and predicting a complete IT-based re-engineering of the financial industry. How it is presented affects the receiver a great deal in Jim Lee's opinion.

> *IT is becoming all the more important and the business is ever more dependent on IT. Historically, IT has been a service function. This has changed and IT is now important for business development, which is a very psychological thing. For the business developer, IT is a tool just like many other tools, but for the IT people it is more than that. (Jim Lee)*

4.1.7 Management of IT Investments

Nowadays, IT investment processes are often initiated by Jim Lee who is most knowledgeable about customer demands. Frederick Long believes the role of the broker is important too. This was especially true in the beginning when there were no customers.

When suggestions for change come from the trading desk they are usually presented by Frederick Long. All suggestions, both external and internal, are collected and presented to Edgar Lucas who judges whether they are feasible or not and makes cost estimates. He also tries to identify synergies between different suggestions. Luc Langdon is involved when it comes to money and resources. There are no sharp limits in this process, instead there is a lot of discussion among Jim Lee, Edgar Lucas, and Luc Langdon. Actually, in many cases Luc Langdon is not even in on the decision either because it is a small change or because Jim Lee and Edgar Lucas judge it to be unreasonable. Luc Langdon's responsibility is the budget. If there is no room he can create it if he believes in the idea.

The overall IT budget is fixed yearly by the board. Everyone is well aware that this is a long time span for IT costs and there is a continuous budget process for information systems development. In 1997 there were two extra board meetings to discuss issues where the IT-budget needed to be adjusted. Overall, the IT budget increased with a few million SEK that year. Thus, there are two processes for IT investments. The internal process prioritizes IT investments within the boundaries of the budget. Luc Langdon is responsible for these priorities. The board process is executed if there is a need to extend the budget.

4.2 IT PORTFOLIO

The IT portfolio of Lambda is dominated by EdbTrade, which is physically separated from the other applications. Apart from EdbTrade, the portfolio consists of standard application packages (see Table 4.1). There are informational systems (e.g. Reuters, Bloombergs), marketplace software (client applications to connect to different electronic exchanges) and ordinary office applications (e.g. Microsoft Office products). The back office is outsourced.

Type of system	**Examples**
Market information systems	Reuters SIX Bloombergs
Marketplace software	Saxess Trade Orc Clients to other exchanges
Other	Microsoft Office Internet

Table 4.1: Systems in Lambda's Portfolio apart from EdbTrade

Note that there are no specific risk management applications as Lambda does not trade on their own account[22].

4.2.1 General Description of EdbTrade

EdbTrade is a client/server based order routing application. It routes orders from clients, or in-house brokers, via a server to the marketplace. Both the client and the server use the Microsoft Windows NT operating system, and the application is based on an Oracle database.

The intelligence of the system is centralized in the EdbTrade server. For example, the server checks that orders are reasonable.

[22] Apart from the fact that customer orders are done in Lambda's name at the exchange.

> *Brokers automatically check that orders seem OK. If someone wants to buy 100 million shares you hesitate. ”What is this?” This kind of control must also exist in straight through order routing. (Jim Lee)*

Edgar Lucas was responsible for developing EdbTrade and defined most of the specifications with some help from Jim Lee. From the beginning Edgar Lucas and Jim Lee worked closely together but over time the roles and responsibilities have become clearer. Jim Lee sells Lambda’s services, i.e. the services available in EdbTrade, to potential customers and Edgar Lucas develops EdbTrade. The reason that they worked together more closely earlier on depends in part on the fact that there was no system to sell at that point, and they had to focus on developing the system. But first and foremost this separation depends on the fact that the workload has increased. Edgar Lucas says that things take a little bit longer when done together and even though things tend to become slightly better that time is not available today.

From the beginning EdbTrade was developed in a very minimalist fashion. Only functionality not available elsewhere was included as Lambda focused hard on what created added value for the customer.

> *It is not possible to build a system which contains everything, at least not without unreasonable costs. (Jim Lee)*

Later, more functionality has been added. Jim Lee points out that a pure trading application is fairly easy to build as long as features such as analytical tools are not included. You can do insert, update, or delete but not much else.

> *EdbTrade is basically a slave under SAX. As long as insert, update and delete as well as trades continue to be the key concepts we see no reason for EdbTrade to have to be replaced. Exchange systems may add some new functionality but the foundation will still be the same. (Jim Lee)*

For security reasons, the electronic trading system is completely separated from other systems by firewalls. The firewall is critical ”both ways”. The customers have Internet connections and from Lambda’s perspective it is important that there are no breaches. Inversely, the customers need IT security and are usually very restrictive with outside connections.

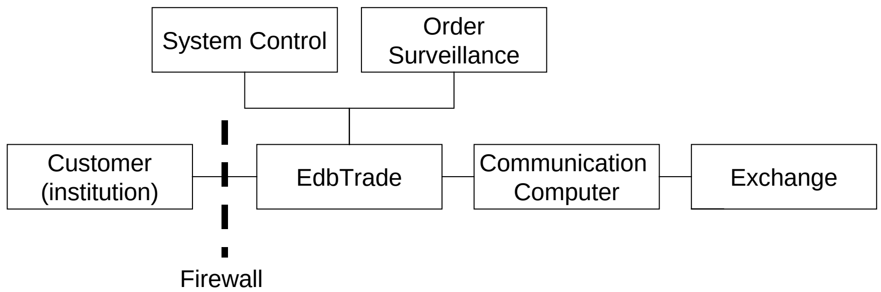

Figure 4.2: EdbTrade System Architecture

The system control is used by operations when a customer is experiencing technical problems. Order surveillance is basically the broker desk where brokers, using EdbTrade clients, manage orders placed by customers (e.g. taking over manual control of orders). At the customer (institution) the EdbTrade client is used.

EdbTrade is a complete system but internally it is component based. In the future more marketplaces, communication computers and different clients will make it even more component based.

There is a new release of the EdbTrade client about 2-4 times a year.

> *You can't provide new systems faster than the customers can cope. The customers and the rest of their systems must be able to manage new solutions etc, otherwise you only create other problems [...] It is not enough to just put an application at a customer's office. It takes support and a service oriented approach. (Jim Lee)*

4.2.2 The Development Process

Choosing In-house Development

When Lambda started, EdbTrade was developed. There were a number of different alternative standard package providers, or at least alternatives of standard package character, which could have provided an application with the functionality Lambda was looking for according to Jim Lee. Among these alternatives were products from companies that license complete systems. Jim Lee did not find this a viable alternative since the companies retain ownership, and there is nothing to prevent them from selling the system to your competitors. If Lambda would want some new functionality it would not be proprietary; instead it could be sold to others. In a way you have to pay for development, but you do not own the finished product.

According to Jim Lee, there were a number of arguments for choosing their own development instead of a standard application solution. Controlling and owning the product was important to Lambda as was getting a new system with no parts inherited from old systems and avoiding competitors finding out about new functionality.

According to Jim Lee another argument for in-house development was that EdbTrade is the core of Lambda's business. Without EdbTrade Lambda would probably not exist. Back office and similar functions can be outsourced, but EdbTrade is mission-critical and thus you have to put in the time and resources to understand and develop it, Jim Lee thinks. To have control over quality issues was also an important factor as illustrated by Edgar Lucas:

> *Developing in-house increases the quality control and quality is a competitive advantage. Quality means that the system is stable rather than it has a lot of features. If the system stops you not only lose the trading during that time but also the confidence in you is reduced and the customers go elsewhere. (Edgar Lucas)*

According to Edgar Lucas, there was no complete standard application package Lambda could have used when development commenced. The choice was between partly using finished components or building from scratch. Edgar Lucas was unsure and wanted to explore the possibilities of using components, mainly for the communications part of EdbTrade. Lambda is still thinking about that question and is actually considering creating a standard product and selling it to others. Among the advantages of using existing components would have been lower cost and speedier development. Jim Lee and Luc Langdon did not want to explore these possibilities, mainly due to the risk of information leaks. They did not want competitors to know that they were planning to build a system for discount brokerage. Thus, they chose to build from scratch.

Luc Langdon did not think of standard solutions as a viable alternative since there were no packages offering the functionality of EdbTrade. There were some parts available from providers like Orc Software. The technology was there and time could have been saved by using finished components. The most important reason not to use this possibility was secrecy.

> *The industry is characterized by a lot of hush-hush. You do not want to tell others what you are doing. (Edgar Lucas)*

Lambda needed one year to finish the system. When the rules of the stock exchange were opened up to allow electronic discount broking, Lambda would be ready without anyone else knowing what they were doing. When the EdbTrade project was started, electronic trading was not allowed, but Lambda was sure that would change.

Edgar Lucas thinks it is hard to protect anything, proprietary solutions are hard to come by. If you buy a standard application package it is not possible to be alone. One advantage of having your own system is that it is harder to copy. The system can of course be copied to some extent if someone really wants to, but for Edgar Lucas it is the organization which is Lambda's strength and that is much harder to copy.

Jim Lee points out that if you buy a standard application package you do not get the same knowledge about the system as if you work closely with the programmers. When you buy the product you are stuck in a license agreement, and you are dependent on the provider.

> *The key question is "Do you want to control your own fate or do you want to be at someone else's mercy?" (Jim Lee)*

Choosing an in-house solution means that Lambda is responsible for updating the system. This is Edgar Lucas' job, and he is also responsible for not only solving the problems of today, but also acting with a more long-term perspective. It is important to know your systems ("know thy systems") and know how they are affected by changes. With a standard solution this problem is moved to the provider, but on the other hand Lambda's ability to affect things would be reduced.

Edgar Lucas thinks that the optimal way would be to buy components but put them together yourself. That way you can enjoy competitive advantages that are hard to copy from how you glue the components together. If you buy a complete standard application package, you do not get the same advantages.

Jim Lee is convinced Lambda made the right choice and thinks that:

> *developing the system on our own only becomes more and more right as time goes on [...] [even though] there is no absolute right or wrong. (Jim Lee)*

Since Edgar Lucas knows what the system does and writes and maintains a very detailed functional specification and also knows the SAX protocol inside out, it is enough with hired outside development competence, Jim Lee thinks. He also likes the fact that by maintaining in-house competence on what the system does and how it works it is always possible, via a well written functional specification, to change the technological platform if it should no longer be a viable alternative. To keep this option it is important to work with the customers and manage changes in a reasonable way. If you let the system degenerate, changing it will in the end be more expensive than rewriting it.

Edgar Lucas thinks that it may be so that you have to go either way, either buy or build and sell to others.

Sourcing the Development Effort

When EdbTrade was to be developed Lambda chose to develop it with the help of a consultancy firm. Both the client application and the server were developed by the same firm. Lambda provided the functional design and specifications while the outside firm did the system design and programming. Lambda went to an established consultancy firm to get a method, a long-term partner and a well-documented system, which enable others to understand the system.

> *Of course, it was more expensive than going to a ”bunch of students coming in at 8 at night working till 4 in the morning”. (Jim Lee)*

Luc Langdon means that secrecy reasons made Lambda choose a consultancy firm with no prior experience from the financial industry. They had built mission-critical systems in other industries, but they had never built any financial systems before. The lack of experience cost time and money since Lambda (mainly Edgar Lucas) had to teach the consultants the business. The advantage was that they had no connections to other companies within the financial industry, which increased the secrecy.

Consultants are more expensive in the short run but you can be very demanding just because they are so expensive, Jim Lee thinks. Having your own development team means not only salary costs but also incurs other costs. These costs are there even when the development rate is slower. However, having your own department can be a good defensive move since you are more secure and do not have to rely on others.

Developing from scratch increases your degrees of freedom since you are not dependent on a component provider. It will be more work when you have developed in-house but:

> *It feels good to be on top of things [...] You have complete control when you develop in-house but it costs more. (Edgar Lucas)*

It is important to Lambda to have control over and responsibility for the development. They do not want the consultants to be responsible. If developers work undisturbed or on their own, the product will be complex. Lambda wanted a simple PC application. The value for the customers does not lie in a number of features but in the access to the exchange's trading systems.

Edgar Lucas says that he puts functional demands on the consultancy firm but really does not have detailed technical and implementation knowledge on the system. He thinks though that if a new system was ordered from a new provider based on the functional specification it would look very much like EdbTrade.

Choosing a Platform

A crucial decision in the development of EdbTrade was what operating system to use. As Lambda was a startup company there was no existing systems to take into consideration; it was a technical clean-slate installation. As it turned out the operating system choice between Unix and Microsoft Windows NT was a key issue[23]. In the end NT was chosen.

> *At that time we did not know what was the right thing to use. It was easier to build it under NT according to the consultancy firm [...] the developers persuaded us. (Edgar Lucas)*

Edgar Lucas recalls that the people at Lambda were not able to decide which way to go themselves. There were basically two arguments from the consultancy firm that tipped the scale in favor of NT:

- It would be faster to develop the system under NT than under Unix since it was perceived to be easier to develop it using NT.
- It would have been possible to port it from NT to Unix if it would have turned out that NT could not have cut it.

[23] At the time, Unix was the dominant operating system for transactional applications, and NT was on the verge of entering this market but was not yet an accepted operating system for mission-critical transactional applications.

There were also Lambda-internal arguments such as the difficulty of finding Unix competent people compared to finding people who know NT. Choosing NT for the client was easier and the reason for choosing it on the server side as well was that (according to Jim Lee) Lambda anticipated faster and more powerful hardware, which meant that lack of speed on NT's behalf was a diminishing problem. Lambda also wanted a stable operations environment and using NT made the operations seem easier. Unix was very strong but did however lead to a rather complicated operations environment, something Lambda wanted to avoid. NT was on the move and offered simpler operations.

The latter point is challenged by Edgar Lucas, who thinks speed might become a possible problem. If the need for speed increases faster than the hardware it could in an extreme case lead to Lambda having to port the system.

At any rate, there really were no calculations, rather it was a decision that grew on the people at Lambda.

> *Finally, you make up your mind! (Jim Lee)*

During the technological evaluation, discussions also were held with different people, such as systems developers and there were a number of arguments against NT (e.g. lack of remote maintenance) but also a turn from Unix towards NT.

> *The basic rule was that we wanted mainstream technology. (Jim Lee)*

Jim Lee also points out that historically you usually had Unix in clients as well as servers. When EdbTrade was built[24] solutions with NT clients and Unix servers started to show up. Lambda chose NT for both the client and the server, a solution that has later become more common.

With hindsight, Jim Lee thinks that NT was the right choice. When the new SAX system comes and increases the possible speed it might turn out to be slow, i.e. a Unix solution would be faster. If there comes to be more program trading, there can be extreme peaks with slower periods in between.

Luc Langdon trusts Edgar Lucas and also Jim Lee. He does not know the technology but is aware of the differences. In retrospect he is happy that they did not choose Unix since the hardware is also more expensive. Luc Langdon is responsible for the budget and keeps the economic perspective

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[24] EdbTrade was built in early 1996.

even though there is an on-going discussion of different solutions and possible enhancements. When there is a choice to be made between better and more expensive on one hand and cheaper and worse on the other, Lambda tries to discuss the predicted income of the different alternatives. Luc Langdon has a lot of faith in Edgar Lucas' ability to talk money and not only technology and systems.

According to Jim Lee Lambda often goes with proven technology when it comes to updating to new versions. They seldom update immediately and never just for the sake of updating.

> *[On rapid technological development] You do like everyone else. You buy new PCs for the brokers and move their old PC to someone else. (Jim Lee)*

Lambda was one of the first to try the new client application provided by SSE. There are a number of bugs still around in the pre-release version they run today. The brokers were keen on the new client since the old one was perceived as rather weak. They want to start using the new client as soon as possible even though it is more demanding with many different settings available. In-house competence will be necessary to tailor the application to the brokers.

The new SAX protocol is managed by SSE's new client but also affects EdbTrade according to Jim Lee. It is a ”forced change” in the same way that legal issues can be. Furthermore it will also place new demands on speed since the number of transactions per second can increase quite dramatically.

Choosing a Database Management System

Another choice was which database management system to use when EdbTrade was to be developed. Jim Lee contends that this was even harder than the operating system choice for EdbTrade, which by the way has led to standardization around NT all over the company. There were a few alternatives to choose from, but Jim Lee found it hard to find any objective evaluations of the database management systems that were not on a very technical level. What turned out to be a decisive factor in this case was an analysis of the company behind the database management system. Oracle, the final choice, was a big company and was perceived as a safe provider that would be around in the future.

> *What really determines the ability to survive? These choices are critical since it is very costly and difficult to change your mind. (Jim Lee)*

Choosing Means of Communication

Lambda chose not to use the Internet as a means of communications. The requirements on speed, security and stability were higher than could be met by using the Internet. Instead, Lambda chose a solution based on dedicated lines leased from a third party vendor. The cost per connection was of course higher with this arrangement but since Lambda did not focus on the retailing niche, they did not have the same need for many cheap connections as a brokerage targeting private investors.

Lambda chose a solution from SSE's network provider. Since the member firms have had a tendency for choosing the same provider as SSE, the provider has become quite dominant in the financial industry.

> *In a way they act like network imperialists. (Jim Lee)*

4.2.3 The Role of EdbTrade

Lambda cannot say "use our system if you want to be our customer", Edgar Lucas notes. Lambda must be able to offer the systems the customer wants. Edgar Lucas does believe in EdbTrade, and he thinks it is a good system. Inviting customers to run other systems can even increase EdbTrade's possibilities since they will then realize that the system they want is inferior to EdbTrade. Running different systems (either as clients or, possibly, even on the server side) will increase the administration and will make both operations and sales more complex. Edgar Lucas is not worried about EdbTrade being ousted:

> *If it is ousted it probably should be! [implying that in that case it is not good enough] The customer chooses, that is the way of the future (Edgar Lucas)*

He admits to being the most positive at Lambda when it comes to bringing in more systems even though he does not think it will happen since EdbTrade is good enough to stand its ground. Lambda is however considering bringing in external systems for tests and would need a third person in addition to Edgar Lucas and Jim Lee since they have a hard time finding time for such system tests. The main purpose is to investigate the possibility of incorporating them into their business if the customers would prefer something other than EdbTrade. These reviews are seldom used for gathering input to the product development of EdbTrade. A future possibility is to run multiple systems in parallel, but the goal is rather to offer the client application that the customer wants.

4.3 IT STRATEGY

Even though there is no formal written IT strategy, a long term strategy for IT does exist among the people involved as a shared view on how things should be done. Since Lambda is so small and the people are so close, strategic issues are discussed in any case. No need is perceived to have a specific IT strategy since it is very close to the business, there is no perceived difference between business activities and IT activities. Furthermore, people at Lambda feel no need for a written IT strategy to be used for internal communication in the way they think a larger company may.

> *As far as I know there is no written IT strategy. However, we use a strategy in terms of long-term thinking. [...] The use of a written strategy as a communication tool is probably greater in larger companies. Lambda is small enough to cope with communications anyway. Furthermore, most cases are unique in some sense, and it is difficult to find guidance in general strategies. (Edgar Lucas)*

4.4 STRENGTHS AND CHALLENGES

4.4.1 How the IT Portfolio Is Perceived

Edgar Lucas sees a number of strengths on an IT-portfolio level

> *Apart from EdbTrade the parts are standardized modules which can be replaced [...] We have the systems we need. The portfolio has the right content. (Edgar Lucas)*

Frederick Long agrees and thinks that

> *We had the right approach from the beginning. (Frederick Long)*

Jim Lee thinks that one strength of the portfolio is that it is based on new technology. Lambda is continually searching for new technology in their environment and upgrades to new versions but not always immediately. “The newest *proven* technology” is preferred. Lambda trusts that NT will not become obsolete for quite some time due to the strength of Microsoft and their ability to create alliances.

> *Being a new company also means that everything is more straightforward. There is not the same mess of different systems that you usually have in older companies. (Jim Lee)*

Another strength of the portfolio is that it is small enough to be manageable in Lambda’s eyes. It does not contain so much. Furthermore, there is a lot of knowledge in-house about what the systems do and how they are enhanced/maintained and can be enhanced/maintained.

Even if you develop in-house the competence is within one area. If there is a change of environment new people must be trained, and your current people need training too. And some people must still run the existing applications, which is not always so interesting to work with.

In retrospect, Jim Lee can see a ”middle of the road” solution where Lambda could have bought a communication solution for interfacing with SAX.

> *We were binary and chose to do everything ourselves. We did not really see the possibility of mixing. (Jim Lee)*

Today, the communications solution is an integral part of the system, which is intertwined with the rest of the application but if any part is going to be changed that is the one.

Even though Luc Langdon actually thinks Lambda has made some choices that were not optimal, he is positive to the portfolio.

> *The system today is stable. It actually works (Luc Langdon)*

Oracle might turn out to be a problem due to licenses if Lambda wants to sell the system to others. Luc Langdon also thinks some problems might turn up when you try to broaden the scope and make the system do things it was not designed to do.

As a general reflection on IT portfolios, Jim Lee feels that if you have well defined interfaces you can solve integration problems on one of three levels: real time, file transfers in batch mode and manual solutions. In some cases choices are easy to evaluate. What does the manual alternative cost for one year? What is the development cost? If time is not essential and the data sets are reasonably small, people are often a good alternative. Manual solutions are often neglected even when it is small data sets and non-critical applications. A trade-off should be made between ”cost of labor” and ”cost of capital”.

Edgar Lucas finds it hard to understand the tendency to centralize and coordinate. Some of Lambda’s customers have applications that are only used at one department but are still managed and run centrally, which increases the risks for instance when someone changes an application which affects something else. The larger the network the harder it is to locate problems and the more people are affected. Edgar Lucas believes in decentralization where possible with communication between independent departments.

4.4.2 The Future of EdbTrade

The client application of EdbTrade might very well be substituted by the customers' own applications using the same protocol as the EdbTrade client to communicate with the EdbTrade server even though it will probably take some time. The key functionality, or intelligence, of EdbTrade is on the server side and will thus remain even if the client application is replaced.

Edgar Lucas is slightly unsure about how the future maintainability is affected by the changes made. Today, most maintenance work is done by the external consulting house, with which Lambda has developed close connections on a personal level. The expected lifetime of the system is an important question. From the beginning, Edgar Lucas expected a lifetime of 4-5 years, but he finds it hard to make a prognosis today.

The most important feature for the future is an increased ability to manage more than one market. One single system at a customer must be able to manage more than one market. The SAX protocol has affected the current system structure too much. There is no clear interface between the communication computer and the server. Edgar Lucas feels that a major challenge for the future is to develop EdbTrade to manage many clients and have a flexible central structure (which cannot be marketplace dependent). He feels that the high level design will have to be updated.

> *It is time for a renovation! (Edgar Lucas)*

Suggestions for future changes usually emanate from the customers. ”We must listen to the customers!” It is however impossible to accommodate every wish or suggestion. Lambda is continuously working on enhancing EdbTrade, and they have a special document containing four lists: short and long-term technical changes and short and long-term functionality changes. Listed for every item is: what is not good, suggested action, cost and consequences if no action is taken. There is also a continuous discussion between the line organization and the developer about which items to prioritize and which to postpone. There are a lot of trade-offs between the documents where one important criterion is what is likely to make Lambda money.

> *We look at the wish list. What do we think is most important? (Edgar Lucas)*

The products Lambda can offer their customers and how they can be developed is more important than their own internal structure. Feasible changes are also dependent on what is offered by the marketplace system.

> *Now, Lambda has the financial resources to develop EdbTrade but we lack the time and consultants. It is also a struggle between the external project [commercialization of EdbTrade] and internal needs. (Luc Langdon)*

However, there is no struggle between IT and other business projects:

> *The tension is not between IT and business, but rather how much we should spend on development. There are limited resources and priorities are very important. (Frederick Long)*

If Lambda felt that there were head-on competitors there would probably be some prestige in being first with new functionality, but revenues are more important than prestige. If prestige leads to revenue in the long run it is OK, but otherwise the prioritization is clear. Other clients, such as the Orc, are a potential threat when it comes to functionality, but the vendors must supply their system to all customers, which makes it hard to reach a competitive advantage that way.

Frederick Long claims that he is less involved in these issues. He believes that the system is re-written for a broader platform [Edgar Lucas renovation to a clearer structure]. He emphasizes his trust in Edgar Lucas' competence.

Luc Langdon thinks that in the long run Lambda will be forced to build a new system where perhaps parts of the existing system can be re-used. New hardware and software will create opportunities that will be hard to obtain by building on the existing system. He believes that Lambda will have to focus on bringing parts of the system to a new platform. The main principle is probably that it will be better to build a new system than to maintain the existing one for too long.

Jim Lee believes that if you use a system too long sooner or later you will have to scrap it altogether and get something new instead. This is not always wrong. He also feels that you often think there is something wrong if you have to scrap something completely. It really does not have to be that way. He believes that the lifetime of the system must be protected. Often the remaining lifetime is reduced by alterations where you lose documentation etc.

Edgar Lucas thinks the complexity of the infrastructure will increase and he also thinks this is unavoidable. If you also offer the customers the possibility of running other systems it becomes even clearer.

An example of a change is the new and faster SAX system and its new protocol. It is important to start using it in stages.

> *If you let loose 1000 transactions per second [indicating a dramatic surge in traffic and thus load for the member systems] every member system will crash. (Jim Lee)*

Jim Lee wants a reasonable and well-known increase. That way the stock exchange can say ”You knew this x months ahead of time. If you cannot upgrade your systems, that is your problem.”

4.4.3 Business Challenges

> *It is hard to tell ”gossip” from substance. There is a lot of gossiping and sometimes almost personal cults when brokers and analysts switch companies. We do not do organized business intelligence. There is risk that you get scared and think, ”We are so small and they are so big. There will be nothing left for us!” [...] You have to stand up for what you do. It is better to find ideas in your own company and from you own customers. [...] It works differently for different people. IT people are active in newsgroups, brokers know other brokers on a personal level. [...] It is better not to take too many impressions from the outside, from other members. (Jim Lee)*

To Frederick Long one business challenge is the long-term danger of customers becoming members of the stock exchange themselves and doing their trading directly. It may nudge today’s business of simple trades.

> *As long as we are the most efficient it is not that dangerous. Why would it be cheaper for an institution to manage it on their own instead of outsourcing it to us? As long as we are on our toes and build a network of customers it will discourage taking it in-house. (Frederick Long)*

Luc Langdon agrees with this. So far it has mostly concerned a few foreign companies who used to use Lambda to trade. The arguments Luc Langdon sees for Lambda is anonymity and its role as an outsourcing partner. By using Lambda, a company outsources part of their IT function to Lambda.

Furthermore, he thinks investor membership is a ”stupid idea to begin with”. The Financial Supervisory Authority would have to oversee everyone and they do not want a lot of members. Luc Langdon sees it both as a threat and an opportunity. Lambda offers access straight to the stock exchange and anonymity. Being a member is not strategic for the customer and giving up anonymity disqualifies the idea in Luc Langdon’s eyes. If, however, an investor wants to become a member, Lambda is looking into how EdbTrade can be provided.

> *A problem for Lambda, especially in the past, was that ”We have not realized ourselves just how good our concept is”. (Frederick Long)*

It is also important to improve the ability to offer added value as in block trading for example. As long as the trading increases it is relatively easy to compete, and the environment reacts less to Lambda’s growth.

Luc Langdon also thinks that Lambda has overestimated the risk of new entrants in their segment of the market.

> *Even though there is of course always a risk of new entrants, it takes quite a while to come up to speed, and it is very hard to change an existing company into an electronic discount broker. [...] It is easy to underestimate the legal issues as well as security matters. (Luc Langdon)*

> *For many presumptive competitors electronic trading would replace parts of the existing business, and they would have to reduce personnel, which makes it politically much harder. [A brokerage company at SSE] avoided this since they did not have retail customers when they started [their Internet brokerage] so they targeted a new market niche, which didn’t affect the going concern. They could differentiate with a sibling company since they did not target retail customers to begin with but rather [institutional customers]. They added a new customer segment which they didn’t have before since [they] work with analysis and large customers. (Frederick Long)*

Lambda is about to start trading in Finland (over the phone). Electronic trading, i.e. customers trading directly via EdbTrade, will be available as soon as it is thoroughly tested. Norway will be included at a later point, and Denmark the following year. At that time Lambda will be a Scandinavian discount broker with both phone based and electronic trading. The fact that the stock exchanges are at war regarding cooperation and mergers gives Lambda an opportunity to link different stock exchanges for their customers.

When it comes to options and futures, Lambda’s customers presently trade over-the-counter. The fee structure at the marketplace has killed off institutional options and futures trading. The fees also decrease Lambda’s margins, which makes it less interesting. Lambda has a few customers who want to trade futures, but offering the Helsinki stock exchange is also important. This is in line with Lambda’s new broader business strategy to cover the Nordic region. Furthermore, the focus is on stocks since that is what Lambda’s customers primarily trade.

Thus, both adding functionality for options/futures and developing the connection to Finland are important but in what order should it be done? There is always a reasoning back and forth, Frederick Long notes. The important questions are: What will it cost? What do the customers want? Is it strategically important? Looking one year ahead, Frederick Long thinks there is more money to be made on the futures. However, in the long term Finland is more important. Frederick Long stresses the importance of being first and creating confidence in the company and locking the customers into Lambda’s solutions. He wants the customers to become members via Lambda rather than becoming members themselves.

When it comes to new functionality in general, such as spread tools, Lambda tries to see what others are doing. If there is capacity one wants all functionality, so the question is whether there are consultancy hours available and if Lambda has enough resources. What really determine things is customer demands and resources.

Luc Langdon does not believe in a pan European stock exchange. There will at least be a few regional stock exchanges, with for example the Nordic region focused on the forest industry, steel and telecom. He does not think that everything will be centralized to a single stock exchange, and if this does happen it is very far in the future. For all the small and medium size companies, local knowledge is needed and even if the large multinationals can be listed on larger stock exchanges they are not likely to de-list from their home stock exchange.

A possible future development is real-time clearing and settlement, which would decrease the transactional risk significantly. However, as Jim Lee points out, the risks related to the problems of correcting trades increase. He sees this as an example of when there will still be problems but problems of a different kind; the problem is moved somewhere else.

The added value from Lambda fronting, i.e. the customer does not have to give up its name to the market decreases as the market gets more liquid. Today the attitude is that ”If Morgan wants to buy 1 million Ericsson, we’ll sell if we have a seller”. Frederick Long thinks it is probably not worthwhile for Morgan Stanley & Co to be a member of the SSE per se but there is a marketing aspect of having global presence, which makes up for the money they (possibly) lose on the venture.

Frederick Long believes in an unbundling of brokerage and analysis fees. The customers will buy analysis separately from trading. The reason this has not happened already is the problem with charging for the analysis. Traditionally customers have received complimentary analyses and then paid via the brokerage when trading. There are some examples of pure analysis companies. Lambda is of course very positive to such companies since they complement Lambda’s business.

4.4.4 Make Business out of EdbTrade

Lambda has recently started a sibling company (Lambda SW), which will take care of maintenance and enhancements of EdbTrade. The idea is also to sell the system to ”non competitors” such as actors in other countries or in other segments (e.g. retail customers). One problem at first is that some application knowledge only exists at the consultancy firm. In the beginning there will be competence transfer from the partner to the new company.

The sibling company also means that maintenance is brought in-house which may lead to a better result. Lambda is not always satisfied with the current service level since sometimes consultants are away or prioritize other projects. In Edgar Lucas’ eyes the consultancy turnover rate is too high, i.e. there are too many people involved in the maintenance of EdbTrade.

Luc Langdon means that he is prepared to sell EdbTrade also to direct competitors if the price was right. The technology and the application are not enough to compete.

> *Maybe it is 25%. The rest is legal issues, security and neutrality [not trading in your own books]. (Luc Langdon)*

The separation between Lambda and Lambda SW will be necessary when the application is sold to external customers. Now, eight people are working with Lambda SW and the development of EdbTrade (two employees and six consultants). Lambda does not want to actively recruit people from the consultancy in order not to ruin that relationship but if someone wants to move in the future that would be positive since they have application specific knowledge

> *The advantage of a sibling company is that you can sell the system and you get better control and lower costs [than when using external consultants]. The drawback is that it is a pain to set it up. If it is sold to others it can also become harder for Lambda to dictate changes. On the other hand that seems like a nice problem because it indicates that you have sold a lot of systems. (Edgar Lucas)*

5 CASE DELTA

5.1 THE COMPANY

5.1.1 Background

Delta[25] is a full service investment bank. The main areas of the business are Equity Sales and Trading, Equity Research, Asset Management and Corporate Finance. The headquarters is located in Stockholm and there are a few branch offices located elsewhere.

5.1.2 Business Strategy

Delta targets almost exclusively institutional investors. It has a strong position in the market and is consistently advantageously rated in different industry rankings. As many institutional customers are shortening their already limited short lists with whom to do business, Delta, together with a few main competitors, is consistently on such short lists. It is a general belief at Delta that it is very hard for new entrants to work their way on to those lists. In that sense it is much easier to keep a market share than gaining share on an existing market, which is one reason why Delta considers time-to-market important for new services.

Delta has been, and still is, a rather closed organization even though this is slowly changing. Pursuing institutional investors, Delta feels no particular need for being seen in the eyes of the general public. There is, and is supposed to be, a flavor of exclusivity to Delta. This exclusivity and Delta's strategy of being a premier brokerage delivering high-quality services to its customers are also reflected in the organizational culture.

5.1.3 Business Activities

Equity Sales and Trading

Equity Sales and Trading is a cornerstone in Delta's business. Its focus is institutional investors and the brokers are generally quite experienced. Delta also has a few traders, i.e. people who are trading in Delta's own books and take on positions on behalf of the company.

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[25] A list of interviewees can be found in Appendix A. The interviews were conducted between April 1998 and December 1999.

Business opportunities from a trader's perspective can be price differences between long and short options ”what happens with the prices on long and short options as a consequence of a certain merger?” The traders use a combination of calculations and feeling to make up their minds in such matters. The calculations are made both in Hugin (Delta's front-office application, see below) and spreadsheets the traders make themselves. Ben Dudley, one of Delta's traders, emphasizes that the idea behind the trade should be a person and IT should be used as a tool for evaluating ideas and not generating them. The applications continuously get better and the models become more complicated but there is always a risk that an error is made. The market feeling must be there and cannot be replaced by a model or an application.

To succeed in trading this feeling for the market must be combined with knowledge. This basically means reading analysis reports and other documentation in order to stay educated. The market feeling is harder to pinpoint. It is based on experience as well as the ability to recognize certain patterns unconsciously.

> *You evolve some sort of intuition. You get a feeling. (Ben Dudley)*

Derivatives trading is also very complex mathematically, and it is possible to exploit others' mistakes. Some people may use erroneous models, while others may make calculation errors when using a correct model.

Equity Research

Historically, one analyst notes, brokers in general have attracted business by wining and dining customers. This has changed dramatically over the years. The Equity Research department produces a number of different types of analyses with varying value added. The scope of the analyses also varies from a single company via the sector level to market analyses. Reports are published in many different ways, e.g. printed, faxed, e-mailed and posted to the web site. Electronic distribution is increasing since quite a number of reports have to be distributed to a large customer-base, which actually make courier costs non-negligible. By avoiding printing and physical distribution lead times can also be shortened. Delta initiated Internet based distribution in 1996.

Delta was also an early adopter of ”analysis maintenance”, which means that customers receive a certain standardized pattern of analyses around company earnings reports. This is a form of standardization, not on content but on time, i.e. on when the analyses are distributed. There is of course a trade off between short update reports and more rigorous reports based on creative thinking.

All analyses are available, and fully searchable, on the Internet for Delta's brokers and customers. Delta's customer-only web site also offers Nordic business news updated daily. From the different news events on the site, links are provided to appropriate Delta analyses.

The analyses are also an important cornerstone for Delta's in-house traders. The analysts are not always right but fairly often and more often than other analysts'.

> *The analyses are good and complete but not always very academic. They are easy to communicate, which is important. Analysts are often good at analyzing but weaker on communicating their analyses but that isn't the case here [at Delta]. (Ben Dudley)*

5.1.4 Delta Organization

Delta's organization, which is described in Figure 5.1, is centered on the different business areas Equity Sales and Trading, Equity Research, Asset Management and Corporate Finance. An IT department and a group for administration and risk management support these business areas.

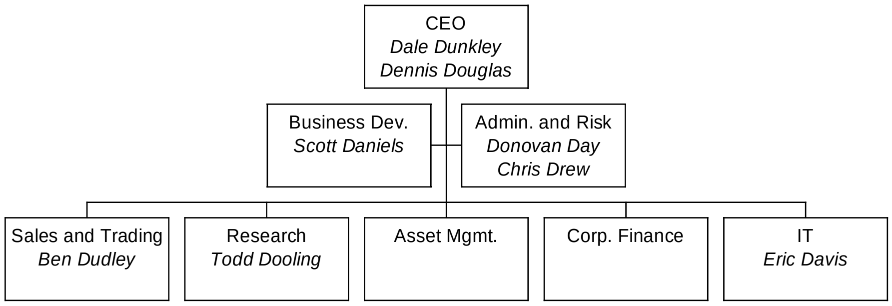

Figure 5.1: Delta Organization Chart[26] *(Interviewees Included)*

[26] The fact that there are two CEOs should not be interpreted to mean that Delta was run by committee but rather that there was a shift of CEO during the data collection phase.

5.1.5 IT Department

Organization

The IT department has no in-house development resources. Instead there are six project leaders, each associated with one or more business areas. Operations and Technology consists of some 25 people. There is also a central group for administration and accounting and control. The organizational chart of the IT department is presented in Figure 5.2.

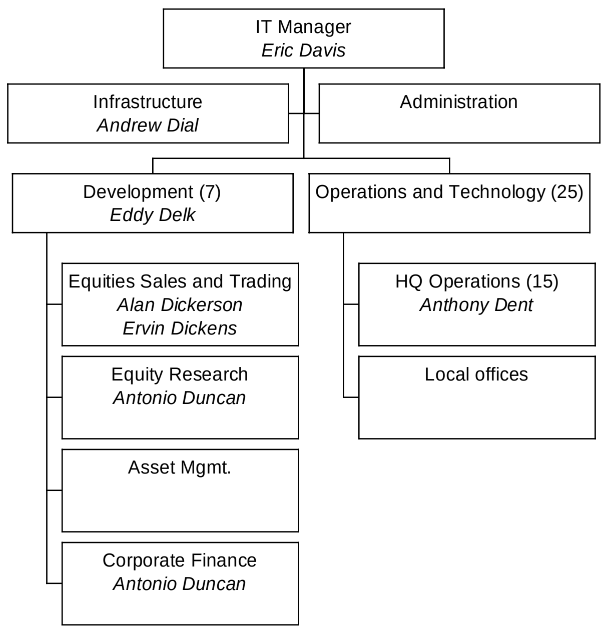

Figure 5.2: IT Department Organization Chart *(Interviewees Included)*

There is an in-house help desk working with ordinary user support such as installing new software on PCs, procurement, managing new users, forgotten passwords etc. There is also a system administrator group where there is one person responsible per operating system environment and one per major application. There is also one person working close to full time on telephony. Apart from the traditional administrative switchboard, Delta has a rather advanced trading switchboard.

At the weekly meeting chaired by the head of the IT department, all the project leaders, the head of Operations and Technology and the infrastructure expert participate.

Three project leaders work with different projects in Equity Sales and Trading, while another project leader copes with both Equity Research and Corporate Finance. The two remaining project leaders work with different parts of asset management.

Whether project leaders should belong to the business organization or the IT organization is an open question according to Eric Davis, head of the IT department. From a competence perspective it is a 50/50 situation; if they belong to the business organization they will understand the business better and vice versa. The chosen solution is that they belong to the IT department. This is mainly due to control and coordination, such as the weekly coordination meetings. On the business side there are to some extent designated contact persons. Some departments have an IT-person who works closely with the project leader from the IT department.

Regarding Equity Sales and Trading, the IT department is often both purchaser and provider. Eric Davis is trying to move the IT department more clearly into a provider role. The IT department was started by Equity Sales and Trading and by tradition there has been a closer connection to that business area than to other business areas. A drawback is that Equity Sales and Trading trusts the IT department to ensure that they stay in front when it comes to IT usage. Eric Davis refers to the large banks where purchaser and provider usually are two distinctly different roles. However, he does see a number of advantages of not having too clear boundaries since it easily becomes a matter of “us and them”. If the IT department becomes a provider (“send us a price list”) it is easy to move apart. Eric Davis has some experience of this from other companies where some business departments even started small IT departments to have some competence in-house. This leads to inefficiencies and if the local IT department were to grow the same problem may repeat itself. Eric Davis does, however, believe that you have to give people enough slack to be creative.

> *The environment and culture must allow you to be creative.*
> *(Eric Davis)*

Antonio Duncan, who is the project leader responsible for Equity Research and Corporate Finance, works more closely with the head of Equity Research than with Eric Davis, head of the IT department. According to Antonio Duncan there are some differences of opinion as to where the project leaders really belong. He means that there are on-going informal discussions among the project leaders, and he feels that the current organizational solution works very well given his close relationship with the head of Equity Research. From a business perspective, analyst Todd Dooling notes that there is a person at Equity Research working on IT issues and acting as an interface to the IT department. He also notes that it is hard to find people who know both IT and the business.

Andrew Dial has a special role as the person responsible for the local network at the head office and for the wide area network connecting the different offices. He also provides support for the local network managers. Furthermore, he is responsible for Delta's use of Internet technology (web, e-mail, etc) and also runs several technology projects. Andrew Dial works with IT related to technology rather than IT related to the business. There is, however, no special group for choosing technologies, rather the pertinent people are involved in each case.

In his business intelligence work, Andrew Dial talks with other stock brokerages and with the marketplaces Delta is connected to. He feels that the knowledge transfer with other actors functions well.

> *You do not discuss business secrets but there are many other things you can discuss more openly. (Andrew Dial)*

Development

The development model traditionally used by Delta keeps idea generation, preliminary studies and specification internally. Implementation and coding are done by external partners and system testing is done internally. Basically, coding is outsourced and everything else is kept in-house. Delta has never had in-house resources for programming but keeps operations, technical knowledge and project leaders in-house. The major advantage of not having programming resources in-house is not having a legacy of old competence, i.e. competence on for instance obsolete technologies. On the other hand, using people for hire for development and maintenance can lead to maintenance problems in the long run. To avoid this, Delta tries to find partners rather than companies that sell consulting hours ("bodies"). Delta wants companies that are willing to take a larger responsibility. This is sometimes hard since many consultancy companies want to sell hours and are not interested in long-term responsibilities. It costs money to get consultancies to take on such long-term responsibilities, but the IT project leader Ervin Dickens thinks it is worth it. One example of this is the partner managing Delta's back-office application Munin, who was even allowed, and encouraged, to license the application to other companies.

When so much is bought from outside companies it is extremely important to be a good buyer, which calls for experienced project leaders.

> *Buying services provides freedom but it is also costly. (Ervin Dickens)*

One example of the flexibility provided is a recent Internet project that moved very rapidly from an initial idea on what to do to putting the application in production.

A drawback with consistently hiring external consultants is that new consultants must learn the business, but Ervin Dickens thinks this drawback is less severe than having employees learn new technologies all the time. Delta knows its business and this knowledge can be transferred to new consultants, as long as they bring technological knowledge with them. By buying services it is also possible to choose partners that are on the technical edge.

> *We do not want consultants that use our project to learn to be good at their next project. We want people who know the technology. (Ervin Dickens)*

Operations and Technology

The speed of development and new functionality demand more people since there are more new versions and more complex systems, according to the head of IT operations, Anthony Dent. Furthermore, the hours are getting longer since there are applications that need supervision close to 24 hours per day. Thus, the cost of operations has increased since there are more people.

> *Astonishingly enough, there is always more stuff to do! (Anthony Dent).*

The quality of available tools for everyday chores is increasing, though. One example is installing new software where the IT department used to have to visit every PC at night. Now there is a tool that installs software overnight. Such tools save a lot of time and without them there would have to be more people working with operations.

The Operations and Technology group used to have a few people working almost around the clock. Now the department is expanding and during this interim phase there have been a few consultants in line positions. Now there is one Unix-expert consultant left, and Delta is presently recruiting his successor. Recruiting can be tough since often the person best suited for the job is the consultant, but hiring a consultant can easily harm the relation to the consultancy. In some rare instances, consultants have been hired but that has, according to Anthony Dent, been with the consultancy's blessing.

Historically, there were few project leaders and few people at Operations and Technology, which made it easier to have a close relationship and discover possible misconceptions early. As the organization has grown the communication between project leaders and the Operations and Technology group has deteriorated regarding questions such as product launches. The worst consequence of this would be that applications could be launched without Operations and Technology even knowing about it. To cope with this problem, informal groups have been created where a project leader has a few special contact persons from the helpdesk and Operations and Technology. The idea is to make it more natural for the project leader to keep the rest of the organization updated on projects.

5.1.6 Risk Management

Delta's risk manager, Chris Drew, talks about market risks, credit risks, legal risks and compliance, and finally operational risks. The first two can be dealt with using policies and systems for evaluating risks and creating reports. Legal issues and compliance is about abiding by the rules, both internal and external. Operational risks are about such things as failing in the settlement process, how trades are managed and the administrative part of the transaction process.

The perspective at Delta, that risk occurs when a trade is made and not over night or the next day, differs from some market participants, according to Chris Drew. A challenge for risk management is that different applications measure risk in different ways. Delta uses a data warehouse to mirror all info to the risk management application, which allows modeling risk consistently. In the trading application, for example, considerations other than optimal risk calculations have to be weighed, such as speed.

Chris Drew acknowledges a trade-off concerning time to market. In order to minimize time-to-market some technical risks have to be assumed and the challenge is to achieve the right balance between such technical risks and the business risk of being late. The business often wants the functionality yesterday while the risk department wants a risk free solution.

An example of how this is managed was when Delta started trading instruments listed in a new currency. Adapting the front-office application, Hugin, was not possible given the time constraint; instead an external standard application was bought as a temporary solution. A criterion for the application was that it had to be compatible with the calculations in Hugin, which the chosen application was. A lot of work went into verifying the calculations, which is a major task also when developing in-house.

Chris Drew is the system owner of some minor presentation applications developed in Excel and Access. In general, the manager who is commercially responsible is also the system owner. Thus, CEO Dennis Douglas, who is responsible for Equity Sales and Trading, is the system owner of the applications needed to trade, which includes risk management applications.

Chris Drew reports formally to the board, i.e. even though he organizationally sorts under the CEO he reports to the chairman of the board. The costs for risk management are ultimately a question for the board. If Chris Drew wants 10 million SEK and Dennis Douglas allows only 5 because it is charged to his Profit and Loss statement the board will have to decide and either say, “OK, 5 will have to do” or “10 it will be”. In the latter case 5 million SEK will be charged to Dennis Douglas and the rest to the overall result. There is also a special risk management committee including among others Chris Drew, Dennis Douglas and Donovan Day, head of administration.

Since risk is considered a natural part of the business, it is not considered as something that is added to IT investments. The IT people calculate costs including risk management to begin with, making it an implicit cost, which has to be borne. When a trader wants to start trading on a new market or in a new instrument, he must present a reliable bottom line. Risk management systems then come into play as a natural cost.

The Straight Through Processing (STP) of Delta’s trading makes a lot of things easier. It is easier to achieve high quality in a process that is clear and salient. The rule of thumb is the fewer the exceptions, the fewer the things that can go wrong. There are of course several checkpoints in the STP logic to prevent errors from propagating. Delta has not achieved STP all the way but the Stockholm office is farthest along.

> *Introducing STP if you have no existing applications really isn’t that hard but gluing existing applications together is much harder. (Chris Drew)*

Other offices are sometimes more into using people instead of applications.

> *We don’t want to think along those lines [using people instead of applications]. If you have people in the process you will have errors sooner or later. (Chris Drew)*

To enable trading in more complex instruments, a suitable incentive structure is necessary. If traders that make a lot of money for the company receive large bonuses, it increases their incentive to take on risks.

> *Who thanks the risk manager for trying to control the positions? When does he get a bonus? (Scott Daniels, Equity Business Development)*

5.2 IT PORTFOLIO

There are a few major applications in Delta's IT portfolio. The front-office system, Hugin, and the back-office system, Munin, are the major parts from an Equity Sales and Trading perspective. For Equity Research the report generator is a crucial application. There are also several complementing information systems of different kinds.

Availability and up-time are very important to Delta and quite an effort has been made to minimize the risk of the applications not functioning. For example, the portfolio is mirrored at a backup center. One reason for this is that Delta feel that their reputation risk is larger than for many of their competitors.

Delta's automatic linkage between Hugin and Munin makes the process less error prone. It also helps manage transaction peaks, which is very important for Delta's reputation. Regardless of the number of trades performed on a given day, the customer must get the contract note the following workday.

> *Furthermore, it can be very costly to make an error since it sometimes forces you to take on a position and then you know what will happen with the market the following day! (Eric Davis)*

5.2.1 Hugin

The Application

Hugin is component based and is client/server based which was very popular in the late 1980s when the application was developed. Later on, since new releases of SAX clients have been released, business developer Scott Daniels notes that people at Delta have felt "so what, we've had that since 1990".

Eddy Delk from the IT department remembers a number of reasons for choosing the particular structure of Hugin:

- A new way of thinking was used. Hugin is a transaction-based system rather than database oriented, which eased the shift towards a new structure. There is of course a database in Hugin, but the approach is transaction based.

- A client/server solution was providing better performance than other alternatives considered.
- Flexibility was a key issue, which made components more appealing. Delta knew they wanted to trade on multiple markets, i.e. have a multi-market application. There was also a vision of multiple sites, i.e. geographically dispersed offices.
- It was also perceived as more interesting and fun to work with process oriented programming. There were also some existing components for real-time information distribution, which could be re-used.

In hindsight, Eddy Delk thinks that the possible advantages partly have been achieved. Version management is hard when there are many components with a life of their own, though. There are sometimes parallel projects changing components that are communicating with each other. If the interfaces are kept nice and clean, different components can be changed independently of each other, at least in theory. In practice it is necessary to have tight teams working together. Sometimes there is a need to harmonize the application to some baseline in order to prevent the application from diverging and becoming too hard to maintain and operate. Eddy Delk does not think it is enough that people know their own component. Someone must have the overall perspective.

> *Too often you have heard "this shouldn't affect that", especially from more inexperienced people. (Eddy Delk)*

Hugin is a trader application including a middle-office component and an interface to the back-office application Munin. Unlike providers of standard trading systems such as Orc Software, who must be more general and interface with different back-office systems, Hugin can be, and is, tailor made to interact with Munin.

The IT project leader Alan Dickerson sees the way everything fits together as Hugin's major strength. He thinks there may be other applications that are more capable in some respect (e.g. slightly better on options or slightly faster order entry) but he is confident that Hugin is a better application overall. Thanks in part to the coordination, risk is managed in real time.

Looking forward, Alan Dickerson wants to be able to attach a FIX[27]-based system to Hugin. Open interfaces make it possible to add applications that

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[27] FIX is a generic protocol for trading applications developed by a number of major international companies within the financial services industry.

are superior to Hugin without having to give up using Hugin as the base application. One of the major challenges in the future is to cope with other high-end applications outperforming Hugin in some respects. When it comes to the choice of a trader station Alan Dickerson feels that the traders and brokers decide. The line organization is in focus when it is time to choose.

An integrated part of Hugin is risk management and position keeping.

> *We cannot and may not take on positions where we can't manage the risk. (Chris Drew)*

The application offers flexibility based on parameters. The trader can set his parameters from a trading perspective, i.e. what he wants to use for trading, while Chris Drew as a risk manager can set the parameters from a pure risk perspective, i.e. more pessimistic values. The different resulting risk measures can than be compared, and a discussion between the trader and the risk management team can reveal a "subjective" truth about the "true" risk.

The mathematical calculations are mainly performed by Hugin while there are some Excel and Access tools for presentation purposes. These tools are however small compared to what is integrated into Hugin both in terms of function and in terms of money.

> *Hugin is the engine in our risk management! (Chris Drew)*

It also takes an administrative effort to be able to trade an instrument and thus manage and value it. Value is not only about the instrument per se but also about factors such as where it should be traded. In Hugin there is also a simulation tool, which is used for testing the consequences of different market changes.

The largest change in Hugin since it was built took place recently when the Stockholm Stock Exchange changed its marketplace system. The server part of Hugin was rebuilt and the network protocol was changed, even though in the short run this was not forced by the exchange. Changing the protocol led to major changes in the server. The users however were hardly affected at all.

> *During the Saturday tests[28] it was hard to get the users engaged since they didn't notice any difference even though*

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[28] The stock exchange performed Saturday tests as trading day mock-ups to test the new marketplace system, networks, etc.

> *it was an enormous change for the technicians! (Andrew Dial)*

In this and similar instances, having a proprietary application led to more work and higher costs than having a standard application package where the costs can be shared. In Andrew Dial's opinion the higher costs are however outweighed by the better business support.

Continuous Development

To trader Ben Dudley a major advantage of Hugin being an in-house application is his ability to affect its functionality by talking to the project leader, Alan Dickerson. It might be that Ben Dudley wants new functionality for evaluating risks of his trading portfolio. Standard applications, such as the Orc, offer such functionality, but it is much harder for Ben Dudley to influence the functionality of the Orc than that of Hugin. Orc Software does take user suggestions into account but it is a much slower process.

A disadvantage of buying standard applications, in Ben Dudley's opinion, is that you buy a black box. You have to trust the provider to do correct calculations, and it is much harder to check this yourself. Concerning Hugin Ben Dudley can check himself exactly how, for example, the delta of an option is calculated and he can make sure it is calculated in a way he is comfortable with. He does not think too many users are interested in the same level of detail as he is. Many people use the values suggested by the application and take for granted that they are correct. Making correct calculations is more important when trading derivatives than when trading equities. A long position in a stock is easy to evaluate but more complex positions involving derivatives can be rather problematic to evaluate. Ben Dudley is reluctant to take on large positions if he is uncomfortable with the risk calculations since even small errors can lead to huge consequences for positions that are large enough. Head of Administration Donovan Day agrees that making these evaluations, and making them correctly, is extremely important.

Even though Hugin fills a very large portion of the traders' needs there are always some small details not covered. Different traders want different functionality and Ben Dudley is active when it comes to thinking about new functionality. He often builds his models in a spreadsheet first to be sure of what he wants and to make sure that his calculations are correct. He then makes a first decision on his own as to whether it is reasonable to include the new functionality in Hugin. If it is a temporary need he just leaves it as a spreadsheet solution and does not even suggest implementing it in Hugin. If he wants the functionality to be implemented in Hugin he suggests the changes and explains why he wants them done. It is then his managers who decide whether the changes should be implemented. Ben Dudley supposes some sort of cost estimate is produced before the decision is made. There are usually no problems, and the suggestions Ben Dudley brings forward usually are implemented in Hugin. Ben Dudley is also very satisfied with his cooperation with the project leader responsible for Hugin, Alan Dickerson.

New external technical demands, such as new protocols, are hidden in Hugin and do not really affect Delta.

> *You get a new spec that you forward to whoever is coding. If you take the Euro it is different. When you have your own set of applications you have to write your own specifications, which is a much bigger task. (Andrew Dial)*

Formalizing the Relation between Hugin and the Line Organization

A while back, Hugin was moved to a separate business area, BA Hugin, with the intention of making Hugin available to other market participants. Sharing development costs was a driving force for creating BA Hugin. All together some 50 employees and a number of consultants belonged to the newly formed business area. A few key people moved there, for example business developer Scott Daniels.

There was a strict business relation between the rest of Delta and BA Hugin even though they worked closely together. Market prices were charged, and Delta's line organization was free to turn to other providers. Ervin Dickens does not think the organizational solution was all that important. Instead, the important thing was that the way of thinking stayed the same.

Alan Dickerson, who acts as system purchaser for Hugin, was relieved of platform thinking when BA Hugin was created. The new business area ran Hugin with more structure than before. An advantage of the new organizational solution was that BA Hugin had more resources available for things like testing. The buyer-supplier relationship was not clear-cut but Alan Dickerson suspects that it would have become stricter as time would have passed, especially if Hugin would have been sold to numerous other customers. In that case, Delta's influence was bound to decrease. Alan Dickerson felt that change requests were accepted readily by BA Hugin, but he can picture a possible scenario if the Hugin were to be have been widely sold:

> *How much can we affect? The positive thing is that we can share other people's good ideas and that way become more competitive. (Alan Dickerson)*

Ben Dudley thinks requests for new functionality used to be taken care of more quickly before the new organizational solution. He does not feel that he benefited and got new functionality initiated by other customers to BA Hugin. On the other hand, work was done better and more professionally than when Hugin was managed in-house. Changes were well documented and there were never any errors in calculations for instance. Eddy Delk agrees that quality increased in many dimensions, such as installation packages. From a BA Hugin perspective there was an incentive to make things easier since that reduced the need for support. For in-house solutions this is not always felt as strongly.

The expected cost reductions were not completely realized. One reason for this was the different interfaces every exchange uses, which increased the need for local adaptations. A perceived drawback of creating BA Hugin was that the application was distanced from the business. The close connection to Operations and Technology was also lost. A filter was created between the developers and the users. Special contact people were appointed to act as middlemen between the rest of Delta and BA Hugin, but Eddy Delk still thinks the direct feedback about what works and what does not was lost. For the developers feedback became slower and declined in quality. On the other hand, people have learnt to formalize feedback and contact patterns to some degree.

Eddy Delk feels that new functional requirements suffered from this filtering. The risk of misunderstandings increased. Even if the contact person was knowledgeable, the developer still got a second hand version of the requirement and it became harder to maintain an understanding of what the business truly needed.

> *When located in-house you talk to the user who wants some specific functionality, but based on the discussion you understand that he really wants something slightly different. [...] Using a contact person puts a lot of pressure on the user to articulate his needs. (Eddy Delk)*

The developers may end up in an ever protected shop. Since no users call them, they may lose touch with the users. People also risk losing the sense of importance of what they are doing if they do not see what it is used for and how it is used. Andrew Dial supports this line of thought, as he is a strong believer of brokers and traders working closely together with the developers.

> *Close to the business and fast feedback are keywords! (Andrew Dial)*

Despite the initial interest, sales were slow and a decision was made to go back to the original organizational solution. Scott Daniels thinks the BA Hugin solution may have led to higher costs and a dilution of competence. Delta used to have 10-12 competent people dedicated to providing Hugin to Delta. The new business area grew considerably, which led to competence problems since the highly skilled core team was diluted. Some of the core team members also quit, which further increased the problems. The new organization also meant more overhead and bureaucracy, which Scott Daniels feels led to increased costs even though the costs could be allocated to more customers.

> *With enough customers [the new organization] would of course be cheaper. (Scott Daniels)*

Technical expert Andrew Dial does not think it will be cheaper to have Hugin as an in-house application than to keep BA Hugin and sell it to other market participants, but he is confident that Delta will be better off. Eddy Delk believes that it will be possible to keep some of the advantages of having Hugin in a separate business area even after switching back to the original solution. Now, there is an in-house organization in place with contact people, and he feels that Delta has learnt from the earlier experience of having the application in-house and will address such issues as lack of formalization. The drawbacks of a separate organization will diminish since people working on Hugin are no longer located separately.

5.2.2 Munin

The Application

> *Back office isn't something you compete with; it is something you got to have. You don't become number one thanks to your back office, but without a good back office you can't ever be number one. (Andrew Dial)*

Munin is a back-office system that Delta owns together with some other market participants. From the beginning it was built by a third-party vendor. Together with some other market participants Delta realized that something new was needed, and together they bought Munin from the vendor. Delta has very few people working with back-office issues given the number of trades that are made. This is, according to Ervin Dickens, due to the automation and streamlining of the business processes.

Munin is a big monolithic system consisting of literary millions of lines of code, which has been continuously enhanced since its inception in the 1980s. Since the application is quite monolithic, Delta is forced to baseline all the time. It is not possible for the application to diverge in the same way Hugin does. However, Eddy Delk's experience is that it can be harder to make big changes in a monolithic application. The underlying batch oriented approach is still kept since it would be hard to change. The system owner, Ervin Dickens, notes that:

> *It is expensive to keep patching and adding functionality! (Ervin Dickens)*

One example of inflexibility on Munin's part is stock loans. When stock loans turned up, Munin did not support it so an application was bought from an outside provider until the internal solution was built.

The MuninPlus Project

In 1995 Delta, together with the other owners and the vendor, analyzed Munin and reached the conclusion that it should be broken up in smaller autonomous parts. Ervin Dickens does not think that the analysis was as thorough as it could have been. The first part of a study was done but a consequence analysis was missing, he thinks.

> *It was a good draft but you only got a very rough estimate of the cost. (Ervin Dickens)*

After the analysis was presented, the project was not undertaken. Instead the project MuninPlus was started in 1996 to address multi-currency, Y2K and the ageing technical platform. Basically, more or less no new functionality was included, instead the project aimed at prolonging the life of the application.

In 1997, time started to be of essence. Hugin was neither Y2K-compatible nor multi-currency capable. Delta performed a fairly quick but yet thorough investigation of possible alternatives for achieving a stable back-office solution beyond both the millennium shift and the introduction of the Euro. Most existing standard application packages on the market were analyzed and evaluated. The analysis focused on three main parts factors:

- *Functionality*. Is it a multi-currency system? Is it Y2K compatible? If not, how will this be solved? At that time, no vendors had applications that were both Euro and Y2K compatible. How the system managed clearing institutes and supported corporate finance activities were also important issues.

- *Organization*. What is the vendor's ability to deal with future change requests? How willing are they to do this? How much can Delta expect to affect? What is their ability to support the application?
- *Platform*. In what environment is the system running? At the time of the analysis Delta was experiencing performance problems with Munin.

Furthermore, a cost estimate was made for developing Munin. Regarding the standard application packages, no process got as far as price negotiations. Given the automated flow of business processes at Delta, no standard package came close to Munin in functionality. One reason for this is of course that the needs of Delta have affected the development of Munin a great deal.

> *All in all, the standard packages did not come up short in terms of cost but instead in terms of functionality. [...] [Munin] has been expensive, but the benefits are there! (Ervin Dickens)*

In 1997, a decision was taken to start project MuninPlus. The decision was prepared by Ervin Dickens and Donovan Day and taken by Delta's board. The cost was significant and not less than the cost of buying a standard package. Switching systems would also have brought other costs in terms of education, updated interfaces etc.

MuninPlus consisted of four subprojects:

1. The first subproject was a technical conversion to a new operating system. The purpose of this was twofold, to increase performance and to avoid running on an unsupported operating system (the provider had quit supporting the operating system that was used).
2. The millennium problem was the next subproject where at least the specification was simple. It was very clear what should be accomplished.
3. The multi-currency project was run partly simultaneously with the millennium subproject. To some extent a minimalist solution was chosen. It can manage multiple currencies, but it does not do it throughout the application, which might have been preferable if there had been

enough time. Due to lack of time a number of shortcuts had to be taken. Ervin Dickens points out that the only resource lacking is time.

> *Time is the only scarce resource! (Ervin Dickens)*

4. Testing is upwards to half of the total time of the project.

Following the MuninPlus project, Munin is up to date even though no new functionality was added so for example adding a new instrument type is still quite cumbersome and should be easier in the eventual successor. Something other than a batch oriented approach will also be needed.

> *Today we have T+3*[29] *and T+1 is being discussed in the US and probably soon here too. Sooner or later it will be T+"something even smaller". (Andrew Dial)*

Andrew Dial thinks a business perspective rather than the batch perspective will also be needed for the back-office solutions. As soon as a trade is made, it should be cleared and settled. He is an advocate of a stronger transaction flow perspective.

The decision to develop a new version of Munin was not uncontroversial. The size of the system and its monolithic structure were brought forward as arguments against developing it further. Scott Daniels is not completely happy with the MuninPlus project. He acknowledges that it prolongs the lifetime of the application, but he considers it a defensive project.

> *Had we seen the need in 95 we could have changed the structure more than when we saw it in 98. [...] Now we can cope with Y2K but we are already facing a big decision on long-term replacement. We could have solved both these problems simultaneously had we started in 95. (Scott Daniels)*

His view is supported by Ervin Dickens.

> *If this replacement process had started in time, a new system would have been in place and adaptations like the MuninPlus would have been avoided. (Ervin Dickens)*

Despite the fact that the MuninPlus project has been executed, Ervin Dickens notes that:

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[29] T+3 means that clearing and settlement occurs three banking days after the trade is agreed upon (see section 1.4.2 on p. 9).

> *Munin is not what we should have in the long term. [...] [but] since it can manage the Euro and Y2K it will nevertheless last for a number of years. (Ervin Dickens)*

He means that Munin must be replaced altogether in the long run since it is too expensive to maintain, and he emphasizes the importance of not rushing the new project.

> *A new system will be needed in a few years, and it is important to start the work early. (Ervin Dickens)*

When it comes to the new system Ervin Dickens believes that it is important to break up the system into smaller components and make use of the progress made in both technology and systems development over the last 15 years. From a technical perspective the benefits of a new system would be lower operations costs and better scalability. From a business perspective the major benefit would be better interaction with standard tools such as Microsoft Office. At present there are two ways to extract data: print out a report or ask someone at the IT department to bring out data straight from the database.

Ervin Dickens feels that the chosen solution to enhance Munin can be regarded as an insurance, or low risk, solution. At the time, both the introduction of the euro and the millennium shift were fixed dates that Delta was forced to adhere to.

> *The uncertainty was great when it came to the effort to enhance the existing system but even more so when it came to whether the third party vendors would complete their Y2K-projects. [...] We knew what we had but not what we would've gotten. By developing our own application we took the responsibility but also the control over matters. We didn't have time to trust a vendor and then realize that they couldn't live up to their promises. No vendor could at this time show how they would solve the problems and make it plausible that they actually would be able to do it. (Ervin Dickens)*

Moving Munin to a Separate Company

Lately, there have been discussions about moving Munin to a separate independent company. Ervin Dickens sees mostly positive consequences from this. He thinks it would increase the long-term perspective but Delta would have to renounce some of their influence and their ownership.

> *If you cannot achieve a true buyer-supplier relationship such a solution won't take off. (Ervin Dickens)*

Some companies have quit using Munin and the main reason given has been that the owners have had too much influence and that other users have had a hard time making their voices heard. Thus, such a product company must be independent. Ervin Dickens notes that:

> *It would mostly be a mental shift and maybe not make such a huge factual difference. (Ervin Dickens)*

5.2.3 Research Tools

Database and Report Generator

The research report generator application (RGA) is a third central piece of Delta's IT portfolio, and it is not connected to the trading related systems (Hugin and Munin). It is an important competitive advantage, according to Eric Davis. The database contains fundamental data on companies going back ten years. Instead of buying this data from external information provider, Delta keeps it in-house.

The analysis report generation is as automated as possible making extensive use of document templates so the analyst can spend his time adding value. There are a number of different analysis reports to choose from. When the analyst chooses a company and what type of report to write, the report generator generates a report with diagrams and tables based on the data in the database. The analyst can then ”fill-in-the-blanks” under the appropriate headings created by the template. Major reports are then checked for linguistic correctness. When the report is finished it is presented on Delta's extranet and available to the customers. The lead time for reports is thus very short.

Todd Dooling thinks that it is important to deliver reports to the customers rapidly, but that they also receive a report they recognize and feel comfortable with. In this respect, having standardized reports where there are always a number of bullet points on the front page is a strength. The customers learn their way in the reports.

> *Have you read the first and the last bullets you should know what the report says. (Todd Dooling)*

Before the RGA, a good analyst was a person who was good at spreadsheets. A former head of research initiated the work to lift everyone to the same high standard of spreadsheet usage (in quality terms). He constructed a valuation model that was implemented in a spreadsheet, in a few different versions for different industries. During the rollout all data was entered by the analysts instead of by hired hands, so that the analysts grew familiar with the valuation model. Furthermore, not every company fit the model so some alterations and adaptations hade to be made.

When the RGA was developed some analysts did not like it.

> *A common argument [among the analysts] was "No one should tell me how to write an analysis report!" (Antonio Duncan)*

The head of the research department had a "take-it-or-leave-it" approach and thanks to a few highly successful analysts who started using it the initial resistance was overcome.

Delta was among the very first brokerages to offer analyses via the Internet, but now it is becoming a common service. Equity Research analyses were the first things offered online by Delta. It even came before an external web site, which was a low priority project since it was not in line with Delta's image. The external site continues to have a rather low priority since Delta is not targeting the retail segment. There is only some company information and contact information, which is in line with Delta's low profile.

Some companies, such as FirstCall, Reuters and Bloombergs, have started to act as clearing houses for analysis reports. They invite analysts to put their reports at their sites and then specify which customers should be able to access which reports. The idea is to act as a portal with the customer only having to visit one site to get all reports on a specific company. Delta wants to keep the customers on its own site and has instead started to think in terms of new and additional services.

A Java applet is available mimicking the valuation model. The customer can do what-if analyses and try his own scenarios and see how it affects the prognosis. It works like a spreadsheet but Delta is reluctant to make the complete valuation model available since the way it is constructed is considered a competitive advantage. By making the Java applet available, Delta still keeps control of the underlying model.

The IT project leader Antonio Duncan was the main creator of the RGA, which may be a potential maintenance problem. It has turned out to be harder to maintain the application than predicted. The main reason for this is the person dependency.

All the analysts within Delta use the application and there have been suggestions to provide it to others too. The IT department declined this, partly because of the person dependence, and partly since it is too hard to control things on the level you need to. To guarantee that the automation works, everything is very standardized down on the device driver level "You have to use this device driver and that printer".

> *I like my family way too much to jump on that suggestion! (Antonio Duncan)*

Updating Office?

Delta has chosen Microsoft Office as a corporate standard and is at this time[30] using Office 95. A few years ago, Office 97 was released and the issue of whether to upgrade from Office 95 to Office 97 came up.

> *It was a big discussion, to put it mildly! [on the shift from Microsoft Office 95 to 97] (Andrew Dial)*

Some departments wanted to use the newest version but the Equity Research department was reluctant since they had a lot of special applications developed in Office 95 that were not portable to Office 97. Eric Davis has been a strong proponent of everyone using the same version since there are a lot of documents being shared among different people, but Antonio Duncan's feeling is that he will have to give in and Delta will have to learn to live with different versions.

> *There is so much interaction with other companies that you can't only consider internal needs and demands. (Antonio Duncan)*

The IT department can recommend Office 95 but someone can still say, "I need Office 97 to be able to…". The IT department cannot stop them but does not have to offer any support if the recommendation is broken. Some users appreciate this while others are questioning it.

The upgrading dilemma was anticipated when the applications were built in the Microsoft Office environment. Despite the dilemma, Andrew Dial has a hard time seeing viable alternatives:

> *Any other decision [than using Microsoft Office] would have been surprising. (Andrew Dial)*

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[30] At the time of data collection, i.e. 1998-1999.

For the analysts the word processor and the worksheet are production systems, like Hugin is to the traders, while to others they are more like pen and paper. Thus, the Equity Research department will view upgrades slightly differently from the other departments.

Delta sees two problems with upgrading to new versions of applications. Usually the file formats differ which makes it harder to share files. The other problem is the dip in productivity, which is very hard to avoid when upgrading. For the analysts this is a dip of productivity in their production system which one is very eager to avoid. The Equity Research department's view is illustrated in Figure 5.3.

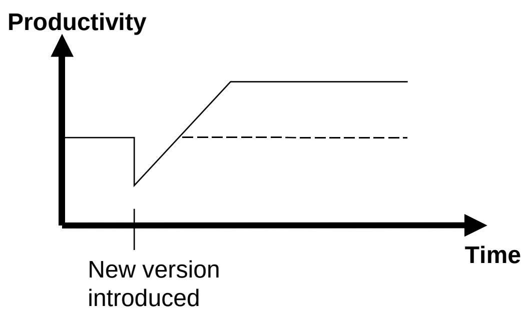

Figure 5.3: Productivity Patterns When Introducing New Software

If the productivity does not increase after the shift the dip is never recovered. If the productivity follows the solid line it is beneficial to upgrade but this is the exception rather than the rule. The experience at the Equity Research department is that the productivity follows the dotted line.

Another reason not to upgrade to a newer version of Office is the special applications developed in-house. The shift from the prior version of Microsoft Word was made only when Microsoft quit supporting it. Antonio Duncan feels that it is too risky to upgrade when you do not have to:

Our production cannot lose momentum! (Antonio Duncan)

What later happened was that the research department continued to use Office 95 while the rest of Delta moved to Office 97. Since there are some backward compatibility problems most analysts have both Office 95 and Office 97 installed (either on the same PC or on two different ones). Office 97 will probably only be a short-term interim solution before the whole company moves to Office 2000, with the analysts moving straight from Office 95.

Todd Dooling points out that there have been problems with Office 97. He feels this is troublesome since there are more and more documents and presentations produced in Office 97 in different parts of the company. When Todd Dooling gets a file he usually mails it to the helpdesk, which converts it to a file format he can read. One drawback is of course that helpdesk only is manned during (normal) office hours. Todd Dooling is not satisfied with this current solution.

> *I got on their [IT department] case but they say there are good reasons. (Todd Dooling)*

It is the head of the IT department, and indirectly the rest of the IT department, who are making this judgment call, but Todd Dooling has not gotten any insights in how difficult it would be to solve the problem. He is, however, eagerly looking forward to the new version (Office 2000), which he is told will solve the problem.

5.3 HOW THE IT PORTFOLIO IS PERCEIVED

> *Gaining competitive advantages from IT is not Delta's strategy. We are striving for competitive advantage from placing power, research and trading [...] we don't compete with IT. However, IT is necessary but not sufficient for doing business. [...] IT is not a deal maker but a potential deal-breaker. (Donovan Day)*

5.3.1 An Executive Perspective

As a reflection on choices in general, CEO Dale Dunkley argues that Delta rarely, if ever, faces grandiose projects introducing new systems. It is a question of evolution rather than revolution. Furthermore, many such choices are determined by the IT department, and it is hard for him as CEO to know if it is cost efficient.

Dennis Douglas thinks he is partly the reason for the shift that has occurred at Delta since he succeeded Dale Dunkley as CEO. Delta used to develop a lot of applications in-house, which Dennis Douglas does not believe in. He partly bases his opinion on experiences from a former employer where a lot of resources were spent on IT and in-house development, but Dennis Douglas did not feel that it added much to the business. It is too costly when others pool together and share the development costs, he thinks. He can see a possible need for small exotic applications supporting for instance trading but not for the more general applications.

> *It is not Delta's business to develop IT-applications. We shall be the best at analyzing [Nordic companies]. [...] Delta does not gain competitive advantages from IT. Excellent IT support is necessary, but it is not sufficient. (Dennis Douglas)*

Dennis Douglas emphasizes that it is no exact science, but he thinks there are factors indicating that it is the right time to make this shift at this point in time. The financial industry has been very profitable ("everyone has made money") thanks to a booming stock market among other things. The competition is likely to increase as globalization is increasing and more international players are becoming active on the Swedish market, which makes it natural in Dennis Douglas eyes to control IT costs.

As CEO he is surrounded by "economic men", who spend most of their time thinking about how to make more money. It was Dennis Douglas' perception that such men thought that IT costs were worth looking into. User input is important since they are the people who must make the money the IT department spends. The current incentive structure, where the individual bonuses are linked to each year's profit, also increases people's tendency to react to excessive costs. In this context it is his responsibility as CEO to guard the long-term perspective.

Donovan Day believes in partnerships in general as a way of sharing costs. He does not believe in outsourcing except possibly for pure operations but since Delta runs a profitable business directed towards relatively few customers, quality is a top concern. It is also extremely important to keep internal intelligence, i.e. to be able to solve problems that are initially unknown. This means that when Delta buys a product a lot of time and resources are spent on evaluating and understanding the finer details of the product.

A current problem perceived by Donovan Day is that the business side is somewhat short sighted in some cases. It is hard to discuss long-term strategy with traders whose business is so short term and hectic. This is one reason that the IT department initiates a lot of strategic IT efforts.

5.3.2 A Business Perspective

Scott Daniels claims that IT managers tend to be technically oriented and have less understanding of the business. He believes strongly in the importance of bottom-up approaches and knowing both the business and IT. It takes industry knowledge to do a good job. A lot of people, at least in the financial industry, become specialists within one area where they start as assistants and work their way up.

> *To be able to change things you have to be able to do what someone does better than he can himself if he is ever to accept changes. Credibility is very important in order to be able to achieve changes. (Scott Daniels)*

Scott Daniels thinks there has been a lack of ability to convert a business strategy to an IT vision and an IT strategy. There are many business people in management, and they have a tactical perspective. The whole industry is evolving from an ad-hoc approach to an industrial approach and traditionally the good craftsmen have ended up in management positions. Thus, there is less understanding of IT and too strong a focus on the daily business. Management can do business but not think long term. They ended up in management because they were good at generating business.

> *A lot of people [in the financial industry] have not yet understood that financial companies really are IT companies. (Scott Daniels)*

Scott Daniels thinks the industry will mature in the future and IT will settle in as a normal part of business operations. Managers will also become more involved and competent since controlling IT will become crucial to control costs.

In Scott Daniels' mind the financial industry is moving towards an assembly line approach. Traditionally there have been many manual hand-offs between people. The broker gets the order, enters it into the system, someone else enters the trade into the correct back-office account etc. Today, Delta is highly automated in-house, but there are "non-electronic" manual interfaces. When T+1 settlement is required this will not be good enough as the demands are continuously increasing. Sweden in general and Delta specifically is doing fairly well in this area but further improvements are still needed. The rest of Europe may have an advantage, he notes, as they have fewer legacy systems to worry about.

The increased gap between IT and the business was also the responsibility of the business side and management. It is important not to separate IT and the business.

> *To be on the Internet or not is not an IT-issue, it is a business issue! (Scott Daniels)*

In large organizations it takes time for ideas and knowledge to sift through from the daily operations to the top management where visions are created and developed, Scott Daniels thinks. This will not be good enough in the future when the business will have to develop even faster. Scott Daniels exemplifies this with the incorporation of derivates trading as a complement to pure equities trading, which has led to a need for more risk management. When the typical top manager was involved in the daily business there was no options trading.

> *They face the problem of manage something which they actually don't understand completely. (Scott Daniels)*

He emphasizes understanding even though you do not always have to know the full details. Using the knowledge of how the business operates is crucial in order to succeed. Scott Daniels' opinion is that business development to a large extent takes place in the interaction between top management and IT. Derivatives trading, for example, is completely dependent on IT. Without IT it is not possible to value the instruments, and it would thus be of less interest to trade, Scott Daniels states.

5.3.3 A Technical Perspective

At Delta there is a plethora of different database engines and operating systems. As head of the IT department, Eric Davis' opinion on standardization is clear.

> *Don't standardize more than you have to! (Eric Davis)*

Eric Davis thinks he may be before his time in the following line of reasoning:

> *It is very popular to choose a database engine, which is a long-term strategic decision. "We run Sybase". This is extremely expensive. You run the potential risk of having to reject superior applications just because of their database engine. If you make the engine the deal breaker you put the provider in a very awkward position. If he really wants you as a customer the application will be ported to Sybase. In the worst case scenario you become the only Sybase customer which means that you get later updates, worse support, as the provider know the original database engine better, and a product which is less well tested. (Eric Davis)*

Delta uses more or less all the major databases. According to the head of IT operations, Anthony Dent, there is in-house competence for all the different databases used, and there is at least one person with a thorough expertise for every database. There is no one who knows all the environments perfectly, rather most people are experts in one and know the others reasonably well. Having fewer different database engines would decrease the vulnerability but it would probably not be possible to decrease the number of people working with operations.

The number of operating systems largely has historical reasons. Hugin and Munin run under different operating systems and the workstations under a third.

According to Anthony Dent it is not possible to formulate a strategy to use a single operating system and then stick to that strategy no matter what. If an application is developed in one environment and then ported to others, he feels strongly that it is best to choose the native environment. That version will be more stable and new releases will usually be released first in that environment.

> *I prefer stable releases to a simple platform! (Anthony Dent)*

Eric Davis also emphasizes the importance of the vendor's preferences.

> *It is also important to try to get a picture of the provider's position: What is his development environment? What environment is he striving for? (Eric Davis)*

One task as head of IT is to protect the homogeneity of the IT portfolio. It is important to avoid having people bring in peculiar things, but at the same time it is sometimes the responsibility of the provider (as in the quote above).

> *Often, you are not even allowed to mess about with the application. If you make any changes, you are on your own, and the application is no longer supported by the provider. (Eric Davis)*

When asked where the biggest challenges lie Anthony Dent responds:

> *I do not want more environments. It sounds contradictory to the argument of using the native environment of application but you can't bring in all sorts of animals. [...]. Another learning experience is that it is not always cheapest to choose the lowest price. (Anthony Dent)*

Eric Davis is also uncomfortable with the really odd stuff. In such cases he tries to make clear to the business that they are about to take on a risk. The extra complexity is translated into money and then it is up to the business to choose. If the line organization is prepared to bear the extra costs for breaking the corporate standard that the IT department has calculated, it is up to them.

> *Catastrophe planning is one example of where the complexity increases by choosing non-standard solutions. If you have backup systems on another location this site must also be prepared to cope with the new deviating application. (Eric Davis)*

The computer power placed on everyone's desk also gives rise to a plethora of small applications, which are hard to control.

> *From an operations perspective you don't want too many systems. The worst ones to cope with are small end-user developed Excel spreadsheets. What to do with those depends a lot on what they are used for. (Eddy Delk)*

Scott Daniels thinks what environment a component uses as regards to operating system will become less and less important. If it is possible to justify the increased costs of bringing in another operating system in terms of people and competence, Scott Daniels sees no reason not to, especially not since the consequences of mixing operating systems are likely to decrease over time. Furthermore, he believes in a careful mix of decentralization and centralization. Some things, such as risk management and data, should be centralized, while others, processes and how things actually are done, should be decentralized. The centralized efforts should aim at providing a platform for the decentralized business operations and decisions.

> *What often happens when you try to set very detailed standards is that it all starts to be about control and politics and people's self interests. You don't want users to evade a standard since it reduces your own control and your influence. (Scott Daniels)*

The IT department tries to enforce standards by stating, ”these are the tools that we are using”. Having too many different tools places a heavy burden on the help desk, so Delta is sticking to Netscape applications. The fact that Microsoft's products are free really does not matter that much since that is only a minor part of the overall cost.

The Operations and Technology group is seldom consulted by project leaders regarding suitable environments. Since Delta rarely develops anything from scratch this is often not an issue.

> *When you enhance an existing application, the choice of environment is often wholly natural since you continue in the existing environment. It doesn't become an issue. (Anthony Dent)*

From an operations perspective Anthony Dent argues to:

> *Standardize on standards, not on products! (Anthony Dent)*

One example of this is the replacement of Delta's old e-mail system. It would have been possible to choose Lotus Notes or some other proprietary system. Instead, an existing standard was chosen, namely the Internet mail standard. Given this choice, Netscape was chosen. The idea, as Anthony Dent puts it, is that if Netscape ceases to work well it is possible to switch to another Internet mail compliant client.

> *It is a problem though, that standards are not always standards, and once something becomes truly standardized it is almost obsolete. (Anthony Dent)*

Changing the browser or mail client is perceived to be a minor problem, at least technically. If there is need for a big bang change there are of course some practical problems, which can be partly avoided by the use of good tools.

When Delta moved from terminals to PCs the need for support increased significantly, and the support department grew from 3-4 to 10-15 people. Delta had to make quite an effort to keeping the new environment running until the tools got better. Now there are tools for remote support and remote maintenance.

> *It's even possible to say: start updating these machines at 23:00 Friday night and call this cell phone if something goes wrong. (Andrew Dial)*

When PCs were introduced people had to be trained to be able to use them. Now, new recruits are able to use PCs, which was not the case in the beginning. What sometimes still is new to people is to work in an integrated environment where one is not allowed to do everything.

5.4 IT INVESTMENTS

5.4.1 A Business Perspective

Historically, Delta has had good time-to-market with innovations since in many respects the company has had a long term perspective and been willing to take on investments which have been useful only after quite some time. One example is transaction capacity where solutions were chosen early on which could cope with volume magnitudes larger than those Delta experienced at the time of the investment decision. This has made possible for the solutions to keep up when transaction volumes have soared.

Scott Daniels acknowledges getting funds for projects by giving the impression that they deal with mathematical valuation models, when in fact they have been more of administrative support projects. He has found it much easier to get funding for the former kind of projects. The quality of the administrative routines is important to Delta both Chris Drew, head of risk management, and Donovan Day, head of administration, note, and they have proven to be an important success factor for the company. They have been indifferent to increased transaction volumes and have instead been able to focus other things.

According to technical expert Andrew Dial, Scott Daniels has been extremely important in getting the line organization to listen to the IT department. One consequence of his overall perspective is the back office's ability to cope with large transaction flows with a small staff. It would be hard to find a replacement for Scott Daniels.

> *The business organization is more interested in IT issues now than before, which is not that strange since they are absolutely crucial for the company. (Andrew Dial)*

An IT budget presented on its own can be intimidating, especially if you haven't been able to affect it, Donovan Day admits. It is also hard for the IT department to prioritize without knowledgeable purchasers. Poor investments are often discovered too late when the solution is already finished.

Lately, the analyst Todd Dooling has seen a change; there is more focus on payback of investments than there used to be. To justify an investment someone has to show how it will pay off. Donovan Day agrees that revenue generation is important to the business side. "How will I make up for this cost through higher revenues?" This change is to some degree a consequence of an earlier tendency for the IT department and its projects to swell.

Todd Dooling thinks the incentive program at Delta has played an important role in restraining new IT projects.

> *If something costs one million to do, maybe 500,000 disappear from the yearly bonuses. Then people want to know what good it does. [...] When people travel more cheaply and try to save money in different ways, they don't want to see exploding IT expenses. (Todd Dooling)*

Todd Dooling also takes it for granted that the business managers question IT investments and ensure that these investments are reasonable. From a user perspective he also feels that the analysts have a lot of freedom when it comes to prioritizing between IT investments.

> *Management expects me to let people know if I do not have good models and tools. (Todd Dooling)*

An important part of the head analysts work is to be proactive and provide better tools in order to free up time for creative thinking and customer meetings. Todd Dooling actually spends most of his time on the phone and in meetings.

> *The analyses you have to write the night after the earnings report has been publicized. (Todd Dooling)*

For every application at Delta there is an application owner appointed. It is his or her responsibility to balance costs and benefits and show how the cost of an investment is covered by an increase in revenue. Chris Drew, who is the application owner of some risk management tools, feels that a general problem in the industry is combining the speed of change with the shortage of time resources that is always there even if funding is available. Many situations are almost impossible to solve due to these conflicting demands.

> *Examples of external changes that must be met can be competitive changes on the market that you have to respond to. (Chris Drew)*

In such cases one has to move away from the rational laws governing what can be done and what cannot, and instead trust the dynamics of the organization. Chris Drew refers to these soft and informal values as the company spirit. Delta has its own, very special, company spirit carrying values and beliefs.

5.4.2 A Technical Perspective

There are other companies testing things earlier than Delta, but Andrew Dial thinks Delta is among the first to get things to work with existing applications. Basically, there are two questions to answer. First, can it satisfy our needs? The next question is, can it survive on the market?

In general terms, mature technologies are preferred, according to Antonio Duncan, IT project leader, and version 1.0 of anything is usually avoided. When a choice was made between Microsoft and Netscape for Internet applications a few years ago, Microsoft was an Internet beginner and Netscape was totally dominant. Its product portfolio was more Internet standard than Microsoft's. The Netscape browser was better than the alternative (Microsoft Internet Explorer) and Netscape also offered good business conditions.

Thus, Netscape was chosen and today Netscape is used for both servers and browsers. People learn the technology, especially the servers which are much more complex.

> *When additional functionality is needed it is usually easier to add to the existing solution, that is you get more Netscape solutions. All of a sudden you have a complex set of applications in a Netscape environment. It is really hard to stop and reconsider the choices you have already made. If the first choice had been made later on, it would probably have been different. We haven't made any new choice; instead we are living with what we chose. There is a risk that Netscape will default and we will be stuck with their products. (Antonio Duncan)*

According to Andrew Dial, the focus was on standardizing on standards and not on products, i.e. to be open to changing products as long as they comply with the standards.

Currently, there is an independent Internet project underway, which is developed in a Microsoft environment even though it may become slightly more expensive. The external consultancy is pushing Microsoft technology.

> *In a Microsoft environment we could do like this etc. [on the arguments of the external consultants]. (Antonio Duncan)*

The external consultants evaluated different platforms and chose Microsoft technology mostly due to better development tools. The old application was using Netscape technology.

Equity Research is starting to use Microsoft for new applications while existing applications continue to use Netscape. Andrew Dial sees this as a way of slowly migrating towards a Microsoft environment, which he thinks is working quite well. The external consultants chose a big bang solution since it was a brand new application but to Andrew Dial there is nothing dramatic about mixing Microsoft and Netscape.

Delta tries to use projects with no legacy for trying new things and learn new environments. This reduces the risk of remaining overly dependent on the Netscape Internet solution. Regarding Netscape as a corporate standard for Internet solutions Antonio Duncan thinks:

> *We have grown accustomed to Netscape. [...] It is a choice we have made. [...] It makes me slightly worried. (Antonio Duncan)*

Eric Davis points out that the problem is the increased pace of technological development. This makes it harder to choose, and he feels that the big choices may not be particularly important since applications must be replaced relatively often. This makes it impossible to make long term plans.

5.5 IT STRATEGY

Historically, there has never been a formal IT strategy as far as Anthony Dent, head of IT operations, can recall. However, he is currently working with developing a strategy, which will be deliberately soft. It will, for example, suggest choosing the native environment for applications. For the standard desktop it may state which applications should be used but for larger application one cannot always have guidelines. An example of this, related to e-mail, could have been “Delta shall use NT servers”. From the beginning only NT servers were used but then performance suffered at the headquarters and the server was moved to a different environment.

Andrew Dial is not aware of any IT strategy.

> *No, not as far as I know. (Andrew Dial)*

However, active work is put into catching ideas and guidelines. Andrew Dial thinks strategic thinking is important in order to cover long-term aspects. Alan Dickerson confirms that there is no documented IT strategy:

> *Who would appreciate you putting 6 months into writing a 50-page document? (Alan Dickerson)*

Even if such a document would be appreciated, it would take too long to write and would be too time consuming to keep updated, Alan Dickerson thinks.

The IT department has weekly meetings and the common perspective is rather clear without any written documents. People know each other, know what different people think and know what expectations exist about how things are supposed to be done.

5.6 STRENGTHS AND CHALLENGES

5.6.1 Current Strengths

The most important strength is that things work together, Eddy Delk thinks. It is extremely important not to have isolated islands. The business flow is supported by Hugin and Munin, and all trades are automatically accounted for from a risk management perspective. This approach renders Delta much less sensitive to increases in volumes.

> *The applications have coped with the dramatic increase in the number of trades, which is the important metric. When they went into production it was about 500 trades per day. Now it is much much more [at the time of the interview, some 65,000 trades per day]. (Eddy Delk)*

Delta is efficient but must become even more efficient at managing transactions. Traditionally, customers get their contract notes the same night or in some cases not until the following morning. Donovan Day does not think this will be acceptable moving forward, and he thinks moreover that the changes can come very quickly. For hedge funds, for example, real-time updates of their positions are important. Today, Delta has STP within the company, which means that from the time the order arrives at Delta until it leaves the company (for clearing and settlement) it is STP. However, in the interfaces to the rest of the world there is a lot that could be done, Donovan Day thinks.

> *When you enter an order there is no more manual work to be done. Everything from then on [back office, clearing] is handled automatically. (Andrew Dial)*

The perceived advantage of having a streamlined process with no manual processing is possibly eroding since:

> *Everyone has that, don't they? (Andrew Dial)*

Donovan Day is quite satisfied with the Munin solution. He thinks it is OK to cooperate closely with other market participants when it comes to back-office solutions where they are not really competing. Trading applications would be a different matter, though. Donovan Day's view is endorsed by Andrew Dial:

> *Come to think about it, we have a pretty good solution cooperating with others where we don't compete [back office, Munin] and keeping it closer to the business where we do compete [front office, Hugin]. (Andrew Dial)*

There is a good infrastructure in place in terms of statistical databases, which enable the writing of analyses. Todd Dooling thinks the solution may be getting old, but Delta was among the first to support this, which makes the analysts work much easier. It can be quite an effort to enter all the data into the database, but once it is there it is rather easy to generate different analyses. Todd Dooling puts a lot of effort into his own models and if that to some extent could be centralized it would make his work easier he thinks.

Furthermore, the standardized consolidation worksheets are very important to the analysts. A lot of Delta's competitors are trying to achieve this but have a hard time doing it. Todd Dooling is unsure why, but he thinks that one reason for Delta's success is the extremely strong technical standardization.

Delta has managed to use an overall perspective where whole processes have been considered. Eric Davis feels that they may no long be unique, but there are still companies that are lacking this perspective. In his opinion, Delta managed this because of a few key people, mainly Scott Daniels, who was able to keep a holistic perspective and was also able to act on this perspective. One contributing factor was that there was, and still is, a culture at Delta which permitted it. Delta spends a lot of money on IT and is aware of it. The organization is used to a high cost level. Eric Davis emphasizes the long-term perspective of prior IT investments. Today, Delta is enjoying the benefits of the long-term thinking and planning done a number of years ago. At the same time that it is possible to reap the benefits of this work, it is also important that similar work is done today, Alan Dickerson adds.

In terms of IT-legacy issues, Chris Drew's down-to-earth approach is:

> *The most important thing is to consider things carefully. (Chris Drew)*

In Chris Drew's mind a lot of issues are judgment calls. The optimal solution is to make changes and amendments to the production system (Hugin and Munin). Often minor changes are implemented in Excel and the problem Chris Drew is worrying about is this becoming a jungle, which is inflexible and hard to keep track of. It takes more time but is more sustainable if the changes are made in the production systems but it is possible to cope with change, given that you act professionally, Chris Drew thinks.

In this respect Chris Drew identifies a discrepancy between the IT department and the business in general. Even though there is no need to put too much effort into IT solutions, the IT department must guarantee future operations and scalability. The user on the other hand usually only looks at the specific situation where really only a small fix is needed. Chris Drew thinks professionalism is needed from both traders and the IT department. IT must establish some level of flexibility for how things are done. Management must implement a stronger long-term perspective in the organization. Andrew Dial also points to the interaction between the users and the IT department.

> *A major challenge is to keep up the good cooperation between IT and the line organization. In the short run everything would work anyway, but in the long run the portfolio would disintegrate and its strength would diminish. (Andrew Dial)*

5.6.2 Technical Challenges

To keep the strengths of the portfolio Eddy Delk believes in continuously developing its components. He also thinks it will become ever more important to have sophisticated interfaces to the outside world, which is continuously changing. Functionality is always important, but completely clear and well-defined interfaces are probably even more important.

> *The only thing you know about the future is that you do not know what it will be like [which means that] you have to be somewhat like a chameleon, but somewhere there is a price to being a chameleon. (Eddy Delk)*

The major future challenge is to activate the customer and integrate the systems with the customer's application. That way Delta can offer something extra and tie the customer to Delta. This will most probably be done using the Internet, Andrew Dial thinks.

> *When he comes to work in the morning, he should log on to his PC, check his mail and then connect to Delta! (Andrew Dial)*

Internet is important even though Delta is not in the retail segment, Donovan Day thinks. He does think that electronic contract notes will be in demand shortly. In order to have short time-to-market, work within this area has already been begun. The strategy is not, however, to push the solution to their customers, but rather to be ready when there is a pull for it.

Antonio Duncan, IT project leader, seconds the opinion on Internet focus.

> *An important challenge in the future is the focus on Internet, which is continuously increasing. (Antonio Duncan)*

When it came to the RGA, porting it to Internet was rather easy. The logic of the application is contained in the database, which made the port to a straightforward interface issue switching from Excel to web pages. However, Antonio Duncan thinks that the initial development of the RGA went too fast. It is hard to maintain without him since he built large parts of it. He thinks porting the application to a more modern environment would solve a lot of the problems, especially if someone else did it, since that would leave two people knowing how the application is built.

Eddy Delk means that the current applications have been developed extensively from the original ones. Hugin's different components have been updated significantly. How long the applications will be able to keep up will be a matter of a cost-benefit analysis.

> *You don't use IT because it is fun. You use it because there is a need to be filled. (Eddy Delk)*

Eddy Delk does not think there will be a big bang shift to a new application totally replacing Hugin, instead he believes some functionality will be removed from Hugin and replaced by a standard component. In that way, replacing Hugin will be less of a big bang than replacing Munin. It is also a matter of competence, the fewer platforms you have the easier they are to manage. The cost of operating applications is often underestimated. Centralized applications are much easier, i.e. cheaper, to run than decentralized applications. Even though the PC boom has provided cheap hardware and software, it is very expensive to run. Eddy Delk exemplifies this trend with local applications developed in Excel, which are widely dispersed in the company even though the IT department may not even know they exist. If the creator of the application then disappears it is very hard to support that application. On the other hand, it is easy to add applications in a PC environment, Eddy Delk adds.

Eddy Delk also believes that standard application packages will become more and more common and managing the integration of different packages in an intelligent fashion will be important. Delta used to develop middleware in-house, but for a number of years a standard package has been used. It became too expensive to develop bread and butter applications that were also developed by specialist software providers. The level of what is standard and what is not is changing all the time, Eddy Delk notes.

> *The hard part is being leading edge without being bleeding edge! (Eddy Delk)*

Scott Daniels, the business developer, believes that the standardization level continuously ascends. It used to be that some companies developed their own operating systems. When that got standardized they built their own databases. In the eighties they built their own window management routines, and so on. He believes in standards up to a certain level, but:

> *Sooner or later you have to differentiate yourself to gain competitive advantages! (Scott Daniels)*

According to Scott Daniels you easily take on an operative risk by accepting what is offered to you even if it covers 80-90% of your requirements.

> *Many companies think "at least we are not doing anything wrong if we do like everyone else"! (Scott Daniels)*

Munin could probably support the core business for another five years, Donovan Day thinks. The work of finding a successor has started. An important part of this work will be to make the application more modular. There is no ambition to develop the whole application, instead it is preferred to buy components and only develop in-house when there are no external components available. Donovan Day also wants to abolish the strong focus on front office and back office and rather focus on the STP aspects. Delta's expertise should be strategy and the ability to integrate a new platform, he thinks. It ought to be possible to buy some components, for instance communication with the exchange, off the shelf.

In Eddy Delk's mind the choice to develop Hugin in-house was a question of timing. In the beginning there were few standard application packages available. When Hugin was developed, there were basically no packages available, and there was definitely no application integrating more than one marketplace, which gave Hugin an important edge. Today, front-end applications are more of a commodity and there are plenty of standard packages. The strength of Hugin today is rather its tight integration. Eddy Delk thinks it would probably be possible to integrate components to reach the same advantages. Doing that would presumably add functionality in some areas but one would risk losing the holistic approach, i.e. Hugin may not be the best solution in every part but making standard components interact as well as Hugin would be very hard.

> *If we'd had standard application packages it would have been easier when change requests come, for example the new SAX protocol. Then you can turn to your provider and, in principle, be unaffected by that kind of changes. This is a price you have to pay when developing in-house. (Eddy Delk)*

On the other hand Andrew Dial points out one consequences of not being responsible:

> *When it comes to Y2K you are more or less in the hands of others since you have to trust that they really are Y2K-compliant. (Andrew Dial)*

Eddy Delk thinks interface issues will be a major challenge moving forward, both regarding external parties and internally. Functionality issues are of course also important, as you never get done with the applications. Eddy Delk is sure that the exchanges will come up with new features once the Y2K issues can be put to rest.

When the development of Munin was started there were some alternatives available but they did not meet the requirements put forward by Delta. Both Hugin and Munin were on the leading edge.

> *If you buy standard components and it does not work you can turn to the provider. He can however say "It will be included in the next release due a year from now" and then you have a problem, especially if it is a critical application or component. When buying standard components you have to consider both the provider and what standing you will have as a customer. (Eddy Delk)*

The IT project leader Ervin Dickens sees no intrinsic value in building applications in-house. However, if a standard application package leads to increased costs in the work processes, a potentially lower acquisition cost is not so important. Instead he is a strong believer in striking the golden mean, which is neither developing in-house nor buying standard packages but instead developing the application with a partner and then selling it to other companies.

When it comes to control in situations of using product companies, buying standard applications, or using different forms of outsourcing, Donovan

Day prefers solutions where the control is kept in-house, at least when there is in-house competence. Historically, Delta has not outsourced much; instead different forms of partnerships have been used.

Scott Daniels sees some sort of opposites attract. If you have developed in-house a lot you tend to say, "let's not develop at all". He thinks the truth is somewhere in between. It is easy to draw the conclusion that "now we have developed everything and it didn't work, let's quit developing and buy everything off-the-shelf". When it comes to developing products for product companies:

> *Understanding the business is the hard part. Calculating the volatility isn't so hard but understanding how business is done is much harder [for a third party vendor]. (Scott Daniels)*

5.6.3 Business Challenges

CEO Dennis Douglas emphasizes that Delta will have competitive, as well as cost effective, applications. Now, he feels Delta has competitive applications in Hugin and Munin. Flexible solutions will also be extremely important, he notes. In general, he is looking towards more component-based solutions in general.

Scott Daniels also believes strongly in component-based solutions where Delta acts as a professional buyer of services and components. Procurement will become something of a core competence for Delta, he thinks. It also becomes extremely important to manage the interfaces between the components. Changing the interfaces becomes very hard and expensive, so long-term solutions are necessary.

Donovan Day thinks there will be a lot of changes going forward. There has been a strong focus on Y2K, which means that new projects and new functionality have been put on hold. There is also a new infrastructure emerging with alliances between exchanges and new clearing solutions. New trading scenarios, such as electronic crossing networks can also become an alternative.

> *When it comes to future development you are at the mercy of what goes on in your environment. [...] Larger changes come at an increasing tempo. (Donovan Day)*

Delta has always been in a competitive situation, but trader Ben Dudley thinks their competitive lead has increased the last few years. How to preserve Delta's strong position is really a management problem, though.

Being aware of the trends that are out there, while at the same time analyzing them critically, is the key, he thinks. Is this really something to spend money on? Or will it be too late if we wait? Ben Dudley thinks of Internet-based stock trading as an example. Many brokerages are going in that direction and it does not seem like a fad.

> *Maybe preaching, "knowledge is more valuable than low fees" doesn't cut it any more? Maybe you have to be in on Internet trading? (Ben Dudley)*

Scott Daniels on the other hand thinks some Internet brokerages can run into problems in the future since the price competition is enormous. He also thinks that the customers will become more demanding and ask for more complex products and services. He doubts whether there will be money to make as an Internet broker.

The IT development is rapid and a lot of people working with IT companies are young while the customers are older. This sometimes makes communicating hard and people see things very differently. Ben Dudley says that this is easy to notice in the financial industry.

From a trading perspective Ben Dudley sees no imminent risks with Hugin since it is component based and can be developed to meet new demands. Furthermore, new instruments are not really common in derivatives where Ben Dudley mainly works.

Time to market is important for competitive advantage, Todd Dooling thinks. One example is the ability to send analyses electronically to print centers around the world in order to distribute paper-based reports the morning after some corporate event. Internet and e-mail are other means providing fast distribution. Furthermore, interactive databases would be a competitive advantage from an analyst's perspective.

In Todd Dooling's mind, Delta has not built on the edge provided by the consolidation sheets. Others are building solutions similar to Delta's but Delta has not added much since they were introduced. Todd Dooling thinks more could be done with the data already in the database. He also foresees some sort of information gathering support, because today it is very hard to know what you have not covered in your research.

> *There is nothing worse than being called [by a broker or a customer] and being asked about the effect of a news piece you haven't even seen! (Todd Dooling)*

Yet a future challenge is to create a centralized customer management system, Todd Dooling thinks. Today it is hard to know what relations and contacts Delta has with a customer since this information is kept locally, and often on paper. Todd Dooling refers to the American investment banks as examples in this area.

> *They [the American investment banks] are good at this and they always know whether you bought or sold Volvo yesterday. (Todd Dooling)*

6 CASE TAU

6.1 THE COMPANY

Our mission is to reduce the cost for the retail customer. We provide a trading tool for the customer. (Mary Thomas, Head Broker)

Availability and simplicity are key words. (Tony Turner, CFO)

6.1.1 Business Strategy

It should be cheap and simple. (Mary Thomas)

We're a little bit like IKEA [...] It is quite down to earth and for the common man. (Tony Turner)

Tau[31] strives to provide their customer with a simple and cheap way of buying and selling stock. In the last few years, Tau has managed to meet the needs of their customers more closely, CEO Ted Taylor notes. The technology has developed, and it enables more advanced solutions, but the customers have also matured. Tau's typical customer is a private retail investor, maybe in his, or more seldom her, 40s. Tau does not allow its customers to use the brokerage account as collateral for borrowing money, which does not seem to be interesting to their customer segment anyway.

Etan Trent sees two niches for brokerage firms from his perspective as a project leader at the IT department:

- *Low cost actors*, such as Tau, focus on transaction flow and keeping the costs down,
- *High end actors* target institutions or wealthy private investors providing full service at higher fees. Technology is not allowed to be a restricting force, and top management attention is geared towards business rather than technology.

[31] A list of interviewees can be found in Appendix A. The interviews were conducted between June 2000 and October 2000.

6.1.2 Business Activities

Tau consists of two business areas: Tau Brokerage and Tau Equity Savings (see Figure 6.1 below). Tau Brokerage acts as a traditional stock brokerage providing order execution services for its customers. Historically, customer interaction was phone based, but Internet has been adopted as a major customer interaction channel. Tau focuses on order execution and does not provide its customers with research reports etc.

Tau Equity Savings provides a savings service also targeted at the retail investor segment, where the investor has a regular brokerage account. The service allows buying stock for a fixed amount of money (potentially ending up with fractions of shares) much in the same way as normal mutual funds work.

6.1.3 Tau Organization

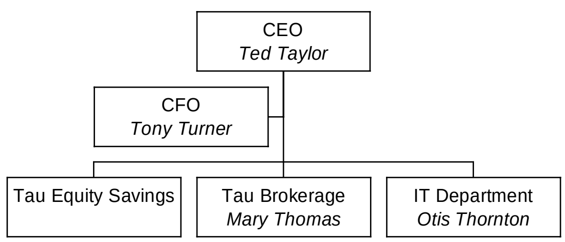

Figure 6.1: Tau Organization Chart *(Interviewees Included)*

All in all, Tau has some 60 employees. Tau Brokerage has close to 30 employees, eight of whom are customer/retail brokers. There are no proprietary traders at Tau. The IT department has eight employees and a few consultants. It serves both Tau Brokerage and Tau Equity Savings. The business areas are of about the same size, but the speed of IT development is significantly slower at Tau Equity Savings. The head of the IT department, Otis Thornton, thinks the IT department (see Figure 6.2) needs to be expanded to some 12-13 employees.

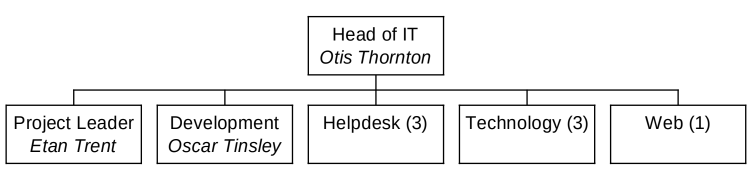

Figure 6.2: IT Department Organization Chart *(Interviewees Included)*

The IT department has a one person helpdesk and two people purchasing and installing PCs. There is also a web-master and three technicians: an AS/400 expert, a Unix expert and an NT/network expert. Otis Thornton works closely with Oscar Tinsley, the head of business development, and they handle most of the contacts with suppliers. Oscar Tinsley usually applies an IT-in-the-business perspective while Otis Thornton is the technical expert. Etan Trent works a lot at the interface between suppliers (e.g. designers, Java programmers and database people) and the business side together with Oscar Tinsley, who takes care of the more technical issues.

6.1.4 IT and the Business

To CEO Ted Taylor, IT is a way of reducing costs. He wants commonly available knowledge and competence in-house but prefers to buy leading edge knowledge. Internally, the employees should develop and learn new technology rather than being niche experts within a small area. He considers IT to be a core competence and wants to use IT proactively to reduce costs. Tau's explicit strategy is to avoid the first hits by being maybe number four or five in introducing new technologies.

When Tau went online a few years ago they were neither the first nor the last to do so, but they were an early adopter and had a good solution. Ted Taylor thinks some companies want to be the first mover mainly because it is cool to be first. It is however considerably more expensive to be the very first compared to being slightly later. Tau is actually making money while many other on-line brokers, many of whom are earlier adapters of new technology, are losing quite a lot of money. Ted Taylor emphasizes that you cannot run ahead of your customers.

> *They have to be ready for the solutions you provide! (Ted Taylor)*

On the other hand, he confesses, you cannot afford to be the last one. Tony Turner, Tau's CFO, agrees with this:

> *We haven't been in the forefront when it comes to new technology. (Tony Turner)*

In the same vein, Oscar Tinsley notes that

> *We are the safe, secure alternative and have always been lagging slightly. It's an explicit strategy to be safe and secure. We bring in stuff that works! (Oscar Tinsley)*

Unfortunately, Tau has been lagging more lately, Oscar Tinsley notes. Others have had more resources, which has meant that Tau has not been able to keep up. Some competitors have a strong traditional brokerage to lean on, while others have been good at raising venture capital.

Etan Trent, the project leader at the IT department, grants that there is a certain marketing impact for competitors that are actively trying to be first movers, but he doubts whether it is really profitable. However, he thinks it is important to decide in what sense one should be the first mover. He would like to be the first mover with a truly stable Internet service but sees no real reason to be the first one offering a wap-based solution for real-time portfolio information, for instance.

The rapid technological development will increase the importance of coordinating productions, marketing and management and will force organizations more in concert. Etan Trent strongly believes the industry will grow farther away from the star-trader culture of yesterday. One way IT and the business are integrated and kept in sync is the incentive system where the people at the IT department share the same system as the rest of the organization.

Choosing not to be a first mover when there is some new technology available means that it is important to have short lead times so you can somewhat catch up with the competitors, head of development Oscar Tinsley notes.

> *Our lead times are not as short as I would like them to be. (Oscar Tinsley)*

An important component to shortening lead times is to be demanding. As Tau's purchasers have gained experience, they have grown tougher in this respect. Another way of keeping the lead times down is to bring in competent consultants.

When it comes to new technology, the people at the IT department are genuinely interested, and since they are also aware where the business wants to go, they pay extra attention to relevant areas. The head of IT, Otis Thornton, defines the following organizational roles:

- IT's role is to be knowledgeable about the technology.
- The business' role is to be knowledgeable about the business.

Given these roles it then boils down to being able to communicate so that the IT department understands what the business wants to do.

> *IT's role is to provide solutions, support technology and be experts on new technology. (Otis Thornton)*

Otis Thornton thinks the IT department plays an active part in the organization.

> *[The] IT [department] is more proactive than before and is not as short handed as we used to be. This means that we have more time to understand the business and its need. It isn't just firefighting anymore! (Otis Thornton)*

> *We want to see if and how we can help. (Otis Thornton)*

The people at the IT department should spend a considerable amount of time in the business joining people when they work in order to better understand how their work could be supported by IT. The IT department can help trigger processes, but the business side must drive the business development processes. IT supports them with technical expertise and tries not to put limitations on users' imagination but tries instead to have the business side think freely and creatively.

> *So far we've been able to solve everything! (Otis Thornton)*

In Otis Thornton's experience users often see technical limitations that may not really be there. When there is a business idea, it is pursued by the business organization and the IT department provides solutions to it. He prefers standard packages and standard solutions as long as they do not hamper the business idea too much.

6.1.5 Management of IT Investments

> *In the long run every step we take in the IT-area must be in the right direction. We cannot afford any B3LA-projects*[32]*. Large actors can afford trial-and-error, but we can't. (Etan Trent)*

IT investments are usually discussed in the management team, which includes the head broker Mary Thomas, CEO Ted Taylor, CFO Tony Turner, the project leader Etan Trent and Otis Thornton, head of IT. Major projects, such as the back-office solution at Tau Equity Savings, are presented to the board in general and the chairman of the board specifically. At Tau, major projects are defined by a monetary threshold. The management team decides on smaller investments.

[32] B3LA was a Swedish military fighter airplane project that was abandoned in 1979 after a number of years and billions of SEK.

Tony Turner sees two distinct different types of investments, the well-planned long-term ones and the firefighting. He feels that the Internet has increased the number of firefights. The tempo was lower when trading was phone based. The customers are much more demanding when using the Internet. One consequence of the information society experienced by Tau is that everything is supposed to be, and is, very fast.

> *If the web server is down, you [as a customer] change brokers. This makes availability crucial. In 1994 the customer didn't always notice if the systems weren't running properly. The customer called the broker and it wasn't apparent if the systems were down. Now, damn it, the customers are on your case all the time! (Tony Turner)*

If the availability for some reason falls off there is a problem somewhere to be solved. Sometimes database experts have had to been flown in from abroad to solve problems in true firefighting spirit.

When it comes to new functionality, speed is not equally critical. If someone else has some new functionality that Tau is lacking, it is not as time critical as an availability problem. The number of such problems is linked to the fact that the technology often is leading edge.

> *Then there are competitive reasons and even though time is important it is not as critical. If there are errors that decrease the availability it is extremely time critical. (Tony Turner)*

The IT department is often involved in investment processes in a very early stage when there is nothing but an idea of what Tau wants to do, Otis Thornton notes. Apart from him being involved as a member of the management team, the IT department also has close contacts with users who often contact him before investments are even proposed. When the investment decision is made, it must be decided what is needed in terms of people, technology and organization. From a technology perspective the next questions then are, in this order:

1. Is it available in-house?
2. Can it be bought?
3. Can we develop it ourselves?

When ending up with alternative 3, Etan Trent, as a project leader, notes that the variety of the decisions to make is, or at least can be, overwhelming for a small organization. There are decisions to make on everything from platform and technical issues to colors in the graphical user interface. Large IT projects are also inherently risky and even when completed, some component, for example the database software, maybe is no longer updated by the provider. Etan Trent thinks that by buying applications and evaluating the provider, you can trust that they will continue to develop the application. That way you avoid a vast number of decisions since the provider has made and will continue to make most of the decisions.

If however, there are enough resources to develop in-house, it can become a competitive edge since the business side does not have to adapt to what the systems can and cannot do, Otis Thornton notes.

In general, Tau tries to buy components, which are then adapted and put together. There is a mix of their own adaptations and adaptations bought from external parties, but Tau is trying to increase its ability to adapt applications. Keeping this in-house is faster and simpler, and there are also some confidentiality reasons.

> *When consultants are hired there is no way of knowing where they take your ideas. (Etan Trent)*

The most common, garden-variety development tool is Excel, where Tau has implemented everything from small simple calculations to rather complex models. Etan Trent is actually in charge of an index fund, which he manages using an Excel worksheet. The use of spreadsheets and other forms of in-house development cause some problems since documentation is usually lacking and there are also security issues that are left open.

6.2 IT PORTFOLIO

6.2.1 Portfolio Ingredients

The main ingredients in Tau's IT portfolio are:

- PCs, which run under NT, and look the same for almost everyone. The two exceptions are the brokers who have trading applications (Saxess Trade and Tellus) and informational systems (SIX and Reuters) and the IT department where people use network tools etc.
- Finess (Tau's back-office system)
- Tau Equity Saving's Back-Office system (TESBO)
- Tau Brokerage's web site
- Tau Equity Saving's (TES) web site

Finess is a back-office solution provided by an external provider while TESBO was developed in-house a number of years ago. Two back-office solutions are needed since TES trades “backwards” compared to normal brokerages. The customer fixes an amount and then buys fractions of the stock, which calls for a different back-office solution than Finess, which is used for “normal” trading. In that sense, TESBO was unique, i.e. it was not possible to find a standard application package that filled that particular need. In general however, Tau uses standard packages that are often cheaper and also easier to get upgraded. To upgrade systems developed in-house takes longer since one has to do everything oneself, Otis Thornton notes.

Regarding Finess there are not that many new needs arising. Change requests put forward by Tau rather have to do with things like performance issues. Finess also is open, which makes it possible to use small components developed in-house to cope with specific queries, for example. The possibility of adding such in-house components is important to Otis Thornton.

The brokers’ desks contain quite a lot of standard packages available for different purposes. Tau uses Reuters as an informational system, but there are viable alternatives such as Bloombergs.

> *[Bloombergs] is actually quite tremendous, but I have a hard time seeing what need we have for it. (Mary Thomas)*

Saxess Trade, the trading application provided by the Stockholm Stock Exchange, has suitable functionality and offers what Tau needs. Tellus, which people at Tau sometimes call a “necessary evil”, is used to connect to SBI[33]. It is a simpler front-end application than Saxess Trade and does not contain as much instrument information as Saxess Trade. The only alternative to Tellus is to continue to trade manually, which Head Broker Mary Thomas finds to be an even worse alternative. Tau has chosen not to invest in a fixed line to SBI. Since Tau was unsure about SBI and whether it would present a viable business, the costs of a leased line were avoided. Instead Tau enjoys the option to upgrade to a leased line should the need arise. SBI has stabilized recently and the major banks have joined in. The move to electronic trading has decreased the number of incorrect trades, since the former manual trading suffered from the trades not being locked in.

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[33] At the time SBI was a small marketplace competing with the Stockholm Stock Exchange for the listing of smaller companies.

6.2.2 Portfolio Structure

Thus, Tau's portfolio consists of a few rather large components with tailor made components using the existing interfaces. Otis Thornton, head of the IT department, notes that the vulnerability increases when there is a lot of functionality in one component. If it goes down or has to be brought down for maintenance the company loses a lot of functionality. On the other hand a lot of small components will get complex even though it is easier to adapt and come close to the IT-support actually needed by the business. Otis Thornton compares the issue with choosing between a compact stereo and a hifi-stereo. He thinks the quality of the organization is crucial. In a small organization the compact stereo may be the right way to go. In a larger organization there is more competence, and it is easier to have a lot of smaller components. On the other hand, the project leader Etan Trent argues that the number of synapses between different applications becomes almost infinite in a large organization, which makes it very hard for any single person to keep track of the whole portfolio. In a smaller company this is easier, even though the number of interfaces and bridges linking different applications together is increasing at Tau. Etan Trent's conclusion is to voluntarily choose a mix of different components if they are noticeably better than the single larger component

Another aspect of small vs. large companies that Tau has experienced is that for small companies, the market governs what is available.

> *A major IT-consultant said "Sorry, this project is too small for us" when we wanted them to develop an application for us. As a small actor Tau must adapt to what's available out there. (Etan Trent)*

In general, Mary Thomas finds software providers to be quite willing to adapt their products. For example, she recently wanted to combine information in a new way in SIX, which was solved very quickly by the software provider. She does think however that the stock exchanges can be restraining. If she, for example, wants real-time information via Reuters, the stock exchange will be the one setting the limits. In Mary Thomas' experience, stock exchanges are far less interested in finding, for instance, viable pricing schemes for information. She feels there is a communication problem with the customers since they expect most things to come for free and do not appreciate that it is really the exchanges that are charging for the price information.

Tau has experienced some problems with the communication between the web site and Finess, while the Saxess Trade – Finess communication is working quite well. There is a gray area in the interface between the web site and Finess, which is an old solution no one really feels responsible for. Tau bought the web site (including the interface) from a competitor a few years ago and has since then developed it further in cooperation with the software company that originally developed it. The interface however is old and poorly documented.

Tau plans to solve the problems on the Finess side by adding some new functionality. Tau is sensitive to the communication since intra-day updates of brokerage accounts are kept in Finess, i.e. there is a continuous communication process between the on-line site and Finess. Other companies download the information from Finess in the morning and keep all the intra-day updates in other systems and then upload the information again at night.

The systems involved run under different operating systems, and even though the problems are not operating system related solving the issues is not made easier by the different environments. In general, Head of Business Development Oscar Tinsley does not think that there are any major problems with mixing different operating systems.

> *The fact that Finess has been a colossus for many years has nothing to do with the operating system. (Oscar Tinsley)*

In reality, Tau often does not have any choice when it comes to operating systems. Finess for example is a crucial application and is only available under AS/400. Other applications are available under Unix while NT comes naturally for administration and PC-network.

6.2.3 Operations

Tau used to outsource some parts of the operation but does not do so anymore since it is now possible to have all the necessary competence in-house. In this respect, Otis Thornton defines four competence areas where he considers the network to be a competence area in the same way the operating systems are:

- AS/400 (Finess and Tau Equity Saving's web site)
- Unix (Tau Brokerage's web site)
- NT servers for internal administration
- Network

If it would turn out to be more efficient to outsource some things, Otis Thornton is ready to do so even though he thinks keeping operations in-house does increase the closeness to the business. A lot of what was outsourced was manual tasks that have been automated.

> *To stare like an idiot at a screen is a waste of human resources! (Otis Thornton)*

This is also the approach on the business side, where for example there used to be a manual step involved for Internet orders, but this has been removed. There are some automatic checks performed such as “does the customer have enough money to pay for the buy order?”, “does the customer own the instrument he is about to sell?”, “is the price reasonable?” etc.

6.2.4 Web Sites and the Internet

In Mary Thomas’ eyes Internet services have been and still are an important strategic issue for Tau. Tau has provided some new functionality in this area compared to some of their competitors. Even though she is not actively involved in the development of the web site Mary Thomas feels that she can influence the content of the site. All the brokers, and actually everyone at Tau, have had opinions on the site and its content.

The on-line sites are tailor made and developed together with external consultants. Some components are shared with other web sites since the consultants have helped others as well. Tau’s site went live about a year ago while TES’ site has been around for a few years. The web application was developed by an external provider, Echo Software[34], which is still important to Tau for enhancements and solving problems with the site. Echo Software has used an object-oriented database, which in some instances has forced them to bring in support from the vendor’s European headquarters.

In some instances there is also a combination of different suppliers that is crucial, for example SIX provides information, which Echo Software, as an external consultant, uses to enhance the site. There are also demands for new functionality put forward by Tau’s customers. Mary Thomas notes that customers not always think of the costs involved:

> *– I want that piece of functionality! [Customer]*
>
> *– Are you willing to pay for it? [Tau]*
>
> *– No! [Customer]*
>
> *– Well, then. [Tau] (Mary Thomas)*

---

[34] Echo Software is a pseudonym.

The on-line site includes some technical analysis provided to Tau's customers from an external company. The information is linked into Tau Brokerage's web site. This works well but can of course go down and then the customers turn to Tau.

> *Tau is responsible that the site works even though we don't have control over the external site providing the technical analysis. (Mary Thomas)*

Oscar Tinsley, the head of business development, coordinates Tau's requests for enhancements and operations from Echo Software. He receives enhancements ideas from various sources at Tau, but the contacts with Echo Software are channeled via him. For a few months Tau has had a Unix expert in-house, and the reason for hiring him was explicitly to take on more of the operations of the web application. This is done in concert with Echo Software since they want to focus more on further development. They took on Tau's operations even though that was neither Echo Software's nor Tau's intention from the beginning. Tau is actually the only customer whose applications Echo Software has been operating. Moving the operations in-house to Tau, will allow Echo Software to focus more on further development than operations.

Oscar Tinsley thinks things have worked well, but Tau will get more control when operations are handled in-house. For example, backup routines become more evident when the application is in-house, closer to the business.

> *What a one minute outage means is not as obvious to Echo Software as it is to us in-house! (Oscar Tinsley)*

Bringing it in-house also enables Tau to plan their work more carefully since they are not dependent in the same way on conditions at Echo Software. To Oscar Tinsley control and planning are the most important advantages of moving the operations in-house. One drawback is that it takes more in-house competence, which costs money.

6.2.5 Different Kinds of Projects

Updating Web Site Structure

The web site has a three-tiered architecture:

1. Presentation
2. Application
3. Database

Tau recently took a new presentation layer (level 1) in production, which was developed together with presentation consultancy. Echo Software's solution covers application and database (levels 2 and 3). The Echo Software solution uses standard components internally in the application, which Echo Software tells Tau makes it easy to add more marketplaces or exchanges. The presentation layer project was initiated by Oscar Tinsley, Etan Trent and Ted Taylor after Tau had received some feedback on the design.

> *It looked like an old Volvo! (Tony Turner)*

The project went through a normal procurement process where a number of possible providers were approached. The providers presented themselves and submitted project proposals. The providers that were approached were specialists within the area of presentation and design.

The presentation layer is largely independent from the platform (levels 2 and 3), and the project was managed by Oscar Tinsley, Etan Trent and Ted Taylor in concert. Had it been more technical, i.e. involving application and database, people with more technical skills, such as Otis Thornton, would have been involved. Oscar Tinsley positions himself as more business oriented than Otis Thornton but less so than Etan Trent.

Early on in the project process the presentation consultancy, Echo Software and Tau sat down to clarify any possible open issues and discuss interfaces etc. Echo Software basically provides a Java-based interface from the application layer to the presentation layer. Oscar Tinsley thinks it was important to have the different parties meet in order to get Echo software on track.

> *Even though Echo Software really isn't into presentation, but rather platform architecture stuff, it becomes somewhat of a competitive situation when you bring in another consultancy company. (Oscar Tinsley)*

A prior attempt to update the presentation layer went awry a few months earlier, which was partly caused by not getting Echo Software on track. Putting the enhanced site into production got complicated since there were some issues in the communication between the layers that were not tested properly. The scalability of the former solution was not good enough so Tau had to put the new solution into production before it was completely tested which led to some availability problems.

> *Fortunately, our competitors had the same kind of problems. (Oscar Tinsley)*

CFO Tony Turner notes that this was not a firefighting process but instead a good calm process that took maybe 6 months in all.

Replacing TESBO

TESBO was developed by third party vendor where the key person later joined Tau as head of IT (Otis Thornton's predecessor). Tony Turner characterizes TESBO as an old inferior application. It lacks some basic functionality, and adding new functionality is difficult.

Tony Turner thinks that the fact that TESBO is used on a daily basis rather than in real time has helped to keep down the speed of the decision process to a reasonable level. Furthermore, Tau has known about the pending need to replace TESBO for four or five years. A year and a half ago, the board decided that it was time to look into whether a new system should be built or the old one should be updated. An external consultant was hired to carry out a review of the system. His conclusion was that the reasonable thing was to build a new system, and when he briefed the board that was their decision.

Offers were requested from four different companies and the management team selected two of the proposals, which were presented to the board. Tau and the selected provider have produced a requirements specification and a price tag, which will then be presented to the board.

Dealing with Availability Problems

> *Availability should be 100%! (Tony Turner)*

Projects are completely different, Tony Turner notes, when they deal with availability. A few months ago Tau had a lot of problems with the web site, and there were availability problems almost every week.

> *In such cases you have to rely on your supplier since you cannot bring in anyone else to support their systems. We didn't have much of a choice. We were stuck. (Tony Turner)*

Tony Turner also notes that it is hard to find suppliers for systems meeting the capacity needs of Tau's on-line site.

> *You wouldn't dare trying something completely new! (Tony Turner)*

Thus, a supplier must show that it works in Tau's environment and with Tau's traffic levels, which calls for a lot of testing. CEO Ted Taylor adds that Tau is striving towards long-term relations with its supplier, which it has been able to achieve. The head broker Mary Thomas agrees.

> *We have established suppliers whom we can discuss with, such as OM, SIX and Reuters. There are suppliers providing cooler and more hip functionality but that aren't established on the market. (Mary Thomas)*

In this area of supplier relationships, Ted Taylor also finds yet another argument to stay clear of brand new technology:

> *A problem with new technology is that it is hard to find good suppliers. (Ted Taylor)*

6.3 IT Strategy

> *IT strategies are like dissertations, well thought out documents that not very many people read! (Otis Thornton)*

There exists an IT strategy at Tau. It was written by Otis Thornton and deals more with how the IT department works than with technology issues. It acts much like a business strategy for the IT department and Otis Thornton spent a lot of time writing it. To him the writing process is important in itself as it forced him to structure his thoughts on different topics.

> *The IT strategy really sits in my head. By writing it down others can see what I think. (Otis Thornton)*

The IT strategy deals with changes in how the IT department works and how it is organized. A few months ago the department consisted of a manager and two employees supporting some 60 people. Now there are seven people supporting twice as many people and also supporting AS/400. This has called for a new organization, and Otis Thornton thinks that the IT department will soon reach its goal of spending about half its time on operations and support, a third of their time in the business, and the rest (about a sixth) on education and knowledge creation taking courses, visiting seminars etc. Otis Thornton admits that Tau has not yet reached this goal, but he thinks that is only a matter of time.

To reach the goal, however, means that people must work smarter and in new different ways. It also means that support agreements with suppliers of hardware, software and service, must be unified. Otis Thornton would like to try to implement the IT department's new, more effective way of working in other parts of the organization to decrease for example the need for more staff when the exchange extends its opening hours.

CFO Tony Turner thinks it would be good to have a yearly business plan to know in what direction to go. Now there is a lot of firefighting and no time for the long-term perspective. There are some strategy documents on business idea and goals but Tony Turner thinks that is more show than actual goals to work towards.

> *Rather than a strategy there is a strong culture. [...] The organizational culture is that everyone is worth the same. At other brokerages the brokers are more important than others but that is not the case here. Everyone shares the same bonus pool and receives the same percentage of their salary. (Tony Turner)*

A lot depends on the CEO Ted Taylor who has been with Tau for some ten years and Tony Turner who joined seven years ago. If both Ted Taylor and himself were to leave, Tony Turner thinks the culture would be weakened or changed and is quick to add that this could be for better or for worse. Ethics is an important part of the culture, and there are discussions groups on business ethics at Tau where sometimes guest speakers are invited.

6.4 STRENGTHS AND CHALLENGES

6.4.1 Current Strengths

From a business perspective Oscar Tinsley thinks that one of Tau's strengths is its cost profile.

> *[We are] cheapest on the market and provide stock trading at do-it-yourself prices! (Oscar Tinsley)*

A drawback of this strength is that it hurts revenues, thus reducing the available resources for developing new solutions. Otis Thornton sees the same problem but also notes that Tau's business vision is do-it-yourself, which makes it less problematic if others have fancier technical solutions.

Tony Turner thinks everyone in the on-line brokerage business prioritizes availability. Tau also adds simplicity, clarity and security. There are no flashy pictures and when other may have blinking banners Tau chooses not to distract the customer in his or her decision process. Tau is competing well when it comes to availability and security compared to their competitive position regarding new technology. This depends partly on the employees.

> *If you like the newest technology, maybe you aren't attracted to Tau. (Tony Turner)*

From a technical perspective Otis Thornton notes that:

> *It [the IT portfolio] works pretty well considering its complexity. (Otis Thornton)*

Otis Thornton would like to unify even more, for instance by reducing the number of operating systems. It is easier to maintain leading edge expertise with fewer operating systems. Moreover, with a unified portfolio, once a problem is solved it is easier to apply the solution elsewhere. Upgrades are also easier if the environment is unified. He concludes by noting that availability is the key. The applications must be up and running. Etan Trent, project leader, also underscores the importance of stability:

> *Stability and security. We at Tau are clear in our message to our customers: availability is paramount. [...] We are "boring and simple", which is reflected in the systems too. (Etan Trent)*

Tony Turner thinks Tau's systems work well even though of course specific components can always be enhanced. He is pleased with the TESBO project and the presentation layer project for the web site. Oscar Tinsley is also satisfied with the presentation layer just put into production. An important part of the new solution is a new hardware solution dealing with load balancing. The new solution is also more stable since there is more redundancy and fewer single points of failure. The load balancing will be implemented in the application layer too, in due course.

The cooperation within Tau is also something Tony Turner likes as he is convinced that soft issues also affects how well the organization and its systems function together.

> *Systems can talk to each other because the people communicate well. Lack of communication between people will lead to errors. We're good at communicating. (Tony Turner)*

6.4.2 Challenges

> *Internet is an unstable foundation. Technically the customer must be able to reach us, and we must be perceived as stable and must know whether or not an error is caused by us. Once the customer reaches us they should get all the help they need. The helpdesk isn't only there to help customers with our site but also with general Internet problems. Yet another challenge is new instruments that the customers not always understand. Gambling problems can also become a problem in the future. (Etan Trent)*

> *To have a system you are comfortable with! [Are you comfortable?] No, I'm not comfortable today. (Tony Turner)*

CFO Tony Turner says he was in favor of changing the on-line application when there were availability problems, but others wanted to pursue the chosen solution.

> *Now and then we've had problems with the availability of the Internet site. It's a long chain of systems that must work. Yesterday we suffered from a problem at [our back-office provider]. There are so many systems that must work together when an order is entered at the on-line site, checked against Finess and sent to the marketplace. [...] It is vulnerable, extremely vulnerable. Each sub-system can go down. (Mary Thomas)*

Oscar Tinsley sees a major challenge in the Finess system, which he thinks of as a black box.

The web site database is object oriented which Oscar Tinsley thinks has caused and is still causing a lot of problems. Even though it is good for achieving performance for large data sets, Oscar Tinsley is not comfortable with the fact that both Echo Software and Tau lack leading expertise in the area. Furthermore, the database vendor does not have a Swedish office. The database makes it harder to develop some services such as a more advanced portfolio management system, which Oscar Tinsley really would like to have.

On a general note Etan Trent contends that IT projects often fail within the financial industry. One reason for this is what he calls the traditional dark suit top management, where people often have incentive programs based on short-term targets. The industry as such is not made for long-term large projects. On the other hand, he notes tongue in cheek, since the others do pretty badly it is easier to get by.

In Internet brokerages Etan Trent thinks that management must be more technically oriented. There are often quite technical issues, such as encryption and bandwidth, which are discussed on management levels. This calls for a slightly different competence than the traditional banker's.

Oscar Tinsley foresees changes in the on-line site when other, Tau external, applications changes protocol. External changes lead to changes in the on-line application while standard application packages are updated by the software provider, which is very convenient. However, a drawback with that according to Oscar Tinsley is that Tau is dependent on a supplier, and if the supplier fails the consequences are significant.

Etan Trent believes that different types of guarantees regarding availability and response times will become a competitive tool in the future.

> *Here, there will definitely be a race! (Etan Trent)*

According to Mary Thomas, head broker, there is also a trend that customers mix-and-match. If Tau offers free price info and someone else offers free news, people open accounts at both companies. Some also keep a brokerage account at a traditional brokerage to get their analysis reports and trade there just enough to continue to get the reports but do most of their trading at e.g. Tau. Mary Thomas however thinks the trend that everything should come for free will change.

Oscar Tinsley emphasizes the importance of being sensitive to what the customers ask for. Furthermore, he stresses business intelligence, “what are the others doing?” Tau must focus on choosing the projects that give most bang-for-the-buck given the strategy of low commissions and do-it-yourself.

7 CASE GAMMA

7.1 THE COMPANY

7.1.1 Gamma Organization

Gamma[35] is a full service retail bank that is geographically dispersed throughout Sweden. It consists of a number of business areas as described in Figure 7.1.

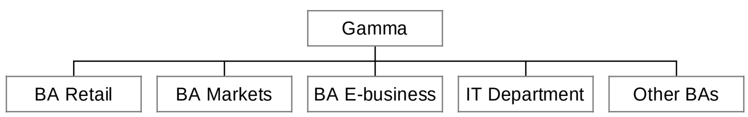

Figure 7.1: Gamma Organization Chart.

Gamma Retail

Business Area Retail is the bank's retail organization and manages all sales channels used to interact with the bank's customers. This includes all the branch offices, the telephone bank service and the Internet bank. Retail also manages the development of offices and bank services while the Internet bank is developed by Business Area E-business. The Business Systems unit within Business Area Retail acts as purchaser of IT systems on Retail's behalf. As purchaser it is up to Business Systems to link IT to business processes and competence issues. In principle, the Retail Business Area has a business relationship with Business Area Markets, where Retail is free to choose other providers' products. In reality this is not very practical, though.

Gamma Markets

A number of years ago Gamma Markets was created when Gamma gathered stockbrokers, bond traders, derivatives trading, foreign exchange, etc into one organizational unit. When the current Head of Markets was appointed, he revamped the organization and formed Markets as it looks today.

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[35] A list of interviewees can be found in Appendix A. The interviews were conducted between November 2000 and June 2001.

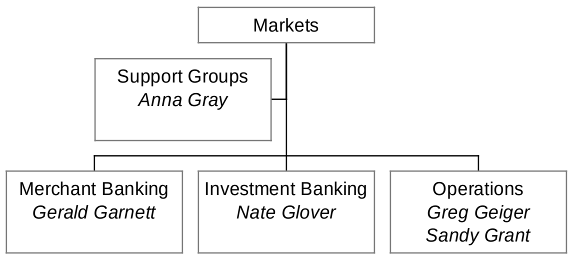

Figure 7.2: Markets Organization Chart (*Interviewees Included*)

Gamma Markets consists of three major departments (see Figure 7.2).

Merchant Banking, led by Gerald Garnett, deals with fixed income trading and foreign exchange trading.

Investment Banking deals with equity trading, mergers and acquisitions as well as other forms of corporate finance.

Operations, led by Greg Geiger, runs Gamma's back and middle office, custodial services, a branch office for large customers and a helpdesk function (supporting Markets and in some areas also the rest of Gamma including the Internet bank and the Telephone bank).

In addition to these departments, where this case study focuses on Investment Banking and Operations, there are some supporting groups, headed by Gerald Garnett, such as Accounting and Control, IT Strategy, IT Services and Legal and Compliance.

Historically, Markets relation with Gamma's IT department has sometimes been somewhat strained. Markets once had its own local IT group located in its offices. Now, that has changed as the management at Markets has changed, and the local IT group belongs to the IT department even if it has not moved geographically. Sometimes the traders still consider this group to be their own resource.

> *The traders think it is their own resource even though it belongs to the IT Department nowadays! (Ed Gatling, Account Manager, IT Department)*

Gamma E-business

The E-business business area works with business development. An important part of this is to "webify" Gamma, which Tom Garrett, the head of Internet banking, has found quite a challenge, not only from a technical and usage perspective. Changing the way people think is perhaps an even greater challenge. There is a business conservatism based on people's long experiences, which leads to new concepts being challenged.

The business developers usually work together with the IT Department when it comes to operationalizing new ideas and ventures.

> *As business developers we work on a conceptual level. I call it development on the PowerPoint Platform. We then order a prestudy from the IT Department where we get specifications and a cost estimate. If it seems OK we push the button and move ahead and produce final specifications and so on. (Tom Garrett)*

Tom Garrett thinks they are fairly good at this but he also feels they are worse at reducing functionality in order to decrease time-to-market.

> *I mean, you can always add functionality afterwards! (Tom Garrett)*

7.1.2 IT Organization

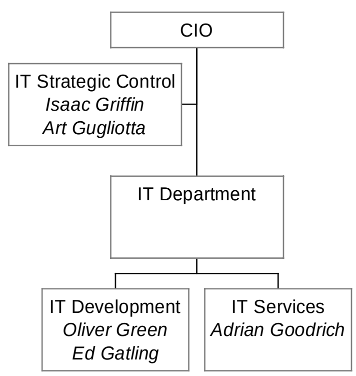

Figure 7.3: IT Organization Chart (*Interviewees Included*)

Gamma's IT Organization is headed by the CIO, who reports to the CEO. As described in Figure 7.3, both the IT Department and the small IT Strategic Control group report to the CIO.

IT Strategic Control

IT Strategic Control is a central group where eight people work. Its overall purpose, to balance coordination vs. business demands, is operationalized into its two main tasks:

- developing IT strategies, rulebooks and guidelines,

- owning infrastructure, application architecture and the guidelines for this.

Markets, and other business areas, produce business plans and IT plans and bring suggestions to IT Strategic Control. The suggestions are then checked against the existing IT strategy where IT Strategic Control has authority to veto projects not conforming to the strategy. Larger projects are presented to parts of top management and decided there.

IT Strategic Control initiates some projects, mainly concerning technical products (e.g. operating systems) or new technology (e.g. new security solutions). It happens that other kinds of projects are initiated by the IT Department as, for example, the automatic teller project was many years ago, where the business side was not involved in the early phases. Nowadays, projects such as the project to upgrade from Microsoft Windows NT 4.0 to Windows 2000, are owned by IT Strategic Control.

> *The decision to go with Windows 2000 was ours. We also determine for example the brand of application servers, but how this is implemented in the production environment is up to IT Services. Choosing the standard is however IT Strategic Control's responsibility. (Art Gugliotta, IT Architect)*

> *I can't make the decision that Gamma should quit using the S/390 environment. That responsibility lies with IT Strategic Control. (Adrian Goodrich)*

The group also maintains common infrastructural applications, which are either technically oriented or infrastructural (e.g. the e-mail system, smart cards etc).

> *A business area which must produce an income statement can't take on that kind of investments when they became too large. (Tom Garrett)*

New technologies are often identified by the business intelligence of IT Strategic Control but the line organization can also trigger such projects.

> *A problem that sometimes arises is that the line organization can move too far before IT Strategic Control is contacted. (Art Gugliotta)*

It happens that the business wants something and just goes out and gets it. Later on it turns out that it does not fit with the rest of Gamma's applications.

> *An example is Tiber [Gamma's web site for retail trading], which Markets developed independently. Due to this, Gamma now has a split personality on the Internet when interacting with the customers, which is not desirable (Art Gugliotta)*

There is a lot of religion in this, Art Gugliotta thinks, since Markets always wants to act independently, which results in them bringing in other systems than the rest of Gamma.

IT Strategic Control also sometimes acts as an internal police force, reviewing for example single projects in terms of security or standards issues. There is also a threshold established where every project larger than the threshold has to be decided by Gamma's top management, which demands that IT Strategic Control has made a strategy review, i.e. checked that the project is in line with established strategies.

IT Department

The IT Department is divided into IT Services and IT Development. The turnover of IT Services is about 1.1 billion SEK and of IT Development some 600 million. The total IT budget for Gamma is about 2.5 billion, which is about 20-25% of Gamma's turnover. The difference, some 800 million, is consumed by products and market channels and not by the IT Department.

For Markets production and development has decreased some 20 million SEK. The Head of Markets IT, Anna Gray, finds this troublesome since production costs increase regardless of available funds, which means that the funds available for development have decreased by some 30 million.

From a retail banking perspective Maria Garrity acknowledges a pressure on IT costs but finds that natural even though she admits that the branch offices (her domain) have been prioritized and maybe less affected by the pressured costs.

> *The IT Department has only one customer and that is the rest of Gamma. It is not however Gamma's only IT provider since Gamma can bring in other providers such as e.g. external consultants or standard application packages. (Oliver Green)*

Apart from internal projects, the IT Department is completely commission governed, and it gets its resources from the business organization.

During the last decade, the IT Department has experienced some quite drastic ups and downs. After some major projects where a lot of external consultants were used, the consultants were discarded in order to press down the IT costs. Then came year 2000 which forced Gamma to bring in a lot of consultants to meet the unusually strict deadline. The number of hours delivered during the last phase was actually double what the organization was designed for. After year 2000 the new IT plan targeted lowered IT costs once again, which meant that the consultants had to go. This led to competence problems and increased costs since new external consultants have to be trained and then have to leave once they are fully up to speed.

IT Services
IT Services is responsible for running and maintaining Gamma's applications. The department has end-to-end responsibility for availability. All in all, about 400 people work at IT Services.

There are four main business processes are at IT services:

- Application launching
- Production (the actual running of applications)
- The support process
- The IT business process, which copes with the negotiations with the line organization regarding Service Level Agreements.

IT services has several competence centers:

- Operations (some 100 people)
- Technical maintenance (some 100 people)
- Application maintenance (some 100 people)
- Certification, which is a small group responsible for certifying, for example, operating systems.
- Customer support including a helpdesk (1^{st} line is outsourced but 2^{nd} line technical support is provided in-house), security administration, application deployment
- IT Services Markets, which operates Markets' local applications.

IT Development

IT Development, which employs just over 300 people, is a project based organization that is heavily process oriented. The change towards a completely project based, process oriented organization is still on-going since it is a major change for the organization. The most dramatic change so far has been that emergency maintenance, such as bug fixing and availability increasing efforts, have been moved to IT Services. There is a risk that it is perceived as an A team and a B team. The developers are the A team while the maintenance work is considered to belong to the B team.

> *We really are, and want to be, a homogenous group, but if you are divided by your assignments it is easy to split the group. (Oliver Green)*

The goal for the IT Development department is to work at 90% of capacity and charge 80%, where the difference is made up by different internal projects such as implementing or removing different tools. It also includes test environments and other platform activities for the projects.

Oliver Green, the head of IT Development, would like IT Development to be involved earlier in IT Strategic Control's projects on new technologies since various possible problems will arise later in the process and then affect IT Development. This can include for example different kinds of technical solutions that do not work satisfactorily.

> *You have to mix progress with what you already have. Gamma has a considerable legacy of existing systems so we don't have full flexibility but instead have to take into account what we already have. Of course you have to do new things and find new solutions, but in this work it is important to understand the legacy you actually have! (Oliver Green)*

Oliver Green emphasizes the importance of understanding what competencies are needed when new technologies are evaluated. The new and the old solutions must work together, which means that different competencies must be combined even if this means different people possessing the different specific competence. In general terms, he calls for a broad understanding across borders. There is a need for good examples where this has worked since unfortunately there is today less than complete trust, Oliver Green thinks.

> *IT must understand the business and the business must understand IT! [...] They [the business] say "IT isn't good*

> *enough" and we [IT] say "they don't understand" (Oliver Green)*

Adrian Goodrich, head of IT Services, underscores the importance of a close relationship between the business and IT in acquisition processes.

> *It's as bad if the business buys what suits them, as if IT buys what suits them [without taking the other party into account]! (Adrian Goodrich)*

7.1.3 Organizational IT and Business Interfaces

> *The system owners have the money, and a lot of them are quite dissatisfied. It is incredibly hard for the business to prioritize–I mean you always try to get what you want for yourself. (Anna Gray)*

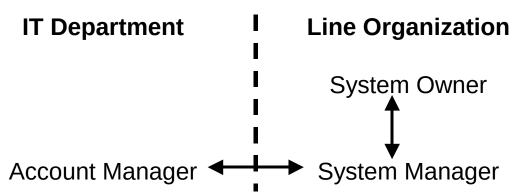

Figure 7.4: IT Department and Line Organization Interaction

System Owner

A system owner is responsible for its availability, the overall costs and for insuring that the functionality meets the needs of the business over time. This means that the owner oversees the budget work, prioritizes between different projects and writes and maintains the Service Level Agreements.

System owners are located in the line organization (see Figure 7.4), which according to Anna Gray works very well. Sandy Grant, who is a full time system owner, owns almost all the systems at Markets, the major exception being Tiber, which is owned by the head of trading.

Markets still has some contractual agreements with providers, but Sandy Grant wants the IT Department to take over these contracts as soon as possible. She often ends up in technical discussions, which she thinks would be handled better by the IT Department.

Maria Garrity points to system owners and business product specialists who know the applications as the actors in the business that are relevant when it comes to IT issues and being able to act professionally as IT purchasers.

System Managers

The system manager is more technically oriented than the system owner and supports the system owner by running operative activities such as gathering demands from the users, coordinating orders, negotiating and following up the Service Level Agreements. The system manager also keeps the detailed budget for the system and runs maintenance meetings and issues. At Markets, there are four system managers supporting Sandy Grant.

Account Managers

The account managers, who work at the IT Department, work primarily with activities geared towards the customer, which is usually an internal customer, i.e. some part of the line organization in the bank. It can take the form of counseling, working on business proposals and it also includes writing contracts. Being part of steering groups is another important task as are various forms of customer contact. Counseling means supporting the (internal) customer in early stages of projects. The line organization often also brings in external advisers in major projects.

> *In the best case we are involved in the whole process. In the worst case they [Markets] come with something they already bought. (Ed Gatling)*

This has become better, but Markets still takes some new decisions locally without interacting with the IT Department. Markets' used to resemble the wild west in this respect though, Ed Gatling, account manager for Markets at the IT Department, concludes.

Even though Markets has been less than perfect in following all IT Strategic Control's guidelines, such guidelines help Ed Gatling rather than restrict him. The guidelines can for example state "Oracle should be used as database", "Netscape is used as browser". He thinks the guidelines are on a good level of detail, even if he may question some of the products chosen.

> *Markets are not always comfortable with such standards. For example, the branch offices and the rest of the bank use one desktop standard while Markets uses another one, even if the difference isn't that huge. [...] Markets also has a lot of small systems bought by the traders almost on an individual basis. (Ed Gatling)*

Another task of the account manager is business intelligence, keeping up with what is going on. This is complemented with Business Area E-business, which is looking at how new technology can be used to meet the customer in new ways.

7.2 IT PORTFOLIO

7.2.1 Components

All in all there are some 400 applications at Gamma, most of which are owned by the business organization. IT Strategic Control owns some applications and runs some projects related to security issues.

Being a full service bank, the general ledger comes to dominate how transactions are recorded. The interface with the ledger as well as the numerous interfaces with other applications are important factors for all applications. Greg Geiger, head of operations at Markets, provides a perspective on the IT portfolio of banks that distinguishes between the usual front-office and back-office applications but also adds ledger applications (see Figure 7.5). The middle-office risk management systems extract data (in real time where that is deemed necessary) from these core systems.

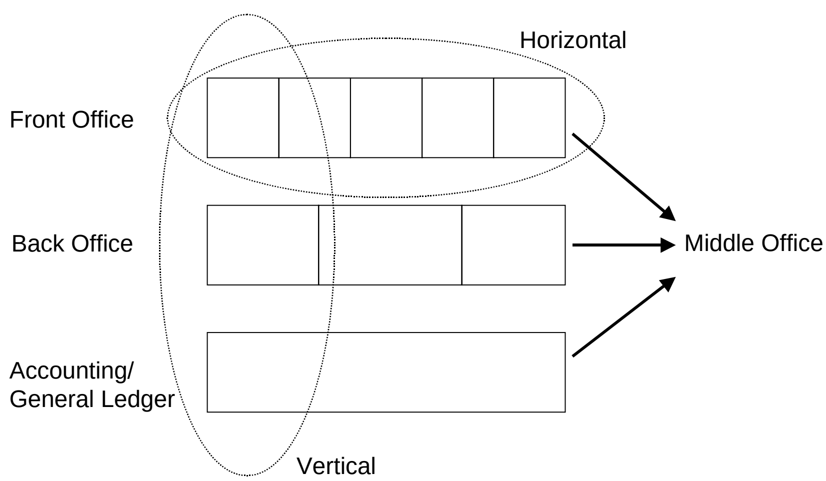

Figure 7.5: Different Types of Applications in a Bank IT Portfolio

The life span of the different systems varies, with front-office applications lasting 3-5 years while back-office applications may last for 10-15 years and ledger applications anywhere from 10 up to 30 years. An interesting question in Greg Geiger's eyes is whether one should aim for vertical or horizontal systems. Vertical systems provide integrated solutions per product area while separate horizontal front and back-office solutions may lead to interface issues. On the basis of varying life spans, Greg Geiger argues for horizontal solutions, i.e. best-of-breed solutions per system type.

The Trader's Desk – Applications used

The traders and brokers at the Investment Banking department at Gamma Markets use a variety of different front-office applications:

- Omni, Orc, and Saxess Trade, which are trading applications.
- Market information systems such as Reuter, SIX and Bloombergs.
- Internet, which is an important source of information to the traders.
- Instinet (Reuter's trading station), which is used to trade on some foreign markets.

Nate Glover, head of trading at Markets, thinks it is troublesome that some information vendors want to restrict what prices and information the user has available.

> *It means that engineering ingenuity is needed to collect all information in the same system so that you don't need three parallel systems. (Nate Glover)*

Markets buys a service from an external provider who integrates information from the different information vendors. There is also an old in-house IBM system for linking this to some other systems, but the intention is to replace this system with the external service.

> *What you mainly see are the front-office systems. They are linked to our back office, which is more stable over time. The front office changes quite quickly. Sometimes you have to dig about in back-office discussions and administrate them. Accountants see things their way, and I see them mine! (Nate Glover)*

There are other applications that can do more than Gamma Markets' present solutions, but what Nate Glover likes about Orc is that it gives him what he asks for but not a lot of other information. Other applications tend to give more than the user ever asked for, he thinks. There are other applications within Gamma Markets, but Nate Glover has no intention of replacing his Orc, which also helps him to manage his risks. In addition to this, there is a risk management department as well as the Financial Supervisory Authority checking risks.

> *It's a safeguard for me not to be left alone. If something should start to go wrong there are many eyes that can catch it. (Nate Glover)*

Back-Office Applications

The two main back-office applications at Gamma Markets are Romulus and Remus. Romulus is a mainframe application for order entry and trade execution management. Similarly, Remus is a mainframe system for brokerage account management. Both were developed in-house using Cobol. They originally stem from the late 1970s and early 1980s.

Isaac Griffin, an IT controller at the IT Strategic Control group, can see a number of advantages with integrated systems, such as synchronized updates, but there are also drawbacks since they become harder to change when applications are more tightly integrated. Changing the core systems at Gamma is difficult and there are only a few people who know how the systems interact in detail and thus what additional changes in other systems any given change requires.

Regarding Remus, the system owner Sandy Grant stresses that the important thing is not keeping deposits, which anyone can do. The important thing, she thinks, is creating reports of the appropriate format with appropriate frequency.

> *If you want it once a year you should have it. If you want it once a week you should have that. You want it by e-mail or ordinary mail? Being able to provide completed tax-return forms would also be a competitive advantage. [...] Creating reports is the important thing to add customer value! (Sandy Grant)*

Remus is growing quite old, and the functionality for creating reports has been added via supporting applications rather than changes in the application itself. Remus is also batch oriented which means that longer trading hours at the marketplaces can become a problem. Markets has looked at more fine-tuned solutions where some customers are handled by VPC[36] while others remain in Remus or its successor. Markets' own trading book could also be moved elsewhere. Sandy Grant is convinced that new demands are what will eventually make it too hard and expensive to keep Remus and force Gamma to seek new solutions.

Sandy Grant also notes that cooperation with other banks could be one solution. Even if interfaces would be a problem she keeps asking herself whether Gamma can afford to continue doing what they are doing. Lower

[36] VPC is a Swedish central securities depository and clearinghouse supervised by the Swedish Financial Supervisory Authority (*Finansinspektionen*).

trading fees add to the dilemma since there are a number of costs involved, e.g. the marketplace, VPC, the systems, hardware, people etc. Some of the major independent brokerage houses have a common back-office solution, which seems to work fine in Sandy Grant's eyes.

> *Maybe the banks must go that way too? [...] Traditionally, all the banks have done everything themselves. (Sandy Grant)*

7.2.2 Tiber

> *Tiber is one market channel [among others]. (Greg Geiger)*

The Application History

Tiber was one of the first equity trading sites on the Internet, and it was started because people at Markets saw a market potential even though the revenue potential was hard to estimate. It was initiated by a number of entrepreneurs who later left and started a competing business. The project was run by external consultants. Its history since then has followed these steps:

1. Tiber was run as a small hobby activity at Markets.
2. It was organized as an independent company within Markets.
3. More production oriented ("customers complain when things do not work, availability more important").
4. Production and maintenance were moved to the IT Department.
5. Markets is still the owner and purchaser, and the IT Department acts as a provider. Departments other than Markets use Tiber in their business and sell the service to the end customer.

At Markets, Tiber lived as an on-going project and never went into a production phase.

> *Funding and organization around Tiber have been messy and hard to grasp. (Ed Gatling)*

There is now a production and maintenance organization as well as a project organization for developing the application. This is the normal organization for all applications at Gamma.

According to Ed Gatling, account manager for Markets at the IT Department, Markets was positive to the IT Department taking over Tiber.

> *If they were to start a similar project, I would hope that they would come to us in the beginning. It could be a problem with time-to-market. If they think that we are too slow, they might opt for a local in-house solution. (Ed Gatling)*

Integrating Gamma's Internet bank and Tiber has been cumbersome since they build on different technical platforms. Tiber chose one particular database because that was the best one around when the application was developed. The Internet bank chose another one because that was the natural one at that time.

While Tiber traditionally has targeted the active trader and competes with other brokerage firms, the Internet bank trading solution targets the more casual bank customer doing a few trades a year, where the main competitors are the other banks. Getting the customers to choose "the right" service will be a matter of pricing the two different services. Gamma has an advantage since they already have a relationship with the potential trader via the Internet bank and do not have to recruit him from someone else.

The functionality for trading via the Internet bank is not made available to all customers at the same time. Instead it is a phased launch where the sign-up button is gradually presented to more and more customers. First of all, active customers not using Tiber are targeted and then there will be a geographical roll-out. Matt Gill at Markets' local IT support is slightly worried that the roll-out may be hard to control.

> *We're sitting on a ticking bomb! If the evening papers' placards say "Now's the time to start trading" we'll drown in applications. (Matt Gill)*

There are some concerns regarding the scalability of the database used in Tiber. Gamma has looked into changing that database to the newer one used in the Internet bank, which does scale well, but it has turned out to be more difficult than expected.

Moving all the customers from the Internet bank to Tiber will take a while though.

> *It will be a while before everyone gets access to Tiber. It is difficult and complicated to test this kind of changes since it involves many different systems. (Ed Gatling)*

The current version of Tiber is a completely new system compared to the old one, which was quite unbridled. A lot of corners were cut in the old version since time-to-market was so important. The old version is still used by a few hundred customers who perhaps never should have become Tiber customers since their needs deviate from the main stream customers' and they do not fit into the new version.

When Markets developed Tiber, including the Core Engine component, with the help of external consultants, the IT Department was involved in the steering group of the project. Oliver Green, head of IT Development at the IT Department, acknowledges that the IT Department was not able to provide the resources needed by Markets, who prioritized time-to-market for the Tiber application.

> *We've designed it ourselves. It is designed to accommodate standard components and to avoid supplier dependencies. (Tom Garrett, Head of Internet Banking,)*

Tiber involves both the Investment banking and Operations departments at Markets. Business Area E-business is also involved by working on business development issues and functional specifications for new functionality in Tiber.

Current Status

Core Engine, which is a real-time system, is the central platform for the Internet solutions. Real time means that the customer, using the Internet, can see his or her present engagement at Gamma. The people at a branch office must use several different systems to get the same overview of a specific customer. On the other hand, these systems enable the user to do more than the Internet solution.

Compared to their competitors, Matt Gill thinks Gamma is rather well off.

> *We have a patchwork around Core Engine, but Core Engine itself is darned well not going to be a patchwork. Others usually have patchworks all over the place! (Matt Gill)*

> *We have in the Internet bank solution an architecture that is an example of how you can work with components. (Ed Gatling)*

Tiber from a Contents Perspective

An important issue concerning Tiber and the Internet bank is what content should be provided. Basic order execution is cheap and Gamma only charges its own cost. If a customer wants more, such as real time news or analyses, there will be additional charges. Some time ago, an independent company providing analyses wanted to sell their analyses via Tiber and the Internet bank, which caused Markets' own research analysts to protest. They were not comfortable with the quality of the external analyses. Matt Gill then wanted to sell Markets' own analyses, which highlighted the issue of charging models for analyses. The compromise that was reached will allow Internet users to access the analysis reports with some time delay and with slightly reduced contents. Matt Gill thinks the situation is different for independent brokerage firms without research departments who can bring in anyone's analyses and then let the customers decide what they want to pay for.

> *It's largely about differentiating services! (Matt Gill)*

Many customers have brokerage accounts at multiple brokerage firms. If Gamma's offer is the best in some respects but not in others, people tend to mix-and-match. Customers sometimes ask why Gamma does not provide better functionality for their customers. Matt Gill thinks that even though this is a valid question, Gamma holds its ground quite well compared to the other banks. The independent brokerage firms, and especially the start-ups, are different. Starting from scratch with no legacy provides them with a very different set of opportunities.

> *How hard can it be? [when you do not have legacy systems] (Matt Gill)*

At Gamma, availability is prioritized. A number of different functions and order types that could be provided to the customers have been identified, but Gamma has chosen to prioritize stability and availability.

7.2.3 Portfolio Characteristics

The IT portfolio components described above interact according to Figure 7.6:

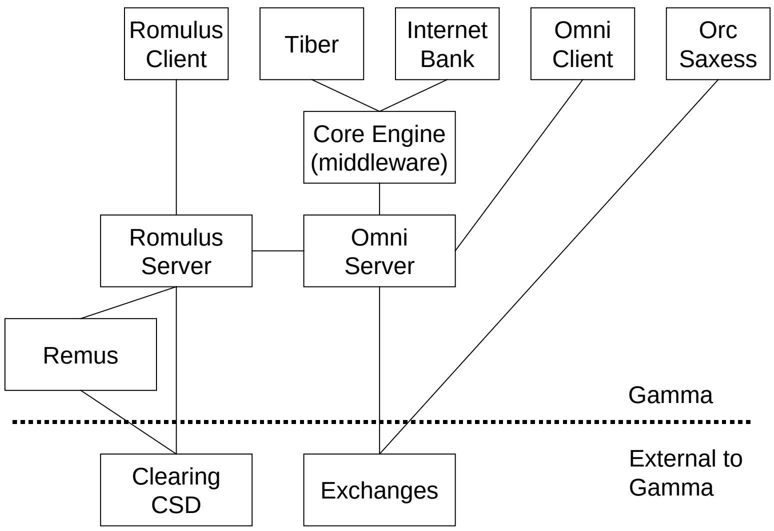

Figure 7.6: Gamma Applications

Orders are entered either by the end customer directly (via Tiber or the Internet Bank), via a branch office (Romulus Client) or Markets' brokers and traders (Omni, Orc, Saxess Trade). Most of the order flow is routed through the Omni application, which handles the communication with the exchanges.

The back-office applications are almost solely in-house solutions. In general there is a tendency to use more external standard applications closer to the user. Markets is one of the biggest users of standard application packages at Gamma. Often stand-alone applications are used with manual transfers back and forth.

Oliver Green thinks in terms of a pendulum. It used to be that everything was developed in-house. Later there was a period where everything was bought. Now he thinks the pendulum is more well-balanced, i.e. Gamma no longer acts as categorically as before. On the other hand, standard packages are almost never bought right off the shelf.

> *You never buy a standard package! To a varying degree, everything has to be adapted. (Maria Garrity)*

The Number of Systems

> *We don't have a good record when it comes to the number of systems. That problem ends up with us at the IT Department [...] People are as uninterested in retiring old systems as they are interested in developing business. You often end up with old systems since you don't cope with the extra cost involved in throwing out the old system. (Adrian Goodrich)*

Adrian Goodrich, head of IT Services at the IT Department, exemplifies this with a new data warehouse solution that was supposed to replace an old proprietary application, which was the last one to use that specific operating system. The new system has run in production for 3-4 years, but the old proprietary application is still around, which means that the operating system is still necessary.

> *It is easy to avoid cleaning up since it is hard and costs money to take the final step. There may very well be zero functional difference but some obscure technical prerequisite makes it hard to throw out the old system. Things interact! (Adrian Goodrich)*

Although all-in-one solutions help bring the number of systems down, a drawback is the vulnerability, which troubles Anna Gray, head of Markets IT. If a system processing all transactions goes down, everything is brought to a stop. Nor does she believe in big bang solutions. Instead she prefers phasing in new systems gradually.

> *The challenge is to cope with running two systems in parallel during the transition phase. The danger is that for some reason you get stuck there! (Anna Gray)*

In the next couple of years, Anna Gray sees her agenda as reducing the number of systems in use at Markets and that way also decrease the operations costs and increase, or at least maintain, the room for development projects. One part of this is to remove manual transfers of different kinds, which is fairly commonplace in today's glorious mess of different systems. To bring order Anna Gray now attests all IT costs, which is a way of centralizing the control at Markets.

> *It's been like the wild west over here! (Anna Gray)*

The Number of Platforms

> *You name it, we have it! (Adrian Goodrich)*

> *There is a plethora of technical platforms, which brings costs as well as risks. It is definitely a competence problem. Unfortunately it is hard to weed out stuff. To remove a platform is difficult. It is much easier to bring in a new platform. (Oliver Green)*

Gamma uses most technical platforms. The number of different platforms used today is quite a shift from the time when Gamma used to be strictly standardized (on IBM).

> *The first time they brought in a Tandem, it was like "wow"! (Oliver Green)*

There are some core operating systems that there is no intention of removing such as S/390, various Unix flavors or PC but there are others, such as OS/2, UNISYS, AS/400 and Tandem, which the IT Department is trying to remove. In practice, this means that they are reluctant to take on new projects on these platforms. It is not unheard of that the business organization decides to buy something that runs on a removal candidate platform. In such cases the IT Department refuses to take on an end-to-end responsibility. The business can put the hardware in the data processing center, but they have to own the hardware and take on the responsibility for maintenance etc.

From a business perspective Anna Gray thinks that functional aspects are more important than technical platforms when it comes to determining what applications to remove. One exception to this rule is a system that became very expensive to operate when the only other system on that platform was removed. Thus, Markets are currently phasing out that system.

Conformance

> *It [Gamma's view on standards] follows somewhat the same kind of pendulum as in-house development. (Oliver Green)*

> *Tiber and the Internet bank are two completely separate solutions with different security approaches, different components etc, which is not good. It is more expensive and you get problems with competence issues. (Adrian Goodrich)*

The IT Department tries to price away old solutions since the business owns them. In order for them to agree to retire systems the true costs must be made explicit. Risk aspects can also be a driving force for removing systems. A problem with a plethora of different environments is poor availability. Generally, it is much harder to cope with interfaces across environments than across applications within the same environment.

There is a standardized desktop deployed across Gamma's branch offices. Most people at a branch office have a fairly standardized way of working, and the standard desktop supports everything from teller transactions to sales support. The users at the branch offices are quite satisfied with their new system support. Maria Garrity thinks that, in addition to cost efficiencies, the standardization is needed to achieve stability.

7.2.4 History

Years ago the business side was free to invest in IT on its own; this coincided with an explosion of financial systems. As a consequence, Markets IT portfolio is a jumble of different systems. All in all, there are about one hundred systems. During a long period a lot of different systems were bought. The fast-moving Markets perceived the rest of the organization too slow and chose to buy what they needed. The users were very heavily prioritized, which caused the application portfolio to grow quite randomly.

Somewhat to her surprise, Anna Gray notes that a consequence of the former acquisition practices is that most of Markets applications are standard packages. Apart from Romulus, Remus, and Tiber all major systems acquired the last five years at Markets are standard package solutions.

Now, acquisition practice has changed, and Markets are working actively on unifying and structuring their applications and their interaction with the rest of Gamma's applications. This change was started by Anna Gray and Sandy Grant who made an application map where they tried to note system owners. It turned out that there where applications that no one owned, and it was hardly known what those applications did.

Compared to the rest of Gamma, Markets lags behind when it comes to security issues, disaster planning and testing. From an IT Department perspective, Markets tends to buy something and when they outgrow it, they buy some more, often without any long-term plan. This behavior has led Markets to sometimes be referred to as the “wild west”. Adrian Goodrich's experience is that it is a tough job to weed things out, especially since there are increasing volumes, extended opening hours and a heavy reliance on some key people.

> *The problem is that the entrepreneurial spirit is lost if it gets too complicated. It must be a really good idea for you to be persistent enough to push it through the whole investment process. We often want to buy something to see if it is something we actually want to use. (Nate Glover)*

Nate Glover, head of trading at Markets, acknowledges that others may not look favorably on this, but on the other hand he feels that Markets is actually quite restrictive. If Markets acted on the smallest whim the set of applications could be almost infinitely complex.

> *I mean, you get at least one call a week from someone who wants to sell their system, which of course is the best there is. (Nate Glover)*

People at Markets do emphasize the importance of finding applications that can be integrated into Gamma's environment. They believe that other people's view of Markets' application portfolio can to some extent be attributed to a lack of understanding for the business environment the traders live in.

> *Some people probably think that we do things ad-hoc, but if you analyze too much the business opportunity is gone. It used to be much larger arbitrage in Ericsson between Stockholm and New York but the trades were so difficult to do that there was a reasonable price on the risk. Now it is significantly less. It can also be that we identify an arbitrage of let's say 20 öre, but over time it decreases so if you are too slow to get there it will be all but erased. (Nate Glover)*

Nate Glover would actually want to automate his work further. Currently the traders at Gamma use auto-quoters, but this could be taken to the next level by building small applications executing arbitrage deals on their own, based on simple rules. However, there is a general reluctance at Gamma to using that kind of systems. To Nate Glover, however, it would free up time for more complex issues.

Markets also sometimes buys tailor made applications from external providers, much to the IT Departments dismay.

> *You buy some tailor made application from external providers, which is a thorn in the side of the IT Department. It is a tough problem to solve. If you buy with the assistance of the IT Department they get to learn what's out there. However, sometimes we feel that they have nothing to*

> *add/bring to the table and then you don't involve them in the process. In such cases there can be a fuss when the system goes into production. (Sandy Grant)*

The quantitative analysis group at Markets builds quite a lot of local solutions, which might be complicated spreadsheets, for example. It also happens that they bring in external consultants that build small special solutions.

> *It feeds a lot of frustration when you have good ideas but not enough resources to realize them in time. Time-to-market is so extremely important to us, and the IT activities in Gamma are not completely in line with that. (Nate Glover)*

Nate Glover would like to have someone locally just waiting to realize a solution based on ideas generated by the traders. It used to work more like that when Markets had their own local IT Department, which was subsequently moved to Gamma's IT Department. Nate Glover thinks this is significantly worse and would very much like to go back to how things used to be.

7.3 ORGANIZATIONAL ISSUES

7.3.1 The Interaction between the IT Department and the Business

Gamma uses a purchaser-provider approach where the basic principle is that anyone responsible for a specific business also is responsible for the IT needed for that business. There are contractual agreements specifying the costs for projects the business side wants performed. Based on their request, the IT Department puts together an offer. This works the same way regardless of whether a standard package is bought or an application is developed.

It has taken some time for the organization to adjust to the new purchaser-provider approach. The competence problems lie mainly on the business side since they took on some new tasks that had previously been performed by the IT Department. Accepting the change is also a question of power.

> *All of a sudden you, as the IT Department, could be questioned. It used to be a given that everything was developed internally and almost nothing was bought from the outside. We were also "True Blue"*[37]*. When the business side took over it took a while before things settled in. It was some-*

[37] Meaning that Gamma's primary provider was IBM.

> *what like the Klondike since the business side basically would buy any damned thing. (Adrian Goodrich)*

Now Gamma has a more mature approach to these issues. The business side uses its resources however they see fit, but the IT Department is taking an active part in evaluating solutions and safeguarding existing architectures. Every application is owned by the business organization and projects pertaining to the applications are usually initiated by the business organization.

> *If it is about, for example, throwing out an old system our [the IT Department] job is to present what running the system actually costs and that way give the business organization a basis for a possible decision to initiate a project to throw it out. In general we work more as advisors to, for example, the system owners. (Oliver Green)*

Gamma has a market economy in place where the purchaser does not have to use the IT Department. In practice all production is run by the IT Department while development resources sometimes are acquired elsewhere.

> *[The business] often buys a specific competence and brings in help during a pre-study phase. The development and implementation effort is however usually performed by the IT Department. (Oliver Green)*

From a business organization perspective there are several reasons for bringing in outside help:

- Short-term specialist competence needs when there is no reason to recruit people to fill the need.
- Geographically dispersed needs, which are not easily met by the mainly centralized IT Department.
- It can sometimes be cheaper than using the IT Department.
- Momentary peak loads, which leads to resource deficits at the IT Department.

The IT Department is always engaged and for example Retail Business Systems' experience is that external help is brought in with the IT Department's blessing. Formally, all external consultants at Gamma shall be hired via the IT Department, but this is not always the case.

7.3.2 Competence Comments and Perceptions

From a Markets' perspective, the developers at the IT Department are lagging somewhat behind.

> *The IT Department doesn't have the expertise on Java, object orientation etc. There the IT Department is not involved; instead you work with external consultants. (Anna Gray)*

Markets used to interact with a person at the IT Department who knew the business very well and also knew his own department.

> *You didn't always have to specify in detail, instead he understood what needed to be done from shorter descriptions. (Sandy Grant)*

Markets also used to have a person at the IT Department two days per week to sort out misunderstandings but this has changed.

> *We really should have closer cooperation. (Sandy Grant)*

This could be achieved by having people from the IT Department spend a week or two at Markets to reach a higher level of business understanding. It is also up to the IT Department to make sure that they get more competent.

> *Technical development is also a challenged in terms of Cobol vs. Java/C++. Cobol programmers do retire but our applications remain! (Sandy Grant)*

Sandy Grant thinks a lot in terms of competence.

> *They [the IT Department] must know the business! How else will they understand what we want to do? Now they sit in their bunker over at the IT Department! Maybe they should start working for other organizations too, to get business knowledge? (Sandy Grant)*

7.3.3 Project Formation and Ownership

Markets' policy on project governance has changed lately. It used to be that every project was outsourced to, and run by, the IT Department. When Anna Gray joined Markets she wanted things to change.

> *I own all the projects! (Anna Gray)*

As project owner Anna Gray assigns people from the business organization to be project leaders. These project leaders then run the business oriented sub-project responsible for initiation, requirements, acceptance testing and user training while the IT sub-project is run by a technical project leader from the IT Department responsible for the development project. In reality, things do not always work like this since often the IT sub-project leader takes on a larger responsibility in the project. The sub-division of projects works very well. Back when the projects were run completely by the IT Department most projects became IT projects rather than business projects. There are also project steering groups where the same group of people are often involved (Anna Gray, Greg Geiger, Ed Gatling, the system owner and sometimes someone representing IT Services).

Acceptance tests were also introduced in order to increase the quality of the applications that are put into production. It is hard to reach complete stability, but at least it has gotten better thanks to the more formalized acceptance testing.

Currently, there are many consultants acting as project leaders. Anna Gray is not too impressed by junior consultants.

> *I don't want those that are here to learn. I want those who already know! (Anna Gray)*

Sandy Grant agrees that lack of competence costs a lot of money.

> *Few people know how to program, know the business and know the applications. From them you get an hour for an hour, while others are much less productive since they don't know all the parts. It becomes extremely expensive when you get less productive people in your projects and you often want to close down the project due to runaway costs. (Sandy Grant)*

All in all, there are some 200 projects at the IT Department. Oliver Green, head of IT Development, thinks many of them are too small (typically .5-1.0 million SEK), and he deliberately tries to package multiple projects into larger release projects. He can see several advantages in this such as:

- The administrative workload is relatively large in the smaller projects.
- Project leaders are used more effectively in larger projects.
- Available resources in general are used more effectively in larger projects.

- Small projects still draw on many individuals. Larger projects allow people to be dedicated to one, or at least a few, project instead of dividing themselves on many different projects.

  In other words, it increases the effectiveness. (Oliver Green)

By using release projects that deliver once a month or even less frequently, launches also become more effective.

7.3.4 Collaborating on Software Acquisition

IT is often involved in the whole software acquisition projects even if decisions, such as buying or building, are made by the business. In larger projects, the IT side is involved all the time, but in smaller projects it can be different.

> *Sometimes, the business buys something that just pops up! (Oliver Green)*

In such cases, the IT Department could turn its back on the business, but when problems arise later on during operations, it will be an IT problem anyway. From a functional perspective standard packages can work just fine, but from a technical perspective they can still cause all sorts of problems.

One example is an application for managing foreign payments. A standard package was bought from a foreign provider, and IT Development built the back-office integration parts. When launch date approached it turned out that the organization wanted to run the application at a location other than IT Services facilities, which introduced response times the application could not handle. The geographical location turned out to be very important. The business then turned to the IT Department to get the issue solved "how were we to know that this mattered? No one ever asked us where we wanted to run the application!" It is hard to turn to the package provider, Oliver Green concludes, so it becomes a problem for IT Development, which will try to build a work-around.

To Oliver Green this shows that there are different competencies at the business and at the IT Department and these competencies need to be combined. One party could not foresee the problem in the example above, but together it could have been foreseen. Markets is working on finding collaborations of different kinds with the IT Department, which increases the opportunities to exchange competencies.

7.4 BUDGETING AND PRIORITIZING

7.4.1 Money Makes the World Go Round

In spite of the market economy approach described above there is also a more budgetary role executed by IT Strategic Control on behalf of Gamma's top management. A limit is set on how much money Gamma as a whole may spend on IT. This limit is applied on both the purchaser (the business organization) and the provider (the IT Department). A consequence, which often is perceived as frustrating, is that priorities must be based on the preset limit.

The business organization can play about with charging costs to different parts of the budget, and e.g. Markets can assign extra resources if they can see a positive effect of a specific investment. The IT Department can in that case not take on the assignment due to their spending limit.

> *In other words we have a market economy approach for the purchaser [the business side] but planned economy restrictions on the producer [the IT Department]. (Oliver Green)*

> *We're living in an old Russian planned economy! (Ed Gatling)*

Even if the business prioritizes a project, the IT Department can be forced to say no. In some instances this leads to the parties disagreeing and the trust between the departments eroding further. The current solution is perceived by Oliver Green to be controlled from the top.

> *In the business organization there is no understanding of the restrictions put on the IT Department. This often leads to different negative reactions. (Oliver Green)*

Art Gugliotta, IT architect at IT Strategic Control, also thinks a shortsightedness is built into the IT efforts just because they are so strictly prioritized. Moreover, only a small part of the resources used that can be managed in the short run. Maintenance issues must be dealt with, so they are always prioritized.

However, Art Gugliotta does think that the management control model works rather well.

> *The purchasers take on their responsibilities and act responsibly. (Art Gugliotta)*

Given the yearly cycle of funds everyone wants their project performed early in the year. There have been discussions on trying to manage this by charging more for development in January than in December, but this has not been implemented since:

> *It is difficult to control through money when it is nothing but internal resources. (Isaac Griffin)*

Instead this time prioritization is decentralized to the different business units, which are supposed to consume internal resources evenly during the year.

7.4.2 The Budget Process

Gamma management sets a company wide IT budget for each year. This budget is split between internal and external costs, where the internal costs are divided between operations/production and development. This is then divided further at the application level where the system owner is responsible for the prioritization. The cost of operations/production is set by the Service Level Agreements, which leaves development to be affected by cost savings.

The funds available to the business must then be coordinated with the IT Department's budget so that it all levels out. The IT Department is expected to break even.

> *We would like to run fixed price projects and act a little tougher in some cases but the management control at Gamma doesn't allow that. (Ed Gatling)*

Infrastructure projects are sometimes paid for by central funds instead of being charged to someone's IT budget. Development projects involving new technology, for instance, can also be mixed where maybe 50% is paid for with central funding. Yet another approach where time is not charged fully is when people at the IT Department are acquiring new competence and thus not deemed "fully productive". All such solutions stray away from the fundamental management control model at Gamma.

7.4.3 Prioritizing

Isaac Griffin has noticed that mathematically correct calculations often become too complex for people to actually use when prioritizing projects. He prefers simpler calculations and showing revenues and costs graphically over time.

> *Compared to net present values you get a feeling for what things look like over time. That way, decision makers can more easily make their own judgments. (Isaac Griffin)*

The normal approach is to compare the financial consequences of a project with not doing the project. In cases where doing nothing is not a viable alternative, different alternative projects are compared. Based on these calculations, templates for economic consequences are completed. Based on those templates, three criteria are used for prioritizing:

- *Importance*. How important is it to the business from "legally required" via "critical" down to "nice to have".
- *Timing*. Are we in a hurry?
- *Money*. What is the expected revenue in terms of cost reductions or increased income?

The money aspect can be quite difficult since even though cost reductions can be quite easy to estimate, increased income is often genuinely hard to estimate and even worse to follow up afterwards. Estimating costs is often fairly straightforward in terms of time, license costs etc. A complication arises in cases where costs and revenues are dispersed across multiple business units. Often initial prestudies are used to get better prognoses for costs and revenues.

Isaac Griffin's experience is that prioritizing together makes it easier to reach consensus. It used to be done individually which led to longer discussions. Still not everyone agrees all the time, but it is very rare that the group has a hard time finally agreeing.

At Gamma in general there is usually a high-level consensus on what should be done, but there are differences over what to prioritize. The time horizon varies between different business units. Often IT Strategic Control helps to resolve issues between business units. If mediation does not work, top management has to make the decision, which happens infrequently. Often the purpose of this is to avoid sub-optimization. In some cases, the group has to force alignment with strategies and policies.

An overall prioritization is between infrastructure projects and applied business projects. Since business projects have clearer benefits and revenue projections, it is easy to prioritize such projects over infrastructure projects. One may end up in a vicious circle if too little money is spent on infrastructure since that will increase the cost of a business project, which will further reduce the funds available for infrastructure projects and so on.

Furthermore, the revenues of infrastructure projects come mainly in the form of lower costs for such future business projects, meaning that the revenues of an infrastructure project depend on the carrying out of future business projects. Furthermore, infrastructure projects take a long time and it is harder to estimate their costs. Business projects are completed on time and on budget more often.

> *Infrastructure is also hard to follow up other than to check that they have been performed. Other goals, which are not directly related to the project as such, are hard to follow up. (Isaac Griffin)*

Another factor is that things change during a project such as technical platforms or the people involved. An example at Gamma is a customer support system which was developed during the 1990s but which is not based on Internet and web technology. Today, it would be preferable to have used such technologies.

When technologies shift during a project, IT Strategic Control sees two main alternatives. The shift may be detected and the project plan revised, or the project is completed and later on it is performed again using the new technology. Gamma also tries to divide large projects into subprojects all with explicit deliveries. A subproject may last 6-12 months, which makes the subprojects less vulnerable to technical shifts.

7.4.4 An IT Department Perspective

> *The problem is the IT planning process. (Adrian Goodrich)*

The past year has been quite problematic for Adrian Goodrich, head of IT Services. Business plans had all been worked out, but just a week before the budget deadline ruthless cost cutting took place. A consequence is that IT Services' costs are 1.1 billion SEK, but the customers have only 1 billion available. So far less than half of the more than 50 Service Level Agreements have been signed since the customers cannot pay what the IT Services must charge. Last year IT Services made a loss of about 100 million.

Adrian Goodrich thinks the ideal solution would be a control model where the IT Department acts as an independent company measured with benchmarks.

> *Gamma has not put its foot down and determined how to measure IT production. The idea is to charge for what we do, but the planned economy restricts the budget which*

> *means that the customers [channels and products] cannot afford it. (Adrian Goodrich)*

Adrian Goodrich does not want IT to be a restricting factor.

> *IT mustn't be a restricting force, but that's what we become since our budget is restricted! (Adrian Goodrich)*

Even though there are no resources to start large internal projects, smaller activities must sometimes be started. One example of this is an on-going project targeting continuous operations (24x7) with 100% up-time. IT services has a number of similar activities headed by an availability manager, where the scope extended beyond the purely technical aspects to include organizational issues as well.

> *You have to take some initiatives. We can't just sit around and wait for orders, but timing relative to future needs is important. (Adrian Goodrich)*

Oliver Green feels somewhat troubled by the shifts in available resources between different years. In the short term, only external consultants can be affected. However, the large switching costs involved in hiring and firing consultants in terms of competence transfer etc, makes them less than perfect as a resource balancing tool.

7.4.5 A Business Perspective

> *The drawback is that it [the budget process] is a slow process compared to how fast the market moves! (Nate Glover)*

However, Nate Glover acknowledges that Gamma can move fast when it comes to front-office issues that do not affect the back office. To exploit this quickness Nate Glover wants simple systems with simple interfaces to the back-office systems.

In order to get things to happen, users sometimes find someone who delivers small projects without going through the formal process.

> *This works until his boss realizes what he spends his time on. Then you have to find someone else! (Nate Glover)*

Markets has their own internal process where users present their suggestions for e.g. the Head of Equity, who brings it to the Head of Investment Banking, who in turn brings it to the Head of Markets. In each step only what is judged to be the best suggestions survive. To support this internal prioritization, Anna Gray has started working with more formal calculations on what the suggestion contributes to Markets.

> *We write a wish list of things that "must" be done. (Sandy Grant)*

Usually this list is fairly long with activities of varying urgency. In the end Anna Gray puts all lists together and presents it to the Head of Markets. The list from Markets is then sent to IT Strategic Control, whose response can be somewhat unpleasant to the system owners.

> *Then, the response can be something like "You have to cut back 50%". (Sandy Grant)*

This cutback is usually done pro rata, i.e. each project is reduced rather than some projects being abandoned. This gives some incentive to exaggerate the budget slightly for a project or inflate the budget of surefire projects that really has to be done in order to get more of the available resources.

Sandy Grant does not like the inertia in the budgets. If a business unit receives a certain amount year one, next year's budget is based on that amount. A consequence of this is that once someone has been able to secure a certain budgetary level it is relatively easy to keep it.

There is a problem when the business uses all of its IT budget. If the project is deemed pressing enough it is changed to a business project and is removed from the IT budget. Since any involvement by the IT Department runs on the IT budget such projects are run without IT Department involvement. The business organization is not allowed to internally fund IT projects, which they think are profitable. One example is a voice recognition project, which was run by the business since there was no room left in the IT budget. Sandy Grant finds this troublesome since she thinks the IT Department should have been involved from the beginning in order to avoid redundant work and the risk of choosing different technical solutions to the same problem.

> *When you're running out of IT funds you also get more sensitive. "How can this take 100 hours?" You start to wonder where their estimates come from! (Sandy Grant)*

Sandy Grant thinks Gamma's management should prioritize some specific areas and then make sure that this has an effect in the organization. Now, crucial projects have to be inflated in order to get the necessary funding.

> *Internet [in terms of Tiber and the Internet bank] and voice recognition have been prioritized areas, but "show me the money!" We see nothing of this in our projects. (Sandy Grant)*

The increased efforts proposed by Gamma's top management never materialized. IT costs too much, so the necessary funding was not available. On the other hand, Internet is prioritized from a business perspective, which means that money must be saved somewhere else.

Sandy Grant thinks Gamma has lost to its competitors after having been very early with the Tiber solution.

> *We're losing ground. Others turn faster and have outrun us. We should be on the leading edge, but we're not anymore. (Sandy Grant)*

7.5 IT STRATEGY

Gamma has an overall strategy for what should be achieved using IT. Gamma's IT strategy is owned by IT Strategic Control, which developed an ambitious strategy a few years ago. During the development both people from the business organization and the IT side were represented. The strategy work is based on a business strategy focusing on "meeting the customer". The IT strategy, which Art Gugliotta thinks may be too concrete, then describes how IT should support meeting the customer via different channels. The IT Department's architects work closely with IT Strategic Control. The strategy is broken down further to come closer to the business. The IT Department also has local strategies for architectural issues.

The IT strategy explicitly states that Gamma should strive to buy instead of build. Even though it makes room for both buying applications and buying development efforts, it emphasizes trying to find components to buy.

In some areas the strategy was broken down to concrete tasks such as replacing certain applications. After a few years, most of these tasks have been performed. The strategy also deals with how IT is controlled in terms of money and organization.

Currently, the strategy is being re-written with increased focus on strategic issues and will work as a guide for management and on guidelines that can be beneficial in the purchaser-provider organization. There is also an external demand for an IT strategy. Large corporate clients have been known to ask for Gamma's IT strategy for evaluation purposes. Hence, there are three receivers of the strategy:

- Management, as a guide for IT-related work.
- IT Strategic Control, as a guide for more concrete guidelines.

- External customers, as a guarantee for orderly IT activities (concerned more with existence than contents).

7.5.1 An IT Strategic Control Perspective

Authority through competence! (Art Gugliotta))

IT Strategic Control has drawn an application map which we use constantly [to increase the awareness of the application portfolio at Gamma] (Art Gugliotta)

There is a decision-making council that says yes or no to everything that is included in the office systems in order to keep them consistent and increase the control over them. Art Gugliotta, IT architect at IT Strategic Control, thinks this will be the case for all systems at Gamma. The idea behind this is to guide acquisition projects before they have come too far and avoid having to reverse projects. This advisor role is the most important issue for IT Strategic Control.

You should check that it's in line with our strategies early on! (Art Gugliotta)

If IT Strategic Control comes to have this advisory role, Art Gugliotta is convinced that the business organization will see the benefits and it will become the norm. Getting to this point is mainly a cultural problem.

Markets for example are used to doing what they want. (Art Gugliotta)

Attaining that role will require some sort of regulation or cultural change. One such change would be the business management (e.g. the Head of Markets) explicitly asking for IT Strategic Control's participation, Art Gugliotta thinks. For larger projects Gamma's top management demands that IT Strategic Control is involved.

Business units sometimes run in different directions, which forces IT Strategic Control to intervene and change something. That they don't like, at least not in the short run. (Isaac Griffin)

7.5.2 A Markets Perspective

Anna Gray does not experience Gamma as having a real IT strategy. Usually the strategy considerations pertain to how the resources for the upcoming year should be spent. There is no forum within Gamma where long-term issues for individual applications can be discussed. This leads to a lack of long-term strategy that would help avoid seeing things only in hindsight.

Anna Gray has formulated her own strategy of trying to reduce the number of systems in order to increase the resources spent on new development. One important obstacle to working on strategies is that resources spent on strategy work draws on the resources available for new development.

7.5.3 An IT Department Perspective

Adrian Goodrich thinks it is time to redo and enhance Gamma's IT strategy. He does not think it communicated to the people at Gamma especially well, even if it is there. At Gamma, money is the preferred way of controlling, and IT is controlled this way, which Adrian Goodrich thinks is right.

> *Those who own the business should control the IT activities! (Adrian Goodrich)*

Oliver Green thinks there is a challenge in new technologies such as the Internet that move quickly and where there is usually less interest in standardizing.

7.5.4 A Business Perspective

Maria Garrity, the IT purchaser from Business Area Retail, thinks that everyone should be aware of the strategy. She asked to see it when she came to Gamma but is not aware of any formal update schedule. Instead she believes that this scheduling is ad-hoc.

Furthermore, strategy is formulated on quite a general level, which is good since it does not hinder people in their work. When it comes to technical platforms it can be quite, or perhaps too, influential. The major drawback with the strategy is that it is largely technology driven rather than business driven. It does affect the behavior of the Retail Business Systems unit:

> *One reason [to turn to independent software providers] is the IT strategy, which states "more standard application packages", which makes you go to external providers. (Maria Garrity)*

Tom Garrett, the head of Internet banking, thinks the strategy does not guide his work in a strict sense but rather provides a number of fairly loose general guidelines to conform to. When it comes to strategic considerations within the E-business area, a local IT group of four people supports the business area regarding IT and strategic issues.

7.6 STRENGTHS AND CHALLENGES

7.6.1 Current Strengths

When thinking in terms of their existing IT portfolio's strengths different things naturally stand out for different people. Art Gugliotta is quite comfortable with the overall structure of Gamma's IT portfolio which enables the business side to add both products (e.g. mutual funds provided by other companies) and channels (such as the Internet bank, branch offices) without too much trouble. Maria Garrity brings up Gamma's ability to encapsulate the old central applications, which enables Gamma to have modern graphical user interfaces and work processes and also to make the central systems available to the retail systems. Maria Garrity also mentions the stable production, which is related to Tom Garrett's point that Gamma is good at developing and maintaining transaction intensive mission-critical applications.

Isaac Griffin, the IT controller at IT Strategic Control, points to the Internet bank, which in his mind is working very well. Adrian Goodrich is also quite impressed by the Internet bank solution Gamma provides its customers.

> *For many banks, the Internet bank is a niche application which is cool and trendy, but that is not how we do it. We've got something that contains everything that the bank has to offer in terms of products and services. (Adrian Goodrich)*

From a more organizational perspective, Ed Gatling thinks the cooperation between Markets and the IT Department is working quite well and he is happy that Tiber has found an organizational home at last.

Thinking more in business terms, Sandy Grant emphasizes the importance of Gamma's retail organization and the customer base it entails. He thinks Gamma could do more to reach out with the message that Gamma offers stock trading and that other competitors enjoy a more positive image in this area. One way of getting there is clarity in the services offered and their pricing.

7.6.2 New Technology

Gamma uses primarily two organizational units for trying out new technologies. IT Strategic Control investigates technology driven ideas while the E-business unit works with business driven ideas.

> *By gathering experimental activities it is easier to know how much you spend on that kind of activities. (Isaac Griffin)*

It also happens that business areas, such as Markets, start almost guerilla like projects, which Oliver Green thinks is a consequence of the IT management control model.

> *Sometimes it was the only way for Markets to get it done. (Oliver Green)*

Maria Garrity agrees that the process is sometimes too slow, which she thinks partly is due to Gamma's size.

> *With my temper I can sometimes think that "Nothing is happening here!" (Maria Garrity)*

Combining new technologies with the old central legacy systems is an on-going challenge at Gamma.

> *We've patched to get a real-time interface into the old central systems. (Tom Garrett)*

Since the importance of integration between different systems is increasing this becomes even more important. There is also an on-going effort to divide the old systems into smaller interacting components.

> *We've had large all-inclusive bank systems, but are moving more and more towards components with distinct interfaces in order to more easily replace different parts. (Oliver Green)*

7.6.3 Evolving Structure

Today, both systems and functions are lumped together and difficult to separate. Tom Garrett thinks an increased modularization is benign, and Ed Gatling, account manager at the IT Department, argues:

> *We're discussing more component based solutions with external consultancies where you buy some parts and build others yourself. (Ed Gatling)*

Today's systems are developed with a 9 am-to-3 pm bank day in mind. The customers using Internet are however using it around the clock, which causes some problems furthering the need for adjustments.

> *We're trying to move away from the stovepipe thinking and instead think in terms of windows onto the set of available functionality! (Tom Garrett)*

Gamma's intention is for the channels (Internet Bank, Phone Bank and Branch Office) to be thinner windows into a platform supplying the functionality needed, thus avoiding duplicating business logic and allowing an easier re-use of components between different channels. If a new piece of functionality is created in the core applications, all channels must make adaptations in the current solution. In the planned future solution the new functionality in the core applications would be reflected in new functionality provided by the middleware insulating the channels from the changes.

The important thing is time to market, which can be shortened by re-using or buying components. By separating sales channels from production it also becomes easier to sell other producers' products, such as mutual funds. There is a will to do this and there are organizational changes to support it, but it is an arduous process. The systems are tightly integrated in the application portfolio, which makes it hard and time consuming.

Sandy Grant wonders if Markets can afford to be too tightly integrated with the rest of the systems at Gamma. Maybe Markets should be more independent? She refers to ideas of breaking up the value chains and providing the best product for the customer, regardless of whose it is.

7.6.4 New Applications

Where to Turn?

> *Historically we've built too much ourselves and to the extent we bought we've changed it beyond recognition. (Tom Garrett)*
>
> *There are no standardized banking systems. (Isaac Griffin)*
>
> *I don't think you should develop in-house. In the end it probably becomes more expensive. Even if you think it will be cheaper, it will be more expensive anyway. Possibly, there are small specialized solutions you can build yourself. (Anna Gray)*

There is an acquisition model, which used to be a development model, which reflects a shift from automatically building applications in-house to striving to buy applications.

Anna Gray does note that standard packages must be adapted both for their functions and their interfaces, and Adrian Goodrich agrees. One acquired standard application package had more than 50 integration points with existing applications, which led to a very complex test effort. The cost of that particular project ended up 3-4 times the original project cost.

> *When you have a cost over-run, and thus usually also a time over-run, you easily put the system in production too soon, which leads to disturbances in your production environment, which is what happened in the fall of 1999 when one system had to be put into production before the turn of the century. (Adrian Goodrich)*

> *You have to get the system operational. First and foremost it cannot disturb other production. In addition it also has to function properly in itself. (Adrian Goodrich)*

From an operations perspective standard packages are often slightly easier to cope with than in-house applications since there is not the same dependency on key people and there is no development responsibility. Normally, the functional adaptations are ordered from the provider while the interfaces are done in-house. The core systems (Romulus and Remus) were built in-house quite a while ago which means that new standard packages have to be adapted significantly, which is both difficult and expensive. Typical examples of standardized components being bought are supporting systems such as credit card systems.

Yet another issue with standard packages is that often only minor parts of the functionality is used. For example a more or less complete banking system (on much too small a scale for Gamma's needs) is used for currency accounting. Conversely, Isaac Griffin notes that existing standard packages for central systems cover too little of the necessary functionality. The adaptations become so significant that buying becomes more expensive than building from scratch.

Tom Garrett thinks that Gamma often tries to adapt the standard package too much instead of adapting how the work is done. If a standard package covers 80% of the total set of requirements, there is tendency to try to increase that coverage to 100% by adjusting the package instead of sometimes adjusting the business processes. As an example, a credit card system bought some time ago was radically adapted, which has made it very expensive when there have been new releases of the standard package.

Another perceived drawback with standard packages is that there are so many different ways of doing things. How things are done determines what the system looks like and the other way around. New systems are bound to create a need for user training.

> *When we choose a system we choose how to work. Everything is related, which not everyone sees all the time. Standard packages do not always support how you actually want to work. (Isaac Griffin)*

Standard packages are often large monoliths, Art Gugliotta thinks, which makes it demanding to make them work together. Gamma has started interacting more with the providers and demanding changes that make interfacing other systems easier. It can also be the case that Gamma tries to avoid redundancy. Recently a provider agreed to break up a system into smaller components so that Gamma could avoid redundancy. It is becoming more and more common that providers do provide components and open interfaces. There is a movement towards smaller components even though they cannot become too small to integrate.

> *Making things into components is important to achieve flexibility and short time-to-market for new services. (Art Gugliotta)*

Keeping Up with the Business

> *You can do pretty much locally without it affecting the rest of Gamma's applications. Changing for example from the Orc to a Front solution would however be a major shift, which definitely would involve the back-office solutions significantly. (Nate Glover)*

Change projects at Markets are often born out of trading ideas and then handed over to project leaders at Markets. Nate Glover thinks the problem is the platform lying in the background, which is quite inflexible.

> *If you've been to the IT Department you've probably seen the diesel engines they have out there! (Nate Glover)*

One recent example is that the traders want to take on positions in multiple currencies in a convenient way. So far the restriction put on this by the central application has been solved by different kinds of work-arounds, which no longer is a viable solution. Multiple currency trading is a change in the environment of the traders, which happens regardless of what Gamma does or does not do.

> *Sometimes you just want to tell them [the IT Department] "Now you have to change your systems so you can talk to the new world!" (Nate Glover)*

Deployment

> *IT is not the hard part when changing systems. It is the new way of working. [...] When new systems are suggested resistant users are simply wishing the new system worked just like the old one! (Maria Garrity)*

Maria Garrity is a strong believer in geographically staged deployment over functionally staging, where users concurrently have to use multiple parallel systems. The normal approach at Gamma is to phase in new systems and avoid big bang solutions. The drawback is the extra work involved in running two systems in parallel, but the benefit is the opportunity to test the new system with parts of the load and also to get the benefits earlier, at least in the most crucial areas.

Another aspect is that most users only use parts of the functionality even though there are super users demanding more functionality than is provided by the systems. An important question of priorities is then whether more functionality should be built for the super users or if the resources should be spent on training the majority of the users.

> *For whom do we develop new functionality and why? (Maria Garrity)*

One example of this dilemma is Romulus where, on behalf of the branch offices, a supporting graphical user interface based application has been added allowing the user to use a graphical interface instead. Expert users find this too slow though and prefer to run the application in terminal mode.

> *Not everything that is work flow oriented is good. Super users are restricted and slowed down while others maybe never get through. (Maria Garrity)*

Maria Garrity's experience from working with the branch offices is that the challenge lies in delivering applications that allow users to use only the parts they need. She is looking for solutions that let the branch office users grow with the application as they develop their skills. Choosing the technical platform is also important. Client/server solutions have served the branch offices well, but they are expensive. Web technology is yet to mature, and there are few good applications using that technology, Maria Garrity thinks.

The challenge is that current solutions [client/server] are good but expensive and you want to switch to something cheaper which is not as good [web based solutions] [...] Switching becomes a timing issue. When is the time up? (Maria Garrity)

7.6.5 Removing Applications

It is awfully hard to remove applications! (Ed Gatling)

When removing an application there is usually an extra effort needed compared to running it for another year. Taking on this extra effort means that the resources for new development decrease, which in the short run is not very tempting to the business organization. As an account manager, Ed Gatling finds this frustrating since it is often easy to see the short payback time in terms of easily quantifiable operations costs.

Often there are a few odd cases that do not fit in the new system, which force some development effort if they are to be moved. One example of this is the new version of Tiber where a few customers are lagging behind using the old version because the new version does not meet their needs.

Yet another reason, Ed Gatling thinks, is that the business side is lacks project management resources. In some special cases IT Strategic Control steps in and applies pressure either directly on the business organization itself or possibly via top management. Such cases usually relate to extreme operational costs or possibly security issues. Usually IT Strategic Control's opinions concern things like certain technical platforms that ought to be removed. This is sometimes quite delicate since the business organization does not know what different things costs. It can also be related to the customer interaction of the business organization where the tradition is to add new channels to reach out to the customer but there is no tradition of removing channels.

Porting old systems is a very central issue for Tom Garrett. He illustrates a common dilemma with a project that aimed at migrating the Internet bank to the new architecture described above (see section 7.6.3 on p. 229).

We asked for and got some 15 million [SEK] which was our estimate at that time. When the project was underway we realized that the total cost would rather be something like 55 million [SEK], so we quit the project. We couldn't spend 55 million [SEK] on something that gave no customer value in the short run. Instead we built something that created customer value immediately. (Tom Garrett)

Markets has an abundance of examples of applications living on.

> *We got a new system for fixed income and moved a couple of products. Each product was more expensive to move than planned and after a while we had run out of money. Some products never got moved and we ended up with parallel systems. (Sandy Grant)*

Another example was an application for trading foreign equity. It was installed, but the project ran out of money before the application was integrated with the other systems so it became a stand-alone application. The traders continued to use the phone since everything had to be entered twice otherwise. Thus, the new application did not add any value.

7.6.6 A New Platform?

> *The main question is "when is the right time to switch platforms?" (Anna Gray)*

There are some plans to develop a new IT platform, which basically means replacing Romulus and Remus. The present cost estimate is quite staggering, which means that it is a top management issue since that kind of money is not available in the usual IT budget. To be able to answer questions like "what are the extra revenues? Will the costs go down?" Anna Gray believes in a smaller pre-study project.

> *Based on the results of such a study we can go to top management to get the necessary funding. (Anna Gray)*

One reason for replacing the central systems is a prediction that the number of transactions will increase heavily over the next few years.

> *A central question is "How large volumes can they [Romulus and Remus] manage?" [...] Replacing Romulus and Remus is technology driven, that is we're not looking for more new functionality, but rather to ensure that the systems will work properly in the future. (Ed Gatling)*

Anna Gray does not believe in large replacement projects, but rather replacing parts of larger systems.

> *In a two year perspective it's rather about what small steps concerning security and performance you have to take. Continuing to improve existing systems works longer than you think. (Anna Gray)*

> *In general, the time of large replacement projects is over, at least in the short run. [indicating that she sees no immediate need for such projects] (Anna Gray)*

This view is shared by others.

> *The analyses that the banks will go under because they don't manage to replace their old applications are wrong since it is all about phasing the applications out gradually in favor of more modern solutions. (Matt Gill)*

7.6.7 Other Portfolio Challenges

If Isaac Griffin could rebuild Gamma's IT portfolio he would like straighter communication between different systems and, above all, fewer systems.

> *Startup banks have much more well-bred portfolios. Maybe we are too traditional. "We've always done it this way", and then we think we have to keep on doing it that way. (Isaac Griffin)*

Concerning Tiber, a future challenge is to spend enough on it to keep up with the competitors. Thinking of Gamma's Internet solutions in general, Matt Gill brings up two future challenges: availability and never underestimating the need for customer support.

On the same topic, Isaac Griffin would like to enable the customer to do more things over the Internet and in the future enable the branch office personnel to interact with the central systems via the Internet solution. The branch office and the Internet bank stovepipes should be merged. In general he finds the different channels to be too much like separate stovepipes.

Yet another major challenge lies in the fact that the integration so far is quite selective. The transactional systems are well integrated but the informational systems are not. Finding an adequate level of integration is important. Technically, the integration can be too tight, which increases the dependency between different systems too much. The functionality of the next generation systems should also be more configurable, i.e. it should be possible to turn features on and off.

For the IT Department Ed Gatling recognizes the challenge of establishing a healthy customer relationship, where Gamma's best is kept in mind while at the same time using an purchaser-provider organization. The IT Department needs solid business knowledge to be a good partner for the business organization. When business knowledge is lacking, the business goes to external sources.

8 EXAMINING IT PORTFOLIOS

Given that the research design actively seeks variation in case company characteristics, it comes as no surprise that the IT portfolios of the case companies vary significantly. This chapter discusses the case companies' portfolios first in light of existing theories. It then addresses some possible extensions of existing theories and the increased IT exposure of companies.

8.1 CROSS-CASE ANALYSIS

8.1.1 Lambda

EdbTrade dominates the IT portfolio at Lambda and is complemented with market information systems (e.g. Reuters, Bloombergs), trading applications and ordinary office applications (e.g. Microsoft Office).

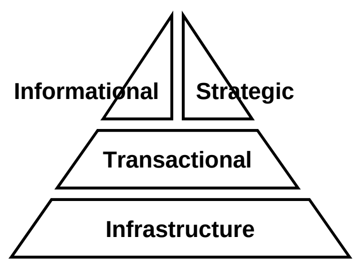

Figure 8.1: Management Objectives for IT Portfolios (Weill & Broadbent, 1998)

Weill & Broadbent's (1998) distinction between different objectives, as described in Figure 8.1, is not evident in the Lambda case. The character of EdbTrade is transactional and infrastructural, but to Lambda it is also a strategic application. To Lambda's customers the services provided by Lambda, or rather EdbTrade, is transactional in nature. By using EdbTrade, the customer gets direct access to a number of different marketplaces (stock exchanges and options exchanges), i.e. Lambda extends the reach of the infrastructure of the customer company (Keen, 1991b). By increasing the connectivity of their customers' infrastructures, Lambda makes their infrastructures more flexible (cf. Duncan, 1995).

It could be argued that EdbTrade does not perform transactional services for Lambda. Rather that capability is outsourced to the customer. Lambda's business idea is not to use EdbTrade to make money. Instead, Lambda makes money by letting others use EdbTrade.

It can also be noted that the market information systems used at Lambda (e.g. Reuters, Bloombergs) are not what Weill & Broadbent (1998) call informational systems. Weill & Broadbent have an internal information perspective, which means that, for instance, management support systems belong to this category. Systems bringing in information from the outside world that is needed in the business activities are not explicitly considered by Weill & Broadbent (ibid.). Real-time business intelligence applications play an important role in the financial industry, probably more so than in most other industries. In Weill & Broadbent's model this application is best described as Transactional.

The Lambda case exposes the internal perspective used by Weill & Broadbent (ibid.). EdbTrade plays an important part in Lambda's customers' IT portfolios as a transactional application. This illustrates that it is not enough to examine an application in isolation in order to understand its characteristics. In this example, it is important to consider who is using the application. Is EdbTrade examined from Lambda's perspective or from a customer's? A fairly similar situation is the back-office solution used at Lambda, where Lambda plays the role of the customer using the transactional services of an outsourcing provider. It is noteworthy that Weill & Broadbent (ibid.) focus on how companies use their own applications. The seamless integration present in the Lambda case where the owner and the user of the application are two different entities is not explicitly covered.

In Ward & Peppard's (2002) typology, EdbTrade is both a strategic and a key operational system. Lambda has taken precautions to reduce its dependency on EdbTrade since they do have other marketplace software at the trading desk. This means that if EdbTrade malfunctions, it is still possible for their customers to trade via Lambda by calling the trading desk, where their orders can be manually entered by the brokers using some other trading application. This is an inferior solution in the long run, but can be applied for shorter outages. Lambda's business vision of providing a "trading floor feeling" to their customers is completely dependent on EdbTrade being up and running. The market information systems are typical support systems in Ward & Peppard's (ibid.) typology.

8.1.2 Delta

There are a lot of similarities between Lambda's EdbTrade and Hugin, Delta's in-house front-office application. The main difference is that Delta uses Hugin in-house for its own business and does not outsource it to others. The Business Area Hugin solution however, was a step in that direction, where the intention was to sell the application to others.

Using Weill & Broadbent's (1998) typology, Hugin is a strategic transactional application, or more precisely, an application meeting both strategic and transactional objectives. It is strategic because it does provide some unique functionality perceived by Delta to be of strategic importance. Its main task, however, is transactional. Munin, the back-office application, on the other hand is a more purely transactional application. The people at Delta see no real competitive advantages arising from a superior back-office solution.

An important dimension for Delta, which Scott Daniels, the business developer, pushes hard, is the interconnection between Hugin and Munin, which maximizes the transactional aspects of trading. Thus, it is essential to create a seamless transactional chain of applications, which moves the focus from individual applications to how they work together, or in Duncan's (1995) terminology, moves focus to their connectivity and compatibility. This emphasizes the shortcomings of examining applications in splendid isolation, which is the predominant approach in many existing portfolio theories (e.g. Ward & Peppard, 2002). Applications sometimes are simply links in a chain that is no stronger than its weakest link. This is particularly true for transactional applications interacting to create a transaction chain.

The transaction chain is also very important in the RGA solution, where analyst reports are partly generated from databases containing pertinent data. A lot of the logic lies in linking different applications together correctly in order to extract the correct data and present it correctly, i.e. to achieve the compatibility needed (Duncan, 1995) or extending the range (Keen, 1991b) of the IT platform. The high degree of standardization needed to accomplish this however severely decreases the modularity (Duncan, 1995) of the solution, i.e. it is difficult to update parts of the application chain.

Risk management is also interesting in this context. A normal approach in the business is to have risk management that collects data from open positions to calculate some risk measures of a trading portfolio or some other set of instruments. With this approach a risk management system is a kind of informational application (Weill & Broadbent, 1998) or directive system (Sundgren, 1992), which is added on the existing trading applications serving internal directional and surveillance needs. As described by Delta's risk manager Chris Drew, risk at Delta is considered to be an integral part of trading, and risk management functionality is inherent in Hugin. Whether this means that Hugin is seen as also fulfilling informational objectives depends on the worldview of whoever makes the categorization. Subscribing to Chris Drew's view, risk is not considered to be something that emanates from the trading (leading to an Informational categorization), but rather it is an integral part of trading (leading to a Transactional categorization).

From a usage perspective, an interesting example of how different actors in the company categorize applications differently is Microsoft Office. For many departments at Delta this is clearly a support application (Ward & Peppard, 2002), which certainly is useful but not crucial to the business activities. To the Equity Research department, with its massive investment in the partly Microsoft Office based RGA system, it is definitely a key operational application (ibid.). Unsurprising this led to quite different views on software updates. Using it as a support application, most of Delta wanted to update continuously in order to have the latest version when for instance exchanging documents with others. Their decision was based on criteria typically used for support applications, such as convenience and cost savings (cf. ibid.). For the Equity Research department, criteria like up-time and quality were important, which are typical for key operational applications (ibid.). The Research department foresaw an unavoidable drop of productivity when updating and had no specific use of the new functionality provided by the new version.

What can be noted from this example is that the character of the application is in the eye of the beholder. The same application can be used in very different ways, which is especially true for applications as plastic as office productivity tools.

8.1.3 Tau

Tau focuses very strongly on providing an un-broken transaction chain from the on-line sites, where the customers enter their orders via the marketplace to the back-office solution. From Tau's perspective, there are no particular applications that fulfill strategic objectives. Rather it is the combination of different applications that is of strategic importance because of the increased connectivity (Duncan, 1995) it offers the customer. This reiterates the importance of studying chains of applications rather than isolated applications, as stated above.

From Ward & Peppard's (2002) perspective, the web sites are clearly key operational applications as stability and availability are the most important features of the sites. The perceived notion of customers switching brokers if the site is down indicates very low switching costs for the retail customers on the Internet brokerage arena. One reason for this low switching cost is that there are no personal ties with the customer. The customer usually does not know anyone at Tau. This differs significantly from how traditional brokerage firms used to function, where it was not uncommon for customers to follow “their” broker if he were to move to another brokerage firm.

Tau’s back-office solution differs slightly from others running the same standard package. Tau leaves information about their customers’ portfolios in the system and updates it intra-day. Other companies usually download this information at the beginning of the day to other portfolio management systems where intra-day updates are performed. At the end of the day, the information is then sent back. This difference in usage means that Tau is quite vulnerable to intra-day operational disturbances, which do not affect other companies as severely as Tau. In this way, the application is “more” key operational to Tau than to other users. On the other hand, Tau does not have to worry about portfolio management systems and thus ends up with a more streamlined IT portfolio. This serves as yet another example of where the application is the same, but its usage varies, and thus accordingly its importance and the consequences of temporary malfunctions.

8.1.4 Gamma

Gamma’s portfolio is very large and consists of literally hundreds of applications. There are fewer applications that are relevant if one focuses on Markets. The core applications are Romulus and Remus, which are quite typical transactional applications (Weill & Broadbent, 1998) and do what any back-office system does. To Gamma, however, tailored reporting would be one way of differentiating the back-office service provided to the customers thus making the applications differentiators rather than commodities (Lacity et al, 1996a). Being able to let the customer choose the frequency and distribution channel could be a differentiator, as would the ability to provide already filled in tax returns forms.

On the trader’s desk there are trading clients and information systems (e.g. Reuters, Bloombergs). The Tiber application is also transactional in nature, but it resembles a Strategic application in Weill & Broadbent’s (1998) terminology since it will be crucial for Gamma’s future operations where Internet trading makes up a significant part of Gamma’s trading activities.

Markets’ application portfolio suffers from a number of systems that have been acquired without really being integrated into the overall whole. These systems are usually intended to support the broker or trader in calculating risks and in managing her portfolio in general. If infrastructure flexibility is operationalized as connectivity, compatibility and modularity (Duncan, 1995), Markets’ portfolio connectivity is low. The compatibility is even lower among the numerous standard application packages acquired by Markets locally. Modularity, or the ability to add, remove or update components, is quite high given the low ambition level concerning connectivity and compatibility. Thus, there is a trade-off among the different aspects of infrastructure flexibility; the decision to tolerate minimum connectivity and compatibility increases the modularity.

8.1.5 Inter-Case Discussion

The IT portfolios in the case companies vary quite significantly in size and complexity, but there are some common applications, such as a front-office solution, a back-office solution and an Internet site. The applications within each of these categories vary significantly in certain dimensions that will be discussed below, but they are quite similar in the terms of the portfolio theories applied above. This similarity indicates that the usage or role of the application is more important than the application itself, as will be discussed below.

In terms of Lacity et al's (1996a) contribution matrix described in Figure 8.2 below, the case companies all reason quite similarly. Given the focus on mission-critical IT the applications considered here all belong to the critical category.

		Contribution to Competitive or Business Positioning	
		Commodity	**Differentiator**
Contribution to Business Operations	**Critical**	Delta: Hugin, Munin Tau: Web-site Gamma: Romulus, Remus	Lambda: EdbTrade Tau: Web-site Gamma: Tiber
	Useful		

Figure 8.2: Categorizing Case Company Applications

At Lambda, EdbTrade really is what the business is about, and it is deemed unique on the market by the people at Lambda.

At Delta, the Hugin and Munin solutions with their tight integration is deemed to be important, but they are not used to differentiate Delta from its competitors.

At Tau, the on-line site, with its connection to back office and the central marketplace system, is certainly deemed critical, but opinions vary on whether it is a commodity or a differentiator.

At Gamma, Romulus and Remus are considered to be critical commodity systems, while the Tiber application is a critical differentiator.

Thus, different companies make different considerations, which is not that surprising taking the market segmentation into account. To Delta, the efficient transaction chain is mostly a hygiene factor. Given the targeted market niche, it goes without saying for Delta's customers that the transaction chain is efficient. Internal efficiency is an important factor at Delta but even more important is automation as a way of reducing (eliminating) errors and enhancing risk management. Thus, the Hugin - Munin chain is critical to the business operation and may, in Delta's eyes, be superior to the competitors' solutions *but it is not critical for distinguishing* Delta. Instead Delta looks to its research department to differentiate itself.

To Lambda on the other hand, the transaction factory business vision demands an efficient way of managing order flow. Of course, at Lambda risk management aspects does not come into play in the same way as at Delta.

At Gamma and Tau, the efficiency is equally crucial, but maybe from two slightly different perspectives. At Tau cost efficiency is crucial and anything but an efficient transaction chain would drive up the costs and thus spoil the basic strategy of being a low-cost provider. Cost control is of course also important at Gamma, but here the sheer number of transactions demands efficient solutions. There is no way of coping with the large order flow without completely automated solutions.

It is also noteworthy that the mission-critical IT in the case companies lean towards the transactional. Other aspects come into, play but the overwhelming focus is on automation and coping with transactions.

8.2 EXTENDING TRADITIONAL PORTFOLIO MODELS

It can be noted that various portfolio theories or models available in the literature bring a rather narrow application focus to the table (e.g. Ward & Peppard, 2002). In themselves they are extensions of prior work focusing on IS contribution to the company as such (e.g. McFarlan, 1984). The purpose of these extensions was to cope with the fact that virtually all companies have applications of different kinds.

8.2.1 Chains of Applications

What becomes apparent in some of the case companies is that examining single applications does not provide a complete picture is not enough. At times, multiple applications working together provide a single service. Examples of this include Hugin and Munin at Delta or Tau's web site communicating with the back-office solution. The unit of analysis in such cases is the application chain rather than the individual applications. The applications are important, not in themselves but as pieces in a larger picture.

A familiar way of thinking about a single application is that it supports a certain business process in some way. This changes when there is a shift towards the business process actually being executed by, rather than supported by, different applications. When this happens, it can be argued that the application chain becomes a more appropriate unit of analysis.

The interaction between different applications is likely to have increased over the years, which may be a reasonable explanation for the fact that existing theories do not seem to take such application chains explicitly into account.

8.2.2 Emerging Categorization

The discussion above points to the fact that categorizing an application is often not a question of "what is this application?". Rather, a usage approach seems more useful because how the application is actually used is more relevant. An application can be, and usually is, used in different ways and for different purposes by different people (cf. Samuelson, 1990, chapter 7). An analogy with Star & Ruhleder's (1996) approach to IT infrastructure would be to apply an emergent perspective. The character resides not with the application itself, but rather with its use. Thus, the usage of the application can be categorized for some purpose and in relation to something else.

Another amendment to the question "what is this application?" would be "what is this application to whom?". This is illustrated with examples from three of the four case companies in Table 8.1.

Case: Application	**On One Hand...**	**...And on the Other**
Lambda: EdbTrade	Lambda itself does not actually use the application (apart from entering orders received over the phone). It is a key operational application since their business operation is to run and operate this application.	Lambda's customers use EdbTrade to interact with the marketplace, which makes it a key operational application. Of course, other means of entering orders are available to the customer, such as over the phone.
Delta: Microsoft Office	To the Research department this is a key operational application vital to their production.	To other departments it is merely a support application, which is not crucial for conducting their business in the short run.
Tau: Back office	To Tau, this application is a key operational application with real-time dependency.	To other users it is a batch-oriented database with no intra-day dependency.

Table 8.1: Applications Being Different Things to Different Users

As illustrated by Lambda, applications can be used by different organizations, and in such cases they are more than likely to play different roles for the company providing the service (the outsourcing company) and the company using it (the customer).

Ward & Peppard (2002) make some additions to the earlier edition (Ward & Griffiths, 1996) in this direction[38]. Apart from providing a definition of "application", they also, in another addition, open up for different user groups making different use of the "output" of an application. Their final recommendation is that when different user groups have different opinions a "*realistic and agreed assessment must be made*" (Ward & Peppard, 2002, p. 306).

Furthermore, Ward & Peppard (ibid.) do not (at least not explicitly) consider user groups in terms of different organizations or companies using the same application, as exemplified in Table 8.1 above.

[38] Being additions to an existing edition, these additions do not seem to have had a major impact on the presentation in general.

8.2.3 Proposed Extensions

Thus, the findings discussed above suggest two extensions to traditional portfolio approaches.

First, considering chains of applications instead of single applications can provide new insights. This entails a shift from the somewhat technical application perspective to a more business process perspective. As described in the theory chapter above, older theories (e.g. McFarlan, 1984) categorize the whole company based on IS contribution, where current portfolio theories (e.g. Ward & Peppard, 2002) consider individual applications within the portfolio. The application chain concept broadens the scope and suggests paying more attention to multiple applications interacting in order to meet some business need.

Second, the character of an application might be in the eye of the beholder. An application can be used in different ways by different users, and it can play different roles for different users. Instead of focusing on the application as such, taking its usage into account can improve our understanding by allowing for emerging categorizations. Often, the revealing unit of analysis is not application instances, but rather application roles.

The two proposed extensions are illustrated in Figure 8.3, where the first development from total IS contribution to individual applications is included.

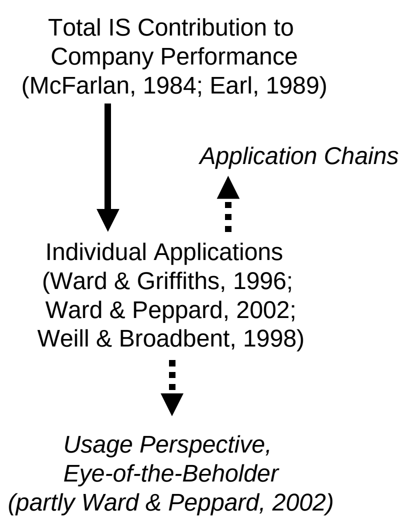

Figure 8.3: Extending Existing Portfolio Theories

8.3 A DIFFERENT WAY OF CHARACTERIZING APPLICATIONS

IT portfolio models usually aim at dividing a set of applications into different ideal groups (e.g. Ward & Peppard, 2002), not taking into account that the character of the application depends on who is using the model and for what purpose. Given this potential shortcoming, and the fact that classifying applications is hard, a different type of model can be developed. Using a transactional perspective as a starting point, a distinction can be made between automated and manual transactions.

Applications can be plotted based on the dimensions *manual cost* and *technical support cost*. Instead of splitting applications in different categories, the dimensions are used simultaneously to characterize applications. The manual cost dimension can be interpreted as the amount of manual work going into one transaction, or more generically, one execution of the business process being supported. Similarly, technical support cost can be interpreted as the average technical cost of one transaction, or one execution of the business process being supported. A solution which is both extremely labor-intensive and expensive from a technical perspective would thus end up far up in the northeast corner. On the other hand, an extremely efficient solution hardly requiring any manual labor and causing almost no technical support cost would end up close to the origin of coordinates.

It is important to emphasize that the model is conceptual in nature and how one would actually measure the technical support cost is not trivial. It is probably easier to have an opinion on the amount of manual work going into managing one transaction.

8.3.1 Placing Applications in the Model

A transactional application such as EdbTrade would be located close to the origin of coordinates, see Figure 8.4 below. Manual work does not have to be put into the process, and the technical support cost is quite low per transaction.

Before the RGA came into use, a research report from Delta would be located along the y-axis, since it was quite labor intensive but incurred very little technical support cost. Introducing the RGA decreased the manual work by automatically generating parts of the report. It did however increase the technical support cost (because of the cost of the RGA) moving it away from the y-axis. Delta’s solution with Hugin and Munin is quite automated and requires little if any manual work when managing a transaction (apart, of course, from deciding what to buy or sell). Tau’s addition of information and analytical tools to their web site moves their web solution to the right, i.e. increases the technical support cost. Placement of the different applications discussed so far gives Figure 8.4[39].

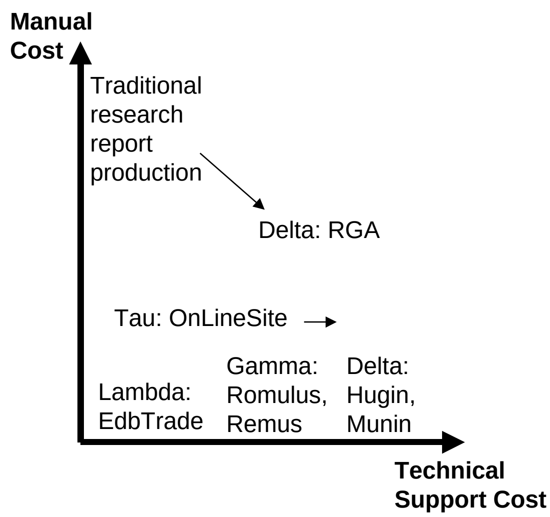

Figure 8.4: Manual and Technical Support Costs

Obviously, placing an application is to some extent an ad-hoc decision, but depicting how changes to applications affect their positioning is somewhat easier. The primary purpose of the model is to explicate the trade-off between manual input and automation.

8.3.2 Relativity or ”The Southwest Misconception”

It is noteworthy that a common perception among the case companies seems to be that they see themselves as being fairly close to the x-axis. Other companies are perceived to have solutions to the “the north” of oneself, if not “northeast”, i.e. less efficient. People at the case companies expressed this in various ways. At Delta, head of administration Donovan Day notes that Delta is well positioned having straight through processing (STP) with no manual interaction in-house. This is a common perception at Delta, even though Andrew Dial serves as an exception as he believes that most companies have that. Otis Thornton, head of IT at Tau, notes that

[39] It should be emphasized that the purpose of Figure 8.4 is illustrative and not to compare for example Romulus and Remus with Hugin and Munin from an efficiency perspective.

many manual tasks have been automated both on the IT side and on the business side.

A perceived strength of one's own applications is quite consistently that they are west and/or south of others', i.e. more cost efficient in some manner. One possible explanation of this possible southwest misconception is that the picture painted is tainted by wishes and intentions to move in the direction of more transactional approaches. Another explanation can of course also be a methodological issue since respondents can have chosen to give a "misleading" image of their own applications.

8.4 IT PORTFOLIO EXPOSURE

8.4.1 Means of Service Rendering

A common trait among the case companies, with the possible exception of Delta, is the extent to which the customers interact with the company directly through an application instead of a broker. Since the complete transaction chain is computerized, customers also have high expectations on immediacy. The lead times in transferring information between systems become evident to the customer who, rightly or wrongly, expects real-time behavior.

For Lambda interacting with their customers via computers was the intention since the inception of the company. According to CEO Luc Langdon, it was even a precondition for the founders to start the company in the first place. For Tau, it was a natural extension of the original phone based trading, where customers call (something they can still do) the broker at Tau who then uses a front-end application to enter the order to the marketplace. The biggest change probably came for Gamma where orders used to either be phoned in to the broker or come from a branch office where a customer placed the order.

In all these cases the customer now has the opportunity of entering the order herself into a computer and having it sent to the marketplace. If anything in this fairly complex chain of applications breaks down due to for example malfunction or hardware/network problems, the customer immediately knows about it and presumably suffers from it. Thus, reliability is essential, which is strongly emphasized by various people at Tau. It is noteworthy that the service provided is still the same as when a broker took an active part in service production. The "order entry" service provided to the customer cannot be produced until requested by the customer (cf. Normann, 1992, p. 31). An important distinction, however, is that even though it cannot be produced until requested, with a broker involved in the process, the actual handling of the request does not have to be produced exactly when requested. If a broker is involved, the service request can be accepted and then temporarily stored, until a transient problem is resolved. In other words, a broker could accept customer orders even if there was some sort of technical problem. Without brokers in the process, there is no such holding tank for service requests received during the technical malfunction.

8.4.2 The Concept of IT Exposure

When a company starts using IT applications to interact with the customer, or even lets the usage of their applications be the cornerstone in their market offering, their *IT exposure* is increased.

The company's IT applications is exposed to the customer as he interacts with the company. An increased IT exposure means that the service rendered to the customer on a daily basis is the use of the IT applications; the service has been packaged as one or more applications. This increased IT exposure is an important difference between production and services, in addition to already existing differences (cf. Normann, 1992).

It can be argued that whether a service comes in the form of a computer-user interface or not is irrelevant, i.e. the important thing is the content of the service. From a customer perspective this is true (apart from the obvious difference in packaging of the service). From the company's perspective it is, however, quite different and is an important tool for improving the efficiency (Levitt, 1972, 1976). Relating to Figure 8.4: Manual and Technical Support Costs above, there has been a shift downwards as the manual work put into different processes has decreased significantly.

Using the order entry example from above, a lower IT exposure allows the possible existence of a "holding tank", i.e. not providing the complete service immediately. In cases with a higher IT exposure, meaning that the service is completely produced by interacting applications, there is typically no such holding tank. A malfunction in an application makes the service unavailable in much the same way as a busy signal when calling the broker.

Going from IT applications as internal support for the business processes within the companies to having the IT applications being the primary interaction channel with the customer is quite a shift. Taken further, this argument suggests that in such cases the company becomes something that resembles a traditional outsourcing provider to the customer.

Lambda and Tau embrace this trend and incorporate this into what they set out to do. Lambda talks about "putting the customer on the trading floor", i.e. their value added is to let the customer use their EdbTrade to access the market on equal terms with the broker community. Tau strives to let their customers trade cheaply and efficiently, i.e. on a retail level Tau adds the same kind of value as Lambda.

To Delta, the direct IT based interaction with the customers is restricted to the distribution of research and the analysis tools provided on the web site. This restriction is consistent with their conception of themselves as a leading research and analysis brokerage. For Gamma, the Internet bank solution is yet a channel for interacting with the customer. To some extent this is the same as Tau's value proposition since the customer choosing to use this particular channel gets basically the same service from Gammas as from Tau. There is a difference in that Gamma consistently provides multiple channels, not only for backup or special cases as Lambda and Tau do, but also for customer segments preferring other ways of interacting with their bank.

8.5 Summarizing IT Portfolio Examination

Important insights seem to be lost when focusing on applications per se, as is the dominant approach in existing theories. The insight that an application can mean different things to different user groups is lost if one fails to consider application usage. Thus, not the application instance, but the role the application plays in the business operations is the important thing. The characteristics of an application are in the eye of the beholder.

Simply defining the concept of an application is not trivial as applications interact more or less seamlessly. A business need is met by a set of applications, or an *application chain*, no stronger than its weakest link. A proposed extension to existing portfolio theories is not only to consider stand-alone applications but also the application chains they make up.

Applications can also be described along multiple dimensions. The transactional nature of an application can be explicated by plotting the manual and the technical cost for handling a transaction or executing a business process. Such plots can help compare different applications and help evaluate proposed changes.

The concept of IT exposure describes the extent to which the IT portfolio is exposed to customers. An increased IT exposure means that customers interact more directly with a company's applications. This in turn affects the consequences of, for example, breakdowns and also makes the user concept more vague as all users are no longer within the company; instead the customers are the users.

9 SOURCING APPLICATION DEVELOPMENT

In this chapter, the case companies will be revisited from a sourcing perspective using for example the framework for selective sourcing presented on p. 68. The central issue is the sourcing of application acquisitions. An activity related to acquiring applications is supplying applications, i.e. providing applications to others. As it turns out, several examples can be found of companies considering the decision to become in part application providers. This chapter concludes with a discussion of different aspects of spin-offs, i.e. when separate software companies are spun off in order to make applications available to others.

9.1 CROSS-CASE ANALYSIS

9.1.1 Lambda

Lambda has chosen quite different sourcing strategies for different parts of its business. There are two different areas that will be discussed in this section, the (continuous) development and operations of EdbTrade, and the back-office solution.

EdbTrade

At its outset, Lambda consisted of just a few key people (Edgar Lucas, Jim Lee, Luc Langdon) facing the challenge of developing EdbTrade. Buying the system was not a viable alternative, mainly due to the lack of existing standard application packages. Available components were discarded partly for reasons of secrecy. Porting the green field aspects over to the IT applications also had the advantage of not bringing in any IT legacy from a standard solution. In hindsight, head of business development Jim Lee acknowledges that he may have been too categorical when he did not want to include any existing components into EdbTrade.

Much of the existing literature predominantly concerns itself with existing companies deciding whether to outsource or not (e.g. Domberger, 1998; Lacity & Hirschheim, 1993a, 1995; Willcocks & Lacity, 1998). In some cases using the literature becomes somewhat hypothetical. Rands' (1993) software make or buy policies, for example, talk about the company's skills relative to the best external software source. In a green field site such as Lambda, it is rather the skills the company is likely to be able to recruit within a given time frame that is of interest. In Lambda's case, secrecy and timing were important factors. Thus, the possibility of recruiting an IT department for in-house development purposes was not really an option. That would also leave the problem of being overstaffed once the application was developed, which would cause cost problems. By outsourcing application development, costs could be contained as the fixed costs associated with internal staff were avoided, supporting the argument that cost reduction and containment is a main driver for outsourcing (Willcocks & Lacity, 1998).

In a case such as Lambda's with low company skills (or rather meager resources) and a strategically important application, Rands (1993) suggests a strategic alliance. In a way, Lambda achieved this by forming a strong relationship with a consultancy company.

Given the decision to outsource the development of EdbTrade to an external party, again the green field question comes into play. Usually a partner that is as knowledgeable as possible is sought for in this situation. Lambda conscientiously chose a partner new to the financial industry, albeit technically competent. The reason for this was mainly secrecy. In Williamson's (1985) terminology, Lambda conscientiously kept down the asset specificity (in terms of financial industry expertise) needed on behalf of the consultancy by providing it in-house. Apart from secrecy issues, keeping down the asset specificity also widens the pool of possible providers.

The head of IT development Edgar Lucas worked with specifications, but the actual development and project management was left to the external company. Further development of EdbTrade is still done by the same external consultancy, which has turned into a preferred contractor (cf. Lacity et al, 1996b).

Lambda chose very consciously to outsource neither the control of, nor the responsibility for, EdbTrade. Instead, not giving up the control of the application was a very important issue to Lambda and is reflected in their tight control of what changes to make to EdbTrade. In this respect, it is not important that the changes are made by the external consultancy. This is in line with Quinn & Hilmer (1994), who point to loss of control as a main strategic concern when outsourcing.

One competitive aspect of this is that Lambda does not run the risk of competitors getting the same functionality by buying the application from a vendor. This implies that Lambda can expect to enjoy more first mover advantages due to technological leadership (Lieberman & Montgomery, 1998). Given the framework for selective sourcing developed above (see

Table 3.7 on p. 68), Lambda's solution can be characterized as a turnkey solution, see Table 9.1.

Type of Solution	**Code Development**	**Project Management**	**Control and Responsibility**
Turnkey solution	External	External	In-house

Table 9.1: Characterizing Lambda's Sourcing Strategy

People at Lambda feel comfortable being in control of their fate and not outsourcing that to some third party vendor. They are very well aware of the responsibility they have taken on and live by the phrase *"know thy systems"*. Adhering to Quinn & Hilmer's (1994) advice to focus on core competencies and outsource activities "*for which the firm has neither a critical strategic need nor special capabilities*" (p. 43), Lambda has chosen not to build internal capabilities for code development and project management. Decisions on enhancements to EdbTrade, however, are kept in-house as a core competence, residing primarily with Edgar Lucas.

In the Lambda case, some sourcing literature would have labeled the chosen solution a buy solution (e.g. Rands, 1993) since the resources needed were bought from the outside. Yet in the case, the important distinctions are to be made between the chosen solution and a standard package (i.e. control, ability to sell to others, competitive exclusivity). The distinction between the chosen solution and an in-house solution are of less importance.

Back-Office Solution

When it comes to back-office solutions, there were more alternatives available since this application carries out a rather standardized procedure performed by every brokerage firm. Lambda opted for outsourcing the business function. There were standard applications available on the market, but Lambda outsourced it since it was deemed to be a commodity rather than a differentiator (Lacity et al, 1996a), i.e. Lambda was not looking for competitive advantages. Even so, Lambda has chosen to retain knowledge in-house in order, for instance, to answer customer questions. Thus, Lambda is outsourcing the activity, but still keeps its responsibility vis-à-vis the customer.

In terms of Lacity et al's (1996a) factor matrices, the back office can be categorized as follows:

- *Business factors*. Back office does not help in the competitive positioning of the company, but it is critical to business operations. Thus, Lacity et al (1996a) suggest "Best-source".

- *Economic factors*. The in-house scale of Lambda's back office is definitely sub critical, while it is harder to tell whether the managerial practices are leading or lagging. The advice is either to outsource or to increase the scale by taking on other companies' business, which was of no interest to Lambda (ibid.).
- *Technical factors* The technological maturity of back-office solutions is high and the degree of integration is high. This calls for a preferred contractor solution according to Lacity et al (ibid.).

The back-office activity of Lambda seems to fit nicely into the factor matrices with the consistent advice to outsource. It is noteworthy that Lambda has taken precautions not to lose critical skills (Quinn & Hilmer, 1994) by keeping back-office competence in-house. Thus, Lambda chose not to outsource the back-office function of the company. In Lacity et al's (1996b) terminology, Lambda purchased resources (the use of back-office application) rather than results (a back office for hire). The reason for this was mainly the overall undertaking Lambda takes on for its customers. From a customer perspective Lambda is responsible for the back-office solution, and pairing responsibility with control, Lambda saw no other way than keeping parts of the back office in-house. The decisive factor for Lambda seems to have been the customers' perception of their undertaking, i.e. customers turn to Lambda to get a certain service and expect Lambda, rather than an outsourcing provider, to provide that service. The literature on sourcing issues adopts a strongly internal perspective, discussing outsourcing (or not) from an efficiency perspective (e.g. Domberger, 1998). The literature does not explicitly address how outsourcing affect customers, especially those expecting one-stop shopping.

9.1.2 Delta

The traditional approach at Delta is to outsource code development but to keep project management in-house. Typically, outside consultants work on Delta's premises in a quite straightforward body shop approach (Lacity & Hirschheim, 1993a). The main argument for not having code developers employed is knowledge and competence issues. Delta prefers to acquire the service from people with the right set of skills, rather than have to keep a group of in-house developers up to speed on a variety of technologies. This is in line with Domberger's (1998) notion that competence does not have to be kept in-house if it can be acquired under reasonably competitive conditions.

Hugin

Hugin, Delta's front-office application, has lived a long life from a sourcing perspective as described in Table 9.2 below. Hugin was originally a completely proprietary solution, which is in line with Rands' (1993) suggestion to "make" strategically important applications, where company skills are relatively high. A recurring assumption at Delta is that the higher costs associated with having a proprietary application instead of a standard application in this area is worth the extra cost from a business perspective.

Phase	**Positive**	**Negative**
In-house proprietary	Ability to affect functionality. Not black-box functionality.	
BA Hugin	Potential to share costs. Professional organization leads to formal, well-documented releases of the application.	Partial loss of control. Increased distance from users to developers. Competence dilution as organization expanded. Cost increase (in absolute terms).
Moved back in-house proprietary	Professionalism can be kept.	Costs cannot be shared.

Table 9.2: Organizational Domicile of Hugin

When Hugin was kept in-house there was an interaction between the line and the IT department. After it was moved to BA Hugin, multiple interfaces were added and operationalized through specific middlemen. The interaction between the line organization and BA Hugin was operationalized by a contact person at the IT department serving as a middleman, i.e. the interaction went from the line organization to the IT department and then on to BA Hugin, as described in Figure 9.1.

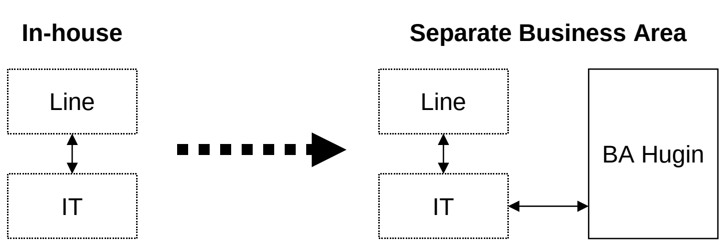

Figure 9.1: Transaction Cost View of Hugin Domicile

The transaction of interest is the acquisition of new functionality (including stability and performance). In terms of the dimensions describing transactions, uncertainty, frequency and asset specificity (Williamson, 1985), all three are affected by this move to a varying degree. The uncertainty can be considered to be increased somewhat as new functional requirements suffered from the filtering and increased distance between the user and the developer.

> *Using a contact person puts a lot of pressure on the user to articulate his needs. (Eddy Delk, IT Department)*

In the long run, it is likely that the frequency of transactions would have decreased as more customers presumably would have led to more formal releases, and less opportunity for Delta to get their immediate needs fulfilled. In any case, the frequency is recurrent rather than occasional or one-time

The third dimension, asset specificity, is divided by Williamson (1985) into site specificity, physical asset specificity and human asset specificity. Both physical and human asset specificity decrease, at least over time, when Hugin is moved to BA Hugin. The physical asset specificity is in this case interpreted as Hugin's match with Delta's need. As the application would have been adopted to meet other customers' needs, it would have become less and less Delta specific. In the same vein, human asset specificity decreases over time in two ways. First, the knowledge of the people at BA Hugin is likely to become less and less Delta specific. Second, the knowledge in general is likely to become less Hugin specific, as new people are recruited bringing with them generic industry knowledge, but not Hugin specific knowledge.

In transaction cost theory terms (cf. ibid.), setting up BA Hugin (going from unified governance towards bilateral governance, and possibly in the long run towards market governance) is linked to Hugin's asset specificity. By moving Hugin to a separate business area, Delta was prepared to lose Hugin as a purely tailor made application. This means that they were prepared to give up some of the specificity in return for sales revenues. When the market faltered, there were fewer gains in terms of external sales to be found from giving up this specificity. Thus, unified governance once again became preferable.

Some of the incurred transaction costs implied by implementing more formal procedures for the interaction between the business areas actually was considered to be beneficial even when Hugin was brought back to the IT department again. The increased formalization of, for instance, procedures and documentation forced by the separation was considered to be positive even when the application was brought back in-house. This could be interpreted as an attempt to reduce asset specificity, with special focus on human asset specificity, or put differently, reduce the reliance on specific key people.

Munin

Munin, the back-office system, is owned by Delta and some other market participants. It is also sold to, and used by, other companies. In terms of Lacity et al's (1996a) business factor matrix (see p. 56 above), Munin is Critical, but a Commodity when it comes to business positioning, which renders the recommendation "Best-source", i.e. "*test the market to determine the economic validity of outsourcing*" (Lacity & Willcocks, 2001, p. 193). Joining forces with other market participants is quite reasonable from a sourcing perspective, as Lacity et al (1996a) suggest in their economic factor matrix in-sourcing for applications where managerial practices are leading, but in-house scale is sub critical. It can be argued that the cooperation with others is a way of increasing scale in order to reach critical mass in terms of application usage, and thus become cost-effective.

Internet and the Report Generator Application

The RGA was developed in-house by a few key people at the IT department (mainly Antonio Duncan). It is a fairly specialized system, which was championed by the head of the research department at that time, i.e. it was developed in very close cooperation with the final users, the analysts. The application deviates from Delta's traditional sourcing strategies since it was developed completely in-house. The Internet solution for distributing reports was developed by one of Delta's preferred contractors (Lacity et al, 1996b).

Summary Delta

A clear pattern in Delta's behavior (broken by the RGA) is to develop proprietary applications using external developers, see Table 9.3.

Type of Solution	**Code Development**	**Project Management**	**Control and Responsibility**
Outside developers	External	In-house	In-house

Table 9.3: Characterizing Delta's Sourcing Strategy

An equally clear pattern is the effort to share costs with others. Both the cooperation with other market participants (Munin) and BA Hugin were results of this cost-sharing strategy.

An important shift came with the new CEO. Primarily because of costs, he strongly feels that in-house development is not viable in the long run. Thus, he has started to shift the mindset of the people at Delta towards standard application packages instead of proprietary solutions.

9.1.3 Tau

Tau has its clear low cost business strategy, which translates quite explicitly into a strategy to buy standard packages whenever possible. The head of the IT department, Otis Thornton, neatly sums up the overall strategy using three key questions: Is it already available in-house? If not, can it be bought? If not, can we develop it ourselves? Thus, the main sourcing strategy is to acquire standard packages with the backup being to acquire turnkey solutions, as described in Table 9.4.

Type of Solution	Code Development	Project Management	Control and Responsibility
Turnkey solution	External	External	In-house
Standard package	External	External	External

Table 9.4: Characterizing Tau's Sourcing Strategies

Any deviation from the buy strategy is well founded and is never done in an ad-hoc manner. One deviation is the web site where there was no standard solution available. Tau currently uses two separate consultancy companies for their web site. The first one, which is responsible for databases and application logic, provides an interface for the second one, which builds the user interfaces. In both cases a long-term relationship is sought for, and the purchasing focus is on results (cf. Lacity et al, 1996b).

When tailor made applications are deemed necessary, in-house development is rarely an alternative. Economies of scale, or rather lack thereof, are often proposed as a reason to outsource (e.g. ibid.; Keen, 1995). For Tau with its limited size and budget, this is an important factor in outsourcing application development. Keeping development resources in-house is just not feasible.

However, lack of size has sometimes turned out to be a restricting factor. On some occasions, Tau has sent out requests for proposals to different vendors for a tailor made application, only to have the vendors decline because the project was too small. Thus, Tau basically was too small to be interesting to the type of contractors interesting to Tau. It seems like Tau, looking to develop mission-critical IT with demanding requirements, felt obliged to approach larger consultancy companies to whom their projects were not large enough to be interesting. Presumably, smaller projects in most cases are managed by smaller consultancy companies.

9.1.4 Gamma

Gamma has a rather ambivalent, emerging approach to sourcing. The tradition within Gamma is to build applications in-house. Over the years, Gamma has been, and still is, large enough to be able to keep sufficient resources within their IT department. The in-house scale simply is large enough to reach critical mass (Lacity et al, 1996b). Temporary shortages are covered by external consultants. The core applications Romulus and Remus are, for example, developed in-house. Currently, Gamma's IT department is striving to use more standard applications and to reduce their in-house development in order to cut costs.

The history at Gamma Markets is slightly different, though. Markets has had a long-standing tradition of being slightly apart from the rest of the organization and to evaluate IT investments on a case-by-case basis. As long as a trader, broker or asset manager felt a need for a new standard package and somehow could show the profitability of buying it, the acquisition was made. The short lead times involved when acquiring standard application packages were also an important factor. As business opportunities were perceived to vanish quickly, rapid implementation was essential.

Over time this has led to a rather wild and complex portfolio of different standard packages more or less well integrated with each other and often with over-lapping functionality. Gamma's mixed approach using both in-house solutions (Gamma) and standard packages (Markets) is illustrated in Table 9.5.

Type of Solution	Code Development	Project Management	Control and Responsibility
In-house solution (Gamma)	In-house	In-house	In-house
Standard package (Markets)	External	External	External

Table 9.5: Characterizing Gamma's Sourcing Strategies

From an IT departmental view it could be argued that, apparently, Markets has already gone where the IT department wants to go, albeit for all the wrong reasons. This is not completely true, as Markets portfolio is not as well groomed as Gamma's overall portfolio.

Tiber is an interesting deviation from the standard application package pattern. When it was initiated, no standard package was acquired (or available for that matter). Instead, Markets used external consultants to develop the application in-house. The brand new technology, which Markets did not think the IT department mastered, along with the importance of a short time-to-market, ruled out Gamma's IT department as a viable option in Markets' opinion.

9.1.5 Inter-Case Discussion

Different Approaches to Sourcing

The various approaches to application development sourcing in the case companies are briefly summarized in Table 9.6.

Company	Sourcing Approach
Lambda	Mainly make (secrecy reasons, lack of alternatives).
Delta	Mainly outsourced make with project management in-house.
Tau	Buy (cost sharing, too small). Make when needed.
Gamma	Mainly make (tradition, economies of scale). Markets history of buying.

Table 9.6: Approaches to Application Development Sourcing

Delta keeps project management explicitly in-house, while consistently outsources code development. Lambda on the other hand outsources project management too. It is important to note that outsourcing project management does not need to imply an abdication from responsibilities. In Lambda's case for example, Edgar Lucas plays an explicit and active role by requesting new functionality from the provider of EdbTrade.

Tau usually outsources code development and project management in the cases where it is not possible to acquire a standard application package. Figure 9.2 below presents a summary of different approaches and also acknowledges Gamma's dual strategy (generally in-house development and Markets historically buying packages). As indicated, Tau complements its standard package route with turnkey solutions when necessary.

	Gamma	Delta	Lambda	Tau
In-house Solution	X			
Outside Developers		X		
Turnkey Solution			X	(X)
Standard Package	X			X

Figure 9.2: Chosen Approaches by the Case Companies

A common trend among the companies is that the level at which standard application packages are used are rising. Standard applications packages are used when possible, and any competitive advantage comes rather from being able to integrate the applications than from the applications themselves.

Compared to the situation in the case companies in this study, some literature on IT sourcing seems to emphasize the make-or-buy distinction (e.g. Rands, 1993). The distinction between buying a standard package and buying a turnkey solution from a consultancy is downplayed. Instead the focus is on whether the resources are provided in-house or not. This is important, but it is not the crucial line of demarcation for Delta, Lambda, Tau and Gamma. Instead, the issue of code ownership and control is central. Whether you control (and is responsible for) the application ("code") is far more important than whether you produced it in-house or if you paid someone else to do it as illustrated by the framework for selective sourcing developed above, and reiterated below in Table 9.7.

Type of Solution	**Code Development**	**Project Management**	**Control and Responsibility**
In-house solution	In-house	In-house	In-house
Outside developers	External	In-house	In-house
Turnkey solution	External	External	In-house
Standard package	External	External	External

Table 9.7: Framework for Selective Sourcing

On Deciding How to Source

It is important to remember that in specific situations all companies usually strive to use standard application packages. When none is available to provide the functionality deemed necessary, or the code ownership is important to the company, proprietary solutions are chosen.

This also has implications for the traditional adage to outsource commodities and keep strategic applications in-house (e.g. Lacity et al, 1996a). In the literature the reasoning behind this adage often is that competitive advantage lies in these latter systems, and that is where you will be able to make a difference by having a better application. The reasoning in the case companies rather seems to be that you dare not renounce control over strategic applications, even though someone else may be better suited to develop the application.

When a tailor made solution is chosen, there is still a choice to be made as to how the resources needed should be organized, as explicated in Figure 9.3.

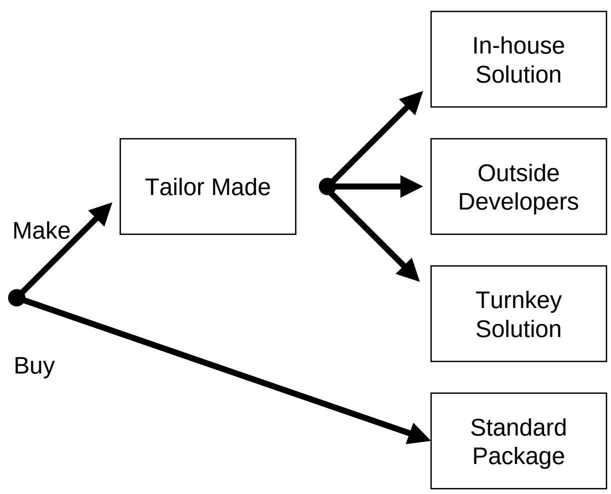

Figure 9.3: Choices in Application Sourcing

In the case companies, code development is generally outsourced except for some interface programming needed for applications to interact. In fact, it is only Gamma that consistently develops code in-house, which is not unrelated to the fact that Gamma is larger than the second largest company, Delta, by the order of magnitudes. There are several espoused reasons among the case companies for not keeping development competence and resources in-house, where the two most prominent are:

- *Load balancing*. Development efforts call for a lot of resources when developing the application and significantly less when maintaining it. Staffing to meet the development needs would mean over-staffing for the periods of time when no major development effort is under way. Gamma is managing this by temporarily hiring external developers.
- *Competence issues*. Keeping the staff up to date on every new technology is a daunting task. Gamma's size allows for coping with this, even though at least Markets thinks that the IT department is sometimes lagging behind. The other case companies prefer to buy the necessary development competence.

Load balancing is generally not framed in this way or explicitly discussed. However, it can be read into the general discussions on cost reduction (e.g. Willcocks & Lacity, 1998).

Competence issues are fairly well treated in the literature (e.g. Quinn & Hilmer, 1994; Cronk & Sharp, 1995). Core competencies are often discussed in terms of certain technologies or solutions, such as precision mechanics, fine optics, and microelectronics (Prahalad & Hamel, 1990). A similar approach to the case companies in general would treat as core competencies activities such as for example analysis (as in Delta) or equity trading. When analyzing IT sourcing, core competencies can also be applied to code development and project management. Outsourcing code development (as everyone but Gamma does) could then be seen as a consequence of whether it is a core competence or not. Likewise, project management would be a core competence of Delta but not Lambda.

One common reason for outsourcing is that organizations are not happy about their internal IT departments (Fowler & Jeffs, 1998). The only case displaying any support for this is Gamma, where Markets' confidence in the IT department is low. The size of the organization seems to be relevant in this respect. All other case companies are small compared to Gamma, which is also the only company where the IT department is not physically co-located with the business (i.e. all other companies house the IT department in the same building as the business organization). At Delta, BA Hugin was not physically co-located with the rest of the IT department. To Gamma Markets, involving the IT department becomes a sort of geographical outsourcing (cf. Ang, 1994).

Three factors that influence the choices made by the case companies are:

- *Company Size*. The company size has consequences for the degrees of freedom. A larger company (Gamma) may achieve economies of scale on the development level. A smaller but still sizeable company (Delta) may achieve it on project management level. The smaller companies (Tau and Lambda) have a harder time in this respect.
- *Legacy*. Hardly surprising, an existing legacy portfolio seems to force some development, either on the application level due to the functional constraints of existing applications or on the interface level due to the amount of interaction between applications.
- *Role vs. Instance*. In some cases it may seem that the same type of application is bought by one company and built by another for no particular reason. To explain this, it is important to take the role of the application into account. For example, Delta's front-end application plays an entirely different role than, say, Tau's. For Delta and its traders it can be a true source of competitive advantage, and the front-end application qualifies as a strategic application, while to Tau it is merely a supporting application.

9.2 SPIN-OFFS

9.2.1 The Idea of Spinning-Off

In the case companies, there are some examples of companies going beyond developing proprietary solutions. Instead they take on the responsibilities of a software vendor and actually make the application available to others. This means not only providing the services your potential providers provide to your own organization, but also adopting their business idea of providing these services to others. This is similar to the in-source suggestion made for activities where managerial practices are leading but the in-house scale is sub critical in Lacity et al's (1996a) economic factor matrix (see above, p. 56). There is an important distinction to be made between integrating software vendor activities by just developing a proprietary solution for in-house use and actually acting as a software vendor providing services to other customers. The examples from the case companies are:

- Delta made their front-office application (Hugin) available to other market participants when forming BA Hugin.

- Delta made their back-office solution (Munin) available to others (jointly with other market participants).
- Lambda made, or at least prepared to make, their EdbTrade available to others.

In none of these instances was selling the application to others an explicit goal at the outset. Instead, it was a way of sharing costs. However, moving into the software provider industry brings with it a set of obligations. Such obligations include the perceived need for more formal procedures for documentation, testing, change request management etc.

Why then, is this need not perceived as important for in-house applications? One aspect is the fixed cost of, for instance, documenting, which does not depend on the number of users/readers. The more formalized approach to changes and testing is rather implemented since improvising and relying on personal connections no longer are sufficient. *Improvisation does not scale well!*

The increased formalism and decreased improvisation seemed to be appreciated in the organization. At Delta, the impression was that things were taken more seriously and done more professionally by BA Hugin than when everything was done in-house. The line organization wanted the new approach to remain, at least partly, even after the application was moved back in-house. They wanted to shift from garage shop mentality to professionalism[40].

In larger organizations the more formalized way of working is accomplished by using separate organizational units. Separating units within a company, as is done in Gamma, introduces the same kind of formalism as buying from outside vendors does. Transaction costs are naturally introduced in terms of, for example, company internal contracts.

One aspect apparently not considered was the initial choice to develop the application in-house. Some common arguments may no longer be valid (e.g. "no standard package existed"), but others still remain valid ("wanted control", "to get exactly what we wanted"). It seems that there is a belief that even though the company enters the software provider business, it is anticipated that their own needs will still be fulfilled and have higher priority than others. This approach has shown itself to have drawbacks as sales of Delta's Munin have been slow. The belief at Delta is that others perceive

[40] It is important to note though, that competence is not necessarily related to this distinction, which rather deals with the degree of formalism.

that Delta's and the other owners' needs have, or at least could turn out to have, higher priority.

9.2.2 Different Approaches: Cost-Sharing and True Spin-Off

Two different strategies can be discerned when spinning-off an application, where the key difference is what, if anything, is kept within the mother company and what is spun-off to the new company. What type of solution will the mother company have in relation to the newly spun-off software company? Will it be like a standard package to the mother company or will it behave like a turnkey solution? The economic factor matrix (Lacity et al, 1996a) does not make this kind of distinction. In Williamson's terminology (1985), one strategy, a *true spin-off strategy*, is to decrease idiosyncrasy, i.e. turn the application into a true standard package, where Williamson suggests market governance (see above, p. 60). Another strategy, a *cost sharing strategy*, is to keep the idiosyncrasy, i.e. keep it as a turnkey solution, where Williamson suggests a unified governance.

The *True Spin-Off Strategy* implies that the company truly spins-off the software provider including control and responsibility, leaving no priority advantages with the mother company. If properly communicated to the market, this of course improves the odds of succeeding with the software provider company.

The *Cost Sharing Strategy* implies that the application package road is seen as a way of sharing costs if buyers can be found. The actual control and responsibility is kept within the mother company even if it is formally moved to the spin-off. Code development and project management are moved to the spin-off. The needs of the mother company will still dominate the future development of the application. Basically, the tailor made application is made available to others.

Which strategy to choose depends on at least two factors: the drawback of using standard package and the potential market size and revenue for the product company. Given these factors, there are a total of four strategies presented in Figure 9.4. The two complementing the spin-off strategies are building without selling to others, and acquiring a standard packages.

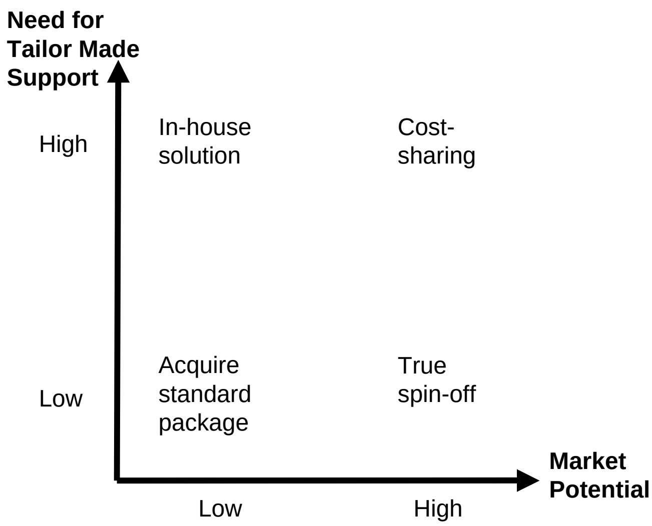

Figure 9.4: Different Approaches to Spin-Offs

If for some reason the market potential is low, either a standard package or some sort of tailor made solution is the reasonable way to go. If the need for tailor made support is low but the market potential is high, a true spin-off strategy makes sense since the drawbacks of losing control over the application is of less importance in this setting. If the need for tailor made support is high, however, losing control can be a severe drawback calling for the cost-sharing strategy, i.e. keep control but try to share the costs of the application with others.

The sales of Delta's Munin have suffered because potential customers think that the owners have too much influence over the application, at least people at Delta believe that is what keeps customers away. Potential buyers see this as a *Cost-Sharing* spin-off. Delta thinks an independent product company is needed to avoid this by showing that it really is a *True* spin-off, even though that would be a "more mental than factual shift". In other words, Delta thinks Munin already is a *True* spin-off, where their influence is not larger than other customers, a sentiment apparently not shared by other existing and potential customers. There are discussions going on about spinning off Munin to a completely independent company in order to give it more independence and thus try to earn a position as a *True* spin-off.

9.2.3 The Emerging Option

It is noteworthy that it does not seem like all these cases traditionally are evaluated at the outset. As described in Figure 9.5 using a decision tree approach, the first choice is very much in focus. Lambda did consider the ownership of the application in general terms, most explicitly in terms of keeping others from gaining access to it rather than keeping the option to sell it.

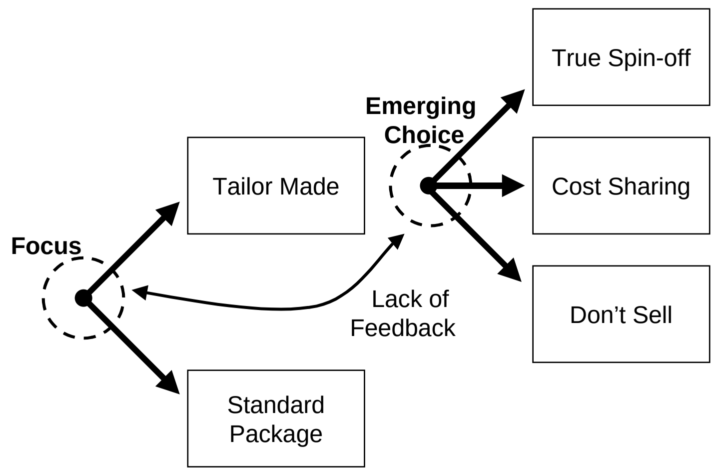

Figure 9.5: Sequential Choices When Spinning-Off

The second emerging choice is not considered (or maybe not identified), when the first choice is made. It could be argued that taking the option of selling the application to others would favor the tailor made solution over the standard packages since the option brings a positive value to the build strategy (cf. Dixit & Pindyck, 1994; Copeland & Antikarov, 2001).

When the second subsequent choice emerges, it seems like the arguments that led to building a tailor made application in the first place are not explicitly taken into account (e.g. tailor made support needed). The impact of the arguments can of course be partly derived from the choice between *Cost Sharing* and *True Spin Off* in accordance with the discussion above.

Furthermore, not considering the emergent choice when developing the application can also affect design choices. In-house solutions tend to have higher asset specificity (cf. Williamson, 1985, p. 96) than standard packages. This may indicate that the in-house application can turn out to be too tightly adapted to the host organization for successful packaging as a standard application.

9.3 SUMMARIZING APPLICATION DEVELOPMENT SOURCING

The case companies have different sourcing strategies, but they seem to act quite consistently over time. A possible explanation for the different sourcing strategies for proprietary applications is economies of scale, which allow the size of the company to influence the degree to which it can become involved in development

The framework for selective sourcing moves beyond the make-or-buy dichotomy sometimes used in traditional IT sourcing literature. This dichotomy does not cover mixed cases where applications are "made", i.e. a proprietary solution is chosen, by buying resources on different levels such as project management and code development resources.

Sourcing decisions for similar applications vary, partly due to the fact that the importance of the application to the company varies. The IT portfolio extension proposed in subchapter 8.2 makes it feasible to argue that companies do not acquire application instances ("product" perspective). Instead they cast roles ("meeting a need" perspective). This means that the same application, for instance a trading front-end application, plays different roles in different companies, thus spurring different sourcing choices.

It can also be noted that the approach to standard packages is more or less the same across the case companies. Standard packages are usually preferred to proprietary solutions. What varies between companies is the estimated (implicit) cost of not meeting perceived needs, which follows from differences in how companies use and perceive their applications.

Spin-offs seem to be one way of achieving the cost-sharing necessary to cope with the costs associated with proprietary solutions. The trend towards standard packages is in line with this since spin-offs mean that an application that had been proprietary is offered on the market as a standard package. If proprietary in-house solutions are not viable, the traditional question "make or buy" may be transformed into "sell or buy", i.e. either you make it and sell it or you buy it.

10 ADOPTING TECHNOLOGIES

The case companies will once again be revisited; this time a technology adoption perspective will guide the examination. This is followed by a thematic discussion of the adoption of new technologies and the abandonment of old ones.

10.1 CROSS-CASE ANALYSIS

10.1.1 Lambda

When Lambda was started it was a green field startup. The people starting it of course had a trajectory of previous knowledge and experience, but the company as such had no legacy. The business idea of being an electronic discount brokerage called for a different technical setup than what was common in the industry at that time[41].

A Technology Provider Perspective: Electronic Discount Brokerage

By providing its customers with a computer terminal and a direct line into (the electronic virtual trading floor of) the stock exchange, Lambda brought a value proposition to its customers different than the usual one. Instead of offering analyses on what stocks to buy or sell and then taking care of the actual buying and selling, Lambda put a tool in the hands of their customers. Lambda conscientiously unbundled (cf. Clemons et al, 1996) the standard brokerage offering consisting of a combination of analyses and order execution, by discarding analyses and focusing solely on order execution.

In many dimensions Lambda's service was worse than the prevailing standard since there was no personal communication with a broker. In other dimensions, such as trading floor feeling, highly valued by Lambda and especially Luc Langdon, Lambda brought a new value proposition to its customers. In very much the same way as disruptive technologies are discussed (Bower & Christensen 1995, Christensen 1997a), Lambda's offering to its customers can be labeled a disruptive service. In Chandy & Tellis' (1998) terminology, Lambda provides a high *customer need fulfillment per dollar* in some areas, namely trade execution (but not in terms of analyses), and provides a high degree of *technology newness* compared to traditional brokerages, thus meeting the criteria of a radical innovation.

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[41] Lambda was founded in the mid 1990s.

It is also important to note that Lambda provides a slightly more up-market service, where customers can call instead of using the computer terminal. Thus, Lambda offers to add the competence and ability of its brokers for more complex or harder trades (typically larger trades relative to the liquidity of the instrument). This is one way of providing backward compatibility to prior solutions, which is an important feature for diffusion of innovations (Rogers, 1995).

The choice to use new technology as a technology provider was clearly a business decision. Luc Langdon even states that without the electronic part of electronic discount brokerage, it would probably not have been interesting enough for him to start Lambda. Thus, a prerequisite for Lambda's existence is the identified business opportunity to become a new entrant providing a disruptive service to the customers of the brokerage community.

To Luc Langdon, the window of business opportunity was limited by first mover advantages; it was important to be the first electronic discount brokerage. In his experience, brokers and traders tend to select client applications on the basis of powerful habit rather than functionality. This is reiterated when Luc Langdon discusses the choice between adding futures trading and a connection to the Helsinki stock exchange and emphasizes the importance of being first and locking customers into Lambda's solutions (see p. 126). Thus, in terms of Mueller's (1997) first mover advantages, *Buyer inertia due to habit formation* is quite important and to a lesser extent *Set-up and switching costs*. *Network externalities* and *Buyer inertia due to uncertainty over quality* are not equally important. On the supply side, Luc Langdon emphasizes *Network externalities and economies* in terms of legal footwork.

It can be noted that even though the business opportunity was created by the technological development, i.e. it became possible to provide electronic discount brokerage services, what Lambda considers to be first mover advantages are not technical in nature. Instead they mention legal and organizational issues as well as user habits.

A Technology Consumer Perspective: Unix vs. Windows NT

Moving on to a technical consumer perspective, Lambda early on in the development of EdbTrade had to choose operating system. At this time (the mid 1990s), Unix was an established standard while Windows NT was not considered ready for mission-critical applications. The trend at that time was that NT had become an alternative on the client side, instead of Unix being the normal choice for both server and client. Thus, Windows NT was an industry innovation, not only within Lambda (cf. Becker & Whisler, 1967).

Lambda considered NT to be less complex than Unix, especially from an operations standpoint. NT applications also ran on slower (but considerably cheaper) hardware than Unix solutions, which would make an NT-based solution slower than a Unix-based one. This drawback was deemed minor, at least by head of business development Jim Lee, since the hardware development was overshooting the rising performance needs of the market. The lack of speed on NT's behalf was a diminishing problem because of *performance oversupply* (cf. Christensen, 1997a, chapter 8).

The consultancy firm that actually developed EdbTrade argued for NT since it would increase the speed of development. It would also be possible to port the solution from NT to Unix in case the NT solution would have turned out to be inferior. The latter argument obviously decreased the risk of going with the unproven technology (NT) quite considerably[42]. The two arguments from the consultancy firm tipped the scale in NT's favor.

The properties of the two technologies, or their value propositions (Christensen, 1997a), appear in Table 10.1, where it should be noted that even if NT's speed was low it was deemed "good enough".

Property	**Windows NT**	**Unix**
Speed	Low, but increasing and already good enough[43]	High
Complexity	Low	High
Time to Market	Short	Long
Cost (hardware)	Low	High

Table 10.1: Different Value Propositions

Once again a disruptive technology perspective can be applied (Christensen, 1997a). Windows NT displays most characteristics of a disruptive technology, for instance being cheaper and simpler but on the other hand slower. The belief that increasing hardware performance would lessen NT's speed deficiency also mimics the traditional behavior of disruptive technologies. It

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[42] The possibility of porting from Unix to NT does not seem to have been considered in the same way.

[43] Compare Grove's opinion "*It does not matter how inferior the new approach is. What matters is, is the new approach good enough for the market?*" (Puffer, 1999, p. 18).

is important to note that there actually was a fear at Lambda that the increased trading that was foreseen would increase the need for speed faster than the increasing hardware performance could deliver.

10.1.2 Delta

A Technology Provider Perspective

Delta acts as a technology provider in quite a limited fashion. One example is the customer web site, where Delta tries to bring its customers closer. Instead of using existing clearinghouse style portals for research reports, Delta uses its own web site, which partly acts as a replica of some internal applications. The Java based analysis tool available on the web site is a simplified version of the analysis tools that the analysts use and allows customers to try their own scenarios. The analysts' tools are considered as providing a competitive edge and are not fully disclosed to the customers. Differentiating the available functionality for different user groups (in Delta's case full functionality for in-house users and a subset of functionality for outsiders) is not uncommon for standard package solutions (cf. Shapiro & Varian, 1998). Delta provides an example where customers get partial access to the functionality of proprietary solutions. Such solutions of course force Delta's analysts to add value in terms of insights and analyses that are not incorporated in the analyst tools (or at least not in the parts made available to the customers).

In terms of IT exposure (see subchapter 8.4 IT Portfolio Exposure on p. 249), it is clearly increased by Delta providing simplified analysis tools to the customers. Instead of just providing analysts' research reports to the customer, Delta's IT solution is (partly) made available to the customer.

A Technology Consumer Perspective

Delta is in quite a different situation than Lambda since they have an IT legacy. Their front-office application, Hugin, dates back to the 1980s via its predecessor. Hugin recently went through its biggest update when the Stockholm Stock Exchange switched to a new marketplace system. Even though backward compatibility was offered for some time, Delta chose to revamp the Hugin server completely and also to shift to a more modern network protocol. For Delta, this was a Product Innovation rather than a Process Innovation (Abernathy & Utterback, 1978) since the users and the business processes were not affected by the shift.

The back-office application, Munin, has been continuously and incrementally updated (ibid.) since its inception in the 1980s. The overall view at

Delta is that *"Back office isn't something you compete with; it is something you got to have."* (Andrew Dial, IT Technology and Infrastructure). Hence, no effort has been put into being on the leading edge technology-wise when it comes to Munin. Triggers to update Munin have been external rather than internal, and Delta acts quite reactively concerning the application.

There were two main reasons for the recent move of Munin to a new operating system. Delta experienced performance problems, i.e. the application was slow, and, maybe even more important, the software provider quit supporting the existing operating environment. Switching environments can be seen as a radical innovation in Utterback's terminology as it, at least partly, removes "*existing investment in technical skills and knowledge, designs, production technique, plant, and equipment*" (Utterback, 1994, p. 200). From a technical perspective, it was a competence-destroying innovation (Tushman & Anderson, 1986).

Delta traditionally has used a reactive incremental approach when it comes to its back-office application turning to more radical innovations when forced by the environment. However, the "*too risky to upgrade when you don't have to*"-argument can be countered with the "*too risky to wait until you really have to*"-argument, since project risk can be expected to increased with fixed deadlines (Gogan et al, 1999).

Andrew Dial, who has the role of a technological strategist at Delta, claims that Delta is among the first to get things working using new technology, even though others may be quicker to start experimenting. The research database used by the Equity Research department, and its way of distributing research via the Internet was an early adoption of Internet technology. Thus, Delta is able to move fast through the stages of knowledge creation and knowledge retention in order to apply their knowledge (cf. Iansiti, 1998).

10.1.3 Tau

A Technology Provider Perspective

Tau acts as a technology provider for its customers on the web. Tau's idea of providing a simple do-it-yourself way of trading stocks also means that their targeted market niche is not looking for the newest and hottest technology. Hence, the introduction of new technology must be adjusted to fit the needs and wants of their users (Dhebar, 1996). Tau competes well when it comes to availability and security but not new technology since the technology properties Tau looks for (stability, low cost) are usually best provided by proven technologies. Furthermore, the people at Tau do not believe that customers are drawn to Tau if they are into new technology, i.e. by its approach to new technologies Tau indirectly targets a certain customer characteristic. This is reflected by CEO Ted Taylor's worry of moving too fast technologically for the customers.

A Technology Consumer Perspective

To Tau, IT is an explicit way of reducing costs. In line with this, it is CEO Ted Taylor's intent not to be the first to introduce new technology, even though he dreads being the last one to do so. Not being the first mover forces Tau to have short lead times in order to catch up somewhat with the early adopters.

There are several reasons congruent with the active choice not to be the first mover. Some stem straight from the business strategy or even business vision of Tau. Since availability is deemed much more important than new functionality, it is natural to avoid technologies that are too young.

However, as noted by Etan Trent, just choosing to be an Internet brokerage business means choosing to rely on a somewhat unproven technology. Of course, given the competitive arena there are few alternatives to this strategy, especially for a discount broker like Tau.

Tau also conscientiously stages investments when possible. Being connected to SBI, the small marketplace competing with the Stockholm Stock Exchange for the listing of smaller companies, was critical from a business perspective. Initially, a dial-up solution was chosen with the explicit intent to upgrade to a fixed line, should the need arise. In this case the extra cost incurred by going first to an Internet solution was minor compared to the benefits created by the option created to abandon the SBI initiative should it not fly (cf. Dixit & Pindyck, 1994; Copeland & Antikarov, 2001).

Thus, Tau has a clearly formulated business strategy, which is then reflected in the technological choices made. First, customer communication was implemented using phones, and when a new technology came along offering better service to the customers it was adopted. Tau was not the first brokerage offering an Internet based service, but still did it fairly early due to the competitive pressure within the industry.

10.1.4 Gamma

A Technology Provider Perspective

Gamma Markets acts as a technology provider in terms of the Tiber solution. The new Tiber solution is offered to Internet bank users in a deliberate staged rollout process, where the solution is offered to one set of users at a time. First, the Internet bank users most likely to become Tiber users are selected. Thus, Gamma tries deliberately to identify early adopters (Rogers, 1995), and also to avoid offering the Tiber functionality to users not yet ready or interested (cf. Dhebar, 1996). On the other hand, Gamma's capability to provide the functionality is limited as Matt Gill noted:

> *If the evening papers' placards say "Now's the time to start trading" we'll drown in applications. (Matt Gill, Markets Local IT support, IT Department)*

In this case, it is not the technical delivery that worries Gamma, since getting the technology itself to scale is less of a practical problem. The challenge lies in soft add-ons such as help desk services. Actually delivering the innovation can become problematic as was identified by Griliches (1957).

A Technology Consumer Perspective

From a consumer perspective, Gamma has two organizational units covering the development of new technologies, *IT Strategic Control* and Business Area *E-business*. One reason for this is cost control, i.e. centralizing allows the organization to know how much is spent on projects related to new technologies. Another reason is to achieve critical mass in these efforts.

It is noteworthy that when Gamma has been at the leading technological edge (the development of the first version of Tiber), the move was not triggered by any of those organizational units, but rather by some entrepreneurs at the line organization at Markets. A natural question is why is that so? Market's effort was purely business driven. Some people saw the business opportunity inherent in the new technology (in this case Internet technology in general, and web technology specifically). There was no interest in evaluating the technology per se as may be the focus of IT Strategic Control. The *E-business* business area, which has a purer business perspective, was not around at that time.

The origin of Tiber is interesting in comparison to Christensen's (1997a) advice on coping with disruptive technologies, namely that they are best adopted by small, independent subsidiaries. At first glance, Markets is in a way a small, fairly independent part of Gamma, at least from a business perspective. On the other hand, the development effort was carried out in close cooperation with the business at Markets, and in fact it was to this business it could be considered a disruptive alternative. So, the development effort was independent of the major IT department, but not independent of Market's core business

Does this mean that the centralized unit is slower at adapting new technologies than the business organization? The answer probably lies in the different questions posed from the two perspectives. The central organization, in this case *IT Strategic Control*, tends to wonder whether the technology is viable in the long run, whether it fits with the existing technical solutions, and what the pros and cons are of the technology as such, see Table 10.2 below. The business area, in this case Markets, sees a window of business opportunity that can possibly be exploited by being an early adopter. Long-term issues are not as important as getting something out there that "gets the job done".

	Central Unit	**Markets**	**E-business**
Focus	Technical fit	Business opportunities	Combined
Time Perspective	Longer term	Shorter term	Short and long term
Challenge	Keeping up with the business	Avoid "loose cannon syndrome"	Is it possible to combine the two perspectives?

Table 10.2: Organizational Solutions to Staying Up-to-Date

This leads to interesting trade offs for the *E-business* business area, which at first sight seems like the best of two worlds.

It is important to distinguish between a central unit's actual ability to keep up with the business and the business organization's perception of this ability. If the central unit loses credibility with the business, their actual business acumen may go unnoticed.

Removing Old Technologies: A Daunting Task

At Gamma in general, including Markets, a task at least as daunting as adopting new technologies is the removal of old technologies. The existing portfolio consists of a large number of applications, often providing redundant functionality. One reason for the plethora of old applications as well as old technologies seems to be Gamma's inclination towards gradual implementation of new applications. One strategy for replacing applications is the big bang strategy, where the old application is closed down at the same time that the new one is put into production. The inherent risk in this approach is that the consequences are quite sever if the new application fails. Yet another drawback with this approach is the size of the implementation effort over a short period of time in terms of, for instance, end user training. The gradual approach often chosen by Gamma can be gradual in different dimensions. Branch office applications can be rolled out geographically, an approach preferred by Maria Garrity, IT purchaser at Business Area Retail. Another approach is to move one function after the other. The approach often chosen by Markets is to move one customer group after another customer group to the new application.

An inherent risk in this gradual approach is that the new application may not provide a superset of the functionality of the old application. In such cases, the customers needing the functionality only available in the old application, quite naturally, stay in the old application the longest. A commonly unfolding scenario is that the new application accommodates the majority of the customers, while the old application serves a few odd cases. This poses a dilemma, since the cost of adapting the new application to these odd cases usually turns out to be a deterrent while at the same time tweaking them into the new application as it is may not be feasible.

A simplified, but for the current discussion useful, view of the available funds is that Gamma spends resources on operations and maintenance (i.e. running existing applications), development projects and abandonment projects. Note that the relative size of respective activities in Figure 10.1 is quite arbitrary, but generally in line with estimates that 50-80% of IS department budgets go into maintenance (Banker et al, 1991).

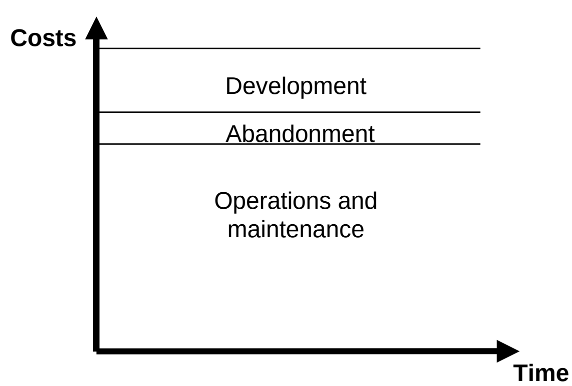

Figure 10.1: Costs in a Steady State

A somewhat problematic situation arises when, due to pressing need for development projects within a fixed budget, abandonment projects are postponed as indicated in Figure 10.2.

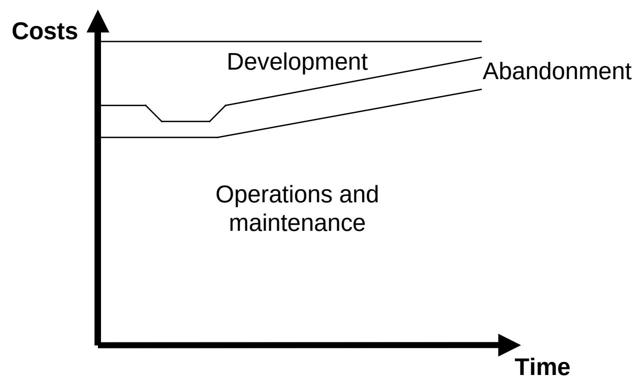

Figure 10.2: Costs When Systems Are Not Abandoned

The increased operations and maintenance cost that follows from this prioritization further reduces the resources available for development and abandonment projects.

10.1.5 Inter-Case Discussion

The cases all show examples of quite distinct ways of dealing with new technologies as is summarized in Table 10.3.

Company	**New Technology Approach**
Lambda	New (well-investigated bet on new technology)
Delta	Mixing new and proven (quite consciously)
Tau	Proven (cost)
Gamma	Mixing new and old (legacy/path dependency driven)

Table 10.3: Approaches to New Technology

In all the cases there is a consistent pattern of actions. It is noteworthy, although not surprising, that the two smaller and newer companies (Lambda and Tau) follow a clearer path either using new or proven technologies. The two larger and older companies (Delta and Gamma) both have a mix of technologies. Gamma’s degrees of freedom are to a greater extent affected by legacy systems than Delta’s. Gamma’s more complex organization, both in terms of size and business activities, leads to a more formalized way of dealing with new technologies. At the smaller companies, IT investment situations are dealt with more on a case-by-case basis.

Yet another difference between the small (Lambda and Tau) and the large (Delta and Gamma) is the explicit option approach taken by Lambda and Tau in investment situations. Without the perceived switching option, choosing NT instead of Unix would have entailed significantly more risk for Lambda. For Tau, the possibility of going after a new business segment (SBI) was enhanced by the step-wise approach, where a first minor investment in a dial-up solution could be followed by a larger investment should the segment prove profitable. In all likelihood, options such as these switching and follow-up options are also present for the larger companies, but their role does not seem to be as prominent[44].

10.2 ACQUIRING NEW AND ABANDONING OLD TECHNOLOGIES

10.2.1 Technology Span

All the case companies have technologies of different ages. The larger, older companies, Delta and Gamma, have a richer history with more and older applications, while Lambda and Tau have comparatively homogenous technology portfolios.

The age of a technology is a fuzzy concept and can be interpreted in a number of different ways. It could be the age of the technology itself ("this operating system was conceived in 19XX") or the age of the technical solution ("this application was conceived in 19XX")[45]. Yet another interpretation would be implementation date ("this application was launched in 19XX"). By choosing some interpretation and using it consistently, applications can be sorted. In fact, if the interpretations above yield significantly different results that may in itself be a cause for further investigation.

Figure 10.3 below depicts the span from a company's oldest to its newest technology. Its progression over time is mapped from left to right, for four points in time, t_0, t_1, t_2 and t_3.

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[44] It could either be that options were not prominent in the larger companies or, perhaps more likely, just that the people in those companies deemed the role of options less important. This seems reasonable, as resources in general were felt scarcer in the smaller companies.

[45] Not to mention that applications are enhanced over time meaning that dating a specific application is anything but clear-cut.

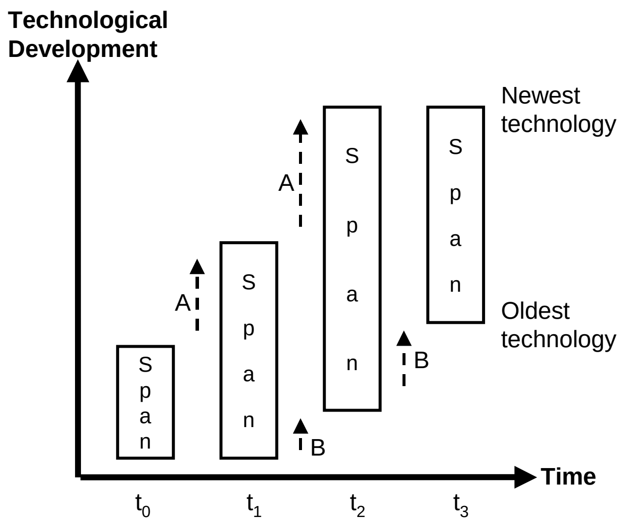

Figure 10.3: Technology Span over Time

Changes of type A in Figure 10.3 describe moving the frontier forward, i.e. acquiring new technical solutions as has happened between t_0 and t_1. Changes of type B on the other hand describe the removal of old solutions. Often the same project includes both types, since removing an old solution (type B) can be done by replacing it with something else moving the frontier (type A). This happens as time progresses from t_1 and t_2. However, it is important to note that this is not always the case as, for example, when time goes from t_2 to t_3. In this case the abandoned solution either is not replaced at all or replaced by something that does not move the frontier forward.

Awareness of the size of the technology span as such is important, as is awareness of how resources are allocated between Type A and Type B efforts. Efforts to acquire new technologies and remove old technologies differ in many different ways, as is evident in Table 10.4.

Company	Type A	Type B
Lambda	Decreasing costs	N/A (yet)
Delta	Develop existing business using new opportunities	Discontinued support from supplier.
Tau	Enjoy benefits from new opportunities	N/A (yet)
Gamma	Enjoy windows of business opportunities	Ageing, competence concentration.

Table 10.4: Driving Forces for Technology Span Changes

A pattern in the driving forces is that technology acquisition usually stems from new opportunities created by new technology resulting in some sort of benefit. It can also be a question of keeping up with the competitors. Removal efforts on the other hand bring different connotations. Old technology is removed if the provider ceases to support it, or if maintenance costs become prohibitive.

A contributing factor for removal efforts is the increased competence concentration commonly associated with older applications. There are fewer and fewer people with a full understanding of the inner workings of the application, for example Romulus and Remus at Gamma. At some point in time, the competence concentration is deemed to be intolerable, thus spurring a Type B effort to remove the application.

Instead of simply replacing the functionality when removing an application, it is possible to remove the need for that functionality as well, thus significantly reducing the problems with removing the technology. Old technology can be removed by removing the users of old technology!

10.2.2 Acquiring New Technologies

First Mover Advantages When Acquiring New Technologies

For a technology provider, there seems to be some first mover advantages to be found. Although, sustainability of advantages can be questioned since sooner or later any advantage is likely to be weakened (D'Aveni, 1994). Within the case companies, the type of first mover advantages and possibly also their durability seem to be linked to user characteristics.

When addressing institutional investors, or "professional users", first mover advantages stem from buyer (or in this case perhaps user) inertia (Mueller, 1997) or buyer switching costs (Lieberman & Montgomery, 1998). Andrew Dial provides one example of this when discussing how Delta tries to tie its customers more closely:

> *When he comes to work in the morning, he should log on to his PC, check his mail and then connect to Delta! (Andrew Dial, IT Technology and Infrastructure)*

Another factor is the buyer inertia due to quality concerns. Delta prides itself on being on customers' short list for analysis reports, which is an advantage based on consistent quality. In neither of these examples are the first mover advantages are based on technology as such. The lack of technologically based competitive advantages is to some extent acknowledged by Edgar Lucas' position. He is quite open to letting users use other solutions than EdbTrade, which would relinquish any advantages from the application as such. Luc Langdon concurs, as he believes that new entrants are deterred not so much by technical issues, as by organizational change. Lambda's position on this is in line with Teece's (1980) finding that administrative innovations diffuse more slowly than technical.

Among private investors, users are quite willing to switch brokerages as indicated by Tau's Tony Turner in relation to availability problems.

> *If the web server is down, you [as a customer] change brokers. (Tony Turner, CFO)*

Thus, there may be first mover advantages since customers can be lured away from competitors by new solutions, i.e. advantages can be based on technological leadership (Lieberman & Montgomery, 1998). There does not seem to be the same kind of user inertia in this user group, which of course becomes a drawback once the customer is won over. There is no guarantee that he or she will stay! If a better service comes along, it is quite likely that the customer will be lost, indicating a lack of sustainability. To some extent this contradicts prior results that positively correlated moving first to market share (VenderWerf & Mahon, 1997; Hoppe, 2002). This difference may be explained by differences in buyer inertia.

The different entrance strategies can be simplified into *being first*, i.e. being an early adopter and providing new functionality early on, and *being best*, i.e. being a fast second but providing high quality services. *Being first* relies on the existence of buyer inertia (Mueller, 1997), while *being best* relies on technological leadership (Lieberman & Montgomery, 1998). As discussed above, the experience of the case companies seems to suggest that *being first* is important when targeting institutional customers while being best would attract retail customers[46].

In situations of rapid development, the longevity of any first mover advantage achieved through technological leadership will deteriorate more quickly, which may increase the importance of buyer inertia. On the other hand it opens up the possibility of consistently creating non-durable first mover advantages, and thus over time creating sustainable competitive advantage (Mansfield et al, 1981).

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[46] Even if being best were to attract only very active retail customers, that would still be important since revenues are almost solely trade related, meaning that active customers are likely to be significantly more profitable than non-active customers.

Lambda and Tau both indicate the risk of moving too fast (cf. Dhebar, 1996). Jim Lee at Lambda puts it like this: "*You can't provide new systems faster than the customers can cope*". Ted Taylor, CEO of Tau, notes that "*[the customers] have to be ready for the solutions you provide*". Gamma makes the same consideration from a proactive perspective as the new Tiber solution is provided first to potential early adopters. Thus, buyer inertia is not only a potential source of first mover advantages. It can also create first mover *dis*advantages (Lieberman & Montgomery, 1998) when companies that are technology providers move too fast.

External Consultants Push New Technical Solutions

A common trait among several cases is that technology choices are governed by two main factors: the existing application and the external consultancy doing the job. Several companies reach their absorptive capacity (Cohen & Levinthal, 1990) for new technologies by relying on certain individuals, as described in Table 10.5.

Company	Absorptive Capacity Source
Lambda	Not designated. Edgar Lucas is closest. Consultancy important.
Delta	Designated (Andrew Dial). Consultancy contributes.
Tau	Not designated. Overall interest spearheaded by Head of IT.
Gamma	E-business and IT Strategic Control.

Table 10.5: Absorptive Capacity Concerning New Technologies

In several of the cases, the choice of a new, or unproven, technology was based on strong recommendations from external consultancy firms. Lambda chose a newer operating system (Windows NT vs. Unix) and Delta's consultants proposed a less proven web-server environment (Microsoft vs. Netscape). In situations where existing applications were enhanced, such choices were mainly determined by the existing applications. Other applications within the company seem to matter less, i.e. the fears of mixing different operating systems are small compared to the benefits of the smooth transitions offered by switching to new environments when developing new applications. Over time such an approach leads to a mixed portfolio of older and newer technologies within the company, which is indeed the case at Delta and Gamma.

So why was it the external company that pushed for the newer technology in these instances? Are the brokerages abdicating this choice or decision? And if so, why? Lambda, Delta and Tau all lack in-house development personnel. Even though they do have technologically savvy people, their governance of the choice of technology is severely hampered since they do not do the actual development themselves. One reason for not having in-house personnel is to avoid keeping the staff updated on new technologies and to buy the competence instead. A consequence of this seems to be that the hired consultants have quite a say when it comes to technology choices.

The case companies concern themselves with first mover advantages from the solutions they provide to their customers, as Delta does for instance, in the case of their Internet solution. The advantages sought coincide partly with Mueller's (1997) types. Buyer inertia due to both habit formation and uncertainty over quality is important, while switching costs and network externalities are less important. None of these advantages, however, stem from the technical choices (e.g. Microsoft vs. Netscape), where the external consultants have a say, at least not directly. For the technical choices it is Mueller's (ibid.) supply side first mover advantages that come into play, but mainly on behalf of the external consultant. Learning-by-doing and achieving economies of scale are viable reasons for consultancies to propose certain technical solutions.

The final decision of course lies with the company, but it is evident from the case studies that they can be strongly influenced by the consultancies. Thus, the role of the external consultants goes beyond what it is first perceived to be. In fact, the choice of a new technology can be implemented by cautiously choosing a specific consultancy. This can be seen as an example of input control, i.e. consultancies are chosen on the basis of what technologies they advocate (cf. Eisenhardt, 1985). This does not seem to have happened in any of the cases, however.

Internet as A New Technology: A Disruptive Perspective

The financial industry in general and the stockbroker industry specifically have been heavily affected by the Internet, which has changed the basis of competition (Evans and Wurster, 1999).

Besides enabling a number of start-ups, thus increasing the threat of potential competitors (as indicated by a bolder arrow in Figure 10.4 below), this new technology has provided ample opportunity for existing companies to develop their businesses. In that way the threat posed by existing competitors has increased.

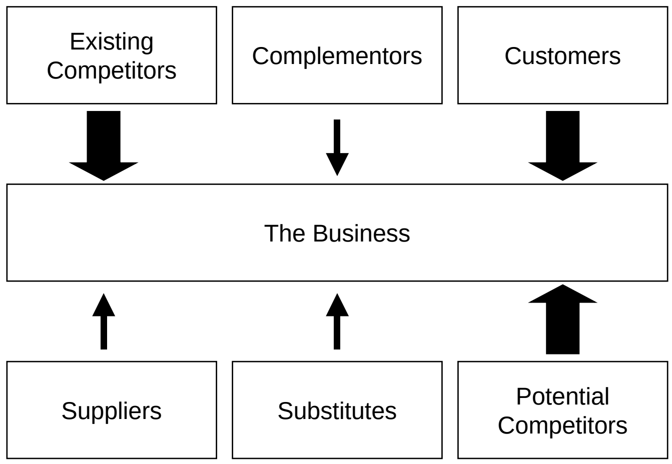

Figure 10.4: Business Impact of Internet Technology Shift (based on Grove, 1997)

As Tau in particular notes, customers switch brokerage firms more easily when using Internet services than before. This means that the threat posed by customers has also increased since there is less of a lock-in. The threat posed by suppliers is more ambiguous. It could be argued that companies without in-house IT resources, i.e. not providing in-house code development resources, become more dependent on their suppliers, as the IT solutions become more important for customer interaction than before. In this regard, the sourcing decisions discussed above are one way of controlling the external threats to the company. The more a company does in-house in this respect, the more they are in control of their own fate!

Taking a disruptive technology perspective (Christensen, 1997a) on Internet, the case companies approaches to the Internet are compared in Table 10.6.

Company	**Internet Approach**
Lambda	Relying on leased lines, which it used as start-up. Incumbent when public Internet provides inferior service of the same type.
Delta	Incorporate into existing business model.
Tau	Created organization first for phone based trading. Along came technology offering a new way of interacting with customers.
Gamma	Initially entrepreneurial approach patched onto existing solutions. Moved to mainstream but still interacts with existing legacy solutions.

Table 10.6: Approaches to Internet

Lambda offered an electronic linkage to the marketplace very early. Thus, it provided a disruptive service to its customers in comparison to the traditional brokerage. However, Lambda itself has now become somewhat of an incumbent as similar solutions based on the public Internet have entered the marketplace. Lambda is targeting institutional customers who are willing to bear the costs of leased lines. The low-end segment of retail customers is targeted by several brokerages using Internet solutions (e.g. Tau). Lambda's transition is illustrated in Figure 10.5 below.

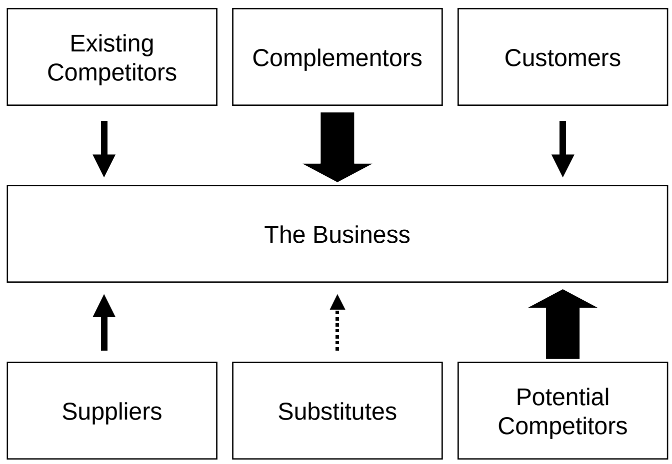

Figure 10.5: Lambda as an Incumbent (based on Grove, 1997)

When Lambda entered the market it was as a potential competitor to existing businesses; a competitor depending on new technology. Currently an incumbent itself, Lambda is dependent on complementors in terms of analysis. It is important to note, though, that many of Lambda's institutional customers provide that service in-house, i.e. they have their own analysts. Potential competitors are important since companies using simpler technical solutions (e.g. public Internet) probably can provide for at least some of Lambda's customers. At least in Lambda's eyes, substitutes are less of a threat (as indicated by the finer arrow).

Delta incorporates the new technology into its existing business model where the service to existing institutional customers is enhanced by, for instance, electronic distribution of analysis reports. In this sense, Internet is only a new means to distributing information to the customer and has the character of a sustaining technology (cf. Christensen, 1997a).

Tau is quite similar to Lambda in the sense that it is offering an unbundled version of the traditional brokerage service. It used to offer a phone based solution, but switched to the Internet when appropriate thus using Internet as a sustaining technology for its business strategy (ibid.). Even as an Internet brokerage, its solution is towards the low-end since fewer add-on services, such as news feeds are offered. Other Internet brokerages have gone the other way. In line with Christensen's (ibid.) predictions, different dimensions of the product or service offered are used to compete until nothing but price remains. Many of Tau's competitors have chosen to add, for instance, news feeds in an effort to avoid competing on price alone.

For Tau, Internet really is not a disruptive technology. Rather it is a better and cheaper way of interacting with the customer than the original phone based trading. The crucial distinction is between Tau's phone based trading, which was completely execution oriented, and traditional phone based trading, which includes analysis and personal service from the broker.

Gamma thrived early on based on a first generation application developed by some entrepreneurs in the line organization. This is consistent with Christensen's (ibid.) argument that disruptive technologies are usually adopted by smaller companies (or independent organizational units of larger companies). The reason for this is that they are small enough to get excited by the initially very limited market for the technology (or in this case service). It is noteworthy that Gamma's formal organization was significantly slower in catching on to the new technology.

Thus, it is not feasible to categorize Internet as such as a disruptive technology or a sustaining technology. Instead this varies with the technology's uses. The usage can be disruptive or sustaining in relation to prior activities.

10.2.3 Abandoning Old Technologies

Old Applications Tend to Be In-house Efforts

A common theme among the case companies is that old applications tend to be developed in-house (e.g. Gamma's Romulus and Remus, Delta's Hugin and Munin). When these applications were developed, there were no viable standard package alternatives, and over time the applications have been developed so that they meet the needs of the respective organization quite closely. Even though subsequently standard packages have become available, later replacement projects have not been worthwhile. In-house applications live on until there is a forced abandonment of some sort.

A second possible reason for old application tending to be in-house solutions, in addition to the short supply of standard packages when these applications were acquired, would be that standard packages are produced and maintained by software providers whose business idea is to provide packaged software. This makes them more inclined to provide migration paths for their customers and possibly also quit supporting aging solutions (see the Delta case where an operating system lost its support). A company that maintains responsibility for an application must provide such migration paths itself. Thus, it could be that a software provider would be less inclined to let an application grow too old, where, obviously, “too” is a relative concept.

Acquiring a software package not only means that development efforts are outsourced, but also, perhaps equally important, maintenance and migration are outsourced. So, in a sense the pertinent question is not “How critical is this application?”, but rather “How critical will this application and its additions be over time?”

In environments with large application portfolios containing many legacy systems and a multitude of different platforms and technologies, it is hard to adopt new technologies. However, abandoning old technologies can prove to be quite a challenge too.

Abandonment Projects

Shifting applications or technologies can usually be done either through big bang solutions or gradually. Such shifts are often thought of primarily in terms of the new technology. Should we introduce this new technology or new application with a big bang or gradually? The same question could be posed as “Should we abandon the old technology or old application with a big bang or gradually?” Traditionally, this is considered to be a choice between maintaining an existing application and rewriting it (Swanson & Dans, 2000).

Gamma prefers gradual implementations to big bang solutions. However, their experience is that it can be quite hard to take the last step, i.e. to move the last customers or the last piece of functionality to the new solution. There are several instances of the old applications running in parallel with the new one for a prolonged period. Usually, there are resource reasons for this. Removing the old system completely tends to require an extra effort. A specific project is needed for example in order to adapt the new system to serve the last customers still using the old one. Furthermore, this often only affects the few customers still using that particular system, meaning that there is little customer value added by migrating them. If the resources needed to operate the system for another year are small compared with what is needed to abandon it immediately, there is an incentive to postpone the abandonment.

Thus, two types of abandonment projects can be identified. The first type, with a focus on *replacing*, is the classical choice to abandon an existing application by rewriting it (Gode et al, 1990; Chan et al, 1994; Swanson & Dans, 2000). Curiously enough, rewriting the application seems to be the preferred sourcing choice considered in the literature. At Gamma, as at other case companies, replacing an existing solution with a standard package is often the preferred alternative.

The second abandonment project type, with a focus on *removing*, concerns taking the final step, i.e. actually getting to the point where the old application can be removed. When a gradual implementation is chosen, the need for such a project can arise regardless of the sourcing choice for the new application. The project can involve either adapting the new application, making changes to other parts of the IT portfolio or introducing other solutions such as for example making changes to business processes.

Balancing Development and Abandonment

There is a constant trade-off between projects of different kinds. Not only must a balance be struck between abandonment on one hand and operations and maintenance on the other (cf. Swanson & Dans, 2000), but new development also comes into this picture. Naturally, in the long run all costs are flexible, but in the short run (typically within a budget year) the cost of operations can for most practical purposes be considered to be fixed. The available resources can be changed, as Lambda illustrates for example when the executive board makes extra funds available, but normally the resources are fixed during the budgetary year.

Striking a prudent balance between development and abandonment projects is complicated by the fact that the consequences of postponing an abandonment project are not as salient as they are for a development projects. Postponing a removal abandonment project typically means that operations and maintenance costs increase because of the need to operate parallel systems. The cost of operating legacy systems can also increase because there are no economies of scale or available expertise. All in all, saving resources in the short run by postponing abandonment projects may lead to a vicious cycle.

10.3 SUMMARIZING TECHNOLOGY ADOPTION

Retiring old technologies is hard; one possible explanation is the reluctance to commit enough resources for abandonment projects. The traditional attitude towards the balance between new and old technology could be summarized as "*Old technology prevents us from keeping up!*" In terms of the technology span (see Figure 10.3 on p. 284) efforts to adopt new technologies suffer because of existing old solutions. Analyzing why these old technologies are still around could lead to the less common attitude "*We spend too much on new technology,*" i.e. more resources ought to be spent on abandonment projects.

Two important factors when deciding on adopting a new technology as a technology provider are user inertia and technology leadership. Relatively high user inertia creates incentives to *being first*, while in cases technology leadership is important *being best* is more attractive, i.e. to provide a superior alternative later.

Apart from the obvious impact of existing solutions, external consultants seem to play an important role in decisions to adopt new technologies. Even though what is actually outsourced is an application development effort on, for example, code development level, the technology decision is also implicitly outsourced.

When considering abandonment projects, i.e. projects that are expected to lead to the retirement of one or more existing applications, two different types of projects can be identified. *Replacement* abandonment projects aim at acquiring a new application that will replace an existing application. *Removal* abandonment projects aim specifically at taking the last step to remove an existing application and avoid running applications in parallel.

The concept of disruptive technologies can be extended to technology usage rather than being confined to technology as such. Disruptive technologies are treated differently in different companies. The theory of disruptive technologies is based on technologies in general (cf. Christensen, 1997a), but here it is applied to IT, which is a plastic type of technology, i.e. its usage can vary significantly. Hence, the technology is not disruptive in itself, but its application in the business is.

11 RELATING MISSION-CRITICAL IT AND BUSINESS OPERATIONS

The notion of a "gap" between IT and the business is common (e.g. Ward & Peppard, 1996; Peppard & Ward, 1999). Yet, important questions are where this gap comes from and why it exists. A common explanation concerns lack of understanding, the business organization's failure to understand IT and the IT organization's failure to understand the business.

At Delta, the gap widened when Hugin was moved to a separate business area, both because of the new organizational structure and the physical relocation this brought with it. Eddy Delk from Delta's IT department notes that the direct feedback of what works and what does not work was lost and that new functional requirements suffered due to the filtering introduced by the increased distance. Andrew Dial, a strong believer in brokers and traders working closely together with the developers, puts it like this:

> *Close to the business and fast feedback are keywords! (Andrew Dial, IT Technology and Infrastructure)*

This particular gap was of course at least partly bridged when Hugin was brought back to the IT department.

At Gamma, the size of the organization is an important factor, and there is a notion of a gap in the organization.

> *IT must understand the business and the business must understand IT! [...] They [the business] say "IT isn't good enough" and we [IT] say "they don't understand" (Oliver Green, Head of IT Development, IT Department)*

> *We really should have closer cooperation. [...] They [the IT Department] must know the business! How else will they understand what we want to do? Now they sit in their bunker over at the IT Department! Maybe they should start working for other organizations too, to get business knowledge? (Sandy Grant, System Owner, Markets)*

One approach to closing the gap was the local IT department Markets used to have, which cooperated closely with the business organization. It still exists, but now it formally belongs to the IT department.

Dealing with this potential gap more generically calls for a continuous consideration of the relationship between IT and the business. This chapter will start out by discussing IT strategies and subsequently their relation with business strategies. The chapter concludes with a discussion of the Resource Allocation Matrix as one way of finding a balance between different kinds of activities.

11.1 IT STRATEGIES

When discussing IT strategies, it is important to be clear about whether one refers to intended strategies, i.e. strategies as plans, or strategies as consistency in a stream of actions and decisions (Mintzberg & Waters, 1985; Pettigrew, 1985). The interviewees in this study consistently interpreted IT strategies as intended strategies, and more specifically, written documents. The interpretation of developing an IT strategy is that it means producing a written plan in accordance with Lederer & Sethi (1996). The written plan is then communicated within the company to various degrees. As discussed earlier, interpreting an IT strategy as an intended strategy or a plan (Mintzberg & Waters, 1985) is also common in IS research (e.g. Bryson & Currie, 1995; Cerpa & Verner, 1998)

11.1.1 Lambda

> *As far as I know there is no written IT strategy. (Edgar Lucas, Head of IT Development)*

Lambda has no written IT strategy, but it has a strong shared view on how to do things, i.e. there is a plan, or intended strategy, albeit not in a written format. Furthermore, there is no perception of a real distinction between business activities and IT activities, rendering the distinction between business and IT strategy somewhat superfluous. The business strategy is clear, and it is operationalized mainly through EdbTrade, which is developed on the basis of input from Edgar Lucas and others.

At Lambda, written IT strategies are primarily seen as a communication tool, which the people at Lambda do not consider necessary in companies as small as theirs.

11.1.2 Delta

> *Who would appreciate you putting 6 months into writing a 50-page document? (Alan Dickerson, IT Project Leader)*

Delta has no written IT strategy. Some work is put into developing a strategy in terms of soft technical guidelines by IT operations' Anthony Dent. Others, such as IT project leader Alan Dickerson, feel it is too time-consuming to keep a strategy updated. The IT department's weekly meetings serve as an important forum for unifying the department, and there is quite a clear perspective on how things are done and should be done. The intended strategy is formulated and communicated through meetings and interaction rather than documents. Overall, people at Delta consider themselves to be a premier brokerage delivering high-quality services, which is also translated into the expected level of IT support.

Delta's business developer, Scott Daniels, expresses a concern for lack of top management involvement and commitment when it comes to converting the business strategy into an IT strategy, a task often conceived as important (Earl, 1989; King, 1978; Ward, 1987). He thinks there is a tendency towards an approach that is too tactical.

When looking at Delta's behavior over time, there are some patterns such as sourcing strategies and the continuous efforts put into IT. The fairly new CEO, Dennis Douglas, discusses shifting Delta's behavior since he wants to move towards standard packages instead of proprietary solutions. This is an example of a strategic change (in this case "buy, not build"). It is an organizational response to environmental change ("it has become too costly to compete against standard packages"), constrained by the momentum of bureaucracy ("existing applications and inscribed ways of doing things"), being accelerated by leadership ("I want us to go this way") (cf. Mintzberg, 1978, p. 941).

11.1.3 Tau

> *Rather than a strategy there is a strong culture. (Tony Turner, CFO)*

Head of IT, Otis Thornton, has developed a strategy for how he wants the IT department to work and to interact with the rest of the organization, i.e. an information management strategy (Earl, 1989). This strategy deals with how the IT personnel should spend their time on different types of activities and not how IT should be used in the business.

There are, however, clear patterns in how Tau chooses to use IT.

> *We haven't been in the forefront when it comes to new technology. (Tony Turner, CFO)*

> *We are the safe, secure alternative and have always been lagging slightly. It's an explicit strategy to be safe and secure. We bring in stuff that works! (Oscar Tinsley, Head of Business Development)*

Note that when Oscar Tinsley talks about an explicit strategy, it does not mean a written strategy, but rather a vivid expression of the business vision and the associated culture. There is a consistent pattern in how Tau adopts new technology, even though there is no written strategy guiding this behavior.

11.1.4 Gamma

You should check that it's in line with our strategies early on! (Art Gugliotta, IT Architecture, IT Strategic Control)

Gamma has a written IT strategy that was developed in an expressed undertaking a few years ago. The IT strategy, which is owned by IT Strategic Control, is based on Gamma's business strategy, and it consists both of generic guidelines and concrete tasks in a to-do list (e.g. "replace this application"). Of the three users of the IT strategy, two seem uncontroversial, namely management and IT Strategic Control. These two fit the traditional arguments for developing IT strategies (cf. Earl, 1989; Ward & Peppard, 2002). The third, external customers, may be more controversial, at least it is not usually covered in the literature. It happens that customers try to gauge the IT activities of Gamma by checking that a written IT strategy actually exists.

11.1.5 Inter-Case Discussion

The Existence of Written IT Strategies

As Table 11.1 illustrates, written IT strategies are not common among the case companies. None of the three smaller case companies, Lambda, Delta and Tau, have written IT strategies. Tau's strategy is, as discussed above, an information management strategy (Earl, 1989) for how work in the IT department should be carried out. At Gamma, which is considerably larger that the other three companies taken together, there is a written IT strategy.

Company	Document	Shared View
Lambda	No	Yes
Delta	No	Yes
Tau	Yes (IM strategy)	Yes
Gamma	Yes	Yes to some extent

Table 11.1: Different Forms of Intended Strategies

In light of the existing Strategic Information Systems Planning (SISP) literature, this is somewhat surprising. This literature usually concerns itself with how to carry out SISP, which is typically expected to be documented in some fashion, and not whether to carry it out or not (Lederer & Sethi, 1988, 1996; Kovacevic & Majluf, 1993). Rather, there is often a concern that strategic IS plans are not implemented (Cerpa & Verner, 1998, Gottschalk, 1999). Smits & van der Poel (1996) found some examples of companies without information strategy *documents*, even though they did have information *strategies*. Their finding is supported by the case companies of this study.

The Existence of Non-Written IT Strategies

Does this mean that these IT intensive companies do not have IT strategies? Relaxing the focus on written strategies, and turning instead to the intended strategies (Mintzberg & Waters, 1985) of the case companies, it can be argued that they do have strategies, albeit not in the form of written strategies. Their intended strategies tend to take the form of shared views communicated in other ways than through documents, as described in Table 11.1 above.

Table 11.2 describes the IS planning practices of the companies in terms of Pyburn's (1983) three approaches.

Company	Main Approach
Lambda	Personal-Informal
Delta	Personal-Formal
Tau	Personal-Formal / Personal-Informal
Gamma	Written-Formal

Table 11.2: Different IS Planning Practices

Perhaps not surprisingly, there is a size correlation, where a larger company is more likely to have a formal approach to IS planning.

One source of a shared view can be organizational inertia in strong and coherent norms (cf. Eriksson & Mattsson, 1996). At Delta, the CEO explicitly refers to economic men in his surroundings, indicating a culture where economic factors are important to people. In such a case, the preconditions for changing a pattern (for instance to start buying instead of building applications) can be improved as people can see a link between their own remuneration and other company costs. Norms that encourage building rather than buying applications will of course make it harder to change the pattern.

The case company where strong and coherent norms are most clearly present is Tau, where the low-cost do-it-yourself identity is omnipresent. CFO

Tony Turner identifies mainly the CEO, but also partly himself, as longtime bearers of corporate values, indicating the importance of individuals in this respect. Both belief and boundary systems (Simons, 1994, 1995) play very important roles at Tau. The belief systems are also important at Delta where the new CEO, based on the input of a diagnostic control system ("being surrounded by economic men"), initiated an effort to reduce IT spending by acquiring standard packages instead of developing proprietary solutions.

A first view could be that the prevailing organizational norms affect choices in a causal relationship. A second view, probably slightly more on the mark, considers this to be a more reciprocal relationship, i.e. the choices made are also actively affecting the organizational norms. A third view, which in some cases is perhaps even more accurate, is that the organizational norms emerge through the choices made. Being a low cost producer *is to* (and not *means that you*) choose certain solutions such as proven technologies.

Intended and Realized Strategies

From an IT strategy perspective, it is argued that there is an intended IT strategy, written or not, which contributes to the realized strategy in terms of general guidelines and approaches to IT. These guidelines and approaches provide the setting in which the business strategy is translated into IT decisions and actions, together creating a Realized IT Strategy, see Figure 11.1 below. In the figure, Mintzberg & Waters' (1985) typology has been applied to IT strategies instead of generic strategies.

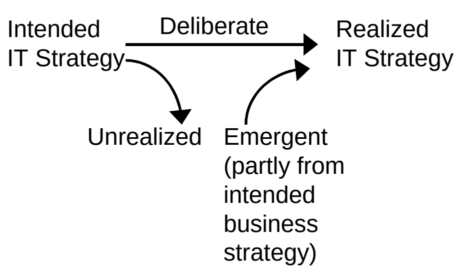

Figure 11.1: Types of IT Strategies (adapted from Mintzberg & Waters, 1985)

Summing up, a key insight is the important difference between having a written IT strategy and having consistency in a stream of IT related actions and decisions. The fact that there can be a deliberate part of a realized strategy (see Figure 11.1) regardless of the existence of a written IT strategy is illustrated in Figure 11.2.

		Deliberate Strategy?	
		No	**Yes**
Document Exists?	**Yes**	Eye candy	Document governed Dual strategies
	No	Ad-hoc	Undocumented

Figure 11.2: Strategy Documents and Strategic Behavior

In *Ad-hoc* situations, there is no IT strategy document and no deliberate strategy, i.e. there is no intended strategy that is implemented.

Eye candy refers to situations where there exists an IT strategy document, but there is no deliberate strategy, i.e. the written IT strategy is unrealized, and the organization does not follow a deliberate strategy.

Undocumented describes cases where there is a deliberate strategy, but there is no written strategy. The deliberate strategy is based on a shared view and not a document. Lambda and Delta fall into this category, as could Tau depending on how its information management strategy is considered. There is an intended strategy, but it is not communicated in document form.

The fourth quadrant, finally, contains two different scenarios.

In the *document governed* scenario, there is a written strategy, which actually is followed and thus contributes to the deliberate strategy.

Finally, having *dual strategies* implies that there is a strategy document, which is unrealized. At the same time, there is an intended strategy based on shared views, and it contributes to a deliberate strategy (but does not comply with the written strategy).

11.2 ALIGNING IT AND THE BUSINESS

11.2.1 Relating IT and Business Strategies

The result of using Mintzberg & Waters' (1985) model of strategies to combine IT and business strategies is given in Figure 11.3. From a business strategy perspective the suggested view extends Mintzberg & Waters' (ibid.) original model by explicitly adding the IT strategy. The Intended Business Strategy affects the Intended IT Strategy (as indicated by "A" in Figure 11.3), which is the main, and often the only, focus of traditional SISP literature (e.g. King, 1978; Ward, 1987). However, it can be argued that it also affects the Realized IT Strategy, by contributing to the Emergent IT Strategy ("B"). The Realized IT Strategy then affects, or actually plays an integral part in, the Realized Business Strategy, by contributing to the Emergent Business Strategy ("C").

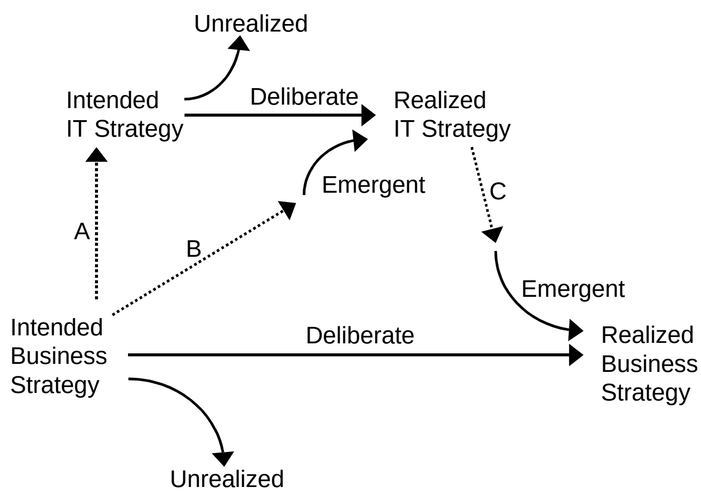

Figure 11.3: Proposed View of Business and IT Strategies

In Lambda, for example, when discussing whether to add functionality for options or develop a connection to Finland, it was a matter of business strategy. What business should Lambda pursue? Options trading or the Finnish market? When this prioritization is made, it will affect the realized IT strategy by moving the focus towards either options capabilities or communication capabilities.

In Tau, the overall business strategy of providing easy-to-use simple solutions is not translated into an intended IT strategy mapping out how this should be implemented from an IT perspective. Instead it continuously affects the IT operations, helping to form the realized IT strategy. This IT strategy is in turn one contributing factor to the realized business strategy.

Delta can also provide examples of this, since for example, the intended (and certainly also the realized) business strategy is to target mainly institutional investors. This means that Delta's web-presence is quite different from, for example, Tau's since there has been no perceived business need for public web solutions. Although not part of an intended IT strategy, one aspect of the realized IT strategy is Delta's low ambition level for public web presence.

It could be objected that "everything affects everything" in Figure 11.3, which would be true if the lapse of time is brought into the picture. For example, the realized business strategy at time zero is quite likely to affect the intended business strategy at a later time.

However, the main idea behind the proposed view is that there is a difference between intended strategies and realized ones, and this difference is important when working with linking IT and business strategies. Too often, the focus is on linking an intended IT strategy to an intended business strategy. This is important, but it is also important to acknowledge that this is different from having realized strategies that are linked.

11.2.2 Aligning IT and Business Strategies

The common notion of a business strategy leading to an (intended) IT strategy, written or otherwise (e.g. Earl, 1989), holds true to some extent. At Lambda and Tau, however, it can be argued that this is not always the case. There is no explicit conscious step that comes up with a plan for IT using the business strategy as input. Rather, implementing the business strategy means taking certain measures in terms of IT. Thus, a different view is proposed for understanding what is going on in the case companies.

The Strategic Alignment Model (Henderson & Venkatraman, 1993) suggests four alignment perspectives, Strategy Execution, Technology Transformation, Competitive Potential and Service Level, each indicating different drivers in the alignment process, see Figure 11.4 below.

For the two larger case companies, Delta and Gamma, it could be argued that Strategy Execution provides the best overall description. Both companies engage in a variety of activities that map onto different alignment perspectives. However, the Strategy Execution perspective best reflects the fact that the companies do have their business strategies, which demands certain organizational capabilities, and which in turn need IT support of some sort.

For Tau and Lambda, it is harder to discern a specific alignment perspective. They both have business strategies, which to a large extent are operationalized by implementing an IS infrastructure. Thus, the notion of IT supporting the business does not fit all that well.

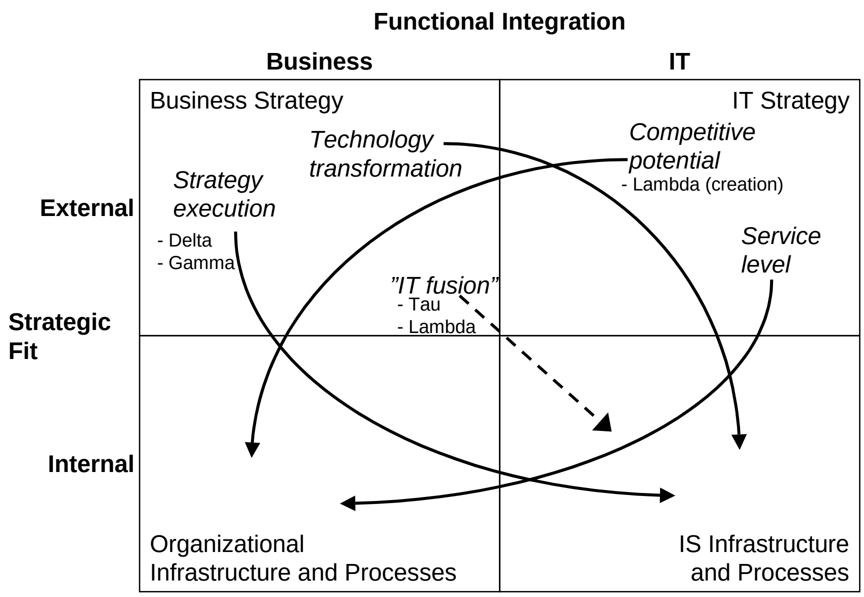

Figure 11.4: Strategic Alignment Model (based on Henderson & Venkatraman, 1993)

Lambda is also an example of how the alignment perspective may evolve over time. The creation of Lambda is best described by the Competitive Potential perspective. The entrepreneurs involved saw the technology potential in terms of electronic discount brokerage, and they started the company in order to pursue this opportunity.

In companies such as Lambda and Tau, non-trivial changes in terms of, for instance, market positioning, can be made without any significant impact on IT strategy or organizational infrastructure and processes. The market offering is provided by the functionality of the applications made available to the customer.

Henderson & Venkatraman (1993) argue that there is no direct link from the business strategy to the IS infrastructure, instead alignment always follows either Strategy Execution or Technology Transformation. The "alignment" view of the Strategic Alignment Model has been questioned as it assumes separability between IT and the business (Smaczny, 2001). The reality in

Lambda and Tau seems to support the notion of a *fusion* between IT and the business strategy (ibid.), as indicated in Figure 11.4 above.

11.2.3 Dual Experts: Fusion Personified

At Lambda and Delta, there are key individuals (Edgar Lucas and Scott Daniels, respectively) that have a common trait. Regardless of their formal organizational position, they are perceived as not belonging to *either* the IT side *or* the business side. They are boundary spanning but not in the sense of being able to bring in information from external sources and disseminate it within the organization (Aldrich & Herker, 1977; Tushman & Scanlan, 1981a, 1981b). Rather, their trademark is to be fully accepted by *both sides* based on proven track records of being knowledgeable across this border (actually to the extent of having expertise rivaling current specialized experts). As individuals they personify the concept of a fusion between business and IT.

The dual experts have a big impact in their organizations because of their credibility and personal skills. Their informal impact is often just as important, if not more so, as their roles in the formal hierarchy. Scott Daniels, for example, is credited with bringing a holistic perspective to Delta's operations based on a broad set of skills.

Since Lambda is quite small, Edgar Lucas has an important formal role as well, but his responsibility for the maintenance of EdbTrade is extremely critical for Lambda. As dual experts, they are important bearers of the intended IT strategy, and through their impact they are also important sources of consistency when it comes to realized strategies.

11.3 THE RESOURCE ALLOCATION MATRIX

This research applies a portfolio approach to IT, which is useful in order to get an understanding of the IT resources available to a company and also to avoid suboptimization. In this upcoming subchapter, a portfolio approach to the management of mission-critical IT will be developed, by introducing the Resource Allocation Matrix.

11.3.1 Constructing the Resource Allocation Matrix

A number of projects, concluded, on-going and planned, have been described in the case companies. These projects differ in many ways, and can be characterized in various ways. Some projects look for immediate pay-off by solving problems, like Tau's efforts to solve web site stability problems, or making money, as when Gamma's traders acquired applications to support trading opportunities. Other projects apply a longer-term perspective. Once again Tau serves as an example with its project to update the web site structure. Lambda's effort to develop EdbTrade is yet another example where the company basically started out with a long-term project to build the application that is now the cornerstone of its business operations.

Thus, one important dimension separating different projects is the time perspective. Some projects are short-term efforts seeking immediate, or at least quick, results, while others are more long term (cf. Abell, 1993, 1999).

Another dimension characterizing projects deals with the type of goal. Tom Garrett at Gamma illustrates this with his concern for business benefits.

> *We asked for and got some 15 million [SEK] which was our estimate at that time. When the project was underway we realized that the total cost would rather be something like 55 million [SEK], so we quit the project. We couldn't spend 55 million [SEK] on something that gave no customer value in the short run. Instead we built something that created customer value immediately. (Tom Garrett, Head of Internet Banking, Business Area E-business)*

The initial project served to build a new platform, which would not bring business benefits. When costs rose the resources were redirected to projects creating direct customer value. Similarly at Delta, the back-office application Munin is managed quite reactively since it is not considered to provide customer value.

The distinction between being market-driven, i.e. taking market structure and behavior as given, and driving markets, i.e. shaping or affecting market structure and behavior (Jaworski et al, 2000), is useful in this respect. This distinction is close to Christensen & Bower's (1996) discussion on the danger of listening too much to existing customers and satisfying their needs (being market-driven) without perceiving other business opportunities (driving markets). Switching to a technical perspective, it is argued that some projects are undertaken because maintaining existing solutions is no longer viable (cf. Chan et al, 1994; Swanson & Dans, 2000), i.e. they resemble the market-driven case. Similarly, from a technical perspective other projects instead pursue different kinds of opportunities, i.e. they drive the market.

Thus, different levels of pro-activity can be discerned ranging from being forced to act by, for instance, technical reasons, via satisfying the needs of existing customers, to driving the market. Furthermore, meeting the needs of existing customers can be split in meeting existing expectations and creating or pursuing new business opportunities (cf. Slater & Narver, 1998). This creates a (simplified) categorization consisting of projects or efforts aimed at meeting obligations by keeping up or fighting deterioration on one hand and pursuing business opportunities on the other. The latter would cover projects that aim at either pursuing existing business opportunities or creating (and pursuing) new opportunities, such as Gamma Markets' initiative to develop Tiber. The former would encompass projects both of a technical nature, such as replacement or maintenance projects, and of a business or market nature, for example delivering services deemed by the customers to be commodities, as illustrated by Chris Drew:

> *Examples of external changes that must be met can be competitive changes on the market that you have to respond to. (Chris Drew, Head of Risk Management, Delta)*

Using the level of pro-activity instead of a distinction between, for example, IT and business projects is important. Not only would separating projects in that manner potentially increase the gap between IT and the business discussed above, it would also fail to reflect the reality faced by the case companies.

Two dimensions long vs. short term perspective and obligation vs. opportunity create the Resource Allocation Matrix, where four separate sets of initiatives are identified in Figure 11.5. Obviously, the dimensions are continua rather than dichotomies but reducing infinite continua of alternatives to a manageable number of discrete options can be fruitful for supporting high-level directions (Ward & Peppard, 2002, p. 303).

	Short Term Perspective	**Long Term Perspective**
Pursuing Opportunities	Draw on existing flexibility *Agile action*	Technology driven business development *Business transformation*
Meeting Obligations	React to everyday problems *Firefighting*	Well-planned orderly upgrade projects *Platform construction*

Figure 11.5: The Resource Allocation Matrix for Managing Mission-Critical IT

Firefighting is sometimes necessary to solve technical problems reactively or fend off business threats. Firefights are characterized by a short-term perspective coupled with some sense of urgency. At Tau, solving operations problems concerning the stability of the web site solution are examples of firefighting efforts.

Agile action means taking advantage of short-term opportunities, for example by making use of vanishing first mover advantages while they last. Doing this relies on having flexible and well-maintained IT solutions in the first place (e.g. Duncan, 1995). Delta is continuously developing Hugin to better support their traders, thus drawing on the infrastructure they have in place in terms of Hugin and Munin. Similarly, Gamma Markets' tradition of acquiring standard packages is a form of agile action, since it is a way of pursuing different business opportunities identified by the brokers and traders.

Platform construction refers to proactive projects that aim at dissolving problems rather than solving them. By being well prepared in the long-term perspective, at least some problems can be avoided down the road. Tau's project to update their web site structure is an example of an effort with a long-term perspective, as is Gamma's development of the Core Engine for Tiber. Prime examples of platform construction are Gamma's potential replacement project for Romulus and Remus and Delta's long term plan to replace Munin.

Business transformation means pursuing business opportunities proactively by transforming the business of the company. Lambda's development of

EdbTrade was an effort to build a new IT platform (and actually a new company) to compete on the market. By design, a large effort was put into the development before any return was received. On a smaller scale, it could be argued that Delta's development of the RGA was a business transformation effort since it enabled a new way of producing research reports.

Business transformation can be used both from a company and an industry perspective. A company spinning off a software provider transforms its own business. It does not transform the way business is done within the industry. A company may also undertake efforts that to some extent transform how business is done within the industry. Such efforts transform both the industry and, naturally, the company's own business.

It is important to note that a given project or activity can cover more than one of these categories. Moreover, in the spirit of emerging strategies discussed above, short-term efforts will build and shape the realized platform of a company, i.e. a platform will also emerge in the absence of explicit platform construction efforts. As is exemplified by Gamma, the need for explicit platform construction efforts can well arise as a consequence from various short-term efforts.

The MuninPlus project undertaken by Delta exemplifies the gradual nature of going from a long-term to a short-term perspective. Had the project been started in 1995 when it was first discussed, several people at Delta argue that more fundamental changes to the Munin application could have been made. It would in that case have had more of a long-term perspective, and it would clearly have been a platform construction project. As it happened, it was not initiated until 1998, which restricted what could be done given the fixed end-of-the-millennium deadline. The project took on more firefighting characteristics than it would have if it had been started three years earlier. Still, it was far from the firefighting efforts needed in stability problem situations.

11.3.2 Striving for Balance in Activities

One way of using the Resource Allocation Matrix is to monitor the resource allocation concerning IT resources. The purpose of the Matrix is to explicate resource allocations and make them transparent. Obviously, there is no single allocation that is optimal for all companies! Instead, the specific allocation in a company is quite likely to depend on the current situation in the company and for example the health of the application portfolio (Weill & Vitale, 1999). In terms of the stage model of electronic data processing growth (Gibson & Nolan, 1974) or technology assimilation (McFarlan et al, 1983), long term efforts can be seen as introducing new solutions, which will go through a typical life cycle. Short-term efforts can then be conceived of as ripples in these long-term life cycles. Seen in this light, it is quite natural that the allocation in terms of the Matrix will vary with the current position in the life cycle of major components of the application portfolio and business operations.

Contingency factors such as the dynamics of the industry and technological developments will also affect the company (Burns & Stalker, 1961; Lawrence & Lorsch, 1967, 1969; Woodward, 1965), and thus the allocation of resources, albeit not necessarily in a straightforward way. A company working in a dynamic environment could argue that resources must be allocated to firefighting as the environment changes quickly. A different take would be to argue that resources must be allocated to platform construction, i.e. to building an infrastructure flexible enough to cope with the dynamics. Similarly, a company working in a stable environment can argue in favor of firefighting because the fires are rare enough, or platform construction, because conditions are stable enough to allow a stable platform. Either way, contingencies are likely to affect the allocation since the strength of the different arguments will vary.

Typically, contingency factors are more likely to create obligations while the pursuit of opportunities to a larger extent is left to the company's discretion. Of course, the availability of such opportunities will depend on contingencies that are partly external to the company. It could be argued that efforts to pursue business opportunities would affect other companies (by affecting their environment) by creating obligations and possibly forcing them to undertake projects to keep up. In a somewhat simplified way, efforts to keep up could be considered mainly reactions on changes in the external environment in terms of, for example, technological development and competitive behavior. Similarly, efforts to pursue business opportunities take advantage of things like new technological solutions and, thus, force others to keep up.

What Tom Garrett, Head of Internet Banking at Gamma, exemplified above with the project being put on hold in favor of customer value creation, was a platform construction project, which was abandoned when the project cost increased. This was deemed too much to spend on platform construction, and instead the resources were transferred to agile action or firefighting projects providing immediate customer value.

Chris Drew, Delta's risk manager, notes that the IT department's long term responsibility for future operations and scalability is sometimes hard to combine with the user's perspective, where there is a specific situation calling for a small fix. Thus, the user is looking for an agile action project while the IT department sees long-term effects and tries to minimize potential platform degradation. Typically, this leads to increased project size, which may make the project too expensive from a business perspective. Similarly, Donovan Day notes that the business side can be short sighted and expect the IT department to initiate strategic or long-term efforts.

Overspending on any given type of initiative may evoke questions or concerns as illustrated in Table 11.3.

Purpose	**Possible Concern**
Firefighting	How did the company end up fighting fires? Is there an end in sight? Is it possible to reallocate resources to other purposes?
Agile Action	Is the focus on reaping the rewards of yesterday's investments? Is this viable in the long run?
Platform Construction	Is there a viable business case for the resources spent on platform construction? Will it result in business benefits later on?
Business Transformation	Are short-run issues sufficiently well catered for? Will the transformation be commercially viable?

Table 11.3: Concerns with Overspending

In the same way, Table 11.4 exemplifies how underspending can also be a cause of concern.

Purpose	**Possible Concern**
Firefighting	Are there fires not yet identified? Has too much been spent on platform construction in the past?
Agile Action	Are business opportunities lost? Is the best possible use made of existing capabilities?
Platform Construction	Is this viable on the long run? Will there be anything but firefights in the future?
Business Transformation	Will the company be overrun? Will the industry change in ways that will make the company and its market offering obsolete?

Table 11.4: Concerns with Underspending

The use of the terms overspending and underspending reflects the fact that there is no generically optimal allocation rule governing how resources should be divided among different kinds of activities. What is important in the Resource Allocation Matrix is what dimensions it suggests should be well balanced, not that efforts should be well balanced in general. The Resource Allocation Matrix may also serve as a monitoring tool in order to increase the understanding of what kind of IT projects are undertaken.

11.4 SUMMARIZING MISSION-CRITICAL IT AND BUSINESS OPERATIONS RELATIONS

There is an important distinction to be made between realized strategies on one hand and intended strategies on the other. The traditional approach in SISP research is to strive to align intended IT and intended business strategies. This literature makes little acknowledgment of the potential emergent character of strategies. Discussions are usually confined to the problem of intended strategies being unrealized. The findings of this study emphasize the importance of distinguishing between intended strategies and realized strategies.

Companies do have IT strategies in the sense of patterns in streams of actions and decisions, but not necessarily as written documents. Intended strategies are often thought of as documents, but that is only one communication tool among others. Shared views play an important role for intended strategies and their realization.

Dual experts have a deep understanding of both IT and the business, which is also acknowledged by both IT and business people. They play important roles as sources of intended and realized strategies. Key people are also important as sources of corporate values over time.

The notion of aligning IT and business strategies can be questioned on grounds of inseparability. When implementing adjustments in business strategy is closely related to offering customers new application functionality, the alignment concept seems less fruitful, and a fusion metaphor may be more beneficial.

When managing mission-critical IT, two important distinctions are between short and long term, and between meeting obligations and pursuing opportunities. Resources can be allocated towards fulfilling four different purposes: Firefighting, Agile Action, Platform Construction and Business Transformation.

12 CONCLUDING REMARKS

12.1 MAIN FINDINGS AND IMPLICATIONS

In this section some of the main findings of the study and their implications will be discussed.

12.1.1 A Business Perspective on Mission-Critical IT

There is a common notion that a gap exists between IT and the business. In information intensive companies like the ones studied, this gap in many respects seems to be quite small. It is pertinent, however, when analyzing different perspectives on what is going on in the companies

When managing IT, it is common to focus on the application level, indicating an IT perspective. A finding of this research discussed in chapter 8 Examining IT Portfolios is that this can be complemented in two ways, namely by considering application chains and application usage. Both these concepts help to bring a business perspective into the discussion.

The first proposed complement to current practice is to extend the unit of analysis from the application to the *application chain*. When applications interact more or less seamlessly, a certain business need is met not by a single application, but by a chain. The application chain concept is qualitatively different from the application concept, since it takes form on the basis of how a business need is met from a business process perspective. In contrast, the application concept is rooted in an IT implementation perspective. Thus, thinking in terms of application chains implies switching from an IT perspective to a business perspective.

The second, related, complement is to consider *application usage*, rather than an application as such. This extension is important as a specific application can be used differently by different user groups within a company. An application can also be used for different purposes by different companies.

Combining application chains and application usage by bringing the usage perspective to the application chain is obviously possible. However, the application chain concept is already tightly linked to the business process it supports. It is thus quite likely that the distinction makes less difference than it does on the application level.

The distinction between the application (or technology) and its usage is also important when different companies take on new technologies in different manners (see chapter 10 Adopting Technologies). The theory of disruptive technologies is based on technologies in general (Christensen, 1997a), but here it is applied to IT. Since this is a plastic type of technology, its usage can vary significantly. Hence, it is relevant to consider disruptive *usage* of technologies and not only disruptive technology as such.

Acknowledging that the same kind of application may play different roles in different companies, it becomes natural that, for instance, the development sourcing of seemingly similar applications varies across companies (see chapter 9 Sourcing Application Development). For one company, a certain application may support a business process that is a source of competitive advantage. In another company, a similar application may support a similar or slightly different business process that is not equally important for competitive advantage.

This would potentially call for most companies having a similar mix of standard and proprietary solutions. It would be conceivable that application portfolios across companies had a similar ratio of proprietary solutions and standard packages (measured in some way). This is however contrary to the empirical findings of this study, where a certain amount of intra-company consistency regarding this choice has been identified. The approach to standard packages (vs. proprietary solutions) actually seems to be quite consistent across companies ("use standard packages whenever possible"). However, the interpretation of "whenever possible", i.e. the perceived cost of not being able to meet the exact demands of the business process, varies significantly. This in turn leads to different choices. The perceived cost is quite likely to be related to prior choices and existing in-house capabilities, for example the capability and tradition of developing proprietary solutions will affect this perceived cost. Changing such a view, or way of perceiving costs, is cumbersome.

Perceiving and relating to mission-critical IT from a business perspective is vital given its importance for business operations. The various aspects of this that are described above show some different ways this can be accomplished.

Theoretical Implications

As discussed earlier, the concepts of *application usage* and *application chains* build on initial portfolio theories using the company as the unit of analysis (e.g. McFarlan, 1984), which were later extended to focus on individual applications (e.g. Ward et al, 1990). The finding strongly supports the initial indications of considering usage aspects presented in Ward & Peppard (2002).

The *application chain* concept extends this line of research, not only by proposing a different unit of analysis, but also, and more importantly, by linking what is being analyzed more closely to the business operations of the company. This extension is in line with mainstream research emphasizing the linkage between IT and the business (cf. Ward & Peppard, 1996; Peppard & Ward, 1999).

In a very similar fashion, the *application usage* concept contributes to the same line of research by proposing yet another unit of analysis, linking it more closely to both the business processes and the people, i.e. the users. This is in line with research emphasizing the importance of considering IT, people and the business (e.g. Lundeberg, 1993; Keen, 1993). In fact, applying a usage perspective emphasizes the emerging character of applications. A certain application emerges when it is used in a business process. Star & Ruhleder's (1996) discussion of emerging infrastructure can possibly be extended to applications as well.

When studying application development sourcing, it becomes purposeful to separate between *application instances* and *application roles*, or between applying a "product" perspective and a "meeting-a-need" perspective. An application is acquired because there is a business need to be met, and the role of the application, regardless of how it is acquired, is to meet this need. This means that the same kind of application, for instance a trading front-end application, may play different roles in different companies, spurring different sourcing choices. This finding supports Lacity & Willcocks' (2001) proposition that an application may serve different purposes in different companies. Their criticism of simple outsourcing rules, which partly builds on this proposition, can nevertheless be questioned (see p. 58).

Yet another theoretical implication of this finding is that it suggests a possible extension to the theory on disruptive technologies (Christensen, 1997a). The theory can be applied not only to the technology, but also to the technology *usage*. The technology itself is not always the interesting unit of analysis. Its usage in the business operations may also be a plausible level of analysis.

This distinction can also be interpreted in terms of contingency theory. Technology is commonly considered an external characteristic of the organization (Burns & Stalker, 1961) and part of its environment (Lawrence & Lorsch, 1967). Again, using the distinction between the technology and its usage, it is argued that considering the *technology* to be part of the environment is probably reasonable. Most companies in the financial industry are technology consumers and do not develop new technologies themselves.

Its *usage*, however, is up to the organization and not externally given. A certain (externally given) technology can, especially given the plastic nature of IT, be deployed in very different ways in the business operations of an organization. To a lesser extent, this deployment will be determined by contingency factors in the organization's environment.

Practical Implications

The notion of *application chains* has practical implications since it emphasizes the importance of not managing individual applications, but instead acknowledging the transactional nature of multiple integrated applications. Hence, considering application chains in addition to individual applications may be fruitful. The interaction between applications is obviously always important, but the notion of application chains goes beyond this by suggesting an increased focus on the interactions related to a specific business process.

The notion of *application usage* also shifts the focus from a technical perspective (the application) to the people and the business it supports. The importance of linking IT and the business is by no means a new insight, but application chains and application usage may be ways of operationalizing this insight, which over time has proven to be a difficult thing to do.

For application acquisitions, the application usage notion suggests the metaphor of the application playing a role in the company. Acquiring the application can be viewed as casting a role, which could increase the awareness of what is actually being sourced. What role does this application play in the company? How important is that role? From a business perspective, what is important is the relation between the application and the business process.

Furthermore, attempts to change patterns in acquisition choices could benefit from making a distinction between the decision rules applied and how the results of applying these rules are evaluated. Companies seem to approach the make-or-buy decision quite uniformly, with similar rules being applied. The results however are valued quite differently (i.e. the result of applying the rule "you buy unless the business cost of mediocre support is too high" will depend on how you estimate the business cost).

A focus on usage may also help explain why technology adoption decisions vary. The same technology (instance) plays different roles in different companies. To some companies a new technology (e.g. the Internet) may be a disruptive technology changing the preconditions for the company's business significantly, while to other companies (in the same industry) it may well be a sustaining technology. For practitioners this means that a certain technology cannot be evaluated in isolation. It can, and potentially will, bring different connotations and opportunities to different companies depending on, for example, their market position.

Finally, the application usage perspective can also be useful in standardization efforts. The notion that the same application, or solution in general, can be used quite differently and for different purposes may have consequences for the deployment and enforcement of standards. When deciding upon, for instance, corporate standards, it becomes important to consider not only what is actually being standardized (e.g. which version of a standard package to use) but also take into account that it may be used in different ways by different users.

12.1.2 Linking Mission-Critical IT and Business Operations

Bringing a business perspective to bear on mission-critical IT is one way of supporting a better mutual understanding between IT and the business. In this section, linking mission-critical IT and the business operations is discussed. A tool often promoted to support such a linkage between IT and the business is the alignment of IT and business strategies.

Before anything is aligned it must exist. This study suggests that companies do have strategies in terms of consistency in decisions and actions (see subchapter 11.1 IT Strategies). For example, the case companies are quite consistent in terms of application development sourcing. In terms of the framework for selective sourcing, each company tends to choose a consistent level (see subchapter 9.1 Cross-Case Analysis).

A written strategy document, however, is only one way of achieving deliberate strategies. Such consistency may also stem from other sources, such as shared views. *Dual experts* are important contributors to such shared views (see section 11.2.3 Dual Experts: Fusion Personified). Written strategies as a communication tool do not seem to be important in the smaller case companies, which, based on the few case companies of the study, may suggest a possible correlation with company size.

The traditional alignment discussion typically assumes that companies have separate business and IT strategies, which are to be aligned. The information intensive case companies do not fully support this approach. In cases where IT and the business operations are heavily intertwined, this distinction makes less sense. Instead, IT operationalizes the business strategy rather than passively supporting it.

Theoretical Implications

The findings of this study do not support the focus on intended strategies that are sometimes prevalent in theories of strategic information systems planning (SISP). Existing theories within SISP pay a lot of attention to strategy formation and the company's intended strategy (e.g. Lederer & Sethi, 1988). Typically, SISP research (King, 1978; Ward, 1987; Earl, 1989) strives to align intended IT and business strategies. It could well be worthwhile to acknowledge emerging aspects of strategies, aspects that are discussed concerning business strategies (Mintzberg, 1978; Mintzberg & Waters, 1982, 1985).

If IT strategy research focuses on intended strategies in terms of plans and reasons why such plans are not implemented properly, while strategy research in general acknowledges the potential existence of emerging strategies, there is a danger that a gap may grow up between the two research streams. Much of the IS strategy research stresses the importance of a close linkage between IS strategies and business strategies. Thus, it would seem beneficial also to seek to link IS strategy *research* and business strategy *research* more closely.

A common concern in SISP research is the lack of implementation of strategic plans (e.g. Cerpa & Verner, 1998; Gottschalk, 1999). Acknowledging the finding that there are other sources for strategic behavior than written IT strategies, for example the *dual experts*, may suggest new methods of implementing strategic plans in addition to traditional strategy documents.

The Strategic Alignment Model (Henderson & Venkatraman, 1993) describes the alignment of IT and the business well in many cases, but in some cases the concept of *fusion* of IT and the business (Smaczny, 2001) may be more fruitful than the concept of alignment. Discussing the alignment of IT and business strategies can be questioned on grounds of inseparability. Note that the separability concerns the strategies, which are potentially merging, and not for example IT and business perspectives, which can still be, and presumably in many cases are, different.

Practical Implications

An important practical implication of this finding is the importance of distinguishing between *having a strategy* and *having a strategy document*. Whether or not a company has a strategy is clearly different from the question whether or not it has a strategy document. An intended strategy can be communicated in different ways, and in the absence of an intended strategy, a strategy may still emerge!

Too strong a focus on intended rather than realized strategies may, where the intended business strategy is not the same as the realized, introduce a gap between the IT and the business strategy. This in turn may render the IT strategy either obsolete or overlooked, neither of which is typically desirable.

Recognizing the impact of key individuals, or *dual experts*, is important due to the influence they may have on the management of mission-critical IT. As a means of bridging the gap between an IT organization and a line organization, their contribution can be extremely valuable.

The case companies pay a lot of attention to issues concerning the management of mission-critical IT. There are patterns in decision and actions, but these patterns vary across the companies, i.e. different companies have different strategies concerning mission-critical IT.

This re-emphasizes that the results of this research does not suggest that what is done is important in a sense of "this-is-generically-right-and-that-is-generically-wrong". What is done is important though since it will help define and form the (realized) business strategy. In an information intensive industry, how mission-critical IT is managed is not so much a carefully planned consequence of the business strategy. Rather, it makes up part of the business strategy, i.e. managing mission-critical IT will contribute substantially to the realized business strategy.

An important practical implication is that although some IT solutions can be considered mission-critical and their success of failure implies more severe consequences, this does not imply managing such solutions in qualitatively different ways by, for instance, consistently making different choices concerning application development sourcing or technology adoption.

12.1.3 Balancing Opportunities and Obligations

Given the normal situation where resources are limited, allocating these resources becomes important. Retiring old technologies is hard, where one possible explanation is the reluctance to commit enough resources for abandonment projects. Reluctance to allocate resources to projects seemingly without positive business effects leads to postponements, sometimes until external contingencies force the execution of the projects (e.g. lack of vendor support and issues concerning the EMU).

A traditional attitude on the balance between new and old technology could be summarized as "*Old technology prevents us from keeping up!*" Contemplating why there is a lack of resources to abandon old technologies could actually lead to the less common "*We spend too much on new technology!*"

The logic would be that if more resources were spent on abandonment projects, resources could in the long run be made available for new technologies.

New technologies and solutions of different kinds that come along create choices to invest or not. Pertinent questions are how well the new solution fits with existing solutions and to what extent existing solutions can be migrated. It is very rarely an evaluation of the new technology in itself.

The Resource Allocation Matrix for managing mission-critical IT, presented in chapter 11 Relating Mission-Critical IT and Business Operations, and illustrated in Figure 12.1 below, frames the time perspective and proactivity of efforts. The former is operationalized by short-term and long-term perspectives, while the latter uses meeting obligations and pursuing opportunities.

	Short Term	**Long Term**
Pursuing Opportunities	Agile action	Business transformation
Meeting Obligations	Firefighting	Platform construction

Figure 12.1: The Resource Allocation Matrix

Resources can be allocated towards: Firefighting, Agile Action, Platform Construction and Business Transformation.

From a contingency perspective, the degree of proactivity denotes a difference between efforts that are (more or less) forced by contingent factors, and efforts that are allowed, or enabled, by such factors. Taking reciprocity into account, efforts from one company on the market may force other actors to allocate more resources to keeping up and less to pursuing business opportunities.

Drawing on the findings discussed above concerning a potential inseparability between IT and business operations, there is no distinction between IT and business projects in the model. When IT exposure increases (see subchapter 8.4 IT Portfolio Exposure), making such a distinction makes less sense. Instead the degree of proactivity of the project is more important from a resource allocation perspective.

The model also embraces the discussion above on the distinction between an application and its usage. What is in focus in the matrix is the purpose of projects, rather than the projects themselves. If, for example, an application acquisition were to be mapped onto the matrix, what would be characterized would not be the application itself, but rather its usage. Will it be used to pursue new business opportunities? Or is it needed in order to meet existing obligations by keeping up with competition and fighting deterioration of the existing solution? Is it a short-term solution or a long-term solution?

Strategies relate to the matrix both in terms of intended strategies, which may affect the distribution of resources, and realized strategies, which can be read into patterns of this distribution. In terms of the time perspective, the role of strategies is twofold.

First, strategies, and mainly deliberate ones at that, may be one way of ensuring a long-term perspective. Examples of this may be strategies outlining the long-term goals guiding platform construction or business transformation. It could also be argued that a lack of such projects can be the consequence of an intended strategy. In the case companies, however, intended strategies have dealt with moving the focus toward longer-term issues rather than the other way around.

Second, a set of short-term efforts will lead to an emerging platform of some sort and possibly also to business transformation. Strategies can be used to help guide such efforts so that the platform that emerges can be guided in some desirable direction if not actually controlled. By having guidelines, or rather creating patterns among the short-term efforts and how they are performed, the long-term consequences of these efforts will be affected.

Theoretical Implications

There is often a strong focus on acquiring, or adopting, new technologies. This finding suggests that a stronger focus on technology abandonment may be fruitful. Existing solutions are often downplayed, or referred to only as “legacy systems”, as the focus is on bringing in new technology (e.g. McFarlan et al, 1983; Applegate et al, 1999). The finding supports Swanson & Dans (2000) and Chan et al (1994) in stressing the importance of balancing maintenance and replacement projects. It also explicitly adds the notion of *abandonment* projects, which includes both the traditionally considered concept of *replacement* projects, and the suggested concept of *removal* projects focusing on finally removing old applications or technologies. The concept *technology switching* could be used to denote the combination of the common technology adoption, and the less common technology abandonment.

The Resource Allocation Matrix focuses on high-level resource allocation. In a sense it complements traditional IT management literature (Earl, 1989; Keen, 1991b; Falk & Olve, 1996) by explicitly dealing with two important trade-offs. It also helps structure research focusing on specific types of efforts, such as agile action (e.g. Weill et al, 2002). By making the distinction between obligations and opportunities, the finding may also contribute to a discussion on how much one should listen to existing customers (Christensen & Bower, 1996; Jaworski et al, 2000).

Practical Implications

A sound balance between acquiring new technologies and abandoning old ones is presumably healthy in any organization. Upgrading or switching technologies actually seems to carry more difficulties than acquiring new ones. Adding a new technology is in many ways an easier process than upgrading an existing solution. One approach to the challenge of finding a sound balance is to pay relatively more attention to abandonment projects compared to adoption projects.

This finding may contribute to a slightly different evaluation of various implementation strategies. The choice between the gradual and the big bang approach may turn into a third, not overly attractive, situation, the *eternal implementation*. Such an implementation is characterized by the implementation not being concluded and the old solution continuing to live on.

The Resource Allocation Matrix may provide one way of guarding against a skewed allocation of resources. It will also provide a partial answer to the question on what IT resources are spent. Finding a reasonable mix in terms of this matrix can be one way of finding a sensible trade-off between different types of projects or efforts.

12.2 Suggestions for Further Studies

Based on the present study, several possible extensions and further studies can be identified.

A natural follow-up study would be to extend the current study to other industries. Investigating the management of mission-critical IT in one or more industries in addition to the financial industry would provide interesting opportunities to analyze similarities and dissimilarities between industries.

A separate study testing the applicability of the Resource Allocation Matrix could be designed as a two-phase study. A first exploratory phase would use historical data to study allocation over time. What kind of patterns can be found? Can correlations between companies in the same industry be found? A second phase would be longitudinal in nature, and study the practical applicability of the approach in a specific company over time.

Finally, some empirical reflections from this study indicate two research topics for the future, namely industry fission and economies of scale and scope.

First, the character of the financial industry, or more specifically the brokerage industry, is changing as brokerages choose different strategies possibly leading to industry fission. Some are ”brokerages using IT” providing a full-service offering, including analysis reports and trading support, as has been the traditional brokerage service offering. Others are becoming ”outsourcing providers, offering brokerage services”. The business for (or value added by) such companies is to operate applications in order to provide end users with the possibility of interacting with the marketplace, thus disintermediating traditional brokerages. Is this behavior transient and will the different strategies in the long run be unified? Or is the industry evolving into two, more or less stable, sets of companies? What factors will determine the industry structure?

Second, the importance of economies of scale is often highlighted when IT is discussed. The empirical findings of this study support this, as the transactional applications normally handle increased loads quite easily. Instead, bottleneck effects are prone to hit other parts of the operations such as support. Economies of scope, however, are seldom discussed. The differences between IT portfolios of different sizes suggest that the increase in complexity due to a widened scope at the business level must not be underestimated. There are certainly economies of scope on the business level, where “one-stop-shopping” can be a strong argument when soliciting customers, but this positive effect may be at least partly offset be diseconomies of scope when it comes to the IT portfolio. What are these economies? How can they be understood?

12.3 EPILOGUE

Returning briefly to Sidney Weinberg's IT investment of 1947 (see p. 1), it could at this point be asked whether he would have been any wiser, had he known the results of this particular study. The question is quite hypothetical as far as questions go, but it can still be worthwhile to reflect on the potential answer.

Regarding the findings discussed in section 12.1.1 A Business Perspective on Mission-Critical IT, it seems safe to argue that IT really was not linked to the business processes. A usage perspective was, using a generous interpretation, brought to the table by asking, "what do you think it does?". The concept of application chains seems somewhat premature for the situation facing Sidney Weinberg.

Whether his behavior was guided by a strategy document remains uncertain, but it seems quite unlikely that that was the case. Neither is there enough information available to tell whether his actions in this case was a pattern in other situations. What is told in the story is the ensuing relationship between Goldman Sachs and IBM, which over the years may or may not have been the result of a premeditated choice.

Concerning section 12.1.3 Balancing Opportunities and Obligations, Mr. Weinberg clearly pursued the opportunities he knew was out there even though he had no idea what they might be. "It will change everything" was most certainly an expression of hope and expectations and not fear and discomfort. He did underestimate the obligations to existing technical solutions however, if not in information technology in electricity and phone lines.

In terms of the Resource Allocation Matrix, it is hard to tell to what extent Mr. Weinberg saw short-term business opportunities, agile action, as a goal, but it seems safe to assume that long-term aspects, i.e. business transformation, was on his mind. Maybe it was too early, but with hindsight it must be handed to Mr. Weinberg that IT has come to transform the business of many companies in the financial industry over the years.

Moving forward half a century to the present time, most investments are probably more contemplated and more fully analyzed than Mr. Weinberg's investment back in 1947, but they are also significantly more important to the companies. Hopefully, this study can help companies to make diligent decisions rather than default decisions when managing their mission-critical IT.

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APPENDIX A: LIST OF INTERVIEWS

Date	Company	Name	Position
98-01-09, 98-02-02	Lambda	Jim Lee	Head of Business Development
98-02-09	Lambda	Edgar Lucas	Head of IT Development
98-02-10	Lambda	Frederick Long	Head Broker
98-03-06	Lambda	Luc Langdon	CEO
98-04-15	Delta	Dale Dunkley	CEO
98-04-27	Delta	Eric Davis	Head of IT Department
98-05-13	Delta	Antonio Duncan	IT Project Leader
98-05-19	Delta	Alan Dickerson	IT Project Leader
98-06-02, 99-11-11	Delta	Andrew Dial	IT Technology and Infrastructure
98-06-10	Delta	Ervin Dickens	IT Project Leader
98-06-10	Delta	Anthony Dent	IT Operations
98-06-11	Delta	Ben Dudley	Trader
99-10-19	Delta	Dennis Douglas	CEO
99-10-28	Delta	Donovan Day	Head of Administration
99-10-28	Delta	Scott Daniels	Equity Business Development
99-11-15	Delta	Todd Dooling	Analyst, Research Department
99-11-16	Delta	Eddy Delk	IT Department
99-12-20	Delta	Chris Drew	Head of Risk Management

Table A.1: Interviewees in Lambda and Delta

Date	Company	Name	Position
00-06-27	Tau	Ted Taylor	CEO
00-07-19	Tau	Otis Thornton	Head of IT
00-08-28	Tau	Etan Trent	Project Leader
00-09-13	Tau	Tony Turner	CFO
00-10-03	Tau	Mary Thomas	Head Broker
00-10-03	Tau	Oscar Tinsley	Head of Business Development
00-11-17	Gamma	Gerald Garnett	Head of Merchant Banking (Markets)
01-01-12	Gamma	Greg Geiger	Head of Operations (Markets)
01-01-31	Gamma	Anna Gray	Head of Markets IT (Markets)
01-02-01	Gamma	Adrian Goodrich	Head of IT Services (IT)
01-02-07	Gamma	Oliver Green	Head of IT Development (IT)
01-02-13	Gamma	Art Gugliotta	IT Architecture (IT Strategic Control)
01-04-05, 01-04-24	Gamma	Isaac Griffin	IT Controller (IT Strategic Control)
01-04-18	Gamma	Ed Gatling	Account Manager for Markets (IT)
01-04-25	Gamma	Maria Garrity	Business Systems (Retail)
01-05-03	Gamma	Tom Garrett	Head of Internet Banking (E-business)
01-06-06	Gamma	Matt Gill	Markets Local IT Support (IT)
01-06-07	Gamma	Sandy Grant	System Owner (Markets)
01-06-18	Gamma	Nate Glover	Head of Trading (Markets)

Table A.2: Interviewees in Tau and Gamma

Appendix B: Trade Ratios

The ratios, which are calculated based on Stockholmsbörsen (2000), indicate the average turnover of a company's trades divided by the average turnover of all trades. Since the average turnover per trade in 1999[47] was about 294,000 SEK, the average size of Morgan Stanley & Co's trades were about 1.4 million SEK (4.65 * 294,000), while Stadshypotek averaged about 18,000 SEK per trade (.06 * 294,000). Of the 59 members, 32 have a ratio above 1, and 25 have a ratio below 1. Two members are not represented since they did not trade at the exchange in 1999.

Morgan Stanley & Co	4.65
Goldman Sachs	3.27
Merrill Lynch	3.21
Credit Suisse First Boston	3.06
Lehman Brothers	3.05
DLJ International Securities	2.73
Deutche Bank AG	2.63
Myrberg	2.53
Evli	2.46
Société Générale S.A	2.33
ABG Securities ASA	2.28
Sundal Collier & Co ASA	2.27
Warburg Dillon Read	2.23
Kleinwort Benson Securities	2.22
Gudme Raaschou Bankaktieselskab	2.01
Bankers Trust International	1.95
HSBC Securities	1.72
NET	1.69
Merita	1.67
Bankgesellschaft Berlin AG	1.66
Alfred Berg	1.65
Carnegie	1.58
Orkla	1.56
Aros Securities	1.52
Amagerbanken A/S	1.42
CAI Cheuvreux Nordic AB	1.38
H. Lundén	1.37
Instinet U.K. Ltd	1.23
Fischer Partners	1.21
Aktieselskabet Midtbank	1.11
Den Norske Bank AS	1.08
Carswell-T.I.R Limited	1.07

Table B.1: Large Trade Ratios

[47] Obviously this set of data was not used to select Lambda and Delta where interviews were conducted in 1998 and 1999. Instead it was used to guide the selection of Tau and Gamma to ensure the desired variation among the case companies.

Stadshypotek Bank	.06	Nordiska	.74
Posten Fondkommission	.10	Timber Hill Europe AG	.77
Aktiespararna Investerings	.13	Unibank A/S	.78
SkandiaBanken	.13	E. Öhman J:or	.80
Tele Trade Solutions	.17	Bikuben GiroBank A/S	.81
E Trade Sweden	.19	Aragon	.85
JP Bank	.26	Den Danske Bank A/S (Head office)	.89
Avanza	.27	Svenska Handelsbanken	.90
Nordbanken	.31	Jyske Bank A/S	.92
Codan Bank A/S	.38	Skandinaviska Enskilda Banken	.94
FöreningsSparbanken	.49	Hagströmer & Qviberg	.97
Matteus	.56	Erik Penser	.97
Den Danske Bank A/S (Swedish branch)	.61		

Table B.2: Small Trade Ratios

APPENDIX C: ABBREVIATIONS

BA	Business Area
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CSD	Central Securities Depository
EMU	European Monetary Union
FIX	The Financial Information eXchange protocol is a public domain protocol for securities transactions
IM	Information Management
IS	Information Systems
IT	Information Technology
NT	Refers to Microsoft Windows NT
PC	Personal Computer
RGA	Refers to Delta's Report Generator Application (pseudonym)
SAX	The electronic trading system of the Stockholm Stock Exchange (originally Stockholm Automated eXchange)
SBI	Stockholms BörsInformation (a marketplace at the time competing with the Stockholm Stock Exchange for the listing of smaller companies)
SEK	Swedish krona
SISP	Strategic Information Systems Planning
SSE	Stockholm Stock Exchange
STP	Straight Through Processing
TES	Refers to the Tau Equity Saving application (pseudonym)
TESBO	Refers to the Tau Equity Saving Back Office application (pseudonym)
VPC	A Swedish central securities depository and clearinghouse supervised by the Swedish Financial Supervisory Authority (*Finansinspektionen*)
Y2K	The year 2000, which refers to the problems caused by information systems using only two digits instead of four when storing years, i.e. 99 and 00 instead of 1999 and 2000

Table C.1: Abbreviations

EFI
THE ECONOMIC RESEARCH INSTITUTE

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2002

Barinaga, E., Levelling Vagueness – A study of cultural diversity in an international project group.

Berglund, J., De otillräckliga - En studie av personalspecialisternas kamp för erkännande och status.

Bolander, P., Anställningsbilder och rekryteringsbeslut.

Damjanovic, T., Essays in Public Finance.

Ekman, M., Studies in Health Economics – Modelling and Data Analysis of Costs and Survival.

Företagerskan – Om kvinnor och entreprenörskap. Holmquist, C. och Sundin, E (red)

Heyman, F., Empirical Studies on Wages, Firm Performance and Job Turnover.

Kallifatides, M., Modern företagsledning och omoderna företagsledare.

Kaplan, M., Acquisition of Electronic Commerce Capability - The Cases of Compaq and Dell in Sweden.

Mähring, M., IT Project Governance.

Nilsson, M., Essays in Empirical Corporate Finance and Governance.

Rekrytering av koncernstyrelsen – Nomineringsförfaranden och styrelsesammansättning med focus på kvinnors ställning och möjligheter. Sjöstrand, S-E. och Petrelius, P.,(red)

Scener ur ett företag – Organiseringsteori för kunskapssamhället. Löwstedt, J. Stymne, B.,(red).

Schenkel, A., Communities of Practice or Communities of Discipline - Managing Deviations at the Øresund Bridge.

Schuster, W., Företagets Valutarisk – En studie av horisontella och vertikala styrprocesser.

Skogsvik, S., Redovisningsmått, värderelevans och informationseffektivitet.

Sundén, D., The Dynamics of Pension Reform.

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Tullberg, J., Reciprocitet – Etiska normer och praktiskt samarbete.

Westling, G., Balancing Innovation and Control – The Role of Face-to-face Meetings in Complex Product Development Projects.

Viklund, M., Risk Policy – Trust, Risk Perception, and Attitudes.

Vlachos, J., Risk Matters - Studies in Finance, Trade and Politics.

2001

Adolfson, M., Monetary Policy and Exchange Rates – Breakthrough of Pass-Through.

Andersson, P., Expertise in Credit Granting: Studies on Judgment and Decision-Making behavior.

Björklund, C., Work Motivation - Studies of its Determinants and Outcomes.

Center for Management and Organization 50 (1951-2001).

Charpentier, C., Uppföljning av kultur- och fritidsförvaltningen efter stadsdelsnämndsreformen.

Dahlén, M., Marketing on the Web - Empirical Studies of Advertising and Promotion Effectiveness.

Eckerlund, I., Essays on the Economics of Medical Practice Variations.

Ekelund, M., Competition and Innovation in the Swedish Pharmaceutical Market.

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Eriksson, R., Price Responses to Changes in Costs and Demand.

Frisell, L., Information and Politics.

Giordani, P., Essays in Monetary Economics and Applied Econometrics.

Gustavsson, P., Essays on Trade, Growth and Applied Econometrics.

Hedlund, A., Konsumentens erfarenhet – och dess inverkan på livsmedelsinköp på Internet.

Hill, M., Essays on Environmental Policy Analysis: Computable General Equilibrium Approaches Applied to Sweden.

Hvenmark, J., Varför slocknar elden? Om utbrändhet bland chefer i ideella organisationer.

Hägglund, P.B., Företaget som investeringsobjekt – Hur placerare och analytiker arbetar med att ta fram ett investeringsobjekt.

Höök, P., Stridspiloter i vida kjolar, om ledarutveckling och jämställdhet.

Johansson, C., Styrning för samordning.

Josephson, J., Evolution and Learning in Games.

Kjellberg, H., Organising Distribution - Hakonbolaget and the efforts to rationalise food distribution, 1940-1960.

Lange, F. och Wahlund, R., Category Management – När konsumenten är manager.

Liljenberg, A., Customer-geared competition – A socio-Austrian explanation of Tertius Gaudens.

Lindkvist, B., Kunskapsöverföring mellan produktutvecklingsprojekt.

Ljunggren, U., Nyckeltal i grundskolan i Stockholms stad före och efter stadsdelsnämndsreformen.

Läkemedel – Kostnad eller resurs för sjukvården? Jönsson, B.,(red).

Löf, M., On Seasonality and Cointegration.

Martensen, K., Essays on Entry Externalities and Market Segmentation.

Matros, A., Stochastic Stability and Equilibrium Selection in Games.

Mårtensson, P., Management Processes – An Information Perspective on Managerial Work.

Nilsson, A., Market Transparency.

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Bergkvist, L., Advertising Effectiveness Measurement: Intermediate Constructs and Measures.

Brodin, B., Lundkvist, L., Sjöstrand, S-E., Östman, L., Koncernchefen och ägarna.

Bornefalk, A., Essays on Social Conflict and Reform.

Charpentier, C., Samuelson, L.A., Effekter av en sjukvårdsreform.

Edman, J., Information Use and Decision Making in Groups.

Emling, E., Svenskt familjeföretagande.

Ericson, M., Strategi, kalkyl, känsla.

Gunnarsson, J., Wahlund, R., Flink, H., Finansiella strategier i förändring: segment och beteenden bland svenska hushåll.

Hellman, N., Investor Behaviour – An Empirical Study of How Large Swedish Institutional Investors Make Equity Investment Decisions.

Hyll, M., Essays on the Term Structure of Interest Rates.

Håkansson, P., Beyond Private Label – The Strategic View on Distributor Own Brands.

I huvudet på kunden. Söderlund, M (red). EFI och Liber Förlag.

Karlsson Stider, A., Familjen och firman.

Ljunggren, U., Styrning av grundskolan i Stockholms stad före och efter stadsdelsnämndsreformen – Resultat från intervjuer och enkät.

Ludvigsen, J., The International Networking between European Logistical Operators.

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Robertsson, G., International Portfolio Choice and Trading Behavior.

Schwarz, B., Weinberg, S., Serviceproduktion och kostnader – att söka orsaker till kommunala skillnader.

Stenström, E., Konstiga företag.

Styrning av team och processer – Teoretiska perspektiv och fallstudier. Bengtsson, L., Lind, J., Samuelson, L.A., (red).

Sweet, S., Industrial Change Towards Environmental Sustainability – The Case of Replacing Chloroflouorocarbons.

Tamm Hallström, K., Kampen för auktoritet – standardiseringsorganisationer i arbete.

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Allgulin, M., Supervision and Monetary Incentives.

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Mägi, A., Store Loyalty? An Empirical Study of Grocery Shopping.

Mölleryd, B.G., Entrepreneurship in Technological Systems – the Development of Mobile Telephony in Sweden.

Nilsson, K., Ledtider för ledningsinformation.

Osynlig Företagsledning. Sjöstrand, S-E., Sandberg, J., Tyrstrup, M., (red).

Rognes, J., Telecommuting – Organisational Impact of Home Based - Telecommuting.

Sandström, M., Evaluating the Benefits and Effectiveness of Public Policy.

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Spagnolo, G., Essays on Managerial Incentives and Product-Market Competition.

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Werr, A., The Language of Change The Roles of Methods in the Work of Management Consultants.

Wijkström, F., Svenskt organisationsliv – Framväxten av en ideell sektor.

1998

Andersson, M., On Testing and Forecasting in Fractionally Integrated Time Series Models.

Berg-Suurwee, U., Styrning av kultur- och fritidsförvaltning innan stadsdelsnämndsreformen.

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Runsten, M., The Association Between Accounting Information and Stock Prices. Model development and empirical tests based on Swedish Data.

Segendorff, B., Essays on Bargaining and Delegation.

Sjöberg, L., Bagozzi, R., Ingvar, D.H., Will and Economic Behavior.

Sjögren, A., Perspectives on Human Capital: Economic Growth, Occupational Choice and Intergenerational Mobility.

Studier i kostnadsintäktsanalys. Jennergren, P., (red)

Söderholm, J., Målstyrning av decentraliserade organisationer. Styrning mot finansiella och icke-finansiella mål.

Thorburn, K., Cash Auction Bankruptcy and Corporate Restructuring.

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