Virpi Pirttimäki

Business Intelligence as a Managerial Tool in Large Finnish Companies

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Thesis for the degree of Doctor of Technology to be presented with due permission for public examination and criticism in Festia Building, Auditorium Pieni Sali 1, at Tampere University of Technology, on the 12th of January 2007, at 12 noon.
“Every morning in Africa, a gazelle wakes up.  
It knows it must run faster than the fastest lion or it will be killed.

   Every morning in Africa, a lion wakes up.  
   It knows it must outrun the slowest gazelle or it will starve to death.

   It does not matter whether you are a lion, a gazelle, or a company.  
   When the sun comes up, you’d better be running to meet the needs of the day.”

– BBC television advertisement, extending the words of Herb Caen
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Keywords: Business information management, business intelligence, information, large Finnish companies, literature review, single-case study, survey

Abstract

In the knowledge-driven economy, a rapid and holistic understanding of business is more crucial than ever before, on account of the new rules of competition and the greater complexity and speed of change. This dissertation focuses on the phenomenon called business intelligence (BI), which is an approach to process and enrich business information in the managerial context. The main focus of BI is on providing management with the information and insight necessary to understand a company’s most crucial business possibilities and risks and how the company should position itself in light of potential changes. The main idea of BI addresses very old management problems, and BI has its roots in various traditional disciplines. Even if the phenomenon is widely known and used in the business world and the consultancy literature, there is no precise or universally shared concept of what BI is.

The dissertation examines BI as a tool for managing business information in large Finnish companies. The thesis starts with definition of the doctrine of BI and its positioning at the level of BI-related concepts. The latter is also the main theoretical objective of the thesis. Another theoretical objective is to confirm the theoretical framework for BI and increase understanding of this young field of research. The empirical objective of the dissertation is to improve on the general knowledge of BI and its evolution, state, and usage in large Finnish companies. In addition, the dissertation examines methods for measuring BI, integration of a BI process into strategic management, and utilization of human-source intelligence. The thesis relies on three sources of data: single-case studies with interviews and observations, surveys, and literature-based research. The theoretical framework of the thesis is based on the traditional management literature and the more contemporary BI and information management literature.

The results presented in the dissertation suggest that the role of BI in Finland has expanded since the 1990s. The use of BI increased in the top 50 Finnish companies in the time span under examination, and BI is likely becoming an integral part of these companies’ activities. Large Finnish companies view BI not only as a defensive tool to ward off perceived threats and changes but also as a proactive management tool for uncovering new business opportunities, trends, and weak signals in the business environment. Most of the top 50 companies utilize their own resources for BI and have an information system dedicated to BI. However, they feel that BI is currently not systematic enough. On the basis of the research, one may cite as possible reasons for the disaffection with BI, e.g., the lack of BI metrics and the fact that the bulk of BI investments have focused on technical details at the expense of human elements.
Tiivistelmä


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PART II: PUBLICATIONS


1 INTRODUCTION

1.1 Starting points for the thesis

1.1.1 Identification of the research issue

Business terminology has been informed by numerous concepts since the late 1990s. Among these are complexity, references to the accelerating pace of change, globalization, information flow, new economy, networking, and proactivity. Those terms and the new ways of thinking and acting that may be associated with them have had a hand in the movement of society from a capitalist-driven to knowledge-driven economy. Finland has been regarded as both one of the leading countries of information society development (Åberg 1997, p. 40; Sitra 1998, p. 4) and one of the most competitive countries in the world (IMD 2006). In addition to the changes in society, advancing technologies and applications have wreaked remarkable change on traditional business models and operations. According to Pietersen (2002, p. 9), running a business is now harder than ever because of the new rules of competition and the greater complexity and accelerated rate of change in the new economy. Because a good portion of economic theory dates from the time of industrialization, both the business and academic world are seeking new ways to increase their business-awareness and know-how in the information society.

The conscious management of information and knowledge is emphasized in the information society because the bottleneck is no longer financial capital but knowledge assets. The role of human capital has changed, and nowadays it is considered one of the strategic resources of companies both internationally (Edvinsson and Malone 1997; Roos et al. 1997; Lev 2001; Mayo 2001) and in Finland (Ståhle and Grönroos 1999; Hannula 2001). Companies have also become aware of new possibilities that have been created by the development of information and communication technologies in the storage and sharing of information. Managers and other key decision-makers have always needed relevant and topical information about their business and the business environment, but management in the current information society should be based on management of business information that is more systematic and proactive than before.

1 According to Åberg (1997, p. 40), an information society is a society in which most people earn their living through information and communication.
As mentioned above, up-to-date information is one of companies’ strategic resources and the basis for competitiveness in today’s ever-changing business climate. In addition, companies have to be competitive at all times. This presumes companies to have ongoing response and changing competence. Companies are forced to utilize business information more effectively than before, and this is not possible without systematic information management. Information management consists of identifying what information is needed, how it should be gathered, how it should be organized, where it should be stored, and who in the company should have access to it (see, e.g., Choo 1998; Tiwana 2002). The goal of information management is to maximize the usefulness of a company’s information resources and thereby their value in business decisions. However, not all existing information and knowledge can be observed or understood, and thus a company has to make decisions without perfect information. In a non-ideal setting such as this, competitive advantage is gained through a superior ability to anticipate raw data, to turn it into information, to craft it into knowledge relevant to the business environment, and to actually utilize intelligence gathered from it. Business intelligence is an approach for processing and enriching the essential business information in the managerial context.

1.1.2 Overview of business intelligence

The concept of business intelligence (BI) is a management philosophy and a tool that is used to help companies to manage and refine business information and to make more effective business decisions (Ghoshal and Kim 1986; Gilad and Gilad 1986). An intelligent company assures that managers utilize the information refined and then modify the way the company behaves accordingly. BI produces up-to-date information for both operative and strategic decision-making. There is no common conception of the content of BI; on the contrary, each author promotes his own idea of its connotations (Gilad 1996, p. 4). The concept refers to various processes, products, techniques, or tools to support the making of faster and better decisions.

Through the utilization of BI, a company can learn to anticipate the actions of customers and competitors as well as different phenomena and trends in its market areas. Often, the focus of intelligence activities is on gathering and analyzing external information.

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2 According to Porter (1985), competitive advantage is the ability to earn return on investment that is consistently above the industry average. Karlöf (2002, p. 122) cites competitive edge as one strategic advantage that has to be maximized, quickly available, and disposable for as long as possible. Grant (2002, p. 22) emphasizes the value of knowledge and innovation as crucial for gaining competitive advantage.

3 For further discussion of the term “information,” its hierarchy, and information management, see Chapter 2.

4 Differences between operative and strategic decision-making levels are discussed in section 2.2.3.
However, a company must also take advantage of existing information and knowledge within the company. Thus, information about a company itself and about its surroundings is necessary if the company is to understand its current and future possibilities and business environment. Also, through combining high-quality external and internal information with the existing knowledge of decision-makers, real competitive advantage can be gained.

As is noted in the previous paragraph, the concept of BI remains ambiguous. Some scholars think of BI as more like market intelligence or competitor intelligence, which aim to gather and analyze useful information concerning just the external business environment of a company – e.g., the market situation, customers, and competitors (Sawka 1996, pp. 47–52; Collins 1997, p. 14; Mendell 1997, pp. 115–118). On the other hand, some ICT-focused actors in the information system market have used a BI-related concept in naming their data warehouse products and such (Kalakota and Robinson 2001; Moss and Atre 2003). One reason for the inconsistency is that, while intelligence activities, in one form or another, have existed as long as there have been companies, boundaries between different terms are not yet very well established.

In the literature written in the United States and Canada, information concerning the external environment and gathered from external sources seems to be emphasized (Fuld 1995; Kahaner 1996; Cottrill 1998; Calof and Brouard 2004; Vibert 2004). The competitive intelligence, competitor intelligence, customer intelligence, market intelligence, and technology intelligence concepts are used in place of BI in these countries. In North America, the concept of BI is typically used to refer to analyzing data and information gathered from a company’s operative information systems, using reporting software and tools such as data mining and online analytical processing (Nelson 2001, p. 44). This viewpoint is quite narrow and focuses only on technologically driven data analyses and databases. In Finland, the broader definition is in use and “BI” is the most popular name for systematic and continuous monitoring, collection, analysis, and sharing of internal and external business information (Hirvensalo 2004; Global Intelligence Alliance 2005; Knip and Fleisher 2005; Article Ia; Article Ib). In this thesis, BI is the concept selected, because from the author’s perspective this concept describes best the activity that is under study and the concept is in broad general use in Finnish companies.5

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5 The concept of BI is discussed further in Section 3.1.
After all, the main idea behind BI addresses very old managerial problems, and the activities include nothing new: it is one of the basic, most self-evident tasks of most management tools (i.e., to analyze the complex business environment for making of better business decisions). For example, Gilad and Gilad (1986) state that organizations have “collected information about their competitors since the dawn of capitalism. The real improvement is in the efforts to institutionalize intelligence activities.” The roots of BI and other intelligence activities lie in, among other areas, military planning and thinkers (for example, Sun Tzu 1988). Intelligence has been a significant factor in military success for thousands of years (McCandless 2003, p. 46), and military plans and strategies have typically been based on monitoring, scouting, and analyses (Prescott 1995; Bavendamm 1998). The genesis of intelligence activities is, however, more recent in the context of commerce and business (Fleisher 2001b, p. 4).

From the business perspective, the first real intelligence activities occurred in the 1960s and 1970s and were oriented towards gathering of marketing data (Greene 1966; Prescott 1995). At that time, intelligence activities were carried out primarily as a library function of a company. The real growth of intelligence activities began in the 1980s when their focus was on the analysis of industry structure and competitors. However, at that time, only a few companies had formal intelligence activities or functions in North America, while in Europe intelligence activities focused mainly on security issues (Gilad and Gilad 1985; Ghoshal and Kim 1986; Tyson 1986; Prescott 1995). In the 1980s, the focus of intelligence activities shifted from data collection toward analysis, but at the same time the activities received an unfortunate association with spying in the American press, which slowed their expansion (Prescott 1995). Until the end of the 1980s, the link of intelligence activities to the decision-making process was poor and their nature was mainly tactical and formal. Since the 1990s, the strategic role of intelligence activities in decision-making has been emphasized and companies have actively developed intelligence processes. At the same time, advances in information technology have enabled intelligence activities to become more systematic and effective.

As discussed above, the bases of BI and other intelligence activities are well known, and none can claim that the activities are totally new. The intelligence field has grown since the 1960s (Greene 1966), and activities have become more systematic over the years as companies recognize that precise information has a direct impact on the bottom line. Currently, BI activities or a BI function acts as a significant link between the business environment and knowledge-intensive activities of a company because BI aims to present business information in a timely, systematic, and easily consumed way and to provide the background needed for reasoning and understanding the meaning behind business information – e.g., through discovery, analysis, and ad hoc querying (Azoff
and Charlesworth 2004). According to Liautaud (Siltala 2005, p. 10), BI is the outgrowth of the technological evolution in companies. Nowadays, a company needs BI because the information yield has increased considerably, in step with the advanced level of automation and implementations of information systems. However, BI does not occur in a vacuum; it must be managed as a core business process (Prescott 1995).

Thierauf (2001) considers BI an effective aid to decision-makers in obtaining a holistic picture of a company’s capabilities and the business environment, and therefore in pursuing greater competitiveness. In addition, BI aims to increase the quality of strategic and operative planning and to decrease the time used for decision-making by improving and accelerating a company’s decision-making process and information management (Gilad and Gilad 1986; Collins 1997; Fleisher 2001b). Thomas (2001, p. 48) states that the most significant goals of BI are: avoiding surprises, identifying threats and opportunities, decreasing reaction time, outthinking the competition, protecting intellectual capital, and understanding where a company is defenseless. In addition, Thomas emphasizes that BI acts as the eyes and ears of a company, but only if the intelligence processed is utilized. According to Gilad and Gilad (1986, p. 53), there are five key tasks in BI:

- to collect raw data
- to evaluate the validity and reliability of data and information
- to analyze data and information
- to store information
- to share the information processed with decision-makers

Besides the above benefits, Cook and Cook (2000, p. 14) mention that it is valuable to a company to have the ability to assess rumors, locate possible data leaks, and – especially – act proactively. It can be concluded that there is no universal definition for BI but its domain is quite broad. However, BI can be illustrated as a support tool of extensive, relevant, and proactive management and decision-making in companies in which shaping the future is considered more important than reacting to it.

1.1.3 Progress of intelligence activities in Finland

According to Poisalo (1997) and Taskinen (2002), there have been information services of some type in Finnish companies since the late 19th century and these can be considered the basis for current intelligence activities. In the 1920s, Finnish banks and

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6 The CEO of Business Objects and the founder of the company.
industrial companies established the first library functions, but the real expansion of Finnish information services came after World War II, when a healthy sum of war indemnities and reconstruction brought structural changes to the country’s economic life. The Society for Finnish Information Specialists was founded in 1947 and has since played an important role as a developer of information services (Poisalo 1997; Taskinen 2002). Over the years, the focus of information services shifted from data collection to more analytical and process-oriented activities and BI started to gain ground in Finnish companies. However, there are also some economic factors that have helped to transform business life and influenced the evolution of BI in Finland.

The 1980s saw an economic boom in Finland, and the control of Finnish money markets dissolved (Loikkanen et al. 1997; Vartia and Ylä-Anttila 2003). The Soviet Union’s collapse meant to Finland the loss of an important export market in 1991. At the same time, a large crisis appeared in the banking sector as a result of the overheated national economy. Those changes in economic and business life caused unparalleled unemployment and the worst recession since the great depression of the 1930s. However, economic recovery began quite quickly in 1994, when the gross domestic product again took an upward turn. The upswing in the economy largely stemmed from the technology boom and the global success of the forest cluster. At the start of 1995, Finland became a member of the European Union and conceptions regarding the business environment and the market areas of Finnish companies became more internationally oriented. A substantial increase in BI began in telecoms companies in the mid-1990s. Nokia’s impact on the development of BI should not be underestimated, because Nokia has been a forerunner in intelligence activities both in Finland and worldwide (Knip and Fleisher 2005). Companies in industry followed the information and telecommunications industry and started implementing BI in the latter half of the 1990s. In Figure 1, these historical developments are illustrated on a 100-year timeline.

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7 Soviet trade made up 10–25 percent of the foreign trade of Finland (Loikkanen et al. 1997, pp. 77–78).
8 In 1990–1994, over 450,000 jobs were wiped out, the unemployment rate soared from 3.4 to 18.4 percent, and the gross domestic product decreased 12 percent (Loikkanen et al. 1997, pp. 12–13, 243, 374–376).
At least partly because of the more international business environment and the dependence on exports (arising from the absolute size of the Finnish market), BI activities and markets have grown rapidly in the last decade (Hirvensalo 2004; Wright 2005; Nenonen 2006; Article Ib). Of course, other factors have played a significant role in the initial stage of BI. For example, better hardware performance and greater storage capacities have sped up processing, enlarged the amounts of information delivered, and decreased application prices. In addition to the progress of technologies, globalization and networking have doubtless weighed in when it comes to the development of BI.

According to the results of two BI surveys (Article Ia; Article Ib), most of the top 50 Finnish companies began BI activities when they recognized a need for better information and knowledge to support their strategic and operative planning and decision-making. In addition, for several companies the driving force behind using BI was a need to obtain knowledge of the business environment and its development in relation to strategic and operative actions. The survey results also indicate that the most significant benefit provided by BI has been the provision of better information. Higher-quality information allows decisions to be made more quickly and makes it possible to anticipate dangers and opportunities earlier. Another important benefit was an increase in the utilization and sharing of existing information resources in companies. One third of the companies interviewed globally⁹ found information quality to be BI’s most important benefit (Global Intelligence Alliance 2005). Other powerful benefits were, in order of importance, improved awareness, accelerated decision-making, and improved dissemination. Time savings, decreased costs, and greater effectiveness were judged least significant. The Finnish and global research results seem to be in parallel with the theoretical benefits discussed in section 1.1.2.

⁹ The survey was conducted in 287 companies, in Brazil, Canada, Finland, Germany, Mexico, the Netherlands, Norway, Switzerland, and 10 Asia-Pacific countries, in 2005 (Global Intelligence Alliance 2005; Hannula and Pirritimäki 2006; Article Ib). The questions of the global studies were based in large part on the questionnaire used in the Finnish BI studies (cf. Article Ia; Article Ib).
In 2005, 95 percent of respondents in the top 50 Finnish companies had systematically organized BI activities (Article Ib). Three years earlier, the figure was 80 percent (Article Ia). This statistically significant difference (cf. section 1.5.3) indicates that BI is evidently becoming an integral part of large Finnish companies’ operations. Today, few companies can forecast only local changes. Most companies need to utilize the synergy benefits of global action, together, to focus and act effectively. Therefore, country-specific characteristics and local needs must be considered in combination with the company’s global goals, and free flow of information has to be ensured across the organization. In other words, it is essential, especially to companies in small countries such as Finland, to understand the international business environment well – regardless of (and, in part, because of) cultural, political, and linguistic differences – because economic growth relies greatly on export markets. Besides in situations involving small domestic markets, hunger for information seems to grow in exceptional circumstances such as economic recession and war (Prescott 1995; Fleisher 2001b; Wright 2005).

Several firms now offer BI consultancy, system development, and news services in Finland. The common mission of all of these actors seems to be to refine and provide relevant business information. In most Finnish companies, “BI” is used to refer to both information-technology-based systems and actual information management processes (Pirttimäki 2002). Liautaud (Siltala 2005, p. 10) states that Finnish BI markets have an important role and are going to continue to do so in the future. One reason for this prediction of growth is that Finland’s ICT infrastructure is among the most developed in the world. In addition, Liautaud (ibid.) notes that Finnish companies and even the public sector use ICT tools highly effectively in comparison to what average companies do globally. Knip and Fleisher (2005) also highlight Finland as one of the world’s most advanced countries for intelligence. The current state of BI and the outlook of the top 50 Finnish companies are described more extensively in two publications in this thesis.10

10 See articles Ia and Ib.
1.1.4 International intelligence research

In addition to their role in business life, intelligence activities have become more common as a research area (Dishman et al. 2003). There are many publications in the field of intelligence activities, and several intelligence practices and methods are presented in the literature. However, the content of the existing publications often serves commercial purposes more than academic interests, although academic research on the subject has increased from the beginning of the 1990s (Prescott 1995; Knip and Fleisher 2005). Until the 1990s, academic writing in this area was very limited and intermittent, and thus the bulk of the knowledge of intelligence activities is still based mainly on the work of consultants. Because of this background, most of the publications focus on advocating particular intelligence techniques and models for collecting and, to a lesser extent, processing business information (Gilad and Herring 1996, p. xii). There is a noticeable lack of theoretical frameworks in research into intelligence activities. McGonagle and Vella (2003, p. vii) state that the focus of the intelligence literature has been on understanding an intelligence process and developing new analytical tools instead of on providing practical assistance for intelligence professionals. Prescott (2001, pp. 2–3) mentions a need for more answers to “How?” instead of “What?”

In the 1960s and 1970s, the intelligence literature dealt mainly with marketing intelligence and data collection issues, whereas in the 1980s the emphasis moved from data collection to analytical skills and techniques (Prescott 1995). As noted above, most publications, however, were written by consultants instead of academics, whose research was scarce in the 1980s. Besides the military literature (see, e.g., Sun Tzu 1988), the roots of the intelligence literature lie in, e.g., the works of strategic scholars such as Porter, Hamel, and Prahalad, who in the 1980s highlighted the importance of strategic planning and positioning in the competitive environment. As mentioned above, the number of intelligence publications grew in the 1990s, but there is still a dearth of academic research. The current literature has proven to be fairly sketchy, and only a few empirical studies have been presented internationally. Ganesh et al. (2003, p. 3) remark that empirical studies of intelligence activities have been conducted mainly via survey questionnaires, despite a need for field research – e.g., case studies. In addition, the perspective of large American companies has been emphasized in the intelligence literature (Fleisher 2001b, p. 5), because many of the intelligence books and articles have been published in North America and little research has been done elsewhere, such as in Europe. Thus, many assumptions, norms, and recommendations of the intelligence literature do not fully reflect the larger reality. Blenkhorn and Fleisher (2005a, pp. x–xi) even argue that no significant global intelligence book has been published since 1993 and that, instead, country-specific issues have informed the intelligence literature. At the same time, Ganesh et al. (2003, p. 2) state that very little knowledge of country-specific factors, as such, that influence intelligence practices has been published. In addition, there is a lack of cross-national comparisons and empirical studies of how intelligence
infrastructure may vary if business is conducted outside North America or in many
countries instead of just one (Ganesh et al. 2003, p. 2; Blenkhorn and Fleisher 2005b, p.
6). With comparisons and empirical studies, both intelligence managers and academics
could learn from each other’s successful actions but also from mistakes.

Fleisher and Blenkhorn (2005, p. 279) state that not even a handful of people are
acquainted with the intelligence literature and research in depth and that there are only a
few doctoral programs in this field worldwide. Fleisher and Blenkhorn (2005, p. 281)
pick up this argument, stating that intelligence research and education have been
dwarfed by older and more established approaches in, e.g., business, management,
marketing, and strategy studies. Badr and Madden (2006) remark that there is a lack of
academic effort and commitment to intelligence activities in Europe, in contrast to the
situation in North America. Overall, the academic research field of intelligence
activities seems to be still very much in an emergent state (Prescott 1995; Fleisher and
Blenkhorn 2001; Badr and Madden 2006), and there is a need for adoption of more
systematic methodologies before intelligence theories can begin to attain an established
position and professional status. The lack of scientific rigor also decreases the validity
of prior and forthcoming intelligence studies and the generalization and comparability
of the research results (Ganesh et al. 2003, p. 3). Miller (2000b, p. 21) says the research
confirms the role of systematic intelligence activities as an enabler of more effective
information management and decision-making. This remark also expresses the need for
building theoretical frameworks for intelligence activities more actively.

1.1.5 Description of Finnish intelligence research

In Finland, academic BI research was launched at Tampere University of Technology
(TUT) in 2000. The first comprehensive study of BI in Finland was carried out in the
summer of 2002 (Pirttimäki 2002). The objective of the study was to determine how
common BI was and how it was applied in the top 50 Finnish companies. The
interviewees regarded BI as a crucial element in competitive business operations or an
enabling activity that could assist in the controlled management of businesses. At the
beginning of 2004, a research project on “Business Intelligence Processes and
Technologies in Improving the Visibility of Business Processes and Value Networks”
(VisiPro) was launched at TUT. The main objective of this project was to deepen the
understanding of BI. Six Finnish companies participated in the project.

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11 The results of the thesis tie in closely with this now completed research project. The two-year project
was financed by the National Technology Agency of Finland and the six companies studied.
12 Metso Automation, Nokian Tyres, Novintel, Perlos, S Group, and Solita.
During the VisiPro project, a questionnaire-based study of BI was carried out in Finland and Canada in 2005. According to the survey results, the intelligence activities were called BI in most large Finnish companies (67%), while in Canada the usage of terminology was more fragmented (Hannula and Pirttimäki 2006). The most common concept in Canada was competitive intelligence (39%). According to the results of a global study (Global Intelligence Alliance 2005), the most popular term for intelligence activities was “market research,” used by 287 companies, in 18 countries, in 2005. Respectively, “BI” and “competitive intelligence” were the second and third most used terms, in general, with “BI” being most common in Finland and the Netherlands, whereas “market research” was used mainly in the Asia-Pacific region and came last in Finland. These results support the theoretical assumption, discussed in section 1.1.2, that intelligence terminology differs between the various markets and countries.

Besides TUT, the Helsinki School of Economics has been quite active in BI research. Each year there have been some master’s theses closely related to BI. Themes have included strategic management, assessment of the implementation of BI, data mining, competitor scanning, and patent knowledge. Most of the theses have been based on a literature review and single-case studies. To the author’s knowledge, there are only two doctoral theses (Pirttilä 1997; Rajaniemi 2005) that closely relate to the research field of BI in Finland. Pirttilä’s (1997) doctoral thesis deals with competitive intelligence and competitor analysis in a large industrial company, and thus the external information and environment are emphasized. The objective of the thesis was to deepen the knowledge of different intra-organizational processes that are used in a corporate organization to manage and exploit the vast amount of competitor information that is received from the environment.

The second doctoral thesis, Rajaniemi’s (2005) work, concerns the external environment – in particular, how strategic knowledge can be gathered from the competitive environment. The author constructed a model called the Strategic Knowledge Cycle for acquiring and sharing that strategic knowledge. The model is drawn largely from the theories of knowledge management and environmental scanning. In the thesis, Rajaniemi also described the use of the model and tested the construction in one case company. In the Strategic Knowledge Cycle, key managers do not gather competitive information and knowledge. According to Rajaniemi (ibid.), this task belongs to experts because they use different, advanced tools for scanning the competitive environment systematically. In addition, experts analyze the knowledge, summarize it, and share it with managers. Before the tacit knowledge can be shared with managers, experts have to turn it into explicit knowledge. Rajaniemi suggested that the Strategic Knowledge Cycle assists a company to gather and share strategic knowledge of the competitive environment.
In addition to the academic research work, commercial research units have carried out some BI-oriented studies in Finland (Market-Visio 2001; Korhonen and Horttanainen 2002; Market-Visio 2002; Vesa 2002). Market-Visio\textsuperscript{13} carried out two BI studies, in 2001 and 2002, the perspective of both of which was technological: Here, BI was defined as a technological information management solution. Both studies focused on BI solutions in Finnish organizations. The target groups of the studies consisted of 80 mainly industrial companies and public administration organizations that were utilizing BI or planning to begin doing so. Individuals responsible for BI were interviewed. In spring 2001, the BI solutions used, investments in BI development, satisfaction with Finnish BI suppliers, and service purchases were researched (Market-Visio 2001). According to the results, 56 percent of the respondents had BI activities and 44 percent were considering purchasing them. In the spring of 2002, selection criteria for BI solutions were researched, along with how a BI solution is selected, what kinds of benefits are expected and achieved, and what kinds of challenges BI faces (Market-Visio 2002). According to the 2002 study, the respondents considered the strengthening of strategic planning the most significant benefit. Other significant benefits were increased effectiveness of operations and better control of information quality.

In the fall of 2002, Observer Finland\textsuperscript{14} participated in the planning and implementation of BI-related diploma work at Laurea Polytechnic (Korhonen and Horttanainen 2002). The main objectives of the work were to determine the present state of BI, the scope of application of BI, and the level of structuring of BI. The target group consisted of hundreds of Finnish companies. An Internet inquiry was used as the primary research method in the study. In total, 156 answers were received: BI was used by 80 percent of the respondents to support their strategic planning and to develop their business, and, in addition, 90 percent of the companies interviewed thought that BI will grow considerably or increase slightly in the future.

According to the Finnish studies, BI is a quite common tool of medium-sized and large Finnish companies as the 21\textsuperscript{st} century begins. Although the results indicate that there are many benefits provided by BI, Finnish companies feel that BI is not currently systematic or comprehensive enough (Article Ia; Article Ib). For example, development of the utilization of internal information is a crucial issue in large Finnish companies. In addition, there seems to be a lack of suitable integrated technologies and human resources, alongside inefficiencies in the measurement of BI.

Overall, there is still plenty to be done in the BI research field. In addition, there are several reasons that it is essential to gain better knowledge and understanding of BI in

\textsuperscript{13} A Finnish analysis and research service company specializing in IT and telecommunications.

\textsuperscript{14} An organization that provides BI and communication intelligence services.
Finnish companies. First, the importance of enriched information and knowledge is a more and more inseparable part of developing business strategy (Pietersen 2002; Global Intelligence Alliance 2005). Second, there have been many problems in developing information systems and implementing them in practice (Turban et al. 2001). Third, intelligence activities in Finland are expected to grow (Global Intelligence Alliance 2005; Siltala 2005; Article Ib). Fourth, information management and enrichment have been presented as increasingly important elements for ensuring success in a dynamic business environment, but at the same time information is a commodity (Pietersen 2002; Savolainen 2006). Fifth, there is a small amount of academic research and work by professionals in the field of intelligence activities (Prescott 1995; Gilad and Herring 1996; Fleisher and Blenkhorn 2001; McGonagle and Vella 2003; Fleisher and Blenkhorn 2005; Knip and Fleisher 2005). Finally, there is an overall lack of academic intelligence research and know-how, especially in Europe (Badr and Madden 2006).

1.2 Research questions and objectives

The dissertation concerns BI in large Finnish companies. As described in the previous sections of this chapter, there has been relatively little academic research into BI in Finland and worldwide. Existing intelligence literature and studies are quite superficial and serve more commercial purposes – after all, most publications in the area are based on consultants’ work. For that reason, there is a considerable need for academic BI research. This thesis examines BI as a tool for managing business information in large Finnish companies. The main objective of the thesis is to increase general knowledge of BI and its evolution, state, and usage in large Finnish companies. As the research object is rather broad to be approached as such, it is approached through four research questions. The questions are posed to support the objective and develop the framework of the dissertation. Together, they cover the aim of the thesis to increase general knowledge of BI. The research questions (Q1–Q4) of the thesis are:

1. What are the relationships among BI-related concepts?
2. How does BI relate to other information-intensive managerial activities of a company?
3. How can one measure BI?
4. How is BI utilized in large Finnish companies?

Because the major objective of the thesis is quite broad, the research problems are approached from different angles and data gathered from several information sources. A literature review and conceptual analyses are needed in relation to all of the questions, for understanding the bases of the research subject and to situate BI in the right context. Question 1 is theoretical in nature and based on the literature review. Answering
Question 1 is a prerequisite for answering the second question. Questions 2 and 3 are partly theoretical and partly empirical, and thus they are considered by analyzing both the literature and empirical data from single-case studies. Question 4 addresses the current state of BI in large Finnish companies. The illustration is based mainly on the empirical results of two surveys carried out in Finland at the beginning of the 2000s. Through analysis of survey results, the main targets for developing BI are formed, and the two most important issues are chosen for more specific dissection. Those issues are examined closely for the case companies, for questions 2 and 3; therefore, these questions necessitate practical insight into the research issue even if a theoretical approach is needed also. Answering all of the research questions should achieve the main objective. As indicated above, the thesis relies on three main data sources: case studies with interviews and observations, surveys, and extensive analysis of the literature. The research methods used in the dissertation are discussed in section 1.5.2.

One of the theoretical objectives of the thesis is to provide an analysis of BI definitions and the related intelligence concepts. Namely, several intelligence concepts are often used to describe the same phenomenon, and the relationships between BI-related concepts are somewhat unclear. It is thus examined in the thesis what the content of each key term is, what it is used to describe, and how these intelligence concepts relate to each other. The theoretical objective of the thesis is also to confirm the theoretical framework for intelligence activities and increase the academic understanding and status of this young field of research. The empirical objective of the dissertation is to improve on the knowledge of how large Finnish companies utilize BI. In addition, the progress of BI, the present state of BI, the methods for measuring BI, and the targets for the development of BI are illustrated. The Finnish survey results are also compared to the findings of global studies in order to increase knowledge of how the intelligence activities of the top 50 Finnish companies fit in at global level.

1.3 Scope of the study

As discussed in the previous sections, BI still receives limited analysis in the academic literature, although the need for analysis has existed for many years and intelligence activities have become commonplace. Therefore, the overall intent of the dissertation is to provide both business managers and academics with an increased understanding of BI and to produce an overall outline of the current state of BI in large Finnish companies. The dissertation also offers recent information and more precise definitions of

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15 According to the recommendation of the European Commission (2003), large companies are enterprises employing 250 or more persons and that have an annual turnover exceeding 50 million euros and/or an annual balance sheet total exceeding 43 million euros.
BI-related concepts and issues. To conclude, the main focus of this doctoral thesis is not on any specific intelligence tool, method, or system; rather, the research aims to produce fresh and well-founded insights on BI in Finland.

Although the primary scope of the study is quite wide, the dissertation also presents some examples and findings of empirical studies. The empirical data of the thesis are based on two surveys and two single-case studies. In the surveys, the target companies represented the top 50 Finnish companies by sales revenue. Also, the companies studied in the case studies were large-sized. Therefore, the scope of the dissertation is limited to large Finnish companies and the conclusions may not be extended to smaller companies in Finland or companies in other countries without further research. The dissertation, however, does offer an example of the use of intelligence activities in a small but competitive and developed country.

The companies that responded to the surveys represented a number of industries, but both companies considered in the case studies were in the telecommunications industry. This industry is strongly characterized by its rapid pace of change. In a less rapidly changing sector, the results might be different. The selection criteria for the case companies are discussed in more detail in section 1.5.4. The dissertation in its entirety does not emphasize any specific industry, but the scope of the case studies is limited. Regardless of these limitations, the focus of the dissertation is kept as broad as possible. In other words, the discussion presented aims also to be relevant to smaller Finnish companies and companies in other industries or countries.

### 1.4 Summaries of the research publications

The thesis consists of six research articles\(^\text{16}\), which are linked with each other in terms of context, means of analysis, time, and data. At the same time, the articles are independently designed to address the specific research objectives in the different studies. The research methods are not the same in all six studies; the approaches and methods are independent and selected to support the separate objectives of the six individual studies. The articles form a core part of the contribution of the thesis. Summaries of the articles are given below.

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\(^{16}\) The articles are presented in the second part of the thesis.
1 Definition of research topics by surveys

a) Business Intelligence – Empirical Study on the Top 50 Finnish Companies

The study was based on the results of a survey on BI that was carried out among large Finnish companies in 2002. The survey was the first comprehensive study of its kind in Finland. Individuals responsible for BI in the top 50 companies by sales revenue were interviewed. Telephone interviews were used as the primary data collection method. The number of useful answers was 46, and thus a response rate of 92 percent was achieved.

The objective of the study was to find out how common BI was and how BI was applied in large Finnish companies. The study examined the initiation and organization of BI and the future scenarios concerning BI. The research also examined the key areas of improvement in BI, benefits gained from BI, and the prospects for the field. The companies researched in the study were split into three groups by line of business: industry, trade and services, and information and communication technology (ICT).

The survey results showed that most of the top 50 companies (80%) had systematically organized BI activities in 2002. For example, all of the ICT firms reported a systematic way of collecting and disseminating business information. Among the respondents, “BI” appeared to be the most popular term for intelligence activities. The majority of the respondents had begun BI as they recognized a need for enhanced information to support their planning and decision-making. Generally, the respondents thought that the most significant benefit provided by BI was the quality of information acquired for decision-making. The most important areas for improvement, as cited by the respondents, were the identification of critical information needs, the utilization of internal information, and the measurement of BI. In 2002, one third of the respondents believed that the emphasis on activities concerning BI would increase considerably in 2002–2007.

b) Comparative Study and Analysis of the Intelligence Activities of Large Finnish Companies

This study was a continuation of the foregoing article, being based on BI surveys carried out in Finland in 2002 and 2005 and globally in 2005. The study presented the main findings of the 2005 survey in Finland and compared them to the results of the previous Finnish and the global surveys. Overall, the study described the state and evolution of BI in Finland. It was conducted similarly to the 2002 survey (see the foregoing article), and thus the empirical data were gathered using telephone interviews of the individuals responsible for BI in the top 50 companies. The number of useful sets of responses was 41, for a response rate of 82 percent.
The target companies were again categorized into three groups by line of business: industry, trade and services, and ICT.

The study’s results indicate that usage of BI increased from 80 percent to 95 percent among the top 50 Finnish companies in 2002–2005, and thus BI is likely becoming an integral part of those companies’ activities. That result also indicates that Finland was one of the three markets in which intelligence activities were conducted most systematically, among the 18 countries considered. In 2005, a sizeable majority of the Finnish respondents (73%) performed information processing in-house. This was one of the highest figures among the 18 countries around the world. According to the study, readiness of large Finnish companies to invest in BI had decreased in three years, although the 2005 result represented well the global average. There were also signs that the focus of BI is becoming more tactical in Finland, though the role of strategic issues is still strong.

II Theoretical background

a) A Cube of Business Information

In this study, the common challenge faced by decision-makers was explored – there is too much information. The study suggested a solution employing the categorization of business information and demonstrating how it might be constructed and presented as a “cube of business information.” Typically, business information is categorized as data, information, knowledge, or intelligence. In the study, an alternative approach was used, and business information was categorized according to the following dimensions:

- whether the source of information is inside or outside the company
- whether the subject of information is inside or outside the company
- whether the information is qualitative or quantitative

The study was conceptual in nature, and the construction of the cube was based on a literature review and the authors’ experiences and research work. The study provided proposals for outlining business information about a different type, which was specified in articles Ia and Ib as one of the most important development issues where BI is concerned. Furthermore, some examples of how the cube could be utilized in BI research and in practice were illustrated in the study.

b) Measurement of Business Intelligence

The study examined the measurement of BI. The results seen in articles Ia and Ib showed that this is one of the critical targets for development of BI in large Finnish companies. The study was based on a review of publications related to BI and business performance measurement. The study discussed how BI could be
measured and identified what types of metrics are covered in the literature. In the study, two main reasons for measuring BI were identified: evaluation of BI in order to prove that it is worth the effort and measurement of BI activities in order to help manage a BI process. The study showed that there are fewer metrics for the BI process than for the effects of BI. In addition, the study presented and assessed commonly known methods for measuring BI. In the study, a balanced approach to business performance measurement was also adapted to measuring a BI process. Overall, the study deepened the theoretical knowledge related to the measurement of BI.

III Empirical findings of single-case studies

a) Business Intelligence for Strategic Management in a Technology-Oriented Company

This study was based on a single-case study. The examination was carried out by conducting 20 in-depth, open-ended interviews among the key strategic decision-makers of the company considered. The interviews were used as a tool to gain deeper insight into the research issue. The study examined the role of non-public, external strategic information received from employees in strategic management. In addition, the study presented a model for a BI process that provided the case company with a systematic approach to the utilization of the aforementioned information. The basic structure of the process suggested followed the idea of BI processes described in the literature. However, the approach was extended by considering more profoundly the connection to strategic management and the roles that should be played by the company behind the process. Overall, the study showed that it is challenging to put this kind of information into use in strategic management and decision-making.

b) Measurement of Business Intelligence in a Finnish Telecommunications Company

The study provides insights into the measurement of BI through refining the results of a case study and the proposals of Article IIb. A case study approach was used to get a pragmatic and insightful view of the phenomenon under exploration. Overall, the study deepened the practical understanding of the measurement of BI. The main part of the study demonstrated how a Finnish telecommunications company measures its BI activities. In addition, the challenges and targets for the measurement of BI in the company were described. The results of the study were twofold: First, a description of the current knowledge regarding the measurement of BI was derived using previous research. Second, the study made a contribution to the empirical knowledge of the topic and proved, e.g., that balanced performance measurement is applied in measuring a BI process in practice.

Articles Ia and Ib form a starting point for the thesis. On the basis of the results of these articles, the state of BI in Finland is illustrated. In addition, the results show the most critical development issues for BI in large Finnish companies. The author chose three of
these for more detailed examination. These three issues are discussed further in articles IIa, IIb, IIIa, and IIIb from both a theoretical and empirical perspective. In articles IIa and IIb, illustrative frameworks for the categorization of business information and the measurement of BI are constructed. Next, those theoretical frameworks are compared to some extent with the empirical findings of the case studies in articles IIIa and IIIb. These articles act as a bridge between the theoretical and empirical viewpoints. Figure 2 illustrates the composition of the articles and which of the research questions are answered in them.

Figure 2. The composition of the articles.

As shown in Figure 2, the thesis consists of six studies that are reported upon in the separate articles, which address the research questions presented in Section 1.2. The articles in their entirety are presented in the second part of the thesis.

The author’s contribution to the original publications was as follows. In Article Ia, the author was the main designer, interviewer, and analyzer of the survey research and other writer of the publication. The author was sole author of Article Ib. For articles IIa and IIb, the author was one of two authors, participating in the design and writing phase. For Article IIb, she was also responsible for contributing a BI approach to the article. For Article IIIa, the author was the second author, participating in the design and writing phase. For Article IIIb, the author was the primary author, being the main designer and writer of the publication.

17 The categorization of business information, the utilization of information received from employees, and the measurement of BI.
1.5 Research strategy

1.5.1 Definition of the research approach

Understanding business and the logic or relations that underlie companies and their interconnections is said to be one of the most essential aims of business economics (Salmi and Järvenpää 2000, p. 265). There are various choices in research in business economics: theoretical or empirical\(^{18}\), hermeneutic or positivistic, descriptive or normative, and qualitative or quantitative (see, e.g., Emory 1985; Uusitalo 1995; Gummesson 2000). Some of these alternatives are introduced at a general level in this chapter. The contemplation of a research strategy for the thesis started from the premise that a purely theoretical approach would not be suitable for answering the research questions and for giving a comprehensive enough view of the phenomena.

According to von Wright (1970, pp. 2–3), research strategies are derived from two main paradigms: the hermeneutic and positivistic. These two paradigms are perceived to be opposite to each other (Olkkonen 1994, pp. 26–34), and thus they can be situated at opposite ends of a continuum, of which the hermeneutic represents a subjective and the positivistic an objective worldview. Positivistic research is based on objective truths from external reality. These truths have to be observable and known without doubt. Thus, the positivistic approach aims at explaining, and the paradigm ignores themes that are based on constructions, perceptions, or assumptions. Positivism is typical in the natural sciences. In addition, positivism is usually linked to realism, determinism, and quantitative research methods (Neilimo and Näsi 1980). In contrast, hermeneutics is completely based on subjective interpretations (Kasanen et al. 1991). Olkkonen (1994, pp. 72–73) cites building theory through deeper understanding of the phenomena as the most important characteristic of hermeneutics. In addition, hermeneutic research can be illustrated as constant rotation between what is learned and what is known (Gummesson 1993). Hermeneutics is often associated with voluntarism, nominalism, and qualitative research methods (Burrell and Morgan 1979). Both paradigms have encountered criticism, and therefore combinations of the two are more often used in scientific research (Olkkonen 1994, p. 53). The dissertation is located towards the subjective end of the subjective–objective continuum, but it also includes parts situated nearer the objective end. The dissertation in its entirety and the majority of the articles aim to increase knowledge of BI from a holistic point of view and to further dialogue between empirical material and theory. In other words, the thesis aims to interpret and explain the phenomenon under study rather than to find law-like generalizations. Thus, the dissertation as a whole is closer to the hermeneutics research paradigm, although

\(^{18}\) According to Näsi (1983), in empirical research, a theory is formed by empirical observations that are generalized by tests, whereas in theoretical research the research questions are approached via different theoretical constructs and then results may be tested in practice.
articles Ia and Ib involve nomothetic research methodology and thus are closer to positivism.

As mentioned before, there are several different research approaches available in business economics, and they are categorized in various ways. According to Olkkonen (1994, pp. 42, 91–92), the selection process is delimited by, e.g., the operating environment, the type of research problem, and the quality of available data and material. Aaker and Day (1986, p. 49) specify that the way in which data are collected and what kinds of results can be achieved depend in part on the research approach selected. Thus, they specify the selection process as one of the most important decisions in conducting any research project. On the other hand, Yin (1994, p. 7) highlights that the research approach selected should contribute to the research question formulation but, for the success of the study itself, it is most essential to formulate the research questions properly. In any case, the selection of research approach leads to outlining of research methods.

In the Finnish business economics research, research approaches are generally classified into five categories: concept-analytical, nomothetic, action-analytical, decision-oriented, and constructive (Neilimo and Näsi 1980; Kasanen et al. 1993). The classification is based on the dimensions of the usage – descriptive or normative – and methods – theoretical or empirical. Typically, individual studies include characteristics of several research approaches because the aforementioned categorization is not unambiguous. The classification acts more like a recommendation or guide in order that a researcher would understand the main differences between the research approaches and how they relate to each other (Neilimo and Näsi 1980). The overview portion of the thesis is concept-analytical, which means that the research is mainly descriptive and theoretical and aims to define concepts and renew theoretical frameworks. The separate articles have their own approaches, which are selected to support the article-specific objectives. Articles Ia and Ib mostly fall under nomothetic research, whereas articles IIa and IIb are situated mainly within conceptual research and articles IIIa and IIIb present aspects of action research. Because the research approaches of the dissertation can be classified roughly under three categories – the concept-analytical, nomothetic, and action-analytical – those approaches are next introduced briefly, except for conceptual research, which is discussed in the following section of this chapter.

The nomothetic approach is closely linked to positivistic scientific tradition (Näsi 1983, p. 40). Nomothetic research is mainly descriptive, and empirical data are gathered by means of extensive samples. The primary goal of the research approach is finding causal relationships and trends in the real world and explaining the reasons for the causalities found (Olkkonen 1994, pp. 50–51). The findings are verified probabilistically through statistical analysis. The approach regards reality as objective, observable, and independent of the researcher. In practice, nomothetic research often means survey studies. Because
constructing the questionnaire and forming the hypotheses should be conducted through existing theories, conceptual research forms a critical part of nomothetic research. The weakness of the nomothetic approach is averaging of the results, grounded in the doctrines of the approach, and thus there is no ability to react to different conditions.

It is typical of action research that the research object and researcher are closely linked. Action research is based on making observations about the research target, and thus a researcher is not an independent observer but an active participant\textsuperscript{19} in the process under study, and that process of change becomes the focus of the research (see, e.g., Pienimäki 2005, p. 17). Gummesson (2000, p. 209) defines an action researcher as acting as a facilitator in an organizational change process or a change agent. The role of the researcher in interpretation and understanding of the research environment and results cannot be emphasized too strongly. According to Benbasat et al. (1987, p. 371) and Westbrook (1995, p. 18), the results of action research should be relevant to practitioners and applicable to unstructured or integrative issues but also contribute to theory and a set of system development concepts. Coughlan and Coghlan (2002, p. 230) define the aim of action research as to take action and create knowledge or theory concerning the action in question. Thus, action research has dual objectives: to contribute to addressing the needs of the client and the interests of the scientific community. Benbasat et al. (1987), however, list many weak points to action research. One of the weaknesses is a potential lack of objectivity when the researcher has an intensive involvement in the research process. Also, the problem of generalization arises in action research. Often, there are only a few research objects to be studied and analyses are based on the researcher’s subjective interpretations. Because of this, the use of quantitative methods is not possible, and verification of the results is one of the main problems in action research.

The division of research into qualitative and quantitative is common even if Alasuutari (1999, p. 32) reminds us that in practice it is almost impossible to find any research that is purely quantitative or qualitative. Stainback and Stainback (1988, p. 8) state that the main difference lies in the aims: quantitative research aims to make statements that are predictive, while the objective in qualitative research is to understand phenomena. In quantitative research, arguments rely on numbers and statistical associations between numbers. Research data are thus gathered from, e.g., questionnaires and can be analyzed with statistical tools. In comparison, qualitative research is based on interpreting verbal or visual research material, such as interviews (Uusitalo 1995, p. 79). Qualitative research is usually related to hermeneutics and quantitative to positivism (Gummesson 2000). This dissertation does not involve the testing of any specific hypothesis, but it aims to produce new knowledge through a combination of quantitative and qualitative

\textsuperscript{19} Uusitalo (1995, p. 90) states that participant observation is one type of action research. It refers to the specific type of observation in which a researcher is an active participant in the group that is studied.
data. In other words, both qualitative and quantitative data are used in answering the research questions. Overall, the thesis involves more qualitative than quantitative aspects, but both approaches have their place in the articles. In articles Ia and Ib, the quantitative research data were gathered using surveys, whereas articles IIIa and IIIb were based on the qualitative research data gathered through interviews and observations in single-case studies.

To conclude, the author has approached the research issue from different directions and gathered research data from several information sources. This kind of approach is referred to as triangulation (see, e.g., Salmi and Järvenpää 2000). Triangulation increases the validity of the research (Bonoma 1985; Leonard-Barton 1990; Green et al. 2002) and can be carried out in relation to data sources, methods, investigators, and theories (Yin 1994, p. 92). In addition, the selections are based on a need for theoretical and practical studies in the BI research field (cf. Prescott 1995; Fleisher and Blenkhorn 2001; Badr and Madden 2006). Without empirical analyses, the results would not have much relevance or contribute much to discussion.

1.5.2 Research methods and data

As Olkkonen (1994, pp. 81–82) mentions, there are some inevitable limitations in selecting the research method. The constraints are set by, e.g., the availability of research material and the personal characteristics of the researcher. The selection of research method also relies on the earlier research done in the specific field and on the nature of the research questions. Because the thesis contains six separate articles, each of these articles includes its own theoretical discussion and literature review focusing on its own research problem. As mentioned in Section 1.4, the research methods used are independent and were selected to support the article-specific objectives. Applying a single research method would not suit the different aims of the articles. In order to meet the challenges of the research questions, several sources were used in collecting empirical data: survey, interview, direct observation, participant observation, and documentation. Below, the primary research methods used and data gathered in the separate articles are presented in more detail.

Conceptual analysis

The general aim of conceptual research is to construct and develop conceptual frameworks or systems that in themselves have no significance but have to serve a specific purpose (Olkkonen 1994, p. 65). Conceptual frameworks are needed for, e.g., describing new phenomena or categorizing and organizing information. According to Emory (1985, p. 24), the describing or classifying is difficult because it is not easy to develop concepts that are accessible to others. Precise analysis and definition are
required before a phenomenon can be quantified or measured. Hence, exactly defined concepts are a necessary starting point for successful scientific research. It is, however, noteworthy that, in everyday life, criteria for the definition of concepts in terms of their form and presentation are not as exacting as in science (Näsi 1980, pp. 5–7).

Olkkonen (1994, p. 100) defines a concept as an abstract, general, and compact definition of a phenomenon. A more precise definition is offered by Näsi (1980, p. 10). He states that concepts are counterparts of the thinking level that are presented at a linguistic level via terms or other symbols related to an imaginary or an objective world. According to him, concepts thus describe compositions of mental images and attach meaning to content. In conceptual research, the conceptual framework developed may be totally new or an improvement on prior versions of concepts. Typically, the methods used in conceptual research are thinking and analytical comparisons with existing literature and knowledge. Uusitalo (1995) defines conceptual research as mostly theoretical, even if the new concepts developed should be connected to empirical findings (Neilimo and Näsi 1980, p. 32). For example, Näsi (1980, pp. 17, 33) and Lukka (1991, p. 167) state that a conceptual-analytical part is included in all research projects but conceptual analysis can be used as an independent research approach also.

The first phase in conceptual analysis is defining the problem and the purpose of using the concepts (Näsi 1980, p. 14). Developing the concepts requires performing both internal and external analysis of them. Näsi (1980, p. 13) states that external analysis refers to separating the concepts from similar concepts and identifying the higher-level concepts while internal analysis involves examining the contents of the concepts. In addition, internal analysis refers to considering a variety of views that have been presented regarding them. Finally, the concepts defined are suggested as a product of the analysis. Olkkonen (1994, p. 67) reminds us that new concepts and their clarity and success should be critically evaluated somehow – e.g., in different settings and cases. However, the verification can be complex to carry out because concepts are often developed for a purpose-specific study (see, e.g., Lönnqvist 2003, p. 278). Many times, the verification is just done through accurate argumentation and reasoning after the publication of the study (Näsi 1980, p. 14). Because of this, outputs of conceptualization can be perceived as hypotheses until they have been verified successfully.

Literature and conceptual research was done for all of the articles of the thesis to find theoretical foundations related to each research issue. The first part of the thesis, especially chapters 2 and 3, is also based on conceptual analysis. A theoretical framework is provided in these chapters by analyzing the field of business information management, key definitions of BI, and how BI relates to other intelligence concepts and information-intensive managerial activities. Articles IIa and IIb were based only on a literature review and conceptual analysis because the aim of those articles was to analyze and define various and partly overlapping concepts and metrics that are used in
the context of BI. In Article IIa, an alternative approach for the categorization of business information was suggested and the authors demonstrated how the categorization might be constructed and presented as a “cube” of business information. The typology and constructing were based mainly on the authors’ conceptual research and hypothesis. The construction was analyzed by placing different information needs of managers at different companies into the cube. The tests were not formal enough to prove the practical utility of the construction. Hence, the requirements of the constructive study could not be fulfilled in the study (Kasanen et al. 1993, p. 253) and the outcomes of the article are mainly in the form of assumptions and suggestions.

Because few academic research articles address the measurement of BI (Marin and Poulter 2004), the authors aimed to generate a comprehensive review of the topic as well as descriptions of various metrics that are applicable in practice, in Article IIb. Also, the inclusion of business performance measurement literature provided new insights on the issue. The research themes were examined using a literature review and conceptual analysis. The literature covered included publications on BI, especially related to the measurement of BI, and also works on business performance measurement. On the basis of the literature and analysis, the conceptual framework for the measurement of BI and proposals concerning BI metrics and measurement practices were illustrated.

Survey

The term “survey” typically refers to questionnaire, interview, and observation methods (see, e.g., Rossi et al. 1983; Hirsjärvi and Hurme 1988; Forza 2002). In all of these methods, data are collected in a standardized way and the target population forms a sample of a certain basic population. Surveys are at their best in producing information about attitudes, values, and opinions of individual persons within the same system. In other words, surveys are viable for clearly defined problems (Uusitalo 1995, pp. 92–93). According to Pinsonneault and Kraemer (1993, p. 78), the main purposes for surveys are exploration, description, and explanation. Gummesson (1993, p. 28) defines questionnaire surveys as a data generation tool that is most generally used in business cases because they can be used to create objective and scientific research that also can be tested for reliability and repeated easily. Questionnaires can be used as a supportive part of quantitative and qualitative analysis. However, they are related mostly to quantitative methods, because a standardized questionnaire can be analyzed with statistical methods (Alasuutari 1999). Forza (2002, p. 166) lists the methods of questionnaires as follows: by telephone, mailed, or personally administered.

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20 Kasanen et al. (1993, pp. 256, 323) define a construction as a solution that has practical relevance and connections with a scientific framework.
There are several advantages to using a questionnaire. Hirsjärvi and Hurme (1988, p. 191) and Forza (2002, p. 167) emphasize the efficiency of the method: quite a wide population can be covered with a rather wide range of questions in a compact time scale. Of course, the overall cost depends on the primary research methods; personal interviews, even semi-personal ones via the telephone, are more expensive than non-personal approaches involving mail, e-mail, or a Web-based questionnaire. If the population is remarkably wide, the analysis of answers is also faster and more effective on account of the codified responses (Fink and Kosecoff 1985; Miller 1991). However, there are some negative sides to non-personal interviews (Gummesson 1993, pp. 30–32; Forza 2002, p. 167). For example, a researcher cannot observe respondents’ nonverbal reactions and there is no possibility of re-explaining questions to the interviewee after sending. Misunderstood, leading, or overly complex questions are difficult to control, especially in postal, e-mailed, and Web-based questionnaire. Accordingly, it is important to test a questionnaire with people familiar with the research theme but also with outsiders (Forza 2002). According to de Vans (1990, p. 80), the following four aspects should be considered, at least, in the development of a survey questionnaire:21

- selection of the areas to be studied
- construction of the questions
- evaluation of the questions
- the layout of the questionnaire

Questions are typically categorized as structured, unstructured, and semi-structured (Gummesson 1993, p. 28). Structured questions are also called formal questions, because they have predetermined response alternatives and thus the responses are closed. Because of this, it is easy to translate the choices defined on the scale into numbers and to analyze the answers with statistical methods (Clark-Carter 1997). Unstructured questions are open-ended and thus more demanding to analyze. Generally, answers to open-ended items demand some qualitative interpretation. However, formal questions are often supplemented with open-ended questions because these add a qualitative touch to the questionnaire (Gummesson 1993, p. 29).

Articles Ia and Ib were based on two surveys conducted in the top 50 Finnish companies, in 2002 and 2005. On account of the quite small size of the Finnish market and the limited interview resources, the target of the surveys was limited to the top 50 companies by net sales.22 The target companies represented a wide array of

21 Creation of a good questionnaire is discussed in a number of works (see, e.g., Hirsjärvi and Hurme 1988; Gummesson 1993; Forza 2002).
22 Respondents were selected on the basis of Finnish business magazine Talouselämä’s top-500 lists in the spring of 2002 (Saarelainen and Vanhanen 2002) and 2004 (Lilius 2004). The top-50 list has not changed radically. 90 percent of the companies were the same, and thus the conclusions based on comparison between these two studies should be justifiable.
multinational Finnish companies with a need to understand both the local and global business environments in order to survive and extend their operations to other countries. The surveys were carried out to collect primarily descriptive data on the prevailing state of BI in Finland. Telephone interviews were used as the primary data collection method, for reasons of distance, timetable, and number of respondents.

In both studies, individuals responsible for BI in the target companies were interviewed. The respondents’ contact information was provided by the orderer of the surveys. Most interviewees represented middle management, but there were also a couple of respondents from the top management. The job titles of the respondents varied quite a lot because the titles reflected the position and focus of intelligence activities of each responding company. The interviewees were sent a cover letter and a questionnaire by e-mail before the interview to enable the discussion to proceed more smoothly. During the interviews, the author navigated the respondents through the questionnaire and assisted when necessary. To increase the response rate, each respondent was promised full anonymity.

The 2002 survey had 46 participants, and the response rate was 92 percent. Four companies declined to respond on grounds of trade secrecy or demanding timetables. In 2005, the number of useful answers was 41, for an 82 percent response rate. Nine companies declined to answer the survey. The main reason for refusal this time was lack of time. For both surveys, respondents were categorized into three groups by line of business: industry, trade and services, and ICT. The industrial background of the respondents did not appear to differ very much between the surveys, on account of the small amount of change in the company list.23 Table 1 gives an overview of the surveys.

Table 1. Response patterns of the surveys.

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaires sent</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Total responses</td>
<td>46</td>
<td>41</td>
</tr>
<tr>
<td>Refusals</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Response rate</td>
<td>92%</td>
<td>82%</td>
</tr>
</tbody>
</table>

In both surveys, the questionnaire had three sections: 1) definition of BI, 2) organization of BI, and 3) future outlook of BI. In 2002, there were 16 questions, whereas the 2005 survey had 19. Questions were derived from the research questions and the theoretical framework used in the study in question. In addition, the 2005 questionnaire was based on the 2002 survey to ensure comparability of the results. In 2002, the questions were

23 The industrial background of the respondents did not appear to differ very much between the surveys, on account of the small amount of change in the company list.

27
confirmed by the author and BI professionals involved in the design and testing of the questionnaire. In the testing phase, BI professionals and outsiders were asked to fill in the questionnaire and evaluate the suitability and understandability of the questions. In 2005, minor modifications were made on the basis of the shortcomings perceived in the first questionnaire. The new questionnaire was tested by BI academics and managers.

The questions in both surveys were mainly multiple-choice and closed-ended questions, but there were a few open-ended questions also. Answers to the closed-ended questions were given on a nominal scale. For some of the closed-ended questions, the respondents were also asked to elaborate on their answers. The author documented the interviews using handwritten notes. The responses were analyzed and interpreted with quantitative and qualitative methods. The analysis of the survey responses is discussed in greater precision in the next section of this chapter. On the basis of the survey results, more detailed research foci for the thesis were identified.

**Single-case study**

A case study is considered a suitable research strategy for new or complex areas (Eisenhardt 1989; Yin 1994). Case research allows the use of multiple data collection methods – e.g., interviews, documentation, and questionnaires. Eisenhardt (1989, p. 532) states that a deep understanding of cases is essential in building new theories. Thus, a case study is also an appropriate research strategy when the existing base of theory is thin or the research problem is too complicated to examine outside its natural environment (Bonoma 1985; Eisenhardt 1989). The research can be based on either single or multiple cases (Yin 1994, p. 14), and the data can be qualitative, quantitative, or both (Eisenhardt 1989; Voss et al. 2002). With a single-case study, a deep understanding of the research theme is gained, whereas use of multiple cases contributes to more extensive understanding of the phenomena under study and provides more generalizable results.

A single-case study was chosen to produce empirical data for articles IIIa and IIIb. In both studies, one of the factors in its selection was that a single-case study provides worthwhile and profound insight into the themes for research in the companies considered. The selection of the cases is discussed in more detail in section 1.5.4. The aim of Article IIIa was to integrate a BI process into the process of strategic management in a case company. Because the co-author of Article IIIa participated in the design process as a facilitator, the research method chosen offered direct access to the research data needed. In addition to participant observation, the empirical data were collected via 20 open-ended interviews and from documentation, such as internal reports, unofficial memoranda, and company presentations. The proposed structure for the strategic BI process for the case company was suggested on the basis of the empirical data.

With Article IIIb, one of the authors worked at the case company, and thus direct observations were used as a source of data. The information gathered yielded insight but
might be biased because of the dual role of one of the authors. Accordingly, the two other authors aimed to be critical enough to ensure that the article would not present too biased a view. The findings of the article were based on comparison between the empirical experiences from the case company and the results of the literature review. The framework based on conceptual analysis and the literature review done for Article IIb were evaluated and refined in light of the results of the single-case study.

**Interview**

According to Forza (2002, p. 167) and Uusitalo (1995, p. 91), during interviewing an interviewer puts questions to an interviewee, who responds verbally. Typically, interviews are individual, but sometimes a group interview is more suitable (as in the case of a focus group).24 Alasuutari (1999, p. 153) emphasizes that single interviews produce different data than group interviews do and that this should be acknowledged in analysis and interpretation of results. Gummesson (1993) states that interviews are used to provide deeper insight into the research field. Above all, interviews suit research in which the phenomenon is relatively complex. Gummesson (*ibid.*) says that existing material is also a form of interview as a researcher “interviews” texts and bookshelves.

Hirsjärvi and Hurme (1988, pp. 35–36) explain that the results of a structured interview are reported upon with a structured questionnaire, while the interview itself is conducted in roughly the same way as interviews in general. Because the structured interview is limited to responding to predetermined questions, the concepts chosen reflect the researcher’s views more than the respondent’s. A thematic interview is defined as a kind of discussion. According to Hirsjärvi and Hurme (1988, pp. 35–36), a thematic interview is a semi-structured interview that is focused on common themes and does not have questions in any pre-established order or form. The answers of a thematic interview are open-ended, but the themes for discussion are predetermined. An interviewer can thus change the form of the interview and even add or remove some topics during the interviewing. Often, the interviewer uses a checklist to guide the choice of question themes. One weakness of a thematic interview is that it is demanding for an interviewer. Because the interviewer has an active role, he should have sufficient understanding of the research issue (Gummesson 1993, p. 33).

As discussed above, the empirical data of articles Ia and Ib were gathered using telephone interviews to provide a wide understanding of the prevailing state of BI in the top 50 Finnish companies. In Article IIIa, the study took the form of semi-structured themed interviews conducted in late 2004 with 20 selected representatives of the case company. The empirical data were collected in order that the establishment of an intelligence

24 A focus group is a specific type of group interview (see, e.g., Gummesson 1993; Morgan 1998). It is led by a moderator, and the group focuses on a specific theme.
process and a network in the case company could be guided. Although the respondents were interviewed individually, every interview addressed the same issues for discussion in the form of 32 in-depth open-ended questions covering issues defined beforehand. However, the order of questions and level of detail varied among respondents. The interviewees were chosen in cooperation with the case company and with the aim of selecting people who had a key role in strategic decision-making in the company. The duration of an interview varied between one and two hours. The interviews were reported upon in written notes, but they were also recorded to verify the answers. The interviews were not transcribed, on account of the duration and the number of respondents. Findings from the thematic interviews were analyzed with qualitative analysis methods (cf. Hirsjärvi et al. 2004).

1.5.3 Data analysis for the survey responses

The samples used for analysis in the survey research were the 46 largest Finnish companies by sales revenue in 2002 and the top 41 in 2005. The companies researched in both studies were split into three groups by line of business: industry, trade and services, and information and communication technology (ICT). The sample for 2002 comprised 17 companies in industry, 23 trade and services companies, and six ICT companies, whereas there were 17 industrial companies, 18 trade and services companies, and six ICT companies studied for 2005. Table 2 provides the frequency distributions for all of the companies by industry.

Table 2. Frequency distributions of companies in the samples, by industry.

<table>
<thead>
<tr>
<th>Line of business</th>
<th>Frequency, 2002</th>
<th>Percent, 2002</th>
<th>Frequency, 2005</th>
<th>Percent, 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>17</td>
<td>37%</td>
<td>17</td>
<td>41%</td>
</tr>
<tr>
<td>Trade and services</td>
<td>23</td>
<td>50%</td>
<td>18</td>
<td>44%</td>
</tr>
<tr>
<td>ICT</td>
<td>6</td>
<td>13%</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>100%</td>
<td>41</td>
<td>100%</td>
</tr>
</tbody>
</table>

The SPSS software package was used to provide descriptive statistics for the variables used in the surveys (see articles Ia and Ib). Before the testing phase, the research data were considered once again, and some unclear items were corrected or eliminated from the data set. Because of this, there are some minor differences between the results given in articles Ia and Ib and the figures presented in the conclusions of the dissertation. The body of tests considered was narrowed because of the nominal variables in the research data. The type of the research data prevented the use of common tests for equality of
group means, such as the independent samples t-test and analysis of variance, since the assumptions for these tests did not hold for the data. Because full description of the test data would require numerous pages, the examination of test data here is confined to the survey responses that are of greatest importance in the dissertation context. Table 3 provides a summary of the tested responses.

Table 3. Summary of the tested research data combined from the 2002 and 2005 samples.

<table>
<thead>
<tr>
<th>Case Processing Summary</th>
<th>Cases</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Valid</td>
<td>Percent</td>
<td>Missing</td>
<td>Percent</td>
<td>Total</td>
<td>Percent</td>
</tr>
<tr>
<td><strong>Systematic intelligence activities</strong></td>
<td>87</td>
<td>100.0%</td>
<td>0</td>
<td>0%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>The name of intelligence activities</strong></td>
<td>76</td>
<td>87.4%</td>
<td>11</td>
<td>12.6%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Top management uses</strong></td>
<td>74</td>
<td>85.1%</td>
<td>13</td>
<td>14.9%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Middle management uses</strong></td>
<td>65</td>
<td>74.7%</td>
<td>22</td>
<td>25.3%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Experts use</strong></td>
<td>65</td>
<td>74.7%</td>
<td>22</td>
<td>25.3%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Other employees use</strong></td>
<td>44</td>
<td>50.6%</td>
<td>43</td>
<td>49.4%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Investments in the next five years will increase significantly</strong></td>
<td>86</td>
<td>98.9%</td>
<td>1</td>
<td>1.1%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Investments in the next five years will increase moderately</strong></td>
<td>86</td>
<td>98.9%</td>
<td>1</td>
<td>1.1%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Investments in the next five years will remain the same</strong></td>
<td>86</td>
<td>98.9%</td>
<td>1</td>
<td>1.1%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Investments in the next five years will decrease moderately</strong></td>
<td>86</td>
<td>98.9%</td>
<td>1</td>
<td>1.1%</td>
<td>87</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Investments in the next five years will decrease significantly</strong></td>
<td>86</td>
<td>98.9%</td>
<td>1</td>
<td>1.1%</td>
<td>87</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The data for the nominal-scale types of questions and their statistical significance were checked with the Pearson chi-square ($\chi^2$) test. The Pearson $\chi^2$ test can be used to compare two variables and their observed frequencies with the expected frequencies, in order to determine whether certain differences in the dependent variable can be explained by characteristics of a different independent variable. The independent variable in this test design was the year of sampling, and the dependent variables were the various BI activities in the target companies.

In the Pearson $\chi^2$ test, results are evaluated by reference to a chi-square distribution. The test statistic is compared to the chi-square distribution with the degrees of freedom ($c-1)*(r-1)$, where $c =$ the number of columns and $r =$ the number of rows. In the dissertation, the degrees of freedom was therefore one. Technically, the chi-square value is calculated by finding the difference between each observed and theoretical frequency, squaring them, dividing each by the theoretical frequency, and taking the sum of the results. The chi-square value is calculated as follows:
\[ \chi^2 = \sum_{i=1}^{R} \sum_{j=1}^{C} \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \]  

(1),

where \( O_{ij} \) = an observed frequency, \( E_{ij} \) = an expected frequency asserted by the null hypothesis, \( R \) = the number of rows, and \( C \) = the number of columns (see, e.g., Alkula et al. 1994, pp. 218–219)

The significance level of the tests in the dissertation was chosen to be five percent. Table 4 provides the results from the Pearson \( \chi^2 \) test for how systematic intelligence activities were seen as being. The results indicate that there appears to be a statistically significant difference (\( p \leq 0.05 \)) between the systematic use of intelligence activities in 2002 and 2005.

Table 4. Results of performing the Pearson \( \chi^2 \) test for the systematicity of intelligence activities.

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>% within Year of sampling</th>
<th>Systematic intelligence activities</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>37</td>
<td>80.4%</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>19.6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>39</td>
<td>95.1%</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.9%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Count</th>
<th>% within Year of sampling</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>76</td>
<td>87.4%</td>
<td>87</td>
</tr>
<tr>
<td>11</td>
<td>12.6%</td>
<td></td>
</tr>
<tr>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crosstab</th>
<th>Systematic intelligence activities</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of sampling</td>
<td>Count</td>
<td>% within Year of sampling</td>
<td>Systematic intelligence activities</td>
<td>Yes</td>
</tr>
<tr>
<td>2002</td>
<td>37</td>
<td>80.4%</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>39</td>
<td>95.1%</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>76</td>
<td>87.4%</td>
<td>87</td>
<td></td>
</tr>
</tbody>
</table>

Chi-Square Tests

<table>
<thead>
<tr>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>4,234a</td>
<td>1</td>
<td>.040</td>
<td></td>
</tr>
<tr>
<td>Continuity Correction</td>
<td>3,008</td>
<td>1</td>
<td>.083</td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>4,583</td>
<td>1</td>
<td>.032</td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td>4,185</td>
<td>1</td>
<td>.041</td>
<td></td>
</tr>
</tbody>
</table>

N of Valid Cases 87

a. Computed only for a 2x2 table
b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.18.

Symmetric Measures

<table>
<thead>
<tr>
<th>Value</th>
<th>Asymp. Std. Error</th>
<th>Approx. t</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal by Nominal</td>
<td>Phi</td>
<td>.221</td>
<td>.040</td>
</tr>
<tr>
<td>Cramer's V</td>
<td>.221</td>
<td>.040</td>
<td></td>
</tr>
<tr>
<td>Contingency Coefficient</td>
<td>.215</td>
<td>.040</td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>87</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.
The Pearson $\chi^2$ test was performed with the research data presented in Table 3. From the test data presented in tables 5, 6, and 7, there appears a statistically significant difference ($p \leq 0.05$) between the utilization rate by middle management, experts, and other employees in 2002 and 2005. The rest of the test results show no statistically significant difference ($p > 0.05$) between the 2002 and 2005 research data and are presented in appendices 1–7.

Table 5. Results of performing the Pearson $\chi^2$ test for middle management utilization of information and knowledge gained through intelligence activities.

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>% within Year of sampling</th>
<th>Middle management uses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>No</td>
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</tr>
<tr>
<td>2002</td>
<td>26</td>
<td>11</td>
<td>37</td>
</tr>
<tr>
<td>2005</td>
<td>39</td>
<td>0</td>
<td>39</td>
</tr>
</tbody>
</table>

Chi-Square Tests

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>13,557</td>
<td>1</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correction</td>
<td>11,261</td>
<td>1</td>
<td>.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>17,814</td>
<td>1</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td></td>
<td></td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>13,378</td>
<td>1</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
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</table>

N of Valid Cases: 76

Symmetric Measures

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Asymp. Std. Error</th>
<th>Approx. $\hat{\phi}$</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
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<td>.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cramer's V</td>
<td>.422</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contingency Coefficient</td>
<td>.389</td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>

N of Valid Cases: 76

a. Computed only for a 2x2 table
b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.36.

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.
Table 6. Results of performing the Pearson $\chi^2$ test for experts’ utilization of information and knowledge gained through intelligence activities.

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
<th>% within Year of sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td></td>
<td>26</td>
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<td>70.3% 29.7% 100.0%</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>39</td>
<td>0</td>
<td>39</td>
<td>100.0% .0% 100.0%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>65</td>
<td>11</td>
<td>76</td>
<td>85.5% 14.5% 100.0%</td>
</tr>
</tbody>
</table>

Chi-Square Tests

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>13.557</td>
<td>1</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correction</td>
<td>11.291</td>
<td>1</td>
<td>.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>17.814</td>
<td>1</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td></td>
<td>.000 .000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>13.378</td>
<td>1</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N of Valid Cases 76

Symmetric Measures

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Asymp. Std. Error</th>
<th>Approx. $\phi$</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phi</td>
<td>.422</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cramer's V</td>
<td>.422</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contingency Coefficient</td>
<td>.389</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N of Valid Cases 76

- a. Computed only for a 2x2 table
- b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.36.

Table 7. Results of performing the Pearson $\chi^2$ test for other employees’ utilization of information and knowledge gained through intelligence activities.

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
<th>% within Year of sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td></td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>100.0% .0% 100.0%</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>16</td>
<td>23</td>
<td>39</td>
<td>41.0% 59.0% 100.0%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>21</td>
<td>23</td>
<td>44</td>
<td>47.7% 52.3% 100.0%</td>
</tr>
</tbody>
</table>
The level of relationship between the independent and dependent variables generally is not very strong, but it is clearly visible nonetheless, as can be seen from the association measurements presented in the table figures calculated by SPSS. Obviously, the data gained with the open-ended survey questions were very multifaceted, and thus they were more difficult to quantify than the answers to the closed-ended questions. Analysis for the latter was faster also, due to the codified responses. The author classified some open-ended data in similar kinds of categories in order to fit the data to a statistical model.

1.5.4 Brief description of the case companies

The empirical data of articles IIIa and IIIb were gathered from two case companies, denoted as A and B. The choice of cases was based on theoretical and practical criteria (cf. Eisenhardt 1989, p. 537; Yin 1994, p. 51; Curtis et al. 2000, p. 1002). These particular companies were selected because both of them represented large organizations in the telecommunications sector. Companies in this industry were an especially interesting research target because it is strongly characterized by high “clockspeed.” In this context, the term “clockspeed” refers to the rate of evolution in business. Fine (1998, p. 19) states that the time window for decision-making decreases as the clockspeed of the business increases. Collecting, organizing, analyzing, and utilizing appropriate information in order to make better and faster decisions is crucial for both case companies, on account of the nature of the industry, and thus the cases presented salient aspects of the research phenomenon.
Another case company participated in a VisiPro research project at the Institute of Business Information Management (cf. section 1.1.5). While the sample was very small, both companies were studied very intensively and produced information about the various phenomena under study (cf. Curtis et al. 2000, p. 1002). The findings of the single-case studies are discussed in depth in articles IIIa and IIIb, but the companies are introduced in brief below.

Company A

The case company in Article IIIa is a telecommunications company that has a global presence, supplying electromechanical modules to the key players in the telecommunications industry. Thus, Company A operates in a business-to-business environment. The company focuses on three main business areas: technology, manufacturing, and supply integration. The company has operations in 11 countries. In 2005, Company A employed an average of almost 7,000 persons and the company’s net sales came to 667 million euros. It is listed on the OMX Helsinki Stock Exchange.

Company B

Company B in Article IIIb is a Finland-based full-service telecommunications company whose customers include large companies, societies, small and medium-sized enterprises, and consumers. The company offers diverse voice and data services, connections to the Internet and content services, voice solutions, customized communication and ICT solutions, international communication solutions, and network operator services. In 2005, the number of employees was approximately 5,000 and the company generated 1,337 million euros in revenue. Its shares are listed on the OMX Helsinki Stock Exchange.

1.6 Overview of the thesis

This doctoral thesis consists of two parts. The first part includes an overview of the thesis and a theoretical exploration of the main issues and perspectives from which BI has been approached in the existing literature. The second part of the thesis consists of six research articles

25, which address the research questions and objectives presented in Section 1.2. In Figure 3, the structure of the first part of the thesis is illustrated.

25 The articles are discussed in Section 1.4 and in the second part of the thesis.
In Chapter 1, the practical and theoretical background of the research is described; research questions, objectives, and the outline of the thesis are specified; and the research methods are presented. Also, brief summaries of the six research publications are provided. The theoretical framework of the thesis is addressed in chapters 2 and 3. In Chapter 2, the role of information in business is examined. In addition, the requirements for effective management of business information and identification of information needs are discussed. Also in Chapter 2, the doctrine of business information management is examined. The chapter offers the necessary background information for the conceptual analysis of BI in Chapter 3 and especially for the results discussed in Chapter 4.

At the beginning of Chapter 3, the concept of BI and its related intelligence concepts are analyzed and integrated with each other. On the basis of the conceptual analysis of BI, the concept is examined from different points of view, and, at the end of the chapter, it is discussed how BI relates to other information-intensive managerial activities of a company. Hence, the most essential conceptual framework for the thesis is built in Chapter 3. Finally, the research questions are answered in Chapter 4 by way of summary and discussion of the key results of the dissertation. The last chapter also includes the assessment of the thesis and offers suggestions for further research.
2 THEORETICAL BACKGROUND

2.1 What is information?

Information is an important factor in production in the information society (see, e.g., Hannula 2001). In addition, more and more people work in occupations in which information and know-how are emphasized and various information and communication technologies are utilized (Sitra 1998). A company can improve its competitiveness by developing new ways of action that are based on the more efficient information management thus allowed. Development of the information society requires that individuals, communities, and societies make their contribution to improving, sharing, and managing information. Thus, information is found to have a significant role in the present society and it is essential for the term “information” to be defined precisely enough for the significance of information to be understood.

According to the classical definition, information is a well-defined true judgment. This definition is based on the conceptions of the theory of knowledge, and it derives from the ideas of Plato and other Greek philosophers. According to the classical definition, there are three conditions that information has to fulfill. First, there always must be an explanation that information can never be a bare statement or claim. Second, there is always a demand for the truth. According to the third condition, an erroneous belief cannot be information. It can, however, be impossible to find a final truth, and the classic definition may set overly strict demands for information. Niiniluoto (1996) proposes a compromise between the classical definition and practical problems and reshapes the conception of information known as the critical realism of science. According to Niiniluoto, the condition of an explanation disentangles information from a belief, the condition of the truth disentangles the truth from a mistake, and the condition of the belief disentangles information from a hypothetical guess. Hence, the claim with the best explanation can be called information. These claims can be called information even when their truth is doubted. Information is closing in on the truth all the time, and thus the quality of information sharpens with time.

In the literature, there are several definitions for data, information, knowledge, and intelligence (see, e.g., Davenport and Prusak 1998; Thierauf 2001; Silver 2004). In addition, there are various opinions regarding the relationship of these concepts. For example, “knowledge” is considered a broader concept than “information” in most cases, and “data” is typically understood as the lowest level of an information hierarchy. Stenmark (2002, p. 930) reminds us that neither of these grouping is exact and that the concepts are interrelated in several complicated ways, depending on the purpose for which the data, information, knowledge, and intelligence are to be used. In this thesis,
one of the most well known classifications is used, and thus a hierarchical distinction
among data, information, knowledge, and intelligence is made.

Davenport and Prusak (1998) define data as a set of separate and objective data
elements. Unanalyzed elements of this set, such as character strings, signals, numbers,
texts, and photos, are the raw material of the first level in the information hierarchy. A
receiver can understand the meaning of data only when the data have a certain context.
Data can be defined as consisting of a portion of raw data that has completely separated
from the concept system. Thierauf (2001, p. 8) defines information as data in structured
form. Information consists of separate data units that are connected to each other. Ståhle
and Grönroos (1999) emphasize that a receiver can understand information only if it has
value for him. Information usually contains some kind of message with some meaning
or interpretation dependent on a receiver. Because information has been given a
meaning, it is more valuable to the receiver than data.

At the third level of the information hierarchy, significance is imparted to information
and information turns into knowledge. However, information does not turn into
knowledge until a receiver has processed the information and connected it to his own
mental structure. Thus, knowledge contains both structured and unstructured elements.
According to Maier (2002, p. 35), knowledge has a dual role in companies: it forms the
basis of company-specific actions, but at the same time it is generated by them.
Davenport and Prusak (1998, pp. 5–6) emphasize that knowledge is more valuable than
data or information since it is closer to action and can be utilized to make sounder
decisions. On the other hand, it is also more complicated to protect or disseminate
knowledge. Thus, the value of knowledge is not axiomatic, because it depends on, e.g.,
employees and their motivation and turnover.

Intelligence is knowledge and foreknowledge of the world around a company, and it
serves as a prelude to presidential decision and action (Herring 1988). Then, a receiver
has a way of applying information and knowledge to solve problems or to carry out an
assignment. According to Thierauf (2001, pp. 10–11), intelligence centers on detecting
crucial trends and patterns as well as relationships between customers’ and a company’s
own activities to identify significant changes and opportunities and to make better
decisions. In summary, intelligence is not only summarized information but also
active knowledge of how to apply the content of information.

The classification of Kasvi and Vartiainen (2000, p. 34) differs from the hierarchical
distinction above. Their categorization is based on five questions as follows: 1) what
information is needed, 2) how information is managed, 3) why information is needed,
4) from where information-related needs are gathered, and 5) when information is
needed. Savage’s (Committee for the Future 2001, p. 35) classification is practical, and
it aims to give well-defined instructions concerning how essential information can be
identified and how the information can support the success of a company. According to Savage (ibid.), information consists of know-how, know-who, know-what, know-why, know-when, and know-where. Choo (1998), in turn, employs four categories:

- everyday information (individual experiences of different social situations)
- personal information (individual experiences that do not relate to each other)
- applied information (information that a person or a group has generated in order to get through a certain situation)
- public information of the society (e.g., books, reports, and printed media)

Like information, knowledge is categorized in numerous ways. According to Maier (2002, pp. 56–59), these classifications are made mainly with a pair of definitions that are derived from various dimensions of knowledge. Those dimensions include the content of knowledge, the value of knowledge, and the life cycle of knowledge. Polanyi’s (Nonaka and Takeuchi 1995, p. 59) approach is one of the most well known pairs of definitions. Polanyi categorizes knowledge as a continuum between tacit and explicit knowledge. This definition is based on Polanyi’s observation that most of workers’ know-how consists of empirical knowledge. Tacit knowledge is mainly hidden and personal, and thus it is quite difficult to formalize, communicate, or share (Nonaka 1991, pp. 98–99). Tacit knowledge is dependent on, e.g., context, beliefs, experiences, values, and feelings, whereas explicit knowledge is exact and can be represented by numbers and words. Explicit knowledge is thus easy to store and to disseminate formally and systematically. Tacit knowledge is based on individual experiences, while explicit knowledge is founded on making deductions rationally. According to Tiwana (2002, p. 44), there are three key dimensions of knowledge: 1) type, which constitutes, e.g., technological and business categories; 2) focus, described as either strategic or operational; and 3) complexity, referring to the distinction between tacit and explicit information.

Data and information can be considered concepts close to explicit knowledge, and knowledge and intelligence as parts of tacit knowledge. However, the division between tacit and explicit knowledge is not the best possible in identifying information needs from the business standpoint. Even if there is no universal definition or classification for information, information and (especially) information management are clearly considered the significant competitive factors in the business world (Dzinkowski 2000, p. 32). The critical information is unequalled in power, and it exists in the core activities of business and adds value for customers. In addition, the crucial information acts as one of the most significant bases for the current and future value of a company.
2.2 Information needs

2.2.1 Varying information needs

Typically, companies need information for the support of decision-making\(^{26}\) and choices. With suitable information, managerial objectives can be set and existing options can be evaluated, prioritized, and timed. In addition, a company can protect itself from business risk and cut costs with relevant information. Information needs exist in the lack of information, understanding, or know-how required at a specific moment. The lack of business information is an obstacle that becomes clear when a company tries to fix problems or to utilize existing opportunities. Choo (2002, p. 28) remarks that an information management process\(^{27}\) cannot be useful as a whole unless the information needs of a company are identified exactly. Hence, identifying information needs is the starting point of an information management process and serves as the most important template for the success of the later phases of the process.

According to Auster and Choo (1996, pp. 67–68), recent studies have approached information needs from three main viewpoints: the cognitive, the systems, and the user-group level. At the cognitive level, the research focuses on individuals because it is, after all, an individual who needs and utilizes information. At the systems level, the aim is to take full advantage of learning and value-adding by integrating relevant information into a company’s processes and outputs. The information needs of the groups of people that form a company and how they gather, process, and utilize information are studied at the user-group level.

Butcher (1998, p. 45) states that the information needs of a decision-maker depend on the types of decisions that are needful in his work. Höglund and Persson (1985, pp. 43–44) divide information needs into subjective and objective needs. According to them, subjective information is something an individual himself thinks is needed in the decision-making at hand whereas objective needs involve common information that is usually needed in certain problem-solving. Stanat (1990, pp. 41–42) sorts valuable information areas according to business activities. The list consists of, e.g., industrial trends, laws and decrees, international events, mergers and acquisitions, and operations of competitors. Stanat’s classification is, however, one-sided because she examines information needs only from the standpoint of the external business environment. Besides Stanat (1990), Vaarnas and Virtanen (2001, pp. 9, 12, 141–147) state that a company needs more and

\(^{26}\) According to Mintzberg et al. (1976, p. 246), a decision process is “a set of actions and dynamic factors that begins with the identification of a stimulus for action and ends with the specific commitment to action.” Harrison (1996, pp. 48–49) finds the managerial decision process to consist of the following components: setting managerial goals, searching for alternatives, comparing and evaluating alternatives, the act of choice, implementing the decision, and follow-up and control.

\(^{27}\) A process of information management is further discussed in Section 2.4.
more refined information about the business environment, in order to reduce uncertainty in decision-making. They classify business information needs under four headings:

- Organization-specific information – e.g., general information about a company, business activities, and key success factors.
- Industry-specific information – e.g., information about supply and demand situations and change processes in the industry.
- General knowledge of the business environment – e.g., demographic, physical, international, legislative, political, economic, technological, social environment, and cultural information – often relating to matters on which companies cannot have any effect but that have an influence on, e.g., the entire industry.
- Information related to a single company or a unit therein.

Pirttilä (1997) studied business information needs in a large Finnish company in her dissertation. The results of her thesis indicate that the most important business information areas include the economic situation of competitors, the structure of ownership, new products, technological resources, marketing position, market behavior, organizational structure, investments, and capital expenditure plans. However, these information requirements are situation- and company-specific, and thus they best reflect the information needs of the case company of the thesis in question.

Recent studies have found that identifying information needs is one of the most difficult operations of information management (Ashill and Jobber 2001; Global Intelligence Alliance 2005; Article Ib). No outside consultant can work these out in depth, and, at the same time, the decision-maker finds identifying needs too demanding and he cannot articulate his information needs exactly enough (Morris 1994). According to Pirttilä (2000, pp. 65–66), one reason for this problem is that some information needs are unconscious and thus are impossible to determine even with the best methods. Typically, such information needs do not arise until the situation of actual decision-making. Also, Karlöf (2002, p. 225) puzzles over problems related to identifying information needs. He mentions the dynamics of information as one of the difficulties. As is information, the business environment is increasingly dynamic, and therefore the information needs of decision-makers and the foci of decisions change quickly. On the other hand, Marti (1996, pp. 126–129) states that there is a need for the element of surprise in decision-making because surprises often contain information that is not wanted but is essential for decision-makers.

To conclude, companies aim to avoid gathering too much information, by identifying information needs as comprehensively as possible. Information provided to decision-makers should address the actual needs instead of burdening them with trivial information or a mass of details. The gap between real information needs and the information gathered is one example of information gaps, discussed presently.
2.2.2 Information gaps

Choo (2002, p. 26) remarks that extensive analysis of the environment where the information is going to be used is needed in order to identify information needs well enough. In addition, Choo says it is valuable to know what is not required. **It is a waste of time and resources to gather and analyze information that decision-makers want but a company does not need for success.** Also, Marti (1996, pp. 126–129) and Kotler (2003) point out that information wants and needs are two different things. This distinction is typically called an information gap. The concept has been approached from several points of view. For example, Harrison (1996, p. 47) considers information gaps from the strategic viewpoint and Zack (1999, p. 135) integrates the knowledge gap28 with the strategic gap29 in order to derive a knowledge strategy from the strategic gap of a company. Dervin (Choo 2002) lists several basic information gaps:

- decision stop (a person faces multiple options for proceeding)
- barrier stop (the only way forward is blocked)
- spin-out stop (there are no options for proceeding)
- perceptual embeddedness (the ambiguousness of the options is not known)
- situational embeddedness (the options available are not known)

In most cases, there is an area where the most relevant information can be offered, and therefore the focus of collection should be on the area where information wants and needs overlap (area 4 in Figure 4). Pirttilä (1997) emphasizes that this area has the greatest utilization potential, although this information cannot be gathered every time.

![Figure 4. Information gap](image)

Figure 4. Information gap (based on Aguilar 1967, p. 7; Marti 1996, p. 124; Pirttilä 1997, p. 46).

As illustrated in Figure 4, there are often needs that it would be valuable to fill while there is no call for this kind of information because decision-makers feel no need for it or are not aware of its significance or even its existence (Aguilar 1967, p. 7; Ghoshal

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28 The knowledge gap exists between what a company must know to execute its strategy and what the company really knows (Zack 1999, p. 135).
29 The strategic gap expresses what the company must do and what it can do (Zack 1999, p. 136).
and Kim 1986, p. 57; Pirttilä 1997, p. 46). Aguilar (1967) categorizes the information gaps of the figure into three classes. First, decision-makers receive information they need but do not want. Second, there is a gap between the information decision-makers want and what they really need. The third gap lies between the information needed and the information received. Vitt et al. (2002, pp. 15, 29) call the gap between the information that decision-makers need and the information that is received the analysis-gap. The focus of their definition is on information overload, because it is impossible nowadays to find the information desired or needed with acceptable cost and in a reasonable time.

Because the information sources available are numerous, careful attention should be paid to their selection and use. There is always a reason for information’s release, and the content of a publication may be even deliberately misleading (Aguilar 1967, p. 60). In addition, many companies are no longer just gathering information; they are also protecting themselves against, e.g., the snooping activities of competitors. Sometimes, knowing what information is not required may be of equal use to knowing precisely what information is needed. In addition, the information gathered should be supplied through suitable and value-adding information products and services in order that the gap between the information required and collected decreases (Choo 2002).

2.2.3 Information needs at different management levels

Because each company has its own information needs, it is difficult, if not impossible, to list information needs generically. Business information needs can be roughly divided in half between external information and internal information (see, e.g., Uusi-Rauva 1994, pp. 5–6). Internal information typically consists of company-specific information – e.g., production and sales figures and know-how of employees – whereas external information consists of information on, e.g., the business environment, technological advances, competitors, partners, and customers. Alongside the division of information, Marakas (2003, pp. 90–91) states, all decisions can be placed into one of three classes: strategic, tactical, and operative. Naturally, the types of information required at these levels differ. The grouping of decisions is quite strict, and in practice drawing lines between different decisions is not so simple. However, the classifications above do form a working starting point for study of information needs at different management levels.

The information needs at different decision-making levels are depicted in Figure 5. At the lowest level (operative level), the significance of internal information is greater than

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30 Protection activities are generally called counterintelligence (see Nolan and Quinn 2000). The term is further discussed in Section 3.1.
that of external information. At the strategic level, external information is more important than internal information. Uusi-Rauva (1994, p. 6) emphasizes that corporate management needs information about 1) the situation or facts that relate to the company or the business environment, 2) quantitative and qualitative objectives, and 3) methods or means and factors by which the mode of operation of a company can be changed to match objectives. Hence, operative activities need information in order to operate without interruptions whereas strategic planning can be described as an ongoing cycle in which different phases need different information. Management accounting is emphasized in Uusi-Rauva’s perspective, but a company needs information about trends, for example, too.

![Diagram of information needs at strategic, tactical, and operative level](image)

Figure 5. Information needs at the strategic, tactical, and operative level (based on Uusi-Rauva 1994, p. 6; Bocij et al. 2003a, p. 19; Marakas 2003, pp. 90–91).

Operative management is not executed only at the lowest levels of a company or strategic management at the highest levels; rather, it is a matter of a discrepancy in weighting. Harwood (1994, p. 31) states that strategic management mainly considers information in relation to forthcoming possibilities because the effects of strategic management are far-reaching and the aim is to be proactive, and thus to find new approaches and work methods. The information needs of operative management are more detailed, focusing on prevailing business activities. Often, operative management is based on the experiences of the past and the aim on which to act. Because the impact of strategic decisions on a company is greater than that of operational decisions, the quality requirements of strategic information and information sources are higher.

In Table 8, Bocij et al. (2003a, p. 19) categorize the information characteristics at strategic and operational levels. As has been mentioned, the observed differences in required form, quality, and sources of information are quite remarkable in operational and strategic decisions. In contrast to Bocij et al. (2003a, p. 19), Herring (1992, p. 54) and Thierauf (2001, p. 196) emphasize that a company always needs both internal and external information in order to make better strategic decisions.
In Figure 6, Laitinen (1998, p. 148) illustrates the nature of information at different management levels. Laitinen (1998, pp. 144–146) defines the task of owners as to create outward circumstances matching the vision and business idea of a company, to delegate implementation of the business idea, and to supervise the effectiveness of execution. The owners need rough information about the direction of trends in the business environment but must also take into account their own preferences (e.g., price/earnings ratio in relation to risks) so that operational preconditions at lower levels are optimistic.
According to the experiences of McKinnon and Bruns (1992, p. 19), information needs typically relate to operative decisions. Because of this, the strategic decision-making viewpoint is often forgotten in identifying information needs. In addition, people who receive strategic information are usually not professional information collectors or analysts, and therefore they should be advised clearly enough to recognize the essential information among the insignificant. In any case, determining the actual information needs is probably the most difficult task in any information management project, and therefore in knowledge-intensive work many information needs are ad hoc in nature.

2.2.4 Methods for identifying information needs

As discussed in the previous sections, decision-making is not always straightforward or rational, and there are many difficulties in identifying information needs of decision-makers (Turban et al. 2001, p. 441). Pirttilä (2000, pp. 66–67) resolves the problem by converting the perspective from identification into demand. Because the call for information is often conscious, it is measured easily and can be examined afterwards. However, this method produces no information on what kind of information a decision-maker really needs and what kinds of information gaps remain. The identification method must be chosen very carefully, and the method selected should be suited to situation-specific requirements (see, e.g., Vuori and Pirttimäki 2006, p. 590).

According to Reynolds (1995, pp. 342–343), a company must start with the identification of business processes in order to perceive what decisions are made and what kind of information really is needed in decision-making. He also states that a company must monitor its critical success factors continually, and therefore these factors for key business units have to be identified as well. Also, Fisher (2004, pp. 10–15) suggests that information needs should be identified through the most essential units and activities of a company. Thereafter, the key decision-makers for those units and processes should be found, so that the information needs of a specific process may be aimed at the right persons. According to Fisher (ibid.), useless information thus can be avoided.

Vitt et al. (2002, p. 57) emphasize the use of brainstorming sessions in identifying information needs. The global view of information needs is easier to achieve if decision-makers are interviewed not individually but together. There are several techniques along with brainstorming sessions for identifying the right information – e.g., written inquiry, observation, structured interview, joint application design, and cross-functional systems (Wetherbe 1991; Morris 1994; Choo 2002). Because these methods are quite elaborate, going through them in more detail is not in accordance with the aims of this thesis. Wetherbe (1991, pp. 53–55) emphasizes that the flow of information must be as wide as the company itself and the information has to be
gathered from numerous sources because most information that is really needed in decision-making comes from outside the company. Wetherbe argues that the main problem is that many information requirements are viewed too narrowly.

It is apparent that both quantitative and qualitative information is needed in successful decision-making. On the basis of the hierarchical classification of information, business information can be categorized as data, information, knowledge, or intelligence (see Section 2.1). In Article IIa, it is, however, stated that this classification scheme is not pragmatic enough. In order to identify the information needs of managers in real business situations, a well-grounded practical framework is required. In Article IIa, three dimensions for classifying business information needs are set forth as follows:

- **The source of information**: inside or outside the company. Information can be gathered from outside the company (e.g., newspapers, research reports, the Internet, trade publications) or inside it (e.g., employees, operational databases).

- **The subject of information**: inside or outside the company. This refers to the content of the information; if the information relates to the company itself, it is internal, and otherwise it is external.

- **The type of information**: quantitative or qualitative. Quantitative information is typically defined as information that can be managed and processed easily, such as statistical information, whereas qualitative information includes, e.g., visions, ideas, and cognitive structures and thus is more difficult to formalize, communicate, or share than quantitative information (Frishammar 2003, p. 319).

These dimensions of business information needs are outlined as the dimensions of a cube (Article IIa). The information source is presented as the X-axis, the subject of the information as the Z-axis, and the information type as the Y-axis. Thus, the cube of business information is based on the sources, subjects, and types of information. The actual cube of business information is constructed by putting these axes together, as shown in Figure 7.

![Figure 7. A cube of business information (Article IIa).](image-url)
The cube of business information provides an illustrative tool for approaching different information needs (Article IIa). In addition, the cube can be used to analyze organizations, including BI-related vendors and service providers, as well as their offerings and position within the marketplace. On the other hand, internality or externality in the various dimensions is subjective: the same information may be available from external and internal sources, and it may relate to either external or internal subjects, depending on, e.g., the receiver and his position. Also, the line between internal and external sources is indistinct in situations of networking because the general aim of networking is to have visible information flows. In Article IIa, how far the source of information should be followed is not specified, and thus there occurs a problem of subjectivity in the framework. According to Choo (2002, pp. 157–158), information is typically transferred and analyzed through numerous sources and providers before reaching an end user (i.e., a decision-maker). This variety complicates the source-based classification of information needs in the above framework also. The two other dimensions in the model are relatively unambiguous and thus are practical for identifying information needs. In summary, both external and internal subjects of information, but also external and internal sources of information, are needed in describing information needs for decision-making from the business perspective.

2.3 Internal and external viewpoints of information

The key to success is said to be the ability of a company to recognize and utilize new external information and to read weak signals. In addition, a company has to take advantage efficiently of existing information and knowledge within the company. In other words, a company has to gather relevant business information from both external and internal sources. As discussed in the previous sections, there are various information needs and even more information sources. The grouping of information sources is often based on their nature. To maximize finding of relevant information, Choo (2002, pp. 31–32) emphasizes that a company has to make plans for how information is gathered. The company-wide plan should include the selection and use of information sources. Logically, sources can be distinguished by their environment, where internal sources are those inside a company and external those outside. For example, Choo (2002, p. 32) divides information sources into two types: external information consists of published materials, such as newspaper and journal

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31 Ansoff (see, e.g., Rouibah and Ould-ali 2002) was the first to present the concept of weak signals in the business context, in 1975. Generally, weak signals denote information received from non-public informal sources and that is mainly complex in nature. Because of the typical characteristics of weak signals, in-depth analysis is needed and several interpretations can be found (Rouibah and Ould-ali 2002).
content, whereas internal information involves internally generated material (e.g., reports). Fogg (Miller 1996, p. 209) further divides the external environment into competitor, customer, the economic, the legislative, the market, the sociodemographic, and technology; several external sources are required for collecting the information needed. Choo (2002, p. 31) reminds us that the information sources should be monitored and evaluated in order to avoid the risk of saturating the system with them.

According to Wheelen and Hunger (1992, p. 47), the scope of the internal environment is composed of a company’s culture, resources, and structure. Culture includes beliefs, expectations, and values created and shared within a company. Resources consist of, e.g., people, raw material, and financial assets, while structure refers to the way the company is organized for communication, decision-making, and workflow. In addition, structure is commonly defined in terms of an organizational chart. Choo (2002) reminds us that employees are the source of the most valuable information but are seldom taken into account in planning information gathering. People can acquire information from several sources by using their senses and interacting socially and thereafter can interpret, summarize, and communicate information more effectively and satisfyingly than any information system. Because of the advantages of human sources, Choo (ibid.) suggests that companies create a database of experts. The database should include subject and business experts who work within the company and external consultants who have worked with it. The experts then act as information sources when information on their fields of expertise is needed.

In order to scan opportunities and threats from the external environment, Wheelen and Hunger (1992, pp. 47–48) divide the external environment into the task environment and the societal environment. According to them, elements and groups of the task environment are in direct contact with the major operations of a company. The actors of the task environment are divided into, e.g., competitors, customers, employees, governments, stockholders, and suppliers. These groups have a dual role in decision-making because they may have valuable sources of information but at the same time they can be a threat to the company. The actors of the societal environment may affect decisions of the company in the longer term, but they have no impact on its short-term activities, and thus they are defined as the general forces (e.g., economic, legal, political, and technological forces).

In addition to the sources of information, the subjects of information are related to both the internal and external environment of a company, as discussed in section 2.2.4. The external subjects include competitor, customer, market, partner, and technological information, whereas internal information consists of, e.g., a company’s own resources and capabilities, financial ratios indicating firm performance, sales metrics for strategic business units, and customers’ profitability contribution. External information can be subcategorized into smaller subjects, and the sources of these pieces of information may
be internal, external, or both. However, some of them are very company and situation-specific, and thus they are not reviewed one by one in this work.

### 2.4 Information as an enabler of business management

As discussed in the previous sections, there are several information needs that depend on, e.g., the decision-maker, situation, and time. Naturally, this diversity of information needs complicates the utilization of information in business management. Hixen (1973, p. 1) stated as early as in the early 1970s that the feature distinguishing a lean and dynamic company from others is the company’s capability to gather new, essential information and to enrich it with personnel. According to Hixen, information is admitted to be one of the essential factors of production and a component of economic growth. Thus, top management should have crucial information, to the greatest extent possible, in the decision situation in order to be successful.

According to Räsänen (2000, p. 17), the success of a company depends on three factors. First, the company has to carry out plans and core tasks well enough. Business management is mostly teamwork in which several people, from different organizational levels and units, participate. Hence, individuals and their know-how play significant roles in decision-making and the company’s success. Second, the company must be able to integrate those operations in compliance with customer needs. The third success factor is the business environment. The top management should foresee changes and make decisions based on real-time, relevant information. Changes in the business environment can be fatal if the company cannot respond to them in time. The top management has to be able to sense, recognize, and estimate changes in the business environment better and more quickly than ever in the information society.

Forrester (Yrjö-Koskinen 1973, p. 1) defines management as the revision of information to form decisions. Also, Simon (1979, pp. 47, 119–122) defines the core task of business management as making decisions. According to him, the greatest barriers to successful decision-making are imperfection of information and difficulties in anticipation. Choo (1998, p. 3) emphasizes that a decision-maker has to analyze information related to alternative resolutions and thus evaluate different possibilities. With relevant information, a decision-maker can choose the most suitable alternative for that moment. Information itself has no value for a company if it is not utilized and new knowledge created (Sydänmaanlakka 2001, p. 171). Successful utilization of

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32 Sometimes, the words “decision-making” and “management” are used as synonyms for each other. One of the core activities in management is decision-making, after which a decision-maker leads or alters the course of a specific proposition or an entire company.
information presumes that the information is systematically created and managed. Probst et al. (2000, pp. 204–206) and Choo (2002, pp. 45–47) mention two purposes for information use: information has to be used for creating or developing knowledge and utilized in decision-making. In creating knowledge, sense and meaning are made for purposive action.

According to Sydänmaanlakka (2001, pp. 172–174), knowledge can be created in many ways – e.g., through studying, brainstorming sessions, or task circulation.33 Nonaka and Takeuchi (1995) have developed a five-phase model of an organizational knowledge-creation process, which encompasses the following phases:

- the dissemination of tactical knowledge
- the creation of concepts
- the explanation of concepts
- the creation of a model
- the adjustment of information

Nonaka and Takeuchi’s (1995) process model illustrates how new knowledge is created; how explicit and tacit knowledge interact; how knowledge can be disseminated; and how knowledge is integrated with a company’s products, services, and systems. New knowledge is created through conversion between tacit and explicit knowledge, and individuals’ tacit knowledge is the basis for that (Nonaka and Takeuchi 1995, pp. 70–73). According to Nonaka and Takeuchi, the model is easier to implement if, e.g., it is part of the company’s strategy, making it easier to identify the company’s information needs. New ideas should emerge as results of the different thinking, conceptualization, and understanding of employees, which increases the company’s ability to adapt to and interpret information flexibly. Also, several studies show that human sources of information are regarded as among the most significant, especially in strategic decision-making (Aguilar 1967; Frishammar 2003; Article IIIa).

Systematic information management allows a company to utilize business information efficiently. According to a Gartner (2000) study, productivity can increase by as much as 10 percent with the utilization of well-organized information management. As discussed in section 1.1.1, the target of information management is to harness information resources and information capabilities so that the company can continuously gain knowledge of and adapt to its changing environment and thus create and reinvent value for itself and its customers (Auster and Choo 1996, p. vii). According to Huotari (2000), the aim of information management is to manage and have control of activities via which the internal information can be recognized.

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33 New knowledge can also be created in constant working conditions.
enriched, shared, and utilized effectively. She states that the information is defined as either static knowledge or a knowing process in the information-management-centered view. Information is explicit when managed as an object (cf. Section 2.1). If it is managed as a process, social characteristics and the significance of tacit knowledge are emphasized. In other words, cultural and sociological factors also must be considered in information management.

In the 1990s, a process view of information management began to gain currency (Davenport 1993; McGee and Prusak 1993). One of the most well known information management processes is Choo’s (2002) information management cycle.34 Choo defines information management as a nonstop cycle with six phases, as shown in Figure 8: 1) identification of information needs, 2) information acquisition, 3) information organization and storage, 4) development of information products and services, 5) information distribution, and 6) information use. According to Choo, an information management cycle does not always contain all of these phases and the phases may occur in a different order – the cycle is generic.

Figure 8. Information management cycle (Choo 2002, p. 24).

Choo’s (2002) model begins at the far right in the figure, illustrating that information is created by a company’s actions (adaptive behavior). These actions interact with those of other organizations and systems to alter the environment and generate new messages and information. In the first real phase, identification of information needs, the company’s personnel must find out what kind of information is needed to solve different problems and to make decisions successfully. Information needs are defined by situation-determined contingencies and by subject-matter requirements. According to Choo (ibid.), the next phase, information acquisition, is driven by the previous one, information needs. Gathering relevant information is complex because there are numerous sources of information both inside and outside a company and information gaps make the acquisition difficult (see section 2.2.2). Troubles can be partly solved

34 It is noteworthy that Choo uses the word “information” as an umbrella concept in his framework, and thus the level of the information hierarchy varies in different phases of the cycle.
through sufficient systematic information definition and technology applications. Also, both conscious and subconscious information needs of decision-makers should be met.

In the third phase of Choo’s (2002, p. 24) information management cycle, information is collected, integrated, and stored. Choo (2002, pp. 24–25) states that an organizational memory is created in this phase. The organizational memory is the active storehouse of a company’s knowledge. The importance of effective information storage has become emphasized as the amount of information available increases in step with advances in information and communication technologies. In the next phase, acquired information and information from the organizational memory are packaged into different levels of information products and services, which are allocated on the basis of the company’s user groups and information needs. In information distribution, work is done to increase sharing of information. According to Choo (2002, p. 25), new insights and knowledge about complicated problems, situations, and organizational learning are achieved via widespread information sharing. The goal of the last phase, information use, is to utilize the knowledge acquired fully in decisions-making processes. Sydänmaanlakka (2001, pp. 172–174) remarks that only the knowledge distributed has value and reminds the reader of the significance of verbal as well as technological communication. The usage of the information determines the profit of information management.

Probst et al. (2000, p. 30) present their own six-phase model for information management: 1) knowledge identification, 2) acquisition, 3) development, 4) sharing and distribution, 5) utilization, and 6) retention. These core activities are represented as individual processes, but Probst et al. (ibid.) highlight the close relationship of the phases and the need to consider them as a unified whole. While they use “knowledge” as a surrogate term for information, their framework is also generic, and thus comparable to that of Choo (2002). The information management processes discussed above are workable models for illustrating different phases and activities in information management. However, both models postulate that information management is a conscious process that always underlies information activities. Probably, the same phases would be found even if there were no well-organized information management in a company, because information is always processed somehow, with or without a conscious management process.

### 2.5 Main points in business information management

Traditionally, information systems and processes have focused on information selected within a certain context. However, what decision-makers need is a comprehensive set of up-to-date information on various contexts. Information from both internal and external sources is important in order to enable sophisticated, proactive decision-making. In
other words, decision-making is not just about having the right information but also involves enabling decision-makers to make the best decision for the situation. The aim of decision-making is to solve a specific problem, and the decision is based on a choice from among several possibilities (Miller and Starr 1967, pp. 21–26; Bartol and Martin 1991, p. 261; Åberg 1997, p. 142). However, only very straightforward, well-structured problems can be solved only on the basis of statistical data. In practice, decision-making always requires a certain amount of tacit knowledge on the decision-maker’s part. Information from human sources has a central role at the start of the decision-making process, when the information needs are identified, and at the end of the process, when cognitive structures and intuition are essential in making the final decision (Frishammar 2003).

Pirttilä (2000, p. 63) highlights that identifying information needs expresses superficially what kind of information should be utilized. According to her, it is equally important at least to consider how information is used in a company. If the information is not used, the process of information management is left without further meaning or worth. After identification of information needs, the results achieved should be forwarded to information producers so that they know to direct their attention towards the information that is really needed. It is important to have enough information sources, because the incorrectness of information decreases and diversity increases if several sources are used. However, an information producer can fulfill no information need, even if the information could be available, unless the need is identified. Also, an information producer should inform decision-makers about new information and information sources. According to Davenport and Prusak (1998), a decision-maker hunts out new information sources by himself if his information needs are not met well enough. Continuous interaction between decision-makers and information producers is essential for assuring the transparency of information needs and the information available.

On the other hand, not everyone needs to know everything, and thus information needs should be considered, to avoid useless distribution of information (Probst et al. 2000). In most cases, the quality of the information should be emphasized rather than the amount of information. According to Fleisher (2001a, p. 86), the quality of information is determined by its relevance, reliability, and validity. Ruohonen and Salmela (1999, p. 83) define information quality in terms of reliability, timeliness, validity, “real-timeliness,” and usability. There are other criteria for information evaluation, involving, e.g., the measurement of information significance, surprise, and urgency (see, e.g., Gilad and Gilad 1985, p. 69; Choo 2002, p. 233; Rouibah and Ould-ali 2002, p. 141). In summary, business information should fulfill at least the following requirements in order to be worthwhile. The first criterion is validity. The information should be correct and as comprehensive as possible. However, no company can gather all-inclusive information, due to the high price. The second criterion is reliability: the
information should not be haphazard, and it should be comparable to existing information. Third, the information should contain all of the essentials. The fourth criterion for usefulness relates to timing; the information should be gathered, analyzed, and utilized in a timely manner.

According to Frishammar (2003, p. 319), information aims to reduce or remove uncertainty in decision-making. Ståhle and Grönroos (1999) state that lack of information capital is often the main cause for failure of business strategies. Concurrently, the amount of information at hand is increasing in step with advances in information and communication technologies. It is not sufficient merely to gather and produce large amounts of information; the information must also be deposited and processed effectively. Thierauf (2001) claims that the real problem is that of how to filter the essential information from a stream of information to produce knowledge for identifying notable events, predicting difficulties, and perceiving opportunities. BI is an approach and a tool for managing and enriching essential information, and therefore that concept is further examined in Chapter 3.

On the basis of the theoretical review offered in Chapter 2, the research field of business information management clearly can be seen to be multidisciplinary in nature, including theoretical concepts and methods from several more traditional disciplines and fields of research such as philosophy, information science, business economics, strategic management, management accounting, and human resources management. The connections between these fields and business information management are examined in the next chapter in order to build a more academic foundation for the theoretical framework of BI.
3 APPROACHES TO BUSINESS INTELLIGENCE

3.1 How to define BI

Typically, business intelligence (BI) is defined as a managerial concept or a tool that is used to manage and enrich business information and to produce up-to-date knowledge and intelligence for operative and strategic decision-making (Ghoshal and Kim 1986; Gilad and Gilad 1986). The concept is not unambiguous but is at least dualistic, referring to:

a) **The refined information and knowledge** that describe the business environment, a company itself, and its state in relation to its markets, customers, competitors, and economic issues

b) **The process**\(^{35}\) that produces insights, suggestions, and recommendations (i.e., the refined information and knowledge described above) for the management and decision-makers

In addition, **the information-technology-based systems** used in analyzing raw data and information and in storing and sharing valuable information and knowledge are considered an important part of BI (Moss and Atre 2003). Some even see the technological approach as being just about all there is to BI (Kalakota and Robinson 2001, pp. 349–350; Raisinghani 2004, pp. x–xv). In addition to the differences regarding the content, the definition of BI varies if the concept is defined from the perspective of an end user or a BI supplier, for example. Because almost every author promotes his own idea of the content and meaning of BI, various definitions are discussed in this chapter.

Although the BI concept has related to some kind of trend-like phenomenon since the 1990s, there is no generally accepted conception regarding what BI is. Mendell (1997, pp. 115–118) remarks that BI has always been an important part of the competing business world, and thus the core activities of BI are far from new, as discussed in section 1.1.2. In the 1980s, Ghoshal and Kim (1986, p. 49) considered BI an activity within which information about competitors, customers, markets, new technologies, and broad social trends is gathered and analyzed. Around the same time, Tyson (1986, p. 9) identified the BI concept as an analytical process by which raw data are converted into relevant, usable, and strategic knowledge and intelligence. Tyson emphasizes in his definition the need for continuous monitoring of customers, competitors, suppliers, and

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\(^{35}\) A BI process is addressed in more detail in section 3.2.4.
actors and forces in other fields. According to him, BI comprises a variety of types of intelligence:

- customer intelligence
- competitor intelligence
- market intelligence
- technological intelligence
- product intelligence
- environmental intelligence

Collins (1997, p. 4) recognizes BI as a process by which information about competitors, customers, and markets is systematically gathered by legal means and analyzed to support decision-making. The raw data gathered are converted into accurate and focused analyses. Collins (1997, p. 19) categorizes the main objectives of BI into three groups. First, a company can avoid surprises and identify opportunities and threats. Second, BI establishes a baseline for performance evaluation. Third, BI provides more time in which to react. Added to this list, proactive decision-making, business planning, and strategy formulation are improved through more extensive knowledge of the company itself and its external environment. Miller (2000b, p. 13) defines BI as including the monitoring of developments in the external business environment. According to Prior (2004, p. 4), BI is a combination of any data, information, and knowledge concerning a company’s operational environment that leads to decisions creating competitive advantage for the company. Also, Sawka (1996, pp. 47–52) states that BI specially focuses on the gathering of external information and the prediction of changes in the markets. Sawka continues that BI is a prerequisite for conscious decision-making.

The aforementioned definitions neglect the importance of internal information. Besides screening the external environment, BI involves the information inside a company. With the integration of internal and external information, a company can adapt more easily to the accelerating rate of change and have a holistic picture of itself and its success in different business areas. According to Brackett (1999, p. 1), BI is a series of concepts, methods, and processes that enable, e.g., monitoring of economic trends and effective utilization of business information in strategic and tactical decision-making. The required business information is gathered from both internal and external information sources, and Brackett issues a reminder of the value of information concerning the experiences and hypotheses of employees. Barndt (1994, p. 22) emphasizes the role of internal information in BI, because, in his opinion, decision-making is based mainly on a company’s strategy, resources, and operational opportunities. Herring (1992, pp. 54–60) stresses that BI yields information for both internal and external information needs. The definition of Hackney (2000, pp. 39–42) solely focuses on internal information. He states that BI includes all activities through which internal information is analyzed, stored, and shared. In summary, the main idea in BI lies in identifying information
needs and processing the data and information gathered, into useful and valuable managerial knowledge and intelligence.

Waters (1996, p. 41) defines BI as a legal and ethical tool in examining strategic changes and options. According to him, BI is becoming a necessity in forming a holistic picture of the business environment. Besides Waters (1996), Gilad and Gilad (1986, p. 53) and Buskard et al. (2000, pp. 46–47) emphasize the strategic role of BI. Buskard et al. (2000, pp. 46–47) remark that BI is not a separate technology or application but a series of productions that includes both analytic tools and the information required. McGonagle and Vella (1996, p. 18) illustrate different roles of BI by dividing BI into three levels: strategic intelligence, competitive intelligence, and market intelligence. Also, Thierauf (2001, pp. 66–67) categorizes BI into three groups: strategic intelligence, tactical intelligence, and operational intelligence, as illustrated in Figure 9.

![Figure 9. Levels of BI (McGonagle and Vella 1996, p. 18; Thierauf 2001, p. 66).](image)

According to Thierauf (2001, p. 66), the information needed varies with the BI level but financial intelligence is required at every level. Thierauf defines the character of the information needed more exactly than McGonagle and Vella (1996, p. 18) in their illustration. Thierauf states that strategic decision-makers most need extensive and enriched information in order to manage upcoming operations and steer the course of a company. At the operative level, more detailed, history-specific information is required to implement daily activities. Between strategic and operative level is the tactical level, where the data are gathered and enriched. Thierauf uses the grouping of internal and external information in his framework: information from external sources is emphasized in strategic decision-making, whereas the focus of the operational level is on internal sources (cf. section 2.2.3). On the other hand, information from internal sources is also needed in strategic decision-making and external information sources at the operative level. Strategic decision-makers have to perceive, e.g., resource sharing and management in the context of long-term strategic planning, which necessitates that they
have enough information from internal sources, besides external ones. At operative level, the marketing and research and development departments need information from external – not just internal – sources on, e.g., markets, trends, and customers.36

According to Vitt et al. (2002, pp. 13–22), BI is more than a management philosophy or an enabling technology. They consider BI an ongoing cycle; it is a performance management framework via which a company sets goals, analyzes development, gains insight, takes action, measures success, and begins all over again. They define a BI cycle as a progression from analysis to insight to action, and finally to measurement. Vitt et al. (2002, pp. 14–16) state that BI is an attitude toward problem-solving and rational management, and in addition they emphasize the relationship between BI and strategy. The role of human-source intelligence should not be dismissed, although rationality is emphasized in their definition. Also, Thomas (2001, pp. 48–49) defines BI as, above all, a systematic process that gathers, analyzes, and classifies the flow of significant business information. He emphasizes that a BI cycle is a process wherein sources of information, including published information as well as information from human sources, play a central role. In addition, he states that the development of information and communication technology has increased the value of BI in decision-making processes but that BI as a way of action was found much earlier.

The perspective of Kalakota and Robinson (2001, p. 161) differs from the former definitions. They define BI as a group of applications that enable both active and passive delivery of information. Data and information are collected from large databases, providing an enterprise and its managers with timely answers to mission-critical questions. In other words, the objective of a BI system37 is to turn raw data into actionable intelligence. Kalakota and Robinson (ibid.) argue that the growth of BI stems mainly from the demand for more competitive business knowledge and growth in electronic data capturing and storage. Their view is supported by Thierauf (2001, pp. xi–xii), who points out that a BI system converts captured data, information, and knowledge into valuable intelligence. Thierauf considers BI systems to be the latest thrust in information systems. A BI system is an effective aid to decision-makers getting the full picture of a company’s capabilities and external operating environment. The perspective applied in Raisinghani’s (2004, p. x) definition is also technology-oriented. He defines BI as a common noun for technical applications, software, and tools that enable more effective processing of business information.

Related intelligence concepts include competitive intelligence, competitor intelligence, customer intelligence, market intelligence, strategic intelligence, product intelligence, and environmental intelligence. Lately, the counterintelligence and technology

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36 The differences between operative and strategic information are discussed more fully in section 2.2.3.
37 A BI system is discussed further in section 3.2.6.
intelligence concepts have appeared more and more often in the context of BI. Several of these intelligence concepts are sometimes used in a context similar to BI. However, most of them focus mainly on the external environment and gather information from external sources (Fuld 1995; Kahaner 1996; Cottrill 1998; Vibert 2004). The content of BI is generally defined as more extensive, with other intelligence concepts considered to be subgroups of BI (Tyson 1986; McGonagle and Vella 1996; Pirttilä 2000; Fleisher 2001b). On the other hand, almost all of those intelligence concepts share the same purpose as BI (Weiss 2003, p. 49; Casado 2004, p. 127) and aim to turn raw data and information into valuable knowledge and intelligence (Tyson 1986, p. 9; McGonagle and Vella 1996, pp. 9, 202). The difference between BI and related intelligence concepts often vacillates because the way intelligence is managed and enriched stays mainly the same and the term applied refers to the specific type of intelligence required in a particular company or situation. Hence, activities in managing and enriching information and knowledge remain essentially the same regardless of the designation.

As discussed in Chapter 1, the term used for intelligence activities seems to vary with the market. The concept of BI is relatively common in Europe, whereas intelligence activities often are called competitive intelligence (CI) in North America (Article Ib). In the literature, Combs and Moorhead (1992, p. 3) and Gilad (1996, p. 4) define CI as an alternate concept for BI, whereas Mintzberg (1994), Pirttilä (2000, pp. 13, 20–21, 186), Choo (2002, pp. 86–87), and Weiss (2003, p. 49) consider CI a part of BI because the scope of BI is broader than CI’s. Miller (2005) states that CI includes competitor and market information but also information concerning a company itself and its possibilities and weakness. This description is very similar to the definition of BI in that it also involves the perspective of internal information. McGonagle and Vella (1996, p. 40) present CI as earlier having been known as BI. They define CI as a process by which external information is gathered from external sources. They continue that CI includes information concerning competitive situation, competitors, market, and strategy. The definition put forth by Cook and Cook (2000, p. 5) is similar, but they emphasize the role of competitor information in CI. Bernhardt (1994, p. 13) states that CI is strategic information about competitors’ plans and that, thus, a company needs market and industry information rather than just competitor information. Mintzberg (1994), in turn, uses the concept of competitor intelligence as a synonym for CI. Typically, however, competitor intelligence is discussed as a sub-activity of CI because CI is considered to involve competitive and market information in addition to competitor information (Choo 2002, p. 86). In Figure 10, the relationships among BI, CI, and competitor intelligence are illustrated.

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38 Concepts related to BI are referred to as intelligence concepts hereafter in the thesis.
According to Choo (2002, pp. 86–88), BI has the broadest scope among intelligence concepts. It needs information from several sources, and its uses are various. In addition, strategic, long-term decisions are based on information produced by BI. In the left top corner of Figure 10, narrow internal information includes company-specific information such as key figures and financial accounting information. Hence, BI covers the whole relevant environment of a company, not just the company itself, while the scope of CI is narrower, covering several elements of the external environment, such as competitor, industry, and market; CI mainly helps a company to assess the competition and market conditions. Choo (2002, pp. 86–88) states that competitor intelligence literally focuses just on competitors. Because the information gathered is narrowly focused, competitor intelligence aims to facilitate decision-making especially at tactical level. Competitor intelligence is typically something that interests the sales and marketing functions, but it can be used in strategic decision-making also. Fleisher (2003, p. 62) and Weiss (2003, p. 49) also situate CI somewhere between BI and competitor intelligence because the focus of CI is especially on the competitive environment and the improving of a company’s competitiveness.

As discussed in section 1.1.5, the most popular term worldwide for systematic activities to collect and analyze information related to the external environment is “market research” (Global Intelligence Alliance 2005). Waters (1996) states that BI is not equivalent to market research, because market research primarily estimates what customers might buy, on the basis of past habits. According to Fleisher and Bensoussan

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39 In the original figure of Choo (2002, p. 88), the concepts of environmental management, management of issues, and social intelligence are included also.
(2003, p. 181), market intelligence (MI) is industry-target intelligence that mainly focuses on the dynamic developments related to place, price, product, and promotion and thereby aims to find more profitable market segments. Hence, the focus of MI and market research is on a specific information need and the time horizon is typically short, varying from days to months, whereas BI aims to find out what kinds of changes may occur in the various aspects of a company itself and its business environment and how they will affect the company’s business in the long term. In addition, the results of MI and market research are not distributed as widely as BI and CI products; typically they are used by marketing and sales managers (Fleisher 2003).

The content of the customer intelligence concept does not differ notably from that of market research and MI. In simple terms, all examine the buying behavior and profitability of customers and products. However, the view of customer intelligence is not so broad or general; it includes information about individuals. Collins (1997, p. 95) defines customer intelligence as “knowledge of customers’ organization, requirements, purchasing activities, strategies, and plans as it relates to the products or services offered by a company and to particular purchase decisions.” According to Davis (2003, p. 147), customer intelligence aims to measure the profitability of customers, products, services, and advertisements.

According to Miller (1996, p. 200) and Liebowitz (2006, p. 14), “strategic intelligence” (SI) is a term used in the context of strategic planning and strategic management. It aims to understand where a company is going, how it can retain its competitiveness in view of future challenges and changes in the long term (Thierauf 2001, pp. 191, 195), and how it can make the best strategic decisions for maximizing its success (Liebowitz 2006, pp. 14, 22). Hence, SI especially addresses the intelligence needs of high-level strategic decision-makers, and the focus is mainly on proactive activities. The concepts of environmental, product, and technology intelligence are not yet in wide use. However, intelligence related to these concepts is valuable nonetheless in decision-making and creation of successful strategies.

Although there are several intelligence concepts, all of the terms emphasize the role of ethics and the legality of intelligence activities (Cook and Cook 2000, pp. 7–8; Fleisher 2001b, pp. 4–5; Hamilton and Fleisher 2001; McGonagle and Vella 2002, p. 35; Miller 2005). The demand for business espionage should be unnecessary because a company can find up to 95 percent of the required information legally, from public information.

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40 Strategic management is discussed further in section 3.3.3.
41 Technology intelligence caters to, e.g., the needs of research and development departments and product development functions.
42 In this case, the world “public” is not synonymous with “published.” According to McGonagle and Vella (2002, p. 35), the former means “all information that can legally and ethically be identified, located, and then accessed.”
sources (Cook and Cook 2000, p. 8). It is, however, noteworthy that the strict sum of information is difficult to measure, due to the intangible nature of information, and thus this percentage is partly speculation. Miller (2005, p. 3) states that an intelligence activity is a failure if there is any sign of industrial espionage. The basic principle of intelligence activities is to gather information only from open and ethical sources. The control of ethics is complex, but SCIP\textsuperscript{43} (Hamilton and Fleisher 2001, p. 266) has drawn up rules of ethics with which every intelligence professional should comply.

Even if industrial espionage is generally considered unethical, a company has to notice that there may be some intelligence work acting against its interests. The concept of counterintelligence has become more general in recent years. It refers to activities protecting against the loss of critical information (Nolan 1997, p. 58; Dutka 1999, p. 295). With counterintelligence, a company can realize which information is most valuable and critical for its business and protect it against attacks by competitors (Pattakos 1997, pp. 72–73; Barrett 2001, p. 29). Hence, counterintelligence activities are partly contrary to BI activities, with the focus being on protection of information assets. It is noteworthy that a company can spread disinformation. This, too, involves counterintelligence activities, and thus a company must be critical enough as well as ethical.

Although intelligence concepts interrelate and differences between them are, in part, ambiguous, in this thesis BI is understood as an intelligence process that includes a series of systematic activities, being driven by the specific information needs of decision-makers and the objective of achieving competitive advantage. Through a BI process, a company can gather, analyze, store, and share accurate and timely information that is essential for its business activities and decision-making. Hence, BI is considered in this study to be a comprehensive concept including both internal and external information and the whole operating environment besides a company itself. Other intelligence concepts are considered as components of BI. The different viewpoints of BI are discussed in the following section.

\textsuperscript{43} The Society of Competitive Intelligence Professionals (SCIP) is a global, nonprofit membership organization that provides BI and CI education and networking opportunities for business and knowledge professionals.
3.2 Different points of view on BI

3.2.1 Information type

As discussed in Section 2.1, a common method in the literature is to categorize information as data, information, knowledge, intelligence, or even wisdom and truth. However, it is usually acceptable to omit wisdom and truth from the categorization. In most business cases, the aim is to refine data and information into knowledge and finally intelligence, whereas wisdom and truth are quite philosophical concepts. It is important to keep in mind that knowledge and intelligence are very subjective, since their value and content is more dependent on individual experience and observations of the world than on data and information. Individuals’ prior knowledge and intelligence are needed for achieving new knowledge and understanding (Article IIa).

Halliman (2001) argues that BI can mean any business information that facilitates decision-making and managing the future. The definition of Powell (1996, pp. 160–162) is more detailed. Powell states that intelligence is communicated knowledge used as the basis of right decisions. Thierauf (2001, pp. 3–4) defines BI as the highest level of the information hierarchy, which includes insights into understanding of relations between essential factors of business activities (cf. Section 2.1). However, the intelligence level is achieved if and only if the enriched information and knowledge are utilized in decision-making. Intelligence thus comes from analyzing seemingly unrelated bits of information and knowledge and adding them up to equal more than the sum of the parts. It is sometimes difficult for decision-makers to see the value of information refined, because the value is set into small and fragmented changes and pieces of information. In any case, intelligence can be defined as understanding of, and insight into, important matters and factors related to a company’s business and success.

The information processed in BI can be divided roughly equally into internal and external (see sections 2.2.3, 2.2.4, and 2.3). Internal information relates to, e.g., a company’s finances, personnel, and production, and it can be collected from, for example, the company’s operative systems. The external information concerns, e.g., competitors, customers, partners, and trends in the business environment. This kind of information can be collected by monitoring different news services, reading newspapers, interviewing customers, etc. On the other hand, it does not really matter where the information comes from as long as the quality of information is good enough (Article IIa). A decision-maker needs business information from different sources and subjects, including those inside and outside his company, and the required information can be quantitative or qualitative (see sections 2.2.4 and 2.3). Business information from several appropriate sources and about different subjects is required in order to paint a holistic picture of a company’s activities and its business environment.
As discussed in Chapter 2, there is a growing number of business information needs and sources, and therefore information-intensive activities require more and more systematic approaches for matching specific information needs and sources. According to Probst et al. (2000, pp. 30–31), external sources, such as competitors, customers, suppliers, and partners, have an important but still underutilized potential to provide valuable information. Choo (2002) recognizes this but adds that, in addition to the aforementioned sources, information should be collected on technological advances, economic trends, and international trade. He stresses that careful attention should be paid to the selection and use of information sources because there are numerous sources available and they are a critical resource in the increasingly competitive business world. An example of potential sources of business information for BI is summarized in Figure 11.

![Figure 11. Possible sources of business information for BI (Salo 2004).](image)

According to the results of a BI survey (Pirttimäki 2002), almost half (49%) of the top 50 Finnish companies gathered business information from both internal and external sources in the context of BI in 2002. Only five percent of the respondents considered internal information sources the most important, and 46 percent gathering information only from external sources. However, the respondents stated that internal information has a central role in business activities. In the literature, information is typically gathered within a BI process either from external information sources or from internal and external sources (see Section 3.1), and thus the survey results support these theoretical assumptions.

### 3.2.2 Information elements

Illustrating information needs and sources as the elements of BI facilitates more systematic examination of the main targets and key development areas. For example, Ghoshal and Kim (1986, pp. 49–58) categorize BI elements as follows: competitors, customers, markets, technological advances, and social trends. The classification system
of international BI provider Novintel (Viva Business Intelligence 1998b, pp. 10–12; Novintel 2006) is more specific. According to Novintel, BI consists of eight elements, which can be considered at three levels of operation. At the company level, there are supplier, competitor, customer, interest group, and other market player elements, and thus the focus of the lowest level is on individual players. The supplier industry, a company’s own industry, and the customer industry constitute the elements of the industry level. However, it is valuable to monitor other industries also, since overly narrow interpretation and monitoring may pose large problems in the competitive situation of a company. At the level of the business environment, the element equates to general trends and critical themes, and the business environment is examined most extensively. Figure 12 shows these elements in the form of a framework with three dimensions.

Figure 12. External elements of BI (Viva Business Intelligence 1998b, pp. 10–12; Novintel 2006).

In the framework used by Novintel (Viva Business Intelligence 1998b, pp. 10–12; Novintel 2006), the vertical dimension indicates the different focus levels of BI, as illustrated above, whereas the value chain of a company is described at the horizontal axis. Because the business environment can be examined from a local or global perspective, the third axis indicates the geographical nature of business information. From a local point of view, the focus is on specific market regions. The framework is generic, and thus each company has to pay attention to, e.g., company culture, market conditions, and company- and industry-specific information needs when defining its external business environment.

Porter discusses the role of external information elements in strategic issues. According to Porter (1980, pp. 35–46), a successful competitive strategy enables a company to perform activities different from those of competitors, or to perform them differently, and to deliver a unique value mix. In Figure 13, Porter (1980, pp. 4–7) illustrates that the stage of competition in an industry depends on the following key competitive forces:
threat of new entrants, rivalry among existing firms, threat of substitute products or services, bargaining power of buyers, and bargaining power of suppliers.

Figure 13. Five forces affecting competition in an industry (Porter 1980, p. 7).

Porter (1980) states that the industry in which a company competes is the most important element of the business environment. The nature of competition in a specific industry, he says, can be analyzed systematically by gathering information about the competitive forces above. By analyzing that information, a company can assess its weaknesses and strengths relative to the industry and develop its competitive position by adopting one or more of the three generic competitive strategies.\(^44\) Porter (ibid.) reminds the reader that separate competitor analyses are needed for forecasting and understanding competitors’ moves and responses. However, these analyses give fairly abstract results, and thus they should be complemented with other tools, like PEST\(^45\), SWOT\(^46\), and scenario analysis (Herring 1996; Fleisher and Bensoussan 2003; Liebowitz 2006).

According to the survey results presented in Article Ib, information about competitors, a company’s own industry, and customers was most often covered by BI in the top 50 Finnish companies in 2005. These three information elements were clearly the most important ones. Competitor information was seen as important in positioning oneself in the competitive field. The respondents also stated that it is important to be up to date on customers’ needs and possible changes in those needs. In addition, some respondents

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\(^44\) The generic competitive strategies are cost leadership, product differentiation, and focusing on a particular product or market segment (Porter 1980).

\(^45\) According to Johnson and Scholes (1999, pp. 104–105), a company is governed by political, economic, social, and technological factors. With PEST analysis, those components are identified.

\(^46\) The acronym “SWOT” stands for “strengths, weaknesses, opportunities, and threats”; SWOT analysis is one of the basic strategic tools for examining a company and its environment.
had a customer-based strategy, making it natural to have a high regard for customer information. Other important information elements were, in order of importance, macro trends, countries, and customer industries. The research also showed that information related to technologies and parallel industries was considered less important.

The leading information elements were ranked in 287 companies around the world equally to the Finnish survey results (Global Intelligence Alliance 2005; Article Ib). The responding companies were even unanimous regarding those topics – competitors, their own industry, and customers – although the ranking varied between countries. Therefore, these three information elements seem to be those that form the core of intelligence activities and have a strong impact on business success in Finland and worldwide. To conclude, the Finnish and global results mainly support the theoretical classifications of BI elements presented in figures 12 and 13.

3.2.3 Human-source intelligence

Collins (1997, p. 73) states that the most significant intelligence asset of a company is its employees. According to him, some information is stored only in human minds and thus employees have essential information beyond formal information. However, the external-environment-related information from a company’s employees is typically invisible and awkward to find or use. Frishammar (2003) remarks that information from human sources is most crucial at the beginning of a BI process (when information needs are identified) and at the end of the process (when cognitive structures and intuition have an essential role in the final decision). Human-source intelligence may take several forms, and it can be gathered from, e.g., discussions, reports, memos, and – naturally – employees. However, there is one disadvantage in human-source intelligence. That kind of intelligence is often biased by reason of a fundamental part of the human psyche and people tend to slant information in keeping with their background, experiences, and values.

In 2005, the top 50 Finnish companies were asked how well they are able to collect and utilize information from personnel about the external environment of the company in the context of BI (Article Ib). None of the respondents indicated that they excel in the area in question; they felt that they were only satisfactory or fair. According to the results, there were only a few tools for managing human-source intelligence, but some

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47 Company representatives were interviewed in Brazil, Canada, Finland, Germany, Mexico, the Netherlands, Norway, Switzerland, and 10 Asia-Pacific countries in 2005 (Global Intelligence Alliance 2005; Hannula and Pirttimäki 2006; Article Ib).

48 The role of human-source intelligence in the context of BI and strategic management is discussed more extensively in Article IIIa.
companies, e.g., collected information through informal discussions, allowed employees to insert news into a portal, or allowed them to insert market signals anonymously onto the intranet. In general, the utilization of human-source intelligence seems to be more effective in the average company at global level than in Finland (Global Intelligence Alliance 2005). Companies in 16 countries felt that their operations involving human-source intelligence were good or satisfactory at least, whereas Finnish and Dutch respondents described their actions here with the word “fair.” Mexican companies were the most satisfied with their actions. It is worth noting, however, that cultural differences among the 18 countries and the subjective opinions and estimations of the respondents might have influenced the results.

Article IIIa presents how non-public, external strategic information received from employees could be utilized effectively within a BI process. According to the results of the single-case study, it is difficult to put such information into use in decision-making or strategic management without a systematic approach to information management and supportive company culture. It also emerged from the case study that geographical wideness and a high clockspeed of actions hinder dissemination of information of that kind effectively, and thus crucial information is not shared or even unorganized information is disseminated. An open company culture makes possible increased sharing of information in a company and improves organizational learning (Miller 2000a). Concurrently, intellectual capital increases when information is not gathered from a number of external sources while a company utilizes information from its own specialists as well and employees process information and knowledge together and share their tacit knowledge and experiences with colleagues. On the other hand, it is also worth considering how much and how broadly information should be shared, on account of, e.g., appropriateness, cost, and confidentiality considerations.

Vitt et al. (2002, pp. 14, 175, 186) emphasize that relevant information should be communicated to decision-makers at lower operating levels of a company, not just to the top management. They postulate that BI will become a more and more cost-effective investment if companies understand that there are benefits to be gained from empowering employees with applicable information. Effective utilization of information assumes, however, the top management’s support to assure employees and decision-makers of the usefulness of BI (Barndt 1994). In practice, the information gathered is sometimes kept secret and shared with only the top management. In that case, the lower management and operations staff do not even know the information exists. The top management is typically a primary user group of BI (Global Intelligence Alliance 2005; Article Ib), but the actual gathering of information often occurs at lower levels of operation. Information thus gathered does not necessarily match the information needs of the top management.

From the results of two surveys (Article Ia; Article Ib), the top management and middle management seem to be the most significant user groups of BI products in the top 50
Finnish companies. There appears to have been a shift in the importance of the top management as an end user of BI products. In 2005, the top management and middle management were almost equally important, as again the difference was bigger three years earlier. In 2002, the top management utilized BI in 95 percent of the companies, while in 2005 the figure was 92 percent. In 2005, members of middle management and experts used BI deliverables in all of the responding companies, as opposed to 70 percent three years earlier. In any case, use of BI products seems to be wide in the top 50 Finnish companies.

In 2005, the top management was the most important user group in 62 percent of the 287 companies in 18 countries, with the middle management most important in 24 percent and experts in 12 percent of the responding companies (Global Intelligence Alliance 2005). Except for Finland, Norway, the Netherlands, and Mexico, the top management was by far the most important user group. In Finland and Norway, the top and middle management were almost equally important, whereas Mexican and Dutch companies considered experts second most important and thus more important than middle management.

It seems essential to utilize human-source intelligence besides formal information and also to make valuable knowledge and intelligence available to decision-makers at lower operating levels. For a company to succeed, information has to be gathered from both internal and external sources, and both technological solutions and oral communication are needed to ensure efficient dissemination of the essential business information (Thierauf 2001, p. 9; Vitt et al. 2002, p. 25). Designing a successful BI process requires understanding of the relationship between internal and external information. However, there is a lack of basic analyses providing direct guidance on how internal and external information should be integrated and utilized in BI. There is also a question regarding the significance of boundary-spanners in BI, and whether they are an external or internal source of business information. In addition, it may be very difficult to distinguish relevant from non-relevant information because the amount of information available is increasing and there are many types of information and information sources.

3.2.4 Process

As mentioned in section 1.1.2, the roots of current intelligence activities are in military intelligence, which has been used in some form for thousands of years. Over the years, military intelligence has become a more formalized process and intelligence activities have been used extensively in both business and the military world (McCandless 2003,

49 Boundary-spanners connect a local network to networks outside its boundaries (Awazu 2004, p. 18).
Endrulat (2003, p. 18) remarks that the phases of an intelligence process are similar to the intelligence procedure used in the context of military activities.

Nowadays, one of the most widely known mental models in the field of BI is that of the intelligence process (Ganesh et al. 2003, p. 2). In other words, BI can be approached as a form of a cycle that simply acquires, analyzes, stores, and disseminates essential information and contains elements required to produce valuable business information. Besides military activities, Choo’s (2002) information management process can be considered some kind of basis for a BI process. Nonaka and Takeuchi’s (1995, pp. 56–89) organizational knowledge-creation process is also a suitable starting point for formulating a BI cycle. The conversions between tacit and explicit knowledge – socialization, externalization, combination, and internalization – can be recognized in a BI process as well (see Section 2.4). However, the focus of a BI process is typically more on business-oriented issues and analysis and on enrichment of raw data and information into actionable knowledge and intelligence.

Academics and consultants in the BI field have presented several BI process models (see, e.g., Gilad and Gilad 1985; Kahaner 1996; Collins 1997; Viva Business Intelligence 1998a; Herring 1999; Thomas 2001; Vitt et al. 2002; Fleisher and Bensoussan 2003). Analysis of the literature suggests that the theoretical process models are quite similar to each other (Pirttimäki and Hannula 2004, p. 259), but at the same time models are also company-specific. The most significant differences among process models typically involve the number of phases; the structure of cycles; sources of information; and methods of gathering, analyzing, and storing information (Pirttimäki and Hannula 2004, pp. 259–260). In addition, some models focus on the external information and the business environment, and then the information processed is gathered from external sources only.

A BI process can be ad hoc or systematic in nature (Gilad and Gilad 1985; Vitt et al. 2002). With an ad hoc process, a company can obtain the information needed for a precise one-time intelligence need, while the aim of a systematic process is continuously gathering business information about competitors and the overall business environment. A systematic process aims to identify trends and discover new business opportunities. Overall, the objective of a BI process is to refine business data and information into useful and valuable knowledge and intelligence as illustrated in Figure 14.
In Figure 14, data and information are inputs of a BI process that produces knowledge and understanding related to important relationships and meanings, whereas the outputs of the refinement process are knowledge and intelligence. Prior knowledge of an individual or a company is also needed to run that process. In other words, human insights and experiences\(^{50}\) refine the data and information into more valuable knowledge and intelligence. The task of the refinement process is to add value to the acquired data and information and to make it useful for decision-makers by transforming it into knowledge and intelligence. However, the refinement model is quite idealistic and theoretical. In the real world, not just knowledge and intelligence are produced in a BI process. For example, information produced by a news service is not very refined; it contains summaries, text, key figures, and graphics without thorough analyses. In other words, one of the outputs in the refinement process is mere information.

Powell (1996, pp. 160–162) calls the refinement process a BI value chain, which illustrates how collected data and information first are transformed into actionable knowledge and intelligence during a BI process and then are utilized in decision-making. In Figure 15, data are the output of collection, information is the output of aggregated data, knowledge is the output of analyzed information, and finally intelligence is communicated knowledge that is used as the basis for right decisions. Typically, a BI process is described as cyclical and ongoing in nature, but, as the refinement process and the BI value chain demonstrate, models of other kinds are possible also.

\(^{50}\) Learning is one critical element of a BI process.
In general, a BI process is understood as a continuous and systematic method of action by which a company gathers, analyzes, stores, and disseminates relevant business information for business activities (Gilad and Gilad 1985; Kahaner 1996; Collins 1997; Fleisher 2001b; Thomas 2001; Vitt et al. 2002). As illustrated in figures 16 and 17, a BI process typically consists of between four and eight phases within which the intelligence activities are carried out (Gilad and Gilad 1985; Kahaner 1996; Collins 1997; Viva Business Intelligence 1998a; Herring 1999; Fleisher 2001b; Thomas 2001; Vitt et al. 2002; Fleisher and Bensoussan 2003). A BI process model is typically generic, and therefore some phases may be in a different order or missing, depending on the company and intelligence efforts involved. The process model illustrated in Figure 16 is a simplified conclusion based on the literature review for BI processes. The stages of an example BI process are examined on the basis of that generic framework.
In the first phase of a BI process, the intelligence needs of decision-makers are specified by clearing the key intelligence topics and questions related to issues, problems, and trends of that moment. The identification phase is very critical from the perspective of the success of the whole BI process. It is necessary to ensure that only relevant information is utilized in decision-making, by identifying the critical information needs as discussed in Section 2.2. Therefore, this phase is the foundation for a successful BI process. On the other hand, there are several decision-making levels and positions, with varying information needs, that complicate the identification phase (see section 2.2.3).

In the second phase, gathering of information, necessary information is found by monitoring various sources in the business environment and actually collecting information. However, proper understanding of the external environment can be achieved only when external information is carefully structured and combined with the internal know-how of employees, because the effectiveness of monitoring is strongly dependent on existing knowledge, experiences, rules, and estimations. This knowledge can be documented either formally in reports and procedures or informally through attitudes, beliefs, and stories. The information gathered can thus be qualitative or quantitative and can be collected from a company’s internal or external information sources via primary or secondary research methods.

In the information processing phase, the information gathered is evaluated and analyzed, thus being processed into actionable intelligence and BI products via various analysis methods and tools. Among such BI products are strategic research, industry analyses, monthly business area reviews, and management team BI briefings. This stage aims to evaluate, interpret, and explain ongoing events and signals from the standpoint of their meaning for decision-makers and business activities. Because successful decisions, solid actions, and competitiveness strongly rely on the quality of results’ analysis, the processing phase can be considered one of the key phases of a BI process.

In the dissemination phase, information is communicated to the necessary decisions-makers at the right time with the most suitable tools. Personal routines and preferences of decision-makers should be considered when the tool for information delivery is planned (Choo 2002). The dissemination can be performed in the form of, e.g., a report, a newsletter, or formal meetings – or through a company’s intranet, internal databases, or portal.

The fifth phase of a BI process closes the loop between those who collect and analyze information and those who actually utilize knowledge and intelligence in decision-making. The goal of the utilization phase is to enable end users and decision-makers to find the information needed in as short a time as possible. Therefore, the storage should be kept relatively simple but also secure enough. In this phase, the effectiveness of the earlier phases is finally measured. The utilization phase cannot be
efficient if one of the earlier phases in the cycle has failed, and therefore nonstop feedback is critical to optimizing each of the BI cycle’s phases. In addition, the outputs of a process serve as input for a new iteration of an ongoing BI process.

Herring (1996, p. 62) categorizes the participants of a BI process into four classes: library, collectors, analysts, and users. The tasks of these participants follow the major phases of a BI process. The responsibility of the library mainly relates to information services, such as acquiring, organizing, and storing intelligence associated with publicly available and published information. The information is gathered by collectors for analysts who analyze and combine the information. They also store the information analyzed in the library and communicate it to the users. The users utilize information in decision-making and initiate a new BI process with specified information needs. Hence, the connections among the participants are very close.

A BI process should lead a company to more systematic analyses of information needs, and therefore faster decision-making through relevant and timely intelligence. Vitt et al. (2002, pp. 13–22) emphasize that a BI process brings together relevant information, skilled employees, and suitable technology to successfully manage a company. With extensive analysis, a company can understand its own business better by becoming aware of conventional and unconventional signals as well as changes in the business environment. According to Pollard (1999), the objective of a BI process is not merely to produce general business information or knowledge. The goal is also to create company-specific intelligence solutions that enable more efficient utilization of business information. In addition, Pollard (ibid.) defines the objectives of a BI process as wide intelligence concerning the business environment and helping a company to notice its strengths and weakness in comparison to competitors. In addition, the systematic BI process cuts across overlapping work processes in information retrieval and analysis, and incoherent raw information decreases as more and more structured and analyzed information becomes available. According to Fuld (1991, pp. 12–17), the main reason for the failure of a BI process is typically lack of support from the top management in the identification of information needs (see Section 2.2). Virtanen (1999, p. 5) emphasizes that an effective BI process demands an open company culture and close interaction between individuals.

A BI process is used to describe the transformation of raw data and information into actionable knowledge and intelligence, which are utilized to modify a company’s behavior to identify changes proactively and to create new insights and understanding. Fyrstén (2005, pp. 57–58) summarizes the key areas of BI in her Master of Science thesis as follows: First, BI includes several concrete activities typically constituting the main stages of a BI process. Second, there are mental processes behind those concrete activities that enable continuous learning on the part of a company. The information refinement chain is situated behind these two processes. A BI process should always be
connected to other business processes, because high-quality business information does not add any value if this information is not utilized in everyday business decisions. A BI process seems to offer a practical way of managing various types of business information and knowledge, but most advantages are less visible, and thereby difficult to measure or even to define, as is discussed in the following section.

3.2.5 Measurement

BI users naturally presuppose that they are going to achieve some concrete advantages if a BI process or activities are implemented. They want results that support their needs and targets. Hence, BI should focus on actual goals of business activities, such as acquisition of clients, product development, and demonstration of new products (Herring 1996). The BI literature suggests that various benefits can be derived through the use of BI (Gilad and Gilad 1986; Collins 1997; Cook and Cook 2000; Fleisher 2001b; Thierauf 2001; Thomas 2001). Because using BI takes resources, there should be a way to assess whether the efforts are reasonable in comparison to the profits and benefits received. For example, refining data and information into knowledge and intelligence is not free. According to von Krogh et al. (2000, p. 122), the total search cost of information has at least the following components: data search costs, information search costs, and knowledge search costs. Search costs should not be understood restrictively here; they consist of all costs caused by acquiring and combining data, information, and knowledge.

Measurement of the direct financial benefits of BI is a difficult task because of the intangible nature of BI activities and outcomes. In addition, the benefits of BI typically disperse through a company. The benefits and certain success features can be identified and listed, but it is hard to specify any actual performance metrics. Hohhof (1996, pp. 217–218) lists the success factors in developing BI systems as follows:

- Intelligence must be relevant, disseminated quickly, and presented for easy use.
- New information sources should leverage existing sources and imitate systems and communication styles already in use throughout the company.
- Most effective information systems combine multiple information sources, processing methods, and delivery systems.

According to Hohhof (1996), the above characteristics apply regardless of whether the BI system is automated or manual. Measuring is important in relation to any business activity and in order to, e.g., demonstrate the impact of activities on business results. In addition, there are some practical reasons that the measurement of BI should be developed. First, the measurement of BI helps in managing a BI process more
systematically. The measurement ensures that BI services and products suit decision-makers’ and end users’ needs and that the process is well-organized (Herring 1996). A BI process is a high-priced waste if the information gathered does not match the information needs or it is incorrect or outdated. According to this view, the target of measurement is to continually improve the BI products and services. The other reason to measure BI is to prove that the activity is worth the effort. For example, Sawka (2000) considers this the most common reason for BI measurements. Davison (2001) states that BI managers need measurements in order to be able to justify their function’s existence. Similarly, executives need to know whether it is rational for them to invest in BI. Also, Williams and Williams (2004) suggest measuring the state of various matters related to a company’s ability to utilize BI. These concern, e.g., continuous improvement culture, information or analytics culture, and technical readiness. In Table 9, the two aforementioned main purposes for BI measurement are summarized.

Table 9. The types of BI measurement (Article IIb).

<table>
<thead>
<tr>
<th>Purpose for measurement</th>
<th>Main users of measurement information</th>
<th>Expected benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valuation of the worth of BI</td>
<td>Companies (i.e., executives) applying BI</td>
<td>Ability to prove that BI services are worth the effort and demonstrate the actual effects of BI</td>
</tr>
<tr>
<td>Management of a BI process</td>
<td>BI service providers BI professionals Researchers</td>
<td>Increased credibility of BI as a managerial tool Improved rigor in BI research</td>
</tr>
<tr>
<td></td>
<td>BI service providers BI professionals</td>
<td>Continuous improvement of BI products and services</td>
</tr>
</tbody>
</table>

Most of the current metrics found in the literature focus on proving the value of BI (Article IIb). The difficulties in the measurement of BI are a well-known fact (Simon 1998; Ganesh et al. 2003; Gartz 2004; Pulkkinen 2006; Article IIb), and only some companies have mechanisms in place to measure the value of BI (Marin and Poulter 2004; Article Ib; Article IIIb). In Finland, almost 20 percent of the top 50 companies had no BI measurements in 2005 (Article Ib). Typically, large Finnish companies measured, e.g., time savings, volume discounts, and utilization rates of BI tools. Half of those companies also used end-user surveys in assessing the benefits of BI. One reason for the slow development of BI measurement may be that BI is executed in several ways, depending on the company. For example, BI may mean single market research for one company, whereas some other company has a nonstop process within which various BI products and services are produced for decision-makers at different levels of operation (Article IIb). Thus, there are various company-specific issues likely to have an effect on how BI could be measured. McGonagle and Vella (2003, pp. 229–230) list the following guidelines for selecting the most suitable BI metrics:
• A small number of key metrics, for a limited group of activities, should be created and captured. The metrics selected should be checked and changed when necessary.
• The metrics should be tied to the company’s strategies, tactics, and operations.
• The past, the present, and the future should be measured.
• The measurements should provide information to everyone involved in the BI value chain.
• There should be quantitative measurements that support qualitative findings.
• It should be recognized that end users often find qualitative measurements more important than quantitative ones.

Although measurement of BI seems to be difficult to carry out, there are some example systems for measuring BI. For example, Herring (1996) suggests four measurements for use in assessing the effectiveness of BI: time savings, cost savings, cost avoidance, and revenue enhancement. The latter elements are typical outcomes expected from the successful implementation of BI. However, Herring (ibid.) does not specify how these effects can be measured, and thus his suggestion is not profound. Simon (1998, pp. 45–48) categorizes BI metrics as “soft” or “hard” measurements. The latter consist of standard measurements of BI, and their focus is mainly on duration, costs, quality, and outcomes. Soft measurements are more subjective\(^{51}\), and the reliability of the end results relies on, e.g., the methods and questions used. Soft measurements are used in research on attitudes, work methods, and company atmosphere. Simon (ibid.) emphasizes that a company should measure the utilization rate of information produced in a BI process because the bulk of decisions are made elsewhere than in a BI unit or function. Simon’s suggestion seems to be reasonable.

The performance of a BI process can be measured in terms of the deployability, scalability, and usability of the information stored (Chadwick 2001). According to Chadwick, deployment ability equates to the quickness, effectiveness, and scope of a BI process, whereas scalability is used to measure the capacity of a process to change. In other words, scalability indicates response to, e.g., the challenges of the information society, globalization, and new technologies. The third metric, usability, is used to measure the ease of use of BI applications and the coherence, suitability, and correctness of the information processed. However, these characteristics seem best for illustrating the properties of the BI software used. More BI measurements are discussed in two publications of the dissertation.\(^{52}\)

\(^{51}\) For example, Kemppilä and Lönnqvist (2003) and Antikainen (2006) also use the approach of subjectivity in their measurement research.
\(^{52}\) See articles IIb and IIIb.
Teleinformatic activities have blossomed with, e.g., the development of information and communication technologies in storing and sharing of information and the advent of the Internet. Systematic and effective BI is both technical and human, and thus the BI concept is also used to describe different kinds of technological applications. Usually, BI solutions aim to process and warehouse the gathered data and information and to refine it for decision-makers. It is good to remember here that the main target of an information system is to respond to the information needs of a company or individual decision-maker, not vice versa. For example, Davenport and Short (1990, p. 12) emphasize that the existence of information technology should not be the main reason for its exercise. They stress that the development of information and communication technologies generates new applications and potential but the development of business activities always must be based on the real support of the core business processes. Even if this rule seems obvious, many companies have begun to develop BI technologies without well-defined targets and cost analysis (Pulkkinen 2006, p. 20).

Numerous information systems are used in the context of BI. In addition, there are several methods for collecting, analyzing, storing, and sharing information, from electronic mail systems to portals and shareware programs. At the same time, there is also growing pressure to integrate formerly disparate information systems and applications to meet today’s actual and upcoming business needs. According to Choo (2002, p. 91), BI applications and systems assure that critical information is not lost, information gaps are located and filled, overlapping information management is reduced, and the information gathered is processed and integrated more systematically for the needs of decision-makers. Hohhof (1996) states that BI systems enable fast access to enriched information for the benefit of analysts, collectors, and end users.

Typically, BI systems consist of software, technologies, platforms, and analytical applications that aim to process and store essential information, and especially analyze possible trends and relationships. According to Thierauf (2001, pp. 4–7), a BI system comprises knowledge management systems, online analytical systems, decision support systems (DSSs), and executive information systems (EISs). Thierauf emphasizes that a company thus gains better insight into the current and, especially, the emerging state of business and operations. In Figure 18, Thierauf (2001, p. 6) illustrates the framework

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53 Vitt et al. (2002, p. 24) state that the BI software industry started in the early 1990s.
54 Decision support systems provide information on company performance, forecasting of sales, and optimization of product mixes for both strategic and tactical decision-making for structured and semi-structured decision (Bocij et al. 2003b, p. 253).
55 Executive information systems help senior managers make strategic and tactical decisions and analyze, compare, and highlight trends to help guide a company’s strategic direction (Bocij et al. 2003b, p. 257).
for an effective BI system. It is good to notice that the focus of the framework is mainly on internal information sources and that it emphasizes the role of data warehousing.

![Figure 18. Example of an effective BI system (Thierauf 2001, p. 6).](image)

According to Thierauf (2001, p. 6), the effective BI system gathers information from operational systems and functions of a company and processes it with BI software into enriched information such as analysis, discoveries, and new ideas. Vesset (2001, pp. 1–2) defines a BI system as consisting of search and reporting systems, online analytical processing (OLAP), data mining, a data mart, a data warehouse (DW), and EISs. He states that BI systems enable the dissemination of relevant information for analysis and reporting. In other words, a BI system is not efficient if the stored information cannot be analyzed and processed systematically and rapidly. Also, Hackney (2000, p. 39) illustrates a BI system as mainly composed of data mining, data warehousing, analytical tools, and reporting systems. Chadwick (2001) lists three features of effective BI systems, as follows:

- **Integration service.** The facility to gather and integrate data and information from several sources.
- **Information service.** The facility to convert raw data into relevant, high-quality information and knowledge. The information processed has to fit the information and reporting needs of end users at different operational levels.
- **Interaction service.** The facility to share information and increase interaction among employees, the management, suppliers, and customers. For example, wireless communication and wireless data transfer are considered a prerequisite for interaction.

Geiger (2001, pp. 1–2, 8) emphasizes the supporting role of a data warehouse for a BI process. He describes an effective information system as akin to an information factory. The information factory enables streamlined gathering and processing of information. In
Figure 19, all of the information gathered from several operational systems is centralized in one data warehouse, in which the information is stored and processed.

The information thus analyzed is transferred from the data warehouse into specific data marts, which are categorized in compliance with the information needs of the decision-makers and the intended application. Data marts aim to speed up and rationalize the utilization of need-specific information (Geiger 2001; Thierauf 2001, p. 123; Vitt et al. 2002, p. 51). According to Geiger (2001), the information factory reduces overlap in information gathering and analyses and it assures the richness and diversity of information in decision-making. Kalakota and Robinson (2001, p. 359) emphasize the ability of BI systems to personify the information processed. According to them, information that is personified facilitates and speeds up the use of BI because the information is automatically in a user-specific form. Kalakota and Robinson (2001, pp. 358–359) categorize the foci of BI applications as follows:

- information organization and collection
- analysis and segmentation
- real-time personalization
- multi-channel delivery and interaction
- performance monitoring and measurement

It is easy to notice that these foci of BI systems are similar to the phases of a BI process (cf. section 3.2.4). This again illustrates the direct link between BI and technical applications; software and technical solutions enable the effective implementation of a BI process.

Bawden and Blakeman (1990, p. 158) emphasize that most of the difficulties of information systems emerge as early as in the planning stage. According to them, forgetting the following factors typically presents problems: end users, real needs related to information systems, complexity of the usage environment, excessive optimism of designers, and readiness for future changes. The most critical complications

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in applying BI or DSSs are, in order of importance, the top management being unable to identify their information needs, poor quality of the information for processing, a lack of internal information, collision between the priorities of users, technical problems, political difficulties in the company, and unavailability of external information (Uusi-Rauva 1994, p. 4). Also, that many companies have islands of data and information in multiple, incompatible formats and information systems instead of having all of the information in the company-wide BI system complicates the effective use of BI.

The survey results presented in Article Ib indicate that there is a wide selection of BI technologies in the top 50 Finnish companies. Most of the respondents (82%) had an information system dedicated to BI in 2005. The companies with a BI tool implemented stated very clearly that this tool was used for disseminating information. A few respondents reported that the tool was used as a data warehouse or a portal of some sort. Some respondents revealed one of their goals regarding BI to be eventually to have all information, internal and external, in the same system instead of having several systems running simultaneously. The respondents also stated that their current tools and systems did not match actual demands. Looking at global survey results (Global Intelligence Alliance 2005), one finds that the highest penetration of technological tools among the 18 countries considered was in Finland (82%). On average, 65 percent of companies around the world had some kind of technological tool.

At the beginning of the 21st century, change seems to be the order of the day. However, it is not just information technology that is changing more rapidly each day; the business environment and requirements are as well. In addition, the target of information processing has shifted from being static to proactive and interactive because of increasing globalization, networking, and competition for market share. At the same time, companies must cater more and more for information security. New information technologies and applications provide a great deal of information surrounding specific topics, but it is not always complete enough; thus, human intelligence is also needed for a fuller picture of a company and its business environment. Roos (Savolainen 2006, p. 6) says the challenges of BI are divided into two types: technical and social problems.

As discussed in section 1.1.2, there have been BI activities in companies since the dawn of capitalism (Gilad and Gilad 1986), but, in the research context, the concept of BI is still quite unspecific and the status of intelligence theories has not been fully established. In addition, BI interfaces with several business activities and processes of a company, and it is stressed that BI should be integrated more actively with those activities (see, e.g., Bärlund 2004, Pulkkinen 2006). Because of this, the connection between BI and other information-intensive managerial activities is discussed in the next section. The activities under consideration have been selected on the basis of the theoretical review in chapters 2 and 3.
3.3 Relationship of BI to other information-intensive managerial activities

3.3.1 Management accounting

Management accounting has seen many changes in recent years. For example, its role has shifted from scorekeeper of past performance to business support (Kaplan and Atkinson 1998, p. xv; Burns and Vaivio 2001, pp. 389–390). Neilimo and Uusi-Rauva (1997, p. 35) point out that the use and scale of accounting information in decision-making is wide and is expanding all the time. The current objective of management accounting is to provide information to decision-makers and managers in their planning and control activities (Kaplan and Atkinson 1998, p. 1; Horngren 2004, p. 207). The importance of planning and control activities seems to be emphasized in many authors’ definition of management accounting. Radebaugh and Gray’s (1997, p. 580) definition is somewhat different. According to them, routine internal reporting should provide information on cost management and the planning and controlling of operations, whereas non-routine internal reporting should provide information for strategic and tactical decisions (e.g., pricing, investments, and long-term plans). The latter purpose of management accounting information is very similar to the main target of BI, but the information refined within a BI process is typically more qualitative than management accounting information, with BI producing both qualitative and quantitative information, whereas management accounting information is typically in a more specified form.

From the analyses in chapters 2 and 3, one can see that those in management should receive information about the overall performance of a company (e.g., outputs or benefits v. resource usage) but also about possible developments in market shares, trends, and revenues in the business environment in order to provide a holistic picture of the factors affecting the company’s success. In addition, management requires long-term information (e.g., life cycle value) besides short-term information (e.g., sales and profitability). Therefore, management accounting and BI together can produce information about the implementation of the current strategy and overall performance (e.g., profit and loss, sales revenues, ROI), not just the relevant operational information. With a comprehensive view of performance, a company can control key figures and optimize its business by minimizing risks and making better use of available market opportunities. However, this assumes the ability to integrate information from various sources and develop it into understanding and insights (Thierauf 2001). With integrated information, a company can make decisions more quickly, reduce uncertainty, and react immediately to changes in strategy implementation.
The Balanced Scorecard (Kaplan and Norton 1996) is one well-known management accounting tool used to refine raw data and information into valuable knowledge and intelligence. Usually, the four measurement perspectives of the framework are the financial, customer, process, and learning and growth perspective. Data and information concerning the measurement subjects are needed for calculating the necessary measurements and figures defined in the Balanced Scorecard. The next step is to present measurements in a well-defined framework based on the company’s vision and strategy. Before all of this can happen, considerable work must have been done to define the visions, strategy, success factors, and the metrics for the scorecard. In order to make the refinement of data and information more efficient in the future, the management’s prior knowledge and intelligence are also needed in building the Balanced Scorecard. To successfully analyze the changing figures for individual measurements, managers need both experience and prior knowledge. Intelligence (i.e., understanding of relevant or causal relationships between success factors) is also more than useful. Analyzing these changing figures, a company actually produces new knowledge and understanding of its business and learns more about the dynamics of business operations, the business environment, and how to outmaneuver its competitors. The Balanced Scorecard can be used alongside BI to add value to raw data and information, and as a tool in communicating and implementing strategy. In addition, the two tools seem to have a similar refinement process for information behind key activities (cf. section 3.2.4).

There seems to be a connection between management accounting and BI. These activities complement each other and together produce comprehensive information through which the management gets a balanced and holistic picture of the company and factors affecting its success. In addition, BI is needed to produce information in a timely and easily consumed way in order to increase the knowledge underlying reasoning and also the understanding of the meaning behind accounting and performance information, through analyses, perception, and systematic or ad hoc querying. Management accounting, in turn, produces useful accounting information for use within a BI process.

3.3.2 Knowledge management

The meaning of intangible assets, the immaterial value of companies\textsuperscript{56}, and the ability to innovate have increased significantly since the 1990s (Edvinsson and Malone 1997; Hope and Hope 1997; Sveiby 1997). In order to develop its ability to utilize intellectual capital, a company needs a suitable accounting system and supportive management methods and tools. Traditional accounting systems are not able to measure the value of

\textsuperscript{56} Relationships with business partners, brand, new business ideas, know-how, company culture, etc.
intangible assets or report on them. More complex cost accounting is required to control and manage new value creation activities. In addition, existing management processes and methods should assure a supportive company culture and a fast and well-organized exchange of information between key managers and decision-makers.

Although knowledge management (KM) is a concept that has been adopted quite broadly in academia and business (Halawi et al. 2005, p. 75), there are several ways to define and understand the content of KM. One reason for the favorable development of KM may be that companies have long recognized the significance of the management of intangible assets. In addition, the ability to create and manage information and knowledge is fundamental to the success of knowledge-intensive companies (Drucker 1988; Prahalad and Hamel 1990). There seem to be two approaches to KM, at least in the literature. The broader approach composes the methods for managing the human capital and intangible assets of a company, whereas the narrower defines KM as a system or a set of tools for managing information and knowledge in a company. Liebowitz (2006, p. 16) presents KM as answering the question of how to best leverage knowledge internally and externally, with KM dealing mainly with creating a process for generating value from the intangible assets of a company. Ståhle and Grönroos (2000) state that KM is a sub-concept of the management of intellectual capital, whereas Wilson (2002) wonders whether management of knowledge is even possible. Wilson defines KM as an umbrella concept for organizational activities focusing on management of information and work methods. Definitions of KM seem to vary with the perspective from which KM is approached. Defining KM is thus difficult because it has several interpretations (Chong and Choi 2005).

Nonaka and Takeuchi (1995) have studied KM in the context of the innovation process in Japanese companies. Their study starts from the premise that KM is the art of management in the dynamic environment. Nonaka and Takeuchi (1995, p. 124) define KM as the management of the dynamic processes of knowledge transformation. They state that any form of information or knowledge in a company is manageable, and that the highest form of knowledge is tacit knowledge. Jashapara (2004, p. 12) defines KM as “the effective learning process associated with exploration, exploitation, and sharing of human knowledge (tacit and explicit) that use appropriate technology and cultural environments to enhance an organization’s intellectual capital and performance.” According to Rowley and Farrow (2000, p. 15), KM consists of explicit and tacit knowledge as well as processes related to identification, creation, renewal, and sharing of information and knowledge represented in the area of any of the three elements

57 Changes in the official accounting rules do not address this, although there is a need to offer a more realistic view of performance by including more information about, e.g., trends, competitors, customers, and intangible assets. It also proves problematic to, for example, recognize intangible assets in accounting systems as assets.

58 Tacit knowledge is created via the internalization of explicit knowledge – i.e., learning (cf. Section 2.4).
(structural, human, and social). They remark that a company needs tools for storing, sharing, and refining knowledge in order to utilize and develop its intangible assets. Martinez (1998, p. 89) emphasizes the human context of KM and states that KM encourages individuals to communicate their knowledge by creating environments and systems for capturing, processing, and sharing knowledge throughout a company. Wah (2000, pp. 308–309) notes the task of KM as to prevent wasting of resources by seeking the best practices, managing intangible and tangible knowledge, and creating an interactive learning environment where employees share their knowledge.

The literature review points to the target of KM and BI as being quite similar; they both aim to enhance information’s utilization, speed up decision-making, refine information, and maximize organizational performance, by gathering, processing, and sharing information and knowledge. Their scope and viewpoint, however, are different. For example, the concrete needs of management and decision-making form the basis for BI, whereas KM gets off the ground from more abstract issues. In addition, BI seems to be more oriented toward business, decision-making, and technology than KM, which typically appears in the organizational context. Management of people and human knowledge are emphasized in KM, enabling interaction between individuals or groups more effectively than BI, which more purely focuses on the managing of information itself. It is, however, noteworthy that human-source intelligence is a theme that is arising in the field of BI (see section 3.2.3) and KM offers practices and methods that could be valuable in enhancing BI with consideration of human issues. For example, social network techniques are applied to map knowledge flows and detect knowledge gaps in a company in the KM field (Liebowitz 2006). Those techniques could be suitable for developing, e.g., the use of tacit knowledge in a BI process. In turn, BI provides more business-oriented information but also methods useful for protecting a company’s information assets in the field of KM (see Section 3.1).

Neither concept is an ultimate tool solving all information management or knowledge transfer problems, but together the two offer very systematic approaches to improving a company’s performance and information management. To develop long-term learning and adapt to business changes, information processed in BI should be integrated with internal knowledge (Weiss 2003, p. 49), which is managed mainly by KM.
3.3.3 Strategic management

In the literature, several definitions are provided for the term “strategy.” According to Chandler (1962, p. 16), strategy aims to define long-term goals and objectives and to control and share resources in accordance with the aims. The definition of Chandler was one of the first to emerge in the business context. In the early 1970s, Andrews (1971, p. 28) defined strategy as a pattern of purposes and goals with major policies and plans for achieving those goals. Andrews also stated that strategy defines in which business a company is present or is to be present and the kind of company it is or is to be. Mintzberg (1987) differentiates five interrelated approaches to strategy: pattern, perspective, plan, ploy, and process. Steiner and Miner (Barney 1997, p. 9) call strategy the formulation of missions, purposes and objectives, policies and programs to achieve them, and methods to ensure that they are implemented to reach organizational ends. Näsi and Aunola (2001) define strategy as the plot of entrepreneurship, the thread of its events. The term “strategy” has traditionally referred to relatively invariable guidelines on the long-term targets of a company, but in the turbulent business environment strategy is as much about “competing for tomorrow’s industry structure as it is about competing within today’s industry structure” (Hamel and Prahalad 1994, pp. 40–46).

Besides strategy, the concept of strategic management has changed since the 1950s and 1960s, when it was used mainly for formal budgeting and financial control (Ansoff 1965; Grant 2002). In the 1970s and 1980s, the concept evolved from corporate strategy and systematic planning and control to choice of industries, markets, and segments and positioning in order that a company could gain competitive advantage and perform activities better than its rivals (Porter 1980; Porter 1985; Porter 1987; Grant 2002). Nowadays, the role of knowledge and innovation is emphasized (Grant 2002, p. 22) and companies must adapt, shape, change, innovate, create, and network in order to thrive in the rapidly changing global business environment (Leibold et al. 2002, p. 18). Because current strategies are not direct plans that can be followed step by step, strategic approaches have to evolve to create new competencies and strategic orientation must move from rational to proactive (Hamel and Prahalad 1994; Ramirez and Wallin 2000; Leibold et al. 2002). The literature contains a number of process models for strategic management (see, e.g., Wheelen and Hunger 1992; Johnson and Scholes 1999; Thompson and Strickland 2001).

In planning their strategy, companies need to consider pressures and challenges caused by the business environment if they are to survive in a dynamically changing economy. It is also said that a strategy can be no better than the information from which it is derived (Herring 1991, p. 49). However, it may be very difficult to pick out what is relevant from an overload of information even if there is a growing need for very

59 The role of BI in the context of strategic management is discussed more extensively in Article IIIa.
timely, first-rate business information and knowledge. Tyson (1986, p. 10) even argues that strategy cannot be created, improved, or implemented effectively without BI. Also, Waters (1996, p. 41) notes that BI has a crucial role in strategic management because a strategy amounts to just guessing if BI is not used in its design. In other words, BI produces information that reduces the uncertainty of strategic planning and decision-making (Tyson 1986, p. 4; Frishammar 2003, p. 320).

The top and middle management are the most important user groups for intelligence products in 287 companies around the world (Global Intelligence Alliance 2005; Article Ib). These two management groups are usually involved in the strategy process, and thus strategic decision-makers also seem to be an important user group of BI in practice. BI is one approach available for facing the challenges of information management in the strategic context. However, Badr and Madden (2006) remark that there is a lack of suitable frameworks providing a basis for integrating an intelligence process into the process of strategic management. One proposal for integrating those processes is discussed in the publications of the dissertation (namely, Article IIIa).

Herring (1999) divides BI activities into three categories: gathering and reporting, analysis and forecast, and processing and sharing of information. These activities are needed in running the main tasks of strategic management: strategic analysis, strategic selection, and implementation of strategy (Johnson and Scholes 1999). According to Prescott (1995), most strategic planning techniques bypass the data collection issues. Those techniques postulate that the information required is available or easily gathered, giving rise to a need for systematic intelligence activities. While BI can support the implementation of a strategic process and strategic planning and decision-making, it also produces information and analyses concerning competitors, trends, opportunities, threats, and weak signals that are needed in formulating the strategy. In addition to external success factors, internal information on a company’s competencies, strengths, and weaknesses is required in strategy creation, evaluation, and execution (Mintzberg et al. 1998, p. 26). From the foregoing discussion, it is clear that the required information should be gathered from both external and internal sources within a BI process. Herring (1988, p. 5) states that BI reflects changes in the business environment and thus enhances the knowledge of the top management and enables their long-term strategic planning and control. Page (1996) even refers to BI as a control tool of strategic management because it offers some mechanisms for managing strategic changes.

Analyses have a crucial role in both BI and strategic management. There existed several analytical methods before BI became common, but the aim of analyses in the BI context is to refine raw data and information into valuable knowledge and intelligence, and thus analysis is a very crucial phase in a BI process. On the other hand, Herring (1996) stresses the systematic nature of the BI process: BI is not just one of the analytical tools but a comprehensive process in which crucial information is systematically gathered,
analyzed, stored, and shared to meet the requirements of strategic management. Since business environment monitoring and analyses are often emphasized in the strategic management context, terms like “environmental scanning” and “competitor analysis” may be used instead of “BI” (Wheelen and Hunger 1992, p. 46). Environmental scanning refers to gathering knowledge about events, relationships, and trends in the environment of a company, knowledge that assists the management in planning the course of action (Aguilar 1967). Porter (1980), in turn, defines environmental scanning as covering competitors, suppliers, customers, technology and economic conditions, the political and economic environment, and social and demographic trends. The steps of environmental scanning are similar to intelligence activities, but environmental scanning has a narrower focus than BI – on the competitive environment, which can be scanned via, e.g., a decision-maker or an intelligence function (Rajaniemi 2005).

In conclusion, it seems obvious that there are several links between BI and strategic management and that, above all, BI creates information and knowledge in terms of insights and understanding that improve and optimize a company’s strategic decisions. Thus, BI is an information refiner and producer in the context of strategic management.

### 3.4 Summary

The literature review and conceptual analyses in chapters 2 and 3 point to intelligence activities as having roots in several fields of science, such as information science, military science, and business economics, but they have not achieved the professional status of the more traditional disciplines (Fleisher and Bensoussan 2003, p. 5). Intelligence activities have a long history, even though their intentional use in business is more recent and they are considered to constitute a relatively young discipline. Intelligence activities have connections with several functions of a company because they have grown out of developments in other functional areas, such as finance, marketing, information systems, accounting, and strategic management. Most companies perform intelligence activities in their daily duties at some level, whether conscious of them as such or not. The question under consideration is how systematic and well organized those intelligence activities truly are at the moment. Amid today’s rapid change, the timely and relevant information has to be gathered and processed for business decisions and for business evaluation and strategy in a systematic way instead of random and haphazard ways. Despite the importance of systematic intelligence activities, they are still trying to find a footing in both academia and the business world.

From the literature review, one sees that there are numerous intelligence concepts and that their categorization is not unambiguous. Also, the concept of BI is multidimensional. There is no precise or universally shared conception of what BI is; on
the contrary each author has promoted his own idea of its connotations. Also, BI practices have not become very well established in the realms of business. Several different forms are employed, depending on the purpose of use. On the other hand, this is not out of line with the approach taken in other managerial activities, but discussion between the use of concepts and methods is common. In Figure 20, the most typical viewpoints of BI are illustrated. All of these areas, except philosophy, are discussed in detail in their own sections of the dissertation. Philosophy here refers to methods and ways of thinking in the BI context, and thus that viewpoint is considered in several sections of the thesis.

![Figure 20. The areas of BI.](image)

It has become clear that BI has much to do with a company’s ability to refine raw data and information efficiently into decision-relevant and strategically valuable knowledge and intelligence. On the other hand, information has a direct connection to several factors related to intangible assets such as know-how, innovativeness, and industrial properties. Management accounting and BI tend to provide the basis for continuous and proactive control and for optimization of a company’s short- and long-term success in a dynamically changing business environment. **Management accounting and BI can be defined as managerial tools that contribute and produce information for strategic and business performance management; BI and knowledge management, in turn, aim to manage and share that information throughout a company as effectively as possible and to generate value from the intangible assets of a company and protect it.** In conclusion, there seems to be a need for information-intensive activities and tools such as BI to provide the management with relevant information for decision-making – e.g., in strategic management and performance management.
4 CONCLUSIONS AND DISCUSSION

4.1 Research questions

4.1.1 Q1: What are the relationships among BI-related concepts?

The literature review shows that intelligence activities have a long history even though their systematic use in the business context is more recent and they are considered a relatively young discipline. In the literature, the author found the first reference to BI in the 1960s (see Greene 1966). The roots of intelligence activities extend at least to military theories, information services, and marketing and strategic activities. Also, BI has grown out of developments in other functional areas of business, such as finance, marketing, information systems, accounting, and strategic management.

The conceptual analysis shows that the content of BI definitions has not varied much from the 1980s to the present, although there is no established or widespread definition and the choice of content is writer-specific as authors tend to promote their own emphases. Newer definitions are in line with the old, although the possibilities provided by information technology have developed a great deal. This may be a sign that BI is more like management philosophy or a managerial tool and that technology is indeed an enabler of BI. Technological advances add considerable value to information management, and thus their significance is certain, but BI cannot be utilized effectively through application of technical solutions alone. It is also noteworthy that, since each company is unique and BI is highly situational and company-specific, it is important to view BI within its own setting. In other words, a BI manager should choose intelligence practices, methods, and applications that fit the demands of the company concerned.

From the literature analysis done in Chapter 3 and the articles, BI seems to be a multifaceted concept; it refers to processes, technologies, methods, information products, and tools to support managing business information and making faster and better decisions. In this dissertation, BI is defined as an information process that contains a series of systematic activities driven by the specific information needs of decision-makers and the objective of achieving competitive advantage. With BI, a company can gather data and information, analyze information and knowledge, discover weak signals, develop approaches and strategies based on the results of analyses, and finally utilize the relevant results in business decision processes. With the refined information, a company can anticipate the actions of its customers and competitors as well as different phenomena and trends in its market areas in order to align its activities with changes in the business environment and outmaneuver the competition. In this
work, BI is considered to be a comprehensive concept including the utilization of both internal and external information sources.

In the process of preparing this dissertation, it became clear that there are numerous BI-related concepts. Among them are competitive intelligence, competitor intelligence, customer intelligence, market intelligence, strategic intelligence, counterintelligence, and technology intelligence. The literature offers various definitions and categorizations for these concepts, and some of them seem to overlap each other. Because the contents of the concepts have many similarities, ambiguous interpretations are possible. On the basis of the conceptual analysis discussed in Section 3.1, **BI is defined as a collective concept for other intelligence concepts because most of them are used as synonyms or subgroups of BI in the literature.** The most significant difference between BI and other intelligence concepts seems to be that most others focus mainly on the external environment or a single information element and gather information from external sources, whereas the content of BI is generally defined as more extensive. Following the comparisons between intelligence concepts in Section 3.1, the main areas of BI are illustrated in Figure 21.

![Figure 21](image_url)

**Figure 21.** Connections between BI and key intelligence concepts (based on Tyson 1986, p. 10; Fleisher 2001b, pp. 4, 7; Choo 2002, p. 88; Fleisher 2003, p. 62; Weiss 2003, p. 49).

During the research process, it has been highlighted that **the intelligence term applied typically refers to the type of information required in a company or specific decision-making situation, and thus the way information is processed stays mainly the same although the intelligence term varies.** In other words, the principles for how intelligence activities should be run systematically remain largely the same although they may be applied to address different issues and information sources. After all, intelligence activities, regardless of the label applied to them, all aim to provide a company with competitive advantage through improving and systematizing information processing and via the execution of effective decision-making. The management of valuable information is essential regardless of the source or type of the information. It
is, however, important to understand context-specific issues and to confirm the theoretical framework for intelligence terminology and activities.

4.1.2 Q2: How does BI relate to other information-intensive managerial activities of a company?

Today, the movement seems to be toward better integration of information from numerous sources, improved collaboration between personnel and interest groups, and more systematic and profitable information management. This trend has been discussed in the last few years but with limited evidence of real action or progress, and thus most companies still suffer from a lack of effective information utilization. The literature review indicates that BI offers a way of managing various types of business information and knowledge. Yet BI is not an ultimate tool, on its own meeting all of a company’s information requirements. Because BI interfaces with several business activities, it should be integrated with those processes more actively. High-quality business information does not add any value if the information produced within a BI process is not utilized in everyday business activities and decisions.

Generally speaking, the competitiveness of a company can be defined as its ability to operate successfully and proactively in changing circumstances. The best insight helps a company to achieve competitive advantage. Despite the emphasis on the future, the best insight involves not merely information but also the best background understanding. Knowledge and understanding are thus the basis for competitiveness in an ever-changing business environment. By integrating accounting, controlling, and management systems more effectively, a company can improve its performance and provide a balanced and holistic view of itself and factors affecting its business. However, companies’ information-intensive activities often operate in isolation, and therefore their collective value is not utilized effectively. In addition, the integration of information to support the existing business processes and the requirements that this integration imposes for information processing have received little study. The general attitude is also sometimes more skeptical than approving for new, seemingly faddish abbreviations and information-intensive activities.

Management accounting offers access to historical data, and thus a good view of past events is achieved. However, there is a need for, e.g., comparison of historical and current performance in order to improve the planning of processes. One reason for the lack of information integration may be the dispersion of data and information across many databases and systems that are not integrated with each other. A company cannot get a 360-degree picture of itself and factors affecting its success if information-intensive activities and technology systems do not complement each other.
and together produce valuable information. In this context, BI is needed to produce business information in a timely and easily consumed way in order to increase the knowledge about accounting, strategy, and performance through analyses, perception, and systematic or ad hoc querying. Overall, BI generates insights into the changing business environment and helps a company to learn from its own actions.

The literature offers no frameworks for integrating an intelligence process into the process of strategic management (Badr and Madden 2006). Some guidelines for attempting to integrate a BI process into strategic management were produced in the single-case study of Article IIIa. First, the utilization of human-source intelligence should not be designed as a separate activity from strategic activities. Second, the integration of various types of information from different sources should occur in the analysis phase of a BI process (see section 3.2.3). However, one important part of interpretation is not done until the utilization phase, when prior knowledge of a decision-maker is integrated with information refined within a BI process. From the case results, it appears that most difficulties in the integration between a BI process and strategic management are related to the lack of a systematic approach to the utilization of human-source intelligence. The case study suggested that a BI process should act as a funnel that systematically produces information for strategic decision-makers by refining information from the operational level through classification, analysis, and compacting into a component of strategic actions. The case study points to a need also for a continuous cycle within which BI and strategic management processes are merged and strategic learning takes place.

Separate information processes are not able to produce a holistic view of the demands of a proactive management that presumes the synthesis of information produced by information-centered activities. Powell (1996) states that separate pieces of information should be integrated, attached to a relevant framework, turned into understanding, and finally applied to a decision. By integrating discrete pieces of different types of information, a company can know where it is and where it will go. In addition, a forfeited possibility is often lost forever because the rate of change of the business environment is significant. In a dynamically changing environment, a company can learn by “creating, acquiring, and transferring knowledge, and – modifying its behavior to reflect new knowledge and insights” (Garvin 1993, p. 80), and thus managerial tools such as BI are required for producing valuable information for decision-makers.

4.1.3 Q3: How can one measure BI?

In the literature, it is emphasized that BI benefits a company in the form of, e.g., intelligent and proactive analyses, early warnings, and support to decision-making (cf.
section 1.1.2). In addition, it is said that BI increases understanding of the business environment in which a company operates; establishes how and where the company can add value; and clarifies the structure, dynamics, and information relating to the company’s markets and industry. However, BI does not come about by itself – it requires considerable, systematic, and continuous work and resources. Despite the growing need for a measurement perspective on BI, the literature presents few BI metrics to uncover those benefits. Reasons for the slow development of BI measurement may be that BI is carried out in several ways, a supporting measurement culture does not exist, and BI measurement is overlooked because of its difficulty and cost concerns. In addition, it is difficult to assess the effects of a separate activity or an information system on the profit of a company. Often, the efforts are known but the increase in value is harder to judge.

As suggested in Article IIb, there are two main reasons for measuring BI: the valuation of BI in order to prove that it is worth the effort and the measurement of BI activities in order to help manage a BI process. It arose in the literature review that measurement is generally considered an important aspect of BI and there are many potential ways to measure BI. However, only some companies are actually measuring BI, because the measurement is considered difficult to carry out in practice. The survey results presented in Article Ib indicate that there are few BI-related metrics applied in the top 50 Finnish companies. Typically, the companies assess time savings, volume discounts, and utilization rates of BI tools. In addition, half of the respondents make inquiries of the end users and four companies use open feedback in assessing the benefit, while 20 percent of the top 50 Finnish companies have no BI measurements at all. Article IIb points to various company-specific issues affecting how BI is measured. Certainly, measuring BI is a demanding task and definitely something on which companies need to concentrate more in the future.

The results of the literature review in Article IIb indicate that balanced performance measurement could be applied for measuring BI. Article IIIb’s case study suggests that the proposition in question is valid: Performance metrics were chosen in line with the case company’s vision and the BI function’s targets and strategies, and parameters were chosen from several perspectives, for a balanced and holistic view of the company. In addition, the case study illustrates that division of the reasons for measuring BI into two main purposes does not occur as clearly in the case company as in the literature and that both uses of measurement seem necessary in practice. In the case company, measurement of BI was used as a tool to develop and improve BI activities and to demonstrate BI’s usefulness. Hence the question arises of whether the purposes of BI measurement can be categorized in practice. The case study indicates that there should be no such strict categories of BI metrics.
4.1.4 Q4: How is BI utilized in large Finnish companies?

As discussed in section 1.1.3, information services have a reasonably long tradition in Finland, but their content has developed from data collection into more analytical, systematic, and process-oriented activities. In particular, the economic and structural changes in Finnish business life in the first half of the 1990s created favorable conditions for the development of systematic intelligence activities. The survey results presented in Article Ia point to most of the top 50 Finnish companies (92%) starting to use BI in the 1990s on recognizing a need for more effective and systematic information management. Because of the changes in Finnish business life in the 1990s, the top management had to foresee changes in the global business environment, expand business operations to other countries, and make decisions more quickly than before. For several companies, the driving force behind using BI was thus a need to obtain knowledge of the business environment and its development to support their strategic and operative planning and decision-making. Overall, there were several reasons for beginning BI activities but the general goal was to increase the refinement and utilization of valuable business information. That trend is no surprise: in the incredibly complex global markets, decisions must be based on very well integrated, up-to-date business information if early insights are to translate into winning business concepts.

Currently, BI is quite common in the top 50 Finnish companies. Between 2002 and 2005, the percentage of these companies that used BI increased from 80 to 95 percent. That statistically significant increase (cf. section 1.5.3) in an already high figure illustrates that large companies use BI and BI is likely becoming an integral part of their activities. Among 18 countries, Finland was one of the top three markets (with Germany, Switzerland, and Brazil) in terms of systematic execution of intelligence activities in 2005 (Global Intelligence Alliance 2005; Article Ib). Large Finnish companies have in 15 years joined the group of countries with the most advanced intelligence activities.

Although BI and other intelligence concepts, as such, have not yet become established in companies or the literature, “BI” seems to be the most popular term for the systematic management of business information in Finland. In 2005, 67 percent of the respondents used that concept, whereas the percentage was lower in 2002, at 49 percent. In 2005, in place of BI, companies most often used terms related to competitor intelligence and market monitoring, with 22 and 12 percent, respectively. Seven percent used the term “competitive intelligence,” “market intelligence,” or “market research.” The survey

60 Representatives of 287 companies were interviewed, in Brazil, Canada, Finland, Germany, Mexico, the Netherlands, Norway, Switzerland, and 10 Asia-Pacific countries in 2005 (Global Intelligence Alliance 2005; Hannula and Pirttimäki 2006; Article Ib).
results show that large Finnish companies appear to differentiate intelligence activities from knowledge management: only two percent placed the activities in question under the heading “knowledge management” in 2005, and none did so three years earlier. While the Finnish terminology varies somewhat, “BI” is a significantly more popular term for intelligence activities than any other. As mentioned in sections 3.1 and 4.1.1, the term applied seems to relate to the type of information processed in each company, but the level of distinction between “BI” and other intelligence terms is often low, because processing methods are similar and it is often only the focus of intelligence terms that varies. The distribution of intelligence terminology in Finland supports the theoretical proposal addressed in sections 3.1 and 4.1.1.

The survey results indicate that three information needs – competitors, one’s own industry, and customers – were most often covered by BI in large Finnish companies in 2002 and 2005. These three needs were clearly indicated to be most important. The ranking of information elements may explain the intelligence terminology usage in Finland. The most popular term, “BI,” encompasses all of the aforementioned information needs, whereas the second most common term, “competitor intelligence,” supposedly focuses on competitor information. In 2005, other necessary information needs were, in order of importance, macro trends, countries, and customer industries. The popularity of information related to technologies and parallel industries declined most in the three years. As discussed in section 3.2.2, the top three information needs (as above) were ranked in companies around the world the same as in Finland, and thus these information elements seem to form the core of intelligence activities and to have a strong impact on business success, in Finland and worldwide.

The survey results presented in Article Ib indicate that the most important benefits expected from BI were, from the most important, improved quality of information, internal information dissemination, and level of awareness. Surprisingly, in 2005, the respondents did not feel improved effectiveness and identification of threats and opportunities to be among the top three benefits gained, but they did see these as moderate benefits. Threat and opportunity identification was ranked second most important three years earlier. Quite often, early signal detection is used as a selling point of BI, and thus the low ranking may indicate that large Finnish companies are not able to utilize BI fully in this respect. In both surveys, accelerated decision-making, decreased costs, and time savings were considered the least important benefits, bringing up the rear in the ranking. The cost and time-savings benefits are typically long-term, and therefore it is asking a lot to associate these benefits with certain activities.

In 2005, the top 50 Finnish companies used continuous monitoring, regular reviews, and ad hoc reports in the context of BI. According to the Global Intelligence Alliance (2005), continuous monitoring is typically practiced in all intelligence markets but ad hoc reports only in mature markets. The results of their global study supported this supposition. Another indicator of mature markets may be the location of an intelligence
process. In mature markets, intelligence is produced mostly within companies, whereas outsourcing is typical of emerging markets. The survey results in Article Ib indicate that 27 percent of the top 50 Finnish companies processed information externally and 73 percent in-house in 2005. These percentages indicate that most large Finnish companies utilize their own resources for BI, which may also be an indication of the market’s maturity. The Finnish distribution matches the global average; globally, 70 percent of respondents reported intelligence activities to be company-internal in 2005 (Global Intelligence Alliance 2005).

The results presented in articles Ia and Ib indicate that the top management and middle management are the most important user groups of BI in Finland. However, there seems to be a change in the importance of management as a user of BI. In 2005, the middle and top management were almost equally important user groups, whereas in 2002 the top management was notably more important than the middle management. In 2005, middle management and experts used BI products in all of the responding companies, whereas the top management utilized BI products in 92 percent and other employees in 41 percent. The change in the emphasis of end users may account for observations during the dissertation process that sometimes the top management do not understand that some insights, analyses, and information that they get from the middle management and experts were originally provided by a BI function. If the top management is uninformed of BI, it is, naturally, difficult to support or utilize BI. On the other hand, the emphasis of BI may even be moving to a more tactical front in Finland, if the role of the middle management as users of BI products continues to grow in importance. On the whole, BI products are used broadly within large Finnish companies, although the top management and middle management are the most significant user groups.

In 2005, most of the respondents (82 percent) had an information system dedicated to BI. The companies with a BI tool implemented stated very clearly that the tool was used for disseminating information. A few respondents reported that the tool was used as a data warehouse or as a portal of some sort. Some respondents revealed that one of their goals for BI was to have all of the information, internal and external, in the same system eventually, instead of having several systems running simultaneously. Overall, the results indicate the use of a wide variety of BI technologies in the top 50 companies. Added to that, Finland had the greatest penetration of technological BI tools among 18 countries around the world in 2005 (Global Intelligence Alliance 2005; Article Ib). This does not, however, indicate successful response of the individual companies to their unique needs: some Finnish respondents stated that “present tools and systems do not match real demands.” The reasons are many, but the result is often information users’ frustration with a multiplicity of applications and complex user interfaces.

One reason for the dissatisfaction with current BI systems may be that some companies have started BI “backwards”; some respondents first acquired numerous information
tools and applications for information processing but at the same time lost sight of the human viewpoint, although cultural and technical issues together determine the utilization rate and success of BI. Bearing out this view, none of the top 50 companies indicated in 2005 that they excel in collecting and utilizing information from personnel in the BI context, even though the respondents did select improved information dissemination as one of the most important benefits achieved through BI. Apparently, those benefits have been achieved through technical tools, such as portals. By contrast, companies in 16 countries felt their operations involving human-source intelligence to be good or satisfactory at least (Global Intelligence Alliance 2005). Only Finnish and Dutch companies described their actions in this area as “fair.” These results may indicate that Finnish companies’ efforts have been more focused on BI technologies than global companies’, on the average, which would also explain the sense of there being less attention to human issues.

The survey results presented in Article Ib show that the top 50 Finnish companies had very few tools for managing human-source intelligence in 2005. A small number of respondents, however, did indicate that they collected information from personnel via informal discussions61, allowing employees to insert news into a portal, or letting them publish market signals anonymously on the company intranet. The case study of Article IIIa illustrates the challenge of putting information from human sources into use in strategic management and decision-making. The study suggests that lack of a systematic approach to information sharing and utilization and of a supportive company culture complicates the flows of information in a company. As discussed in Chapter 3, it is essential that companies encourage an information-sharing culture before implementing new tools or technologies. New applications provide a great deal of information about specific topics, but it is not always perfect or complete, and thus human-source intelligence is needed for building a holistic picture of the company itself and its business environment. Besides formal information, decisions rely on decision-makers’ experiences, opinions, understanding of business, and business plans. Hence, it is essential that BI involve the management of people at least as much as that of information and technologies.

From the survey results presented in Article Ib, the percentage of large Finnish companies planning to increase their BI investments at least moderately saw a decline from 78 percent to 64 percent on a three-year scale. The percentage of respondents expecting company BI investments to decrease moderately remained constant, at two percent, whereas the proportion of the companies expecting no change in investment increased from 20 to 34 percent. None of the companies planned to decrease BI investments notably. Because 73 percent of the Finnish companies carry out their BI

61 On the other hand, there is, presumably, no organization wherein informal discussions are not carried out in some way.
operations internally and 82 percent of them have an information system dedicated to 
BI, it is reasonable to assume that developing BI has demanded investments and 
resources in recent years and that, with these developments largely complete, the efforts 
put into BI are now staying at the same level or are on the decline. The results also show 
that **BI may be at the stage where the top 50 companies tend to systematize and 
rationalize activities instead of making initial investments.** However, moderate 
growth in BI is still expected for 2006–2011, and the readiness of the top 50 companies 
to invest in BI corresponds to the global average. Namely, 69 percent of the companies 
around the world expected their investments in intelligence activities to increase on the 
same time scale (Global Intelligence Alliance 2005).

Identification of information needs was felt to be the most demanding area for 
improvement of BI in the top 50 companies in 2002 and 2005. One reason for this result 
may be that those needs are partly unarticulated or unconscious. Identifying critical 
information needs is one of the activities proving BI’s usefulness in meeting significant 
needs and keeping the end users satisfied. Without such effort, BI may be an expensive 
waiste of money and time, and thus there seems to be a fundamental problem in the 
execution of BI among large Finnish companies. Utilization of human-source 
intelligence was also considered a notable area for development. The ranking result is 
no surprise in view of the aforementioned concern of most respondents that company 
exploitation of human-source intelligence was only satisfactory or fair. **Alongside identifying critical information needs and utilizing human-source intelligence, 
effectiveness of information gathering and management was considered one of the 
top three areas for improvement of BI.** These development issues were ranked as the 
top three in 2002 and 2005, which may show that there has not been any significant 
progress and that many companies struggle with these development issues, making them 
a reasonable target for general attention in the future. These issues overlap to some 
extent, and thus they also call for similar development activities.

There were some changes in terms of the areas considered most crucial for 
improvement of BI. For example, the importance of top management commitment 
climbed from eighth to fourth most critical development target on the three-year time 
scale. The ranking of human resources and measurement of the benefits of BI did not 
change; these remained the fifth and the sixth most critical target for development, 
respectively. As was discussed above, it is middle management and experts who use BI 
products most often in large Finnish companies, and that result may explain, in part, the 
need expressed by respondents to improve the top management’s commitment to BI. As 
discussed in section 4.1.3, the literature presents few BI-related metrics. However, using 
BI consumes resources, and thus there should be a way to determine whether the efforts 
are reasonable in comparison with the profits received.
To conclude, BI is in common use in the top 50 Finnish companies and has developed since the 1990s. Generally, large Finnish companies view intelligence activities as **holistic and essential activities incorporating information, people, processes, and technology**. Larger companies need most of all information about competitors, the industry, and customers (e.g., global markets, where Finnish culture, practices, and language cannot serve as a sufficient guide). Although the results illustrate that the position of BI is quite stable in Finland, the respondents would like BI to become yet more systematic. In other words, they felt that BI is currently not systematic or comprehensive enough. In addition, they expected the requirements of BI and the number of information elements only to increase in 2006–2011. One respondent pointed out in 2005 that personnel understand the benefits of BI only after wider implementation of BI. Hence, BI should be recognized throughout a company, and especially by the top management, if its status is to be confirmed. In addition, there are several human information sources that are bypassed in the top 50 Finnish companies. Decision-makers need business information from different sources and subjects, inside and outside the company. Also, the type of information needed can vary from quantitative to qualitative and can be stored in both databases and human minds. The top 50 companies might experience BI as more systematic if they put greater emphasis on the development of human issues.

Ensuring information quality plays a crucial role in BI. The information processed should be both accurate and valid (see Section 2.5) because BI aims to aid managers and key decision-makers to improve company performance by increasing the correctness of mission-critical decision-making. If quality targets are not met, there is no real purpose in any operations concerning BI. However, there is a need to make not only better decisions but also better decisions more rapidly. In order to speed up and rationalize decision-making and information management in general, highly developed applications and knowledge of technology are needed. The top 50 companies felt that current tools and systems do not match the demands, and they ached for a company-wide BI system ensuring that valuable information would be achievable in a BI process. An ideal BI system would decrease the number of disparate databases and applications and integrate internal and external information, with all of the information being achievable via one company-wide BI system. An advance of this kind would be advantageous, but there is a risk of the bulk of the investments being focused on technical details, at the expense of human elements. Because BI has developed quite rapidly in Finland, there does also remain a risk of companies being lulled into complacency or a sense of safety due to past success, and thus pursuing a less informed route to the improvement of intelligence activities. It is here where some critical issues could be forgotten.
4.2 Contribution of the research

Producing new information is the essential criterion for a dissertation (see, e.g., Olkkonen 1994). The starting point of this thesis was the scarcity of knowledge about the utilization of BI in large Finnish companies. The contribution of the dissertation to knowledge is based on the examination of the research topic in question and the improvement in the knowledge and understanding of the evolution, state, and use of BI in the setting of large Finnish companies.

One of the theoretical contributions of the dissertation is the comprehensive definition of BI and the positioning of BI-related concepts, obtained as a result of the conceptual analysis. The connections between BI and its related intelligence concepts have been quite confused, and well-established definitions have been lacking in companies and in the literature. The dissertation clarifies a collection of BI-related concepts. Conceptual analyses and a theoretical framework are built mainly in chapters 2 and 3 but also in the publications.

The description of the utilization of BI is achieved via empirical data from two surveys and two single-case studies presented in the articles. Empirical findings can be seen not only as a supplementary part of the theoretical contribution but also as an independent contribution. For example, the survey results in articles Ia and Ib give insight into the use of BI in the top 50 Finnish companies but also information about the evolution of BI in Finland and how the intelligence activities of the top 50 Finnish companies are situated in a global context. One of the findings of the dissertation is that BI has developed into a key management tool of the top 50 companies and established its position in Finnish business life since the 1990s. Numerous global, economic, and business changes in the early 1990s compelled large Finnish companies to search for new market areas and methods of working. In particular, the companies became aware of the value of systematic information refinement as an enabler of competitiveness in the rapidly changing business environment and amid global competition. In other words, those changes created favorable conditions for the evolution of BI in Finland.

According to the empirical findings, the top 50 companies feel that BI currently is not systematic or comprehensive enough. One reason may be that company culture does not support information sharing and some large Finnish companies have forgotten the human viewpoint while focusing their BI investments more on technologies. Another means for systematizing BI, besides utilizing human-source intelligence, is to develop the measurement of BI. Measurement of BI is a complicated issue consequent on the intangibility of most BI products and benefits, but it is also difficult to obtain any measurement information without a systematic approach or supportive company culture. Measurement might be a driver for more systematic development and implementation of a BI process when BI managers are more
conscious of the strengths and weaknesses of BI. One of the outcomes in the context of measurement is that balanced performance measurement can be applied for measuring BI. Such an approach might be a workable method for starting BI measurement in companies. The dissertation makes BI managers better informed on how to design, implement, and use BI measurements and gives examples of the kinds of metrics that are available for various purposes. Hence, one of the contributions of the dissertation is new knowledge regarding measurement of BI and utilization of human-source intelligence because these two issues have been identified as basic challenges in BI for the top 50 Finnish companies. In addition, the dissertation specifies the challenges of the measurement of BI and thus confirms BI’s legitimacy as a research field by illustrating a conceptual framework for the measurement of BI.

At the moment, many of the intelligence books and articles deal with large American companies, with little research having been done outside North America (for example, in Europe) (Fleisher 2001b, p. 5; Badr and Madden 2006). Ganesh et al. (2003, p. 2) remark that there is a lack of empirical studies and too little knowledge about country-specific intelligence activities. The dissertation presents several approaches to BI and connects this managerial tool to theories of information management and business management. Hence the thesis improves the knowledge of a fairly new business and research area by presenting central disciplines that seem to be at work in business information management. The dissertation uses existing theories together with empirical material to produce more detailed concepts and insights. The theories and findings presented in the thesis offer background information for the beginning or development of BI. For example, BI managers can assess whether they have noticed basic points in the use of BI or opt for the particular framework best suited to their purposes. Also, the case studies of the dissertation can be used as a reference when similar issues are examined in companies, and thus they offer the practical contribution of the thesis. The dissertation does not provide any normative guidelines; it offers something closer to a theoretical framework and an understanding of BI’s utilization in large Finnish companies, which also is the main target of the thesis.

### 4.3 Assessment of the research

#### 4.3.1 Relevance

Any research should be assessed through its results and the usefulness and purposefulness thereof. Relevance, validity, reliability, and generalizability are quite commonly used criteria for evaluating the quality of research (see, e.g., Gummesson 2000, p. 185). The dissertation is assessed on the basis of these criteria.
The dissertation is characterized as applied research. For the results of the thesis to have some demonstrable value, the dissertation must meet the relevance criterion. The relevance of the dissertation stems from the following elements. First, competitiveness and success today rely on, e.g., the ability of a company to refine business information, combine pieces of information, and translate early insights into winning business concepts. Thus, it is more than important to be able to manage business information systematically enough and pay attention to BI. Second, there is little theoretical knowledge about intelligence activities. Hence, the theoretical frameworks of those activities must be studied more actively and systematically. Third, the content of BI is not completely clear, and, in addition, there are several intelligence concepts related to BI. At the start of a new millennium, IT companies are marketing new versions of their data warehouse solutions and applications, BI providers are producing information and knowledge products for companies that are doing business in a turbulent environment, and companies are applying BI activities to improve the quality of their decision-making. This leads to a need for more specific, in-depth understanding of BI, and thus it is helpful that the dissertation achieves coverage of the topic.62

Fourth, there is currently little knowledge concerning the application of BI in Finnish companies, although utilization of BI has increased in Finland since the 1990s. There is a particular lack of knowledge of measuring BI, utilizing human-source intelligence, identifying information needs, and integrating internal and external information. Hence, examining BI in both theory and practice may lead to improved understanding and more effective methods for managing business information. Fifth, the dissertation is based on empirical findings, not just theoretical research. The work gathered actual BI experiences and insights from the top 50 Finnish companies twice and that took place in real situations in two case companies. Therefore, the actual factors affecting the research issues have been accessed in their natural settings.

4.3.2 Validity

The second quality criterion for research is the validity of the research. Validity is a question of whether the research examines the issues that it intended to examine or something else (Yin 1994, pp. 33–36; Gummesson 2000, p. 91). To answer to the primary scope of the dissertation and to increase validity, several types of data were collected, from a variety of sources, during the research. The methods of gathering and analyzing the research data have been discussed in detail and carefully, to present different perspectives on each issue under study and to ascertain the correctness of the

62 Individual intelligence terms were not analyzed as thoroughly as possible, since the thesis focuses on BI.
conclusions. The conclusions of the dissertation are not based on one source of evidence only; they are based on survey, interview, and participant-observation data; reasoning; and a literature review. One or two researchers besides the author participated in both case studies and reviewed the case descriptions. The drafts of the case reports were also critiqued by and confirmed with representatives of the case companies.

In the surveys and one case study, validity was increased by formulating the questions asked in accordance with the existing theoretical knowledge. In both surveys, the validity of the questions was also confirmed by a number of BI academics and experts involved in the design and testing of the questionnaire. Besides BI professionals, the questionnaires were tested by a few outsiders. To the knowledge of the author, the questionnaires have been used in other studies in at least 18 countries besides Finland since 2002. The wide use of the questionnaires may indicate that outsiders have judged the original questions to be valid enough. Another critical aspect of the questionnaires is the quality and the choice of answer alternatives. To conclude, the case studies and the surveys have been designed, implemented, and presented as carefully as possible to increase the validity of the research, and thus they should reflect reality quite well.

4.3.3 Reliability

Reliability is often considered to refer to the repeatability of the research – i.e., someone other than the original researcher should obtain the same findings and conclusions if he were to repeat the research and the same procedures for conducting the study were followed exactly (Yin 1994; Gummesson 2000). In other words, the objective of a high level of reliability in conducting research is to minimize the errors and biases in the study (Yin 1994). At the minimum, there should be documentation of the methods followed in the study. Typically, qualitative research is much harder to document and report upon than quantitative research.

In the dissertation, several data sources and research methods have been used to support the reliability of the research. However, it is probable that the author or co-authors have influenced the research subject and the interpretation of results in the two action-research-oriented case studies. In action research, a researcher tends to have an actual influence on the research issue, which, naturally, impairs the reliability of the results. It can also be questioned whether a single case per research issue provides enough information to produce reliable results and to answer two research questions.

63 A similar survey was conducted in Croatia in 2004 (Ivančević and Jurišić 2005) and in Brazil, Germany, Mexico, the Netherlands, Norway, Switzerland, 10 Asia-Pacific countries (Global Intelligence Alliance 2005), and Canada (Hannula and Pirttimäki 2006) in 2005.
(Q2 and Q3). On the other hand, the aim of the two case studies was to verify proposals and conclusions based on the literature review and to increase the pragmatic understanding of research issues instead of generalization. It is extremely possible that additional cases would provide new information and that the results of the single-case studies suffer from random error. In consequence, the criterion of reliability is not met totally for the case studies of the dissertation.

Two surveys were conducted, where the author’s influence has been slighter than in the single-case studies. As discussed in the previous section, the questionnaires have been used in other studies worldwide. Consequently, the questions apparently are not too situation- or country-specific, and the questionnaires seem to be a suitable starting point for conducting similar surveys even globally. Since the two surveys were similar, comparing their results was possible. The reliability of the comparison should be reasonable, due to the use of similar questions in the two surveys. In addition, the results of the second survey were well in line with the results of the first study. This may be a sign that the first study and its results are repeatable. Overall, these factors can be expected to have a positive effect on the reliability of the results.

The reliability of respondents’ answers must be considered because the conclusions of the dissertation are also based on the results of the surveys. Because of the limited timetable and resources, only one individual from each of the responding companies was interviewed, both times. On this account, it is not possible to know whether an interviewee’s answer represented the company itself or a subjective opinion of the respondent. The respondents were mainly people responsible for BI, and they knew well what they were asked, but it is unclear whether they were honest enough or even too close to the activity and thus possessing a biased view of BI. However, BI is quite a specific field; so random respondents might not have had an extensive enough picture of BI to participate meaningfully in the surveys. There is also a risk that the author or a co-author led or influenced the respondents or interpreted responses in too biased a manner because of not being able to observe respondents’ nonverbal reactions during telephone interviews. Use of multiple respondents per company would have provided greater depth and reduced the biases associated with a single perspective (Ganesh et al. 2003, p. 7). To conclude, in the author’s estimation, the results of the dissertation are in their entirety at a sufficient level of reliability to support the conclusions of the thesis.

4.3.4 Generalizability

According to Yin (1994), the goal of any researcher should be to obtain research results that are credible in light of other findings – i.e., to achieve generalizability of the results. Because the generalizability of the results in quantitative research and surveys
(statistical generalization) varies from that in qualitative studies and case studies (analytical generalization) (Yin 1994; Stake 1995), a researcher should always illustrate the constraints and environment of the study in question. With the different research settings, results are not necessarily relevant or may have no meaning. Lukka and Kasanen (1995, p. 75) state that the rhetoric of contextual generalization is a way to move from isolated research results to a more general status.

In this case, the research results of the dissertation should be applicable in a context similar to that in which the studies have been carried out and the limitations are within the primary studies presented in the articles. Because the data were gathered in three ways – through a literature review, surveys, and single-case studies – the terms of generalization for the thesis are as follows. Both case companies were large Finnish organizations operating in the telecommunications industry. The companies interviewed in the two surveys were also large Finnish organizations, representing a number of industries. In other words, all of the companies studied were large, and thus it is unclear whether the results would apply in smaller companies. In addition, both case companies represented organizations in the telecommunications industry, which is characterized by high clockspeed and where technological competence is one of the key issues. Because the research results might differ in other types of organizations or in industries that are changing less rapidly, the industry’s structure and business logic must be analyzed before application of the results. On the other hand, the target of the case studies is not to generalize results to a larger population but to give details about the real business of a case company (see Yin 1994; Stake 1995). Generalizations are typically more relevant for survey studies (Yin 1994; Stake 1995; Alasuutari 1999). In the survey research, the response rate was 92 percent for the first study and 82 percent for the second, and thus the results probably present the state of BI in the target companies well.

The research was carried out mainly in 2002–2005, and thus the external environment and factors might be variable. On the other hand, the aim of the dissertation is to describe the current state of BI in large Finnish companies. It is thus reasonable to expect the research results to be useful in large Finnish companies and to be usable at least as a starting point for further research on BI in smaller and medium-sized companies. Because of the Finnish viewpoint, the conclusions do not apply to any other country as such, but they can be taken as an example of a small but competitive and developed country in Europe.

4.4 Suggestions for further research

In the information society, traditional management approaches from the industrial age have to be complemented with additional insights and new tools. At the beginning of
the 21st century, managers need more precise information and a deeper understanding of the relationship between a company and its business environment in, e.g., formulating strategies but also the massive support of information technology in managing and refining essential information. Because the amount of information available is increasing and there are many different types of information and information sources, a large amount of the information gathered is completely unnecessary. In addition, information is generally meaningless if it is not filled out with prior knowledge, and thus intelligence can be defined as understanding of, and insight into, important matters related to a company, its business environment, and factors affecting the company’s success.

This dissertation dealt with many of the above issues. There are, however, several topics requiring further research in the area of BI. For example, in-depth case studies should be carried out in order to strengthen the understanding of BI. In addition, there is a need to develop the measurement of intelligence activities to prove their necessity and to improve on their performance. Recently, there have been some global surveys on intelligence activities, and thus the reliability of those surveys could be improved by, e.g., repeating cross-national studies and using statistical data analysis methods.

Several topics for further research have arisen during the dissertation work. Possibly one of the most interesting deals with the nature of information and knowledge as discussed in one of the research articles. It has become clear that a significant area of information needs is very difficult to express or define explicitly. In the academic world, the nature of tacit knowledge has been explored for several years, but actual resolutions and applications are lacking in companies. The constructs of tacit knowledge and human-source intelligence could conceivably be used in seeking better ways to identify the implicit information needs in companies. Another interesting topic in this framework is the nature of the information produced by BI. In theory, a BI process turns business information into valuable knowledge and intelligence, but there have been no studies exploring this area with empirical evidence. One of the typical questions in the context of information management is whether internal information is more valuable than external information, or vice versa. A question also arises regarding the significance of boundary-spanners in BI and whether they are an external or internal source of business information. Future research could show whether impersonal sources have less value than social and personal relationships (i.e., human sources) in BI. Namely, a company’s own employees and especially persons in close relationship with the external environment (cf. boundary-spanners) have a great deal of essential knowledge, and there are signs that tacit knowledge concerning the business environment and a company itself is the most valuable business information.

Nowadays, companies are faced with the issues of getting a product or service to market more profitably and quickly than competitors. Driving a new product to market requires
a variety of information from the discovery stage through launch. Information analysis of a development cycle is all the more difficult when information needs vary from product-specific information to incomplete and proactive information. In the literature, inadequate market analyses are considered one of the main causes of new product failure (Cooper 2005). Before launching a product, companies need information on, e.g., customers, competitors, markets, and new trends that are evolving beyond the horizon. When companies are gathering information about these information elements (i.e., the external environment), they often neglect knowledge about internal conditions that could help them to understand what kinds of products they can produce and deliver efficiently. Thus, there seems to be a need to study how to gather and produce crucial information about a company's own abilities and external factors in order to develop new products and deliver them to the marketplace effectively and profitably.

It is important to note that the role of BI is not only to provide a solution for a specific decision situation but also to help decision-makers find the right questions to be asked and to aid them in questioning prevailing assumptions and opinions. In today’s rapidly changing business environment, many companies have to take a proactive approach to management in place of a reactive approach, and thus methods and tools for systematic information management are necessary. Accordingly, the need to continue the study of BI seems to be obvious from both the academic and business perspective. There is an especially strong need to confirm the academic research in the field of BI because there is a lack of received theoretical frameworks and additional value comes mainly from efficient methods and practices improving and systematizing information management and decision-making.
REFERENCES


115


<http://www.marketvisio.fi/itmanagement/m multiclient2.cfm?tutkimus_ID=206>. (In Finnish.)


APPENDICES

APPENDIX 1: Results of performing the Pearson $\chi^2$ test for the name of intelligence activities

APPENDIX 2: Results of performing the Pearson $\chi^2$ test for top management utilization of information and knowledge gained through intelligence activities

APPENDIX 3: Results of performing the Pearson $\chi^2$ test for “investments in the next five years will increase significantly”

APPENDIX 4: Results of performing the Pearson $\chi^2$ test for “investments in the next five years will increase moderately”

APPENDIX 5: Results of performing the Pearson $\chi^2$ test for “investments in the next five years will remain the same”

APPENDIX 6: Results of performing the Pearson $\chi^2$ test for “investments in the next five years will decrease moderately”

APPENDIX 7: Results of performing the Pearson $\chi^2$ test for “investments in the next five years will decrease significantly”
**APPENDIX 1**

Results of performing the Pearson $\chi^2$ test for the name of intelligence activities

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>Within Year of sampling</th>
<th>% within Year of sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>18</td>
<td>19</td>
<td>48.6%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>51.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100.0%</td>
</tr>
<tr>
<td>2005</td>
<td>26</td>
<td>13</td>
<td>66.7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>33.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>32</td>
<td>57.9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>42.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100.0%</td>
</tr>
</tbody>
</table>

### Chi-Square Tests

<table>
<thead>
<tr>
<th>Value</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>2.529b</td>
<td>1,112</td>
<td></td>
</tr>
<tr>
<td>Continuity Correction</td>
<td>1,844</td>
<td>1,175</td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>2,542</td>
<td>1,111</td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td>,163</td>
<td>,087</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>2,495</td>
<td>1,114</td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a. Computed only for a 2x2 table
b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.58.

### Symmetric Measures

<table>
<thead>
<tr>
<th>Value</th>
<th>Asymp. Std. Error</th>
<th>Approx. $\tau$</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal by Phi</td>
<td>-.182</td>
<td>.112</td>
<td></td>
</tr>
<tr>
<td>Cramer’s V</td>
<td>.182</td>
<td>.112</td>
<td></td>
</tr>
<tr>
<td>Contingency Coefficient</td>
<td>.179</td>
<td>.112</td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.
APPENDIX 2

Results of performing the Pearson $\chi^2$ test for top management utilization of information and knowledge gained through intelligence activities

<table>
<thead>
<tr>
<th>Crosstab</th>
<th>Top management uses</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of sampling</td>
<td>Count</td>
<td>35</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>% within Year of sampling</td>
<td>100.0%</td>
<td>0%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>2005 Count</td>
<td>36</td>
<td>3</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>% within Year of sampling</td>
<td>92.3%</td>
<td>7.7%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Total Count</td>
<td>71</td>
<td>3</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>% within Year of sampling</td>
<td>95.9%</td>
<td>4.1%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chi-Square Tests</th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>.162b</td>
<td>1</td>
<td>.688</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correctiona</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>.163</td>
<td>1</td>
<td>.687</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td></td>
<td>1.000</td>
<td>.525</td>
<td></td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>.159</td>
<td>1</td>
<td>.690</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>76</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Computed only for a 2x2 table
b. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.43.

<table>
<thead>
<tr>
<th>Symmetric Measures</th>
<th>Value</th>
<th>Asymp. Std. Errorb</th>
<th>Approx. p</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal by Nominal</td>
<td>Phi</td>
<td>.046</td>
<td>.688</td>
<td></td>
</tr>
<tr>
<td>Cramer's V</td>
<td>.046</td>
<td>.688</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contingency Coefficient</td>
<td>.046</td>
<td>.688</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>76</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.
APPENDIX 3
Results of performing the Pearson $\chi^2$ test for “investments in the next five years will increase significantly”

### Crosstab

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>% within Year of sampling</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>15</td>
<td>30</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>33.3%</td>
<td>66.7%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>8</td>
<td>33</td>
<td>41</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19.5%</td>
<td>80.5%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>63</td>
<td>86</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26.7%</td>
<td>73.3%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Chi-Square Tests

<table>
<thead>
<tr>
<th>Value</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>df</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Chi-Square</td>
<td>2.092b</td>
<td>1</td>
<td>.148</td>
</tr>
<tr>
<td>Continuity Correctiona</td>
<td>1.446</td>
<td>1</td>
<td>.229</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>2.121</td>
<td>1</td>
<td>.145</td>
</tr>
<tr>
<td>Fisher’s Exact Test</td>
<td>2.121</td>
<td></td>
<td>.222</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>2.067</td>
<td>1</td>
<td>.150</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>86</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ a. \text{Computed only for a 2x2 table}\]
\[ b. 0 \text{ cells (0\%)} \text{ have expected count less than 5. The minimum expected count is 10.97.}\]

### Symmetric Measures

<table>
<thead>
<tr>
<th>Value</th>
<th>Asymp. Std. Errora</th>
<th>Approx. b</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal by Nominal</td>
<td>Phi</td>
<td>.156</td>
<td>.148</td>
</tr>
<tr>
<td></td>
<td>Cramer’s V</td>
<td>.156</td>
<td>.148</td>
</tr>
<tr>
<td></td>
<td>Contingency Coefficient</td>
<td>.154</td>
<td>.148</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>86</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ a. \not assuming the null hypothesis.\]
\[ b. Using the asymptotic standard error assuming the null hypothesis.\]
### APPENDIX 4

Results of performing the Pearson $\chi^2$ test for “investments in the next five years will increase moderately”

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td></td>
<td>20</td>
<td>25</td>
<td>45</td>
</tr>
<tr>
<td>% within Year of sampling</td>
<td></td>
<td>44.4%</td>
<td>55.6%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>18</td>
<td>23</td>
<td>41</td>
</tr>
<tr>
<td>% within Year of sampling</td>
<td></td>
<td>43.9%</td>
<td>56.1%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>38</td>
<td>48</td>
<td>86</td>
</tr>
<tr>
<td>% within Year of sampling</td>
<td></td>
<td>44.2%</td>
<td>55.8%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

#### Chi-Square Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>.003</td>
<td>1</td>
<td>.960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correctiona</td>
<td>.000</td>
<td>1</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>.003</td>
<td>1</td>
<td>.960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher’s Exact Test</td>
<td></td>
<td></td>
<td>1000</td>
<td>.566</td>
<td></td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td></td>
<td>1</td>
<td>.960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- a. Computed only for a 2x2 table
- b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.12.

#### Symmetric Measures

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<thead>
<tr>
<th>Measure</th>
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<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal by Nominal Phi</td>
<td>.005</td>
<td>.960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cramer’s V</td>
<td>.005</td>
<td>.960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contingency Coefficient</td>
<td>.005</td>
<td>.960</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- a. Not assuming the null hypothesis.
- b. Using the asymptotic standard error assuming the null hypothesis.
# APPENDIX 5

Results of performing the Pearson $\chi^2$ test for “investments in the next five years will remain the same”

### Crosstab

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>% within Year of sampling</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td>9</td>
<td>36</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20.0%</td>
<td></td>
<td></td>
<td>100.0%</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td>14</td>
<td>27</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34.1%</td>
<td></td>
<td></td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>23</td>
<td>63</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26.7%</td>
<td></td>
<td></td>
<td>73.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Chi-Square Tests

<table>
<thead>
<tr>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>2,191b</td>
<td>1</td>
<td>.139</td>
<td></td>
</tr>
<tr>
<td>Continuity Correctiona</td>
<td>1,529</td>
<td>1</td>
<td>.216</td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>2,200</td>
<td>1</td>
<td>.138</td>
<td></td>
</tr>
<tr>
<td>Fisher’s Exact Test</td>
<td></td>
<td></td>
<td>.153</td>
<td>.108</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>2,166</td>
<td>1</td>
<td>.141</td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Computed only for a 2x2 table.

* 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.97.

### Symmetric Measures

<table>
<thead>
<tr>
<th>Value</th>
<th>Asymp. Std. Errora</th>
<th>Approx. Tb</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal by Nominal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phi</td>
<td>.160</td>
<td>.138</td>
<td></td>
</tr>
<tr>
<td>Cramer’s V</td>
<td>.160</td>
<td>.139</td>
<td></td>
</tr>
<tr>
<td>Contingency Coefficient</td>
<td>.158</td>
<td>.139</td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>86</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Not assuming the null hypothesis.

* Using the asymptotic standard error assuming the null hypothesis.
APPENDIX 6
Results of performing the Pearson $\chi^2$ test for “investments in the next five years will decrease moderately”

Crosstab

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td></td>
<td>1</td>
<td>44</td>
<td>45</td>
</tr>
<tr>
<td>% within Year of sampling</td>
<td>2.2%</td>
<td>97.8%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>1</td>
<td>40</td>
<td>41</td>
</tr>
<tr>
<td>% within Year of sampling</td>
<td>2.4%</td>
<td>97.6%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2</td>
<td>84</td>
<td>86</td>
</tr>
<tr>
<td>% within Year of sampling</td>
<td>2.3%</td>
<td>97.7%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

Chi-Square Tests

<table>
<thead>
<tr>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>.004*</td>
<td>1</td>
<td>.947</td>
<td></td>
</tr>
<tr>
<td>Continuity Correction</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>.004</td>
<td>1</td>
<td>.947</td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td>1</td>
<td>1.000</td>
<td>.729</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>.004</td>
<td>1</td>
<td>.947</td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Symmetric Measures

<table>
<thead>
<tr>
<th>Value</th>
<th>Asymp. Std. Error</th>
<th>Approx.</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phi</td>
<td>-.007</td>
<td>.947</td>
<td></td>
</tr>
<tr>
<td>Cramer's V</td>
<td>.007</td>
<td>.947</td>
<td></td>
</tr>
<tr>
<td>Contingency Coefficient</td>
<td>.007</td>
<td>.947</td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>86</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Computed only for a 2x2 table.
b. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .95.
APPENDIX 7
Results of performing the Pearson $\chi^2$ test for “investments in the next five years will decrease significantly”

<table>
<thead>
<tr>
<th>Year of sampling</th>
<th>Count</th>
<th>% within Year of sampling</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>45</td>
<td>100.0%</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>2005</td>
<td>41</td>
<td>100.0%</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>100.0%</td>
<td>86</td>
<td>86</td>
</tr>
</tbody>
</table>

Chi-Square Tests

<table>
<thead>
<tr>
<th>Value</th>
<th>Value</th>
<th>a.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Continuity Correction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear-by-Linear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Association</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>86</td>
<td></td>
</tr>
</tbody>
</table>

Symmetric Measures

<table>
<thead>
<tr>
<th>Value</th>
<th>Value</th>
<th>a.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal by Nominal Phi</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>86</td>
<td></td>
</tr>
</tbody>
</table>

a. No statistics are computed because Investments in the next five years will decrease significantly is a constant.