Turun yliopisto
University of Turku

THE POTENTIAL OF LOCATION INTELLIGENCE SOLUTIONS IN FINLAND

Towards Combining Geographical Information System and Business Intelligence

Master's Thesis
in Economic Geography

Author:
Pia Lindqvist 14344

Supervisors:
D.Sc. (Econ.) Päivi Oinas
M.Sc. (Geogr.) Anna-Maija Kohijoki
M.Sc. (Tech.) Arno Aaldijk

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1 INTRODUCTION

1.1 Background of the Study

People are using an increasing amount of map services in their private life. This trend affects the requirements people have for solutions at their work place as well. The importance of location in decision making is becoming more apparent to organisations, and location is increasingly used in different business processes. It was estimated already two decades ago that more than half of all data stored in corporate databases has a spatial component, and this is still considered to be true (Franklin 1992, 12). In addition, geotechnology is one of the most important emerging and evolving fields of the 21st century (Gewin 2004, 376). Together, these two factors demonstrate that spatial data and related technologies are increasingly valued in organisations, and therefore, also constitute a topical research theme. Geographical information systems (GIS) are used to create, manage and analyse spatial data in organisations (Longley 2000, 37). Since so much of organisations' information is spatial in nature, GIS can provide extremely important tools for decision making processes; spatial data displayed on a map is much more informative than in a table format. Because managers have less time for decision making but masses of information available to them, it is very important to have tools that make the process as simple as possible. Therefore, GIS can ultimately affect the productivity of organisations by improving the decision making process with tools that enable managers to fully use the information they possess (Pick 2008, 1).

Information is the cornerstone of effective decision making (Berry 2007). Data must be converted into useful information to ensure a high-quality basis for making business decisions. Organisations may be data rich but information poor because it can be challenging to transform data into valuable information (Carver & Ritacco 2006, 3). The ability to convert a huge amount of data into useful information in the shortest possible time can offer organisations a significant competitive advantage because the time managers have for making business decisions is constantly reduced. One of the technologies that assist managers in doing this is business intelligence (BI) which is currently considered a top priority especially for IT management. (Hočevar & Jaklič 2010, 89−91; Vänskä 2012.) Having the right information available for decision making is vital in order to compete successfully. BI can provide organisations with the tools they need to manage and analyse the volumes of data they possess, and thus, guarantee sound business decisions.

While organisations collect increasingly significant volumes of data to form the basis for decision making, it is not always used to its full potential; the spatial component is too frequently left out which decreases the richness of the data (Rivest 2001, 539). In

addition, decision making requires information about events within the organisation and its operating environment (Hočevar & Jaklič 2010, 88). The integration of GIS and BI presents a good solution for these challenges because it allows organisations to better understand their own business as well as their operating environment. Thus, the use of GIS and BI together can lead to changes in decision making process that facilitate improved performance in organisations. In this study the integration of GIS and BI is referred to as *location intelligence*. It is defined as the ability of an organisation to use the principle of location to reason, plan and solve problems (Transforming location intelligence −− 2007, 1−2). Location intelligence is achieved by combining location data with other important business data to ensure sound decision making and business planning (Location intelligence 2010, 4). Integrating GIS with BI ensures greater benefits from both solutions and maximum returns on investments (The location intelligent −− 2007, 1).

1.2 Purpose of the Study

The purpose of this study is to discover what types of benefits organisations may gain from combining GIS and BI. Both of these technologies are used to transform data into information that can be used in decision making. However, GIS and BI have unique features which is why they are considered complementary technologies. Therefore, it is useful to study how organisations benefit from using both GIS and BI, and what challenges are hindering the wider implementation of these technologies. It is also important to note that this study examines this topic from the point of view of Finnish organisations operating mainly on the Finnish market. The general discussion of GIS, BI and location intelligence, drawing on earlier research and knowledge on practical applications, considers the state of the art globally, but the empirical study focuses on the current and future trends in Finland. Therefore, it is possible to also find characteristics that are typical for the Finnish GIS and location intelligence sectors.

In this study both GIS and BI are examined to discover their strengths and weaknesses as well as opportunities and challenges. Based on this analysis it is possible to begin studying the integration of GIS and BI, that is location intelligence. The main research question of this study is:

What advantages and challenges are related to adopting location intelligence solutions in organisations?

In order to answer this question, the term location intelligence must be further elaborated and its value for organisations established. It is also important to acknowledge the challenges related to these solutions to find out why all organisations do not use them. The challenges and opportunities of combining GIS and BI are examined from both the

solution provider and customer points of view to evaluate the full potential of location intelligence.

The study was carried out by conducting qualitative interviews. This method was chosen to get as an extensive picture as possible of the characteristics of GIS and BI sectors and their future trends which is necessary to find the answer to the research question. Interviewees from the solution provider side were selected so that both GIS and BI knowledge was represented in order to understand both components of location intelligence. The sectors that were chosen to represent the customer point of view are retail and insurance. These two sectors were chosen because they have very different backgrounds in using GIS; the retail sector has used GIS in various processes for decades, whereas in the insurance sector, the use of GIS is still in its infancy. Therefore, it is useful to compare how these sectors perceive the potential of location intelligence solutions to be able to make generalisations about the state of location intelligence in Finland.

2 GEOGRAPHICAL INFORMATION SYSTEM

2.1 Definition of Geographical Information System and its Components

There have been many attempts to define GIS, but there is still not a clear consensus about the matter (Heywood, Cornelius & Carver 2006, 18). The definition is heavily dependent on the background and viewpoint of the person who is giving it (Pickles 1995, according to Heywood et al. 2006, 18). Traditionally GIS has been used to solve problems in the environmental domain (Drummond & French 2008, 162) and the US. Department of the Environment has given one of the clearest definitions of GIS. According to the Department (1987, 132) GIS is "a system for capturing, storing, checking, manipulating, analysing, and displaying data which are spatially referenced to the Earth". This and many other definitions of GIS include three main components. They consider GIS to be a *computer system* that includes hardware, software as well as appropriate procedures. They also imply that GIS uses *spatially referenced* or *geographical data* and carries out various *management and analysis task* with it. (Heywood et al. 2006, 18.) Thus, it can be stated that GIS has four core components: hardware, software, data, and users (Figure 1) (Heywood et al. 2006, 19; Longley, Goodchild, Maguire & Rhind 2011, 25; Löytönen et al. 2003, 50). In addition, the organisation using GIS holds great responsibility towards its implementation and the consequent training and support of personnel (Pick 2008, 45). Therefore, the role of the organisation should not be undermined when describing the components of GIS.

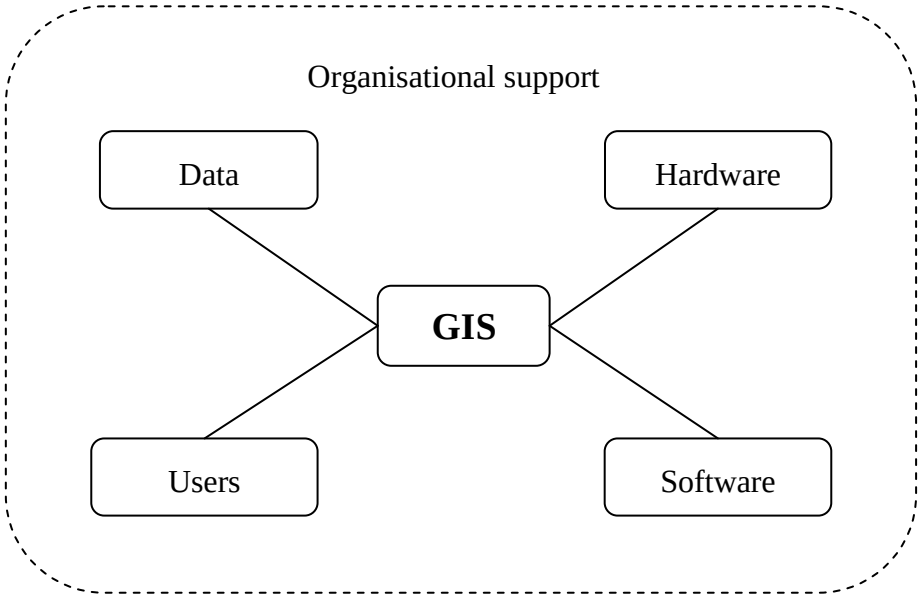

Figure 1 Components of GIS (modified from Longley et al. 2011, 25; Pick 2008, 45)

The most important component of GIS is *data* because without data, GIS cannot exist (Maguire 1989, 174; Löytönen et al. 2003, 55). GIS handles spatial data which is characterized by information about position, connections with other features and details of non-spatial attributes (Heywood et al. 2006, 21). The data defines the purposes to which GIS can be used (Löytönen et al. 2003, 55). Much data can be found on the internet, but all of it may not be usable in solving business problems. The use of the data may be restricted by, for example, copyright, the data may be of low quality or the dataset may have to be transformed in order to correspond to spatial data from other sources being used in the same GIS. (Pick 2008, 45.)

Hardware needed to use GIS consists at the simplest level of a computer with optimised processors and storage units (Löytönen et la. 2003, 51). For GIS operations to be effective, a good quality, high resolution colour graphics screen and data input and output devices, such as scanners, digitizers and printers, are also required (Heywood et al. 2006, 19). Technological development has enabled GIS functions to be used also on laptops, personal data assistants (PDAs), in-vehicle devices, and even mobile phones (Longley et al. 2011, 24). In the future, tablets may become the next hardware where GIS applications are used on a daily basis.

Software provides the users with tools to store, transform, analyse and visualise data (Löytönen et al. 2003, 52; Heywood et al. 2006, 19). These procedures can be done using a standard web browser, if all work is done remotely using digital services offered on large servers, or a package bought from a GIS vendor. GIS software can range from

a simple package designed for a PC to a major industrial-strength package designed to serve an entire enterprise of networked computers. (Longley et al. 2011, 25.)

Competent *users* of GIS are the cornerstone of the system because GIS is useless without people who design it, supply it with data and interpret its results (Löytönen et al. 2003, 55; Longley et al. 2011, 25). The implementation of GIS is an important event in many organisations bringing with it, for example, the need for retraining of personnel (Heywood et al. 2006, 27). People in the organisation will need to have different skills depending on tasks they perform with GIS (Longley et al. 2011, 25). Therefore, the amount of training should be determined by individuals' tasks. In addition, organisations should have enough people, such as managers and people in key GIS user departments, who appreciate GIS and understand what types of benefits it provides the organisation with. (Pick 2008, 44.)

Because GIS is rather new in business, *organisational support* is extremely important. Organisations should promote organisational learning and training as well as support the people working with GIS. (Pick 2008, 44.) Organisations must establish procedures, lines of reporting, control points, and other mechanisms that ensure GIS activities meet the needs of the organisation (Longley et al. 2011, 25). The novelty and rapid innovation pace of spatial technologies present organisations with further challenges concerning GIS. Specialised knowledge and capacity to plan for emerging spatial technologies should be present in organisations using GIS, but is still lacking in many organisations. (Pick 2008, 45.)

2.2 From Industrial to Commercial Use

The history of GIS originates to the mid-1960s (Goodchild 2001, 6176). The demand for GIS was prompted by the limitations of traditional maps, and thus, the initial development did not focus on the production of high quality output, but on the analysis of the data (Heywood et al. 2006, 287). Vast increase in the quantity of data available in computer format had a crucial impact on the creation of GIS. Advances in geographical theory and techniques also led to the need for a sophisticated computer system. Multidimensional nature of spatial data required more than conventional computer database management systems were designed to handle. Thus, there was a need to develop a new system capable of handling large quantities of spatial data. In addition, governments and commercial agencies realized the practical nature of GIS and its significant commercial value. (Maguire 1989, 173.) All of this led to the development of the first GIS: the Canadian Geographic Information System (Goodchild 2001, 6176). In the latter half of the 1960s, more cartographers and mapping agencies begun to wonder whether computers

could facilitate cost reductions and shorten the time of map creation (Longley et al. 2011, 17).

In the early 1970s, computer mapping automated map drafting. This meant that changes and updates to maps could be made easily which was a clear improvement. (Berry 2007.) All of this was facilitated by the rapid advances in computing technology which included increasing memory sizes and processing speeds as well as falling costs. The development, however, was still occurring in two separate areas: in GIS which were commercially available with limited analysis opportunities and in computer cartography in which high quality graphics and simple data editing were the focus of improvements. The 1970s was also the decade when the awareness and communication about GIS increased; the first GIS conferences were held and papers were published. One of the most important observations about GIS in the 1970s was that the problems it faced were not merely technical; the management side of implementing an information system was perhaps even more challenging. (Heywood et al. 2006, 291.)

These early efforts were expensive and GIS became widely available for organisations only in the early 1980s (Goodchild 2001, 6176). Spatial database management systems emerged and linked computer mapping capabilities with traditional database management capabilities. In addition, increasing demand for mapped data focused attention to data availability, accuracy and standards as well as data structure issues. (Berry 2007.) This development was driven by the need to use and analyse available databases more effectively (Cresswell 1995, 195).

In the early 1990s, map analysis and decision making became more important, and systems that were purely for data display became available separately (Berry 2007; Heywood et al. 2006, 292). This was also the decade in which GIS really began to expand to the business market. As GIS became available on personal computers the number of potential business users increased. (Drummond & French 2008, 165.) This development did not occur earlier because of the high cost of GIS and lack of perceived benefits (Pick 2008, 1). However, many organisations that could have benefited from GIS also did not know about it. There was not a great deal of information about what type of an impact GIS could have on organisations which was to a certain extent due to the lack of any evaluated cost-benefit analysis to justify the investment on GIS. Technical problems associated with GIS were mostly solvable, but the real issues lied in the management, implementation and integration of GIS into an organisation. (Heywood et al. 2006, 293, 378.)

Since the 1990s the development of GIS has been significant. The Global Positioning System (GPS) has been a major growth area and its use is now extremely common. One great example of this is the in-car navigation system. (Heywood et al. 2006, 381−382.) Mangold suggested in 1997 (according to Heywood et al. 2006, 383) that GIS products should change from top-down consultant designed systems to bottom-up small-scale

user- and problem-led solutions. His suggestion was justified since the market has moved towards out-of-the-box solutions. More and more organisations use GIS to solve geographical problems. They are more aware that decision making has a geographic dimension, and the wider availability of GIS through the internet has made it easier to use GIS to solve these types of problems. Technology has also evolved and supports applications better, especially in terms of visualisation, data management and analysis. (Longley et al. 2011, 43.)

2.3 Evaluating Costs and Benefits

The analysis on possible costs and benefits of GIS is extremely important to do before making the implementation decision. Implementing GIS simply because it is perceived a sound investment or because the competitors use it is dangerous because the benefits gained by using GIS are different in every organisation. GIS strategies must be aligned with business strategies and GIS processes must reflect business processes in order for them to be successful (Longley et al. 2011, 429). In this section some of the benefits and challenges related to GIS are studied and different methods for evaluating these are presented.

There are many ways to describe the success or failure of a GIS project, but one of the most widely used methods is the calculation of return on investment (ROI). Traditionally ROI is calculated by dividing the average net profit by the invested capital. Therefore, the basic idea is to compare the returns gained from the investment with the amount of capital it binds. (Knüpfer & Puttonen 2009, 106.) In relation to GIS, ROI studies use a combination of qualitative and quantitative measures to assess the advantages organisations can gain from the investment. Such ROI methodology (Figure 2) proposed by Maguire, Kouyoumjian and Smith (2008, 3−4) includes ten interrelated steps designed to be performed by a GIS professional supported by a small project team. However, the challenge of this methodology is that not all organisations have GIS professionals that could perform the study. Therefore, solution providers could offer services to support this kind of activity.

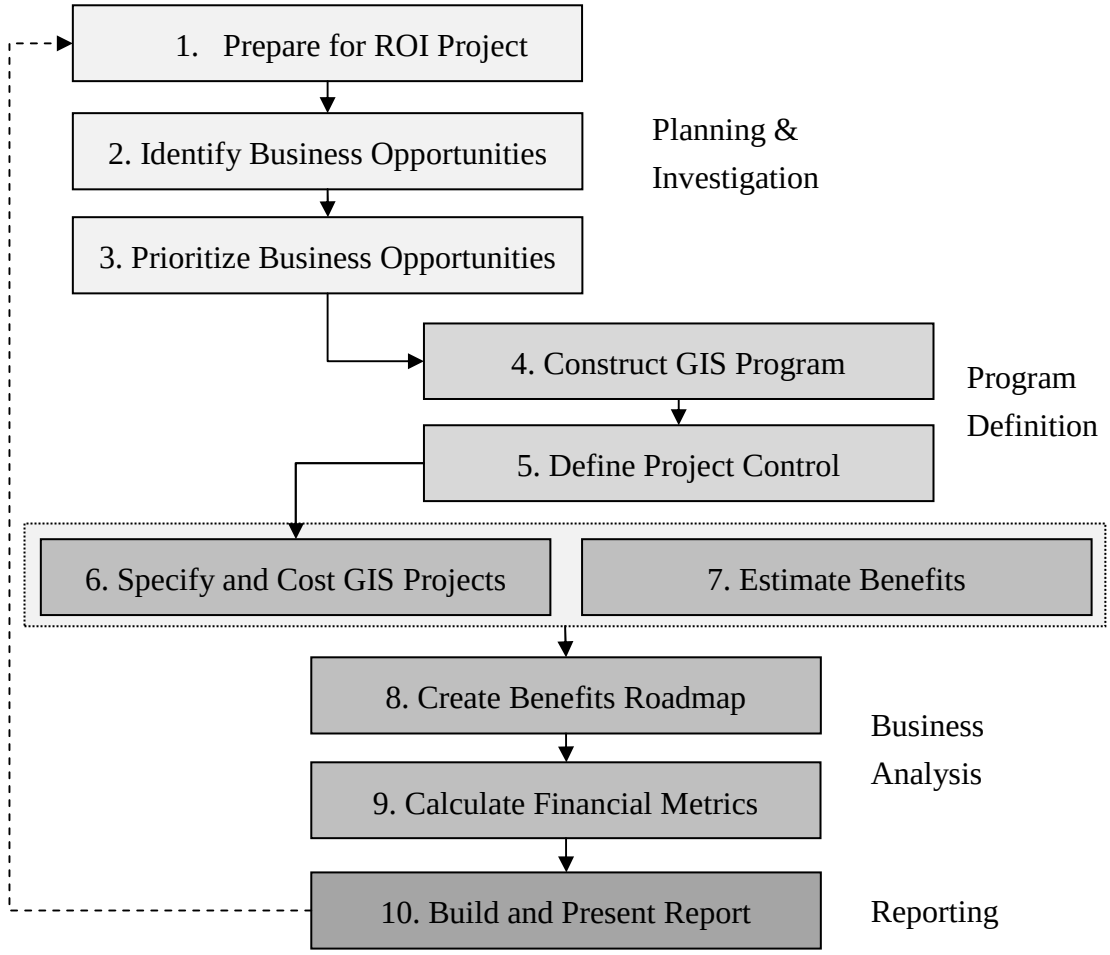

Figure 2 Overview of GIS ROI methodology (Maguire, Kouyoumjian & Smith 2008, 5)

The methodology begins with a series of planning and investigation activities that lay the groundwork for subsequent steps. Preparing for the ROI project (step 1) requires a review of an organisation's mission statements and an understanding of its past and present landscape of GIS. Thereafter (step 2) a series of interviews with key stakeholders can be conducted to elicit how GIS can contribute to the organisation's mission. This should result in information about high-level business issues and challenges that the organisation faces. These insights are organised into different types of business opportunities and then prioritized (step 3). The next group of steps concerns the GIS program definition. The information gathered in the earlier steps is used to define a program of GIS projects (step 4) and to determine how these projects will be governed and managed (step 5). The next series of steps form the core of the methodology and are concerned with business analysis. The defined projects are broken down into segments and the resource costs are determined (step 6). Thus, the estimated benefits can also be de-

tailed (step 7). The benefits roadmap helps the organisation see when the benefits will be realized (step 8). After that, ROI and other relevant financial metrics are calculated to demonstrate quantitatively the value of GIS (step 9). The last step of the methodology (step 10) consists of writing a compelling report by collecting the information from the research completed previously. If the GIS ROI project is successful, this report will show how GIS can affect the organisation, including its costs, benefits, time to implement, resources required, governance, and the return on investment the organisation will realise. (Maguire et al. 2008, 4.)

Another approach to evaluating the value of GIS to an organisation is to carry out a cost-benefit analysis. It can assist organisations in addressing the issues that affect the decision about whether to implement GIS. It is important to evaluate what type of benefits the organisation may gain from introducing a GIS, and if it could improve the effectiveness of the organisation. The relationship between anticipated costs and benefits should also be taken into account because naturally, the benefits of GIS should outweigh the costs. In cost-benefit analysis each cost and benefit is given a monetary value and thereafter, a graph may be drawn up to predict how costs and benefits will vary in relation to each other. However, the main problem about cost-benefit analysis of GIS is the difficulty of identifying and quantifying the costs and benefits of a new project. (Heywood et al. 2006, 343.) As the costs and benefits related to GIS can be either tangible or intangible, it can be challenging to give all of them a monetary value. (Pick 2008, 199.)

There is a very high start-up cost when implementing GIS and in addition, providing an up-to-date GIS services incurs high maintenance costs (Culley 2010, 12). Grimshaw (1991, 292) stated two decades ago that particularly in the private sector few organisations have thought about the potential of GIS in solving their business problems, but there are still today numerous sectors that do not take advantage of GIS. GIS should be viewed as an opportunity, not merely a cost as many organisations now see it. In the 1990s, many managers were unaware of the opportunities GIS could bring to their business, but this is still true today. (Grimshaw 1991, 295). GIS is still frequently seen as simply a map making software which is far from the truth. Management rarely understands the levels of visualisation of GIS, and as a consequence, many GIS development efforts are unfounded and prematurely abandoned. The amount of time and money required to implement a properly structured GIS is one of the greatest reasons for deciding not to implement one. (Galati 2006, xxiii−xxiv.) Therefore, it is extremely important to increase the awareness of managers and organisations about the possibilities GIS offers (Grimshaw 1991, 295). The organisations that know about the opportunities of GIS may still see it as a technical operation tool rather than a strategic resource that can be used in multiple processes in the organisation. Therefore, the failure to fully exploit GIS is increasingly a non-technical issue. Rather, it is the information literacy of managers

and the information culture of organisations that limits the use of GIS. (Cresswell 1995, 211, 225.) However, it has to be taken into consideration that GIS implementation requires different types of skills from an organisation and its personnel. GIS is able to transform raw data into information with spatial analysis, but the usability of the information depends on the personnel's ability to interpret it (Grimshaw 1994, 117). Thus, higher-skilled workforce is required which obviously presents some type of a cost to an organisation (Heywood et al. 2006, 344).

Lack of training and understanding the potential of GIS for advanced uses is one of the major obstacles in introducing GIS in an organisation. Lack of funding can be one reason why training is not provided and this makes it difficult to maximise the positive outcomes of GIS. Without proper training taking full advantage of what GIS can offer is almost impossible. In addition, training would ensure that personnel in an organisation know how to use specific tools and in which scenarios they can be used. Therefore, the lack of knowledge about the potential of GIS technology hinders its use significantly. The rapid changes in the GIS software and technology make it hard to keep up while maintaining stability in GIS operations. It requires much time and effort to gain expertise with new versions of software and advances in geospatial technologies which can cause difficulties in completing daily tasks and learning how to use the new version simultaneously. Without continual and effective efforts to raise awareness about the potential of GIS and training to improve the skills needed to undertake advanced functions, it is likely that organisations continue to use GIS only for basic functions. (Göçmen & Ventura 2010, 176−177.)

GIS technology is perceived attractive because of three main reasons: 1) spatially referenced data represents a large proportion of data processing, 2) information is considered a fundamental resource and 3) pressure for improving performance is high (Nedović-Budić & Godschalk 1996, 554). In addition, GIS has an important role in solving business problems because it provides the capability to process the high proportion of geographical business data, and thus, promotes a more scientific approach to location analysis (Grimshaw 1994, 3; Hernandez & Thrall 2007, according to Culley 2010, 2). Information is more readily available with the use of GIS which improves the decision making process. GIS also offers justification to the decisions that are made. (Heywood et al. 2006, 344; Pick 2008, XIII.) In fact, many GIS applications aim at supporting decision making and solving day-to-day problems by displaying geographical data and providing tools for doing different types of analyses (Goodchild 2001, 6180; Sheppard 2001, 6182). GIS enables organisations to reveal patterns in data that are unlikely to be revealed using, for example, statistical analysis techniques, because of better outputs (Culley 2010, 1; Pick 2008, 201). This type of visualisation helps transform heterogeneous data into information and subsequently into knowledge (Hernandez 2007, 249). IT in general can add value to business, and because GIS is still not used in all of the or-

ganisations it could be used, GIS can bring competitive advantage to those who use it (Grimshaw 1994, 120; Heywood et al. 2006, 344). However, these types of intangible benefits are much harder to measure than costs (Longley et al. 2011, 429). It can be difficult to see the monetary value of a more informed, efficient and decisive organisation. (Longley et al. 2011, 429; Pick 2008, 200.)

2.4 Future Trends

Predicting what will happen in any field involving developing and changing technology is difficult, and this is also the case with GIS (Heywood et al. 2006, 377). History has shown how powerful GIS is for managing information, and GIS has been able to grow into a huge and sophisticated industry in only a few decades (Shahab 2008, 274; Berry 2007). It has realised its potential as a mainstream technology for management of geographical information and as an effective tool for the use of resources. (Shahab 2008, 274.) On the other hand, some of the current GIS software has somewhat time-consuming, clumsy and unreliable tools. With increased exposure to information technology the future users of GIS will not tolerate these types of problems. They will expect systems with tools, for example, for real-time modelling of complex phenomena and for better representation of real world. (Barr 1995b, according to Heywood et al. 2006, 387). Some future prospects for GIS are presented in Table 1.

Table 1 Trend factors likely to have a role in the future development of GIS in business (modified from Pick 2008, 382)

Factors in data, architecture, software and technology	**Factors in GIS industry, workforce, management, and organisations**
- Transition to a more web-centric environment for GIS - Integration and interoperability of GIS software with enterprise systems. More enterprise software with built-in spatial functionality - Geocoding and digitizing of growing amounts of business information - Expanded public data sets for a wider reach of business functions, linked to broader and enterprise-wide attribute data - GIS incorporated extensively into mobile devices - Enhanced enablement of spatial databases and data warehouses - Personal, consumer use of GIS and spatial technologies globally - GIS applications available across the entire enterprise in simple formats - Sophisticated systems to support spatial decision making and BI	- More manufactured products that are GPS-enabled - Expanded spatial service products, both consulting and web-based - Larger and better-trained GIS workforce - Business education that includes GIS and spatial technologies in standard curricula - Improved integration even up to merger in organisations of the GIS and IS functions and departments - Expanded selective or complete outsourcing of the GIS and spatial functions - Stronger security measures in organisations for GIS and spatial applications - Broader laws and court precedents that businesses and society can recognise and plan for - Continuing importance of ethical awareness in spatial decision making

From Table 1 the factors in data, architecture, software and technology are more relevant for this study. One important development for GIS is that it will become more of a built-in functionality in enterprise software and not seen as an independent system. In addition, geocoding organisational data is extremely important because once this is done the data can be combined with any other data to produce new information. The integration of GIS to other functions in the organisation ensures that it is used to its full potential. When GIS is integrated with several other enterprise systems, easy to use GIS applications become available across the entire organisation. These integrations also enable users to gain new insights to the business because spatial data is combined with other important business data. The most important factor presented in the table for this research is that GIS will develop into a more sophisticated system that supports spatial decision making and BI. As a consequence, GIS will become a strategically important system that is essential for making informed decisions.

New and unexpected ways of using GIS can be expected for firms and industries that are already heavily into GIS as well as for ones with little of it now. Taking risks and applying GIS to unforeseen business problems can result in different types of impacts on business processes, employees and organisations in the future. (Pick 2008, 381.)

There can be expected to be two types of developments in business GIS applications. Firstly, GIS will become a similar tool to a database or spread sheet for middle managers. These widely available and inexpensive systems will be used for mapping to support day-to-day activities. Secondly, more sophisticated and intelligent GIS will be used by the highest levels in organisations. GIS will be used for strategic advice and the systems required will be customized and expensive. (Heywood et al. 2006, 387.)

The essence of GIS lies in the digital map data. Data was once a major obstacle to GIS development, now it has become one of the greatest possibilities of GIS. (Shahab 2008, 274.) The amount of data will increase enormously, so the need for tools to handle geographical data effectively will, thus, increase as well (Barr 1995a, in Heywood et al. 2006, 387). In addition, the future holds enormous promise for new types of data as well as more complete data, higher-resolution data and more timely data. (Shahab 2008, 274.) For example, more timely data will provide firms with new opportunities to use GIS as a part of everyday decision making processes. This will decrease the possibility of basing a decision on outdated information.

The INSPIRE directive (Infrastructure for Spatial Information in Europe) aims to create a common spatial data infrastructure in the European Union (About INSPIRE 2011; Inspire 2011). It was implemented in May 2007, and it creates the framework for the accessibility and use of certain spatial data possessed by authorities (INSPIRE 2010). The directive enables public sector organisations to share environmental spatial information and facilitate public access to spatial information in Europe (About INSPIRE 2011). According to a study by The Research Institute of the Finnish Economy in those EU countries where spatial dataset are open, the organisations that use spatial data have grown 15 per cent more in sales than in those countries where the use of spatial datasets is priced based on their cost (Koski 2011, 13). Thus, the INSPIRE directive will offer an increasing amount of organisations the opportunity to use spatial data in their decision making. As a consequence, they are able to make better decisions and be more competitive.

It cannot be stressed enough how much GIS has been revolutionised by the internet. In the 21st century, the shift in spatial applications is steadily towards the internet (Pick 2008, 4). Most public-domain data and even a large proportion of commercially produced data are now available on the internet (Shahab 2008, 274). People find the internet platform appealing, simple and flexible between devices (Pick 2008, 4; Longley et al. 2011, 22). They can visualise objects that they wish to see on a map with, for example, cities' map services. In addition, route planning and address searching have become regularly performed activities. (Löytönen 2003, 15.) This one single trend has had, and will continue to have in the future, the most impact on the field of GIS. Previously a GIS project would have begun with digitising or scanning geographic base maps, but now most of the GIS work involves bringing into a system a base layer of public-do-

main data and then enriching it with layers relevant to a particular GIS problem. (Shahab 2008, 274.)

Cloud computing is one of the current trends in the IT business, and it will increasingly influence the GIS sector in the future as well. Cloud computing is a technology model in which all resources, such as software, processing power, data storage, backup facilities, and development tools, are delivered as a set of services via the internet (Haag & Cumming 2010, 205). This can bring significant cost savings for firms. Cloud computing lowers the cost of IT infrastructure because firms do not have to invest in a large number of servers. In addition, cloud computing can lower software costs because the software can be accessed from the cloud as opposed to buying separate software packages for all computers. (Aljabre 2012, 236.) GIS in the cloud offers an alternative for the conventional GIS applications in order to provide broad spectrum of services to different types of firms. When optimisation and costs reductions are critical for a firm, GIS in the cloud can be an excellent option. The amount of time and money that has to be initially invested in traditional GIS can be significant, and this is can become the reason why organisation chooses not to implement GIS. Therefore, the reduction on implementation costs that cloud computing can offer could be the most significant reason for organisations to choose that option. (Bhat, Shah & Ahmad 2011, 595.)

There are naturally also several issues of concern in the future of GIS. How the user community reacts to the challenges will have an important role in shaping the industry. Privacy is an issue that raises itself constantly as GIS databases become increasingly widespread. Facts one considers very private, such as one's personal income, information about family, one's health record, and employment history, are all stored in someone's database. GIS offers the opportunity to integrate this data through their common geography, and therefore, raises the issue of personal privacy. (Shahab 2008, 288.) Thus, there should be common rules that ensure the rights of a person and on the other hand, foster the further development of GIS (Löytönen et al. 2003, 16).

3 BUSINESS INTELLIGENCE

3.1 Support for Information Management and Reporting

In today's rapidly changing business environment, the need for timely and effective business information is essential for organisations (Lönnqvist & Pirttimäki 2006, 32). However, firms can be data-rich but information poor which means that they cannot use the data they possess effectively to make better business decisions. Organisations lack the type of actionable information and analytical tools needed to improve profits and overall performance. BI is a direct response to this need. (Williams & Williams 2007, 1; Gartz 2004, 48; Hsu 2004, 142.)

BI term was first used in 1996 by Gartner Group Inc. when they referred to BI in forward thinking organisations. They defined BI as information and applications available broadly to employees, consultants, customers, suppliers, and the public. According to Gartner Group Inc. the key to succeeding in a competitive marketplace is staying ahead of the competition which requires making sound business decisions based on accurate and current information. Data analysis, reporting and query tools help businesses go through a wide range of data to synthesise valuable information from it. (Gartner Group 1996, according to Shariat & Hightower 2007, 40.) Now BI technologies are mature and low-risk technologies that have been successfully used by a wide range of organisations for over a decade (Williams & Williams 2007, 5).

Later BI has been redefined many times by various researchers. Several of these definitions state that BI involves collecting, managing, mining, and analysing data gathered from both internal and external sources, resulting in information and knowledge with strategic value (Thierauf 2001, 6; Lönnqvist &Pirttimäki 2006, 32; Williams & Williams 2007, 2; Ranjan 2008, 463). BI means that the organisation acts effectively through the exploitation of its human and information resources. In addition, BI includes the applications, platforms, tools, and technologies needed to support the process of exploring business data. (Raisinghani 2004, x.) Ultimately it has an important role in the creation of current information for operations and decision making (Popovič, Turk & Jaklič 2010, 6).

The purpose of BI is to aid in controlling the vast amount of business information that an organisation acquires, for example, about sales and customers. Although the availability of more and better data should result in better decisions, it is possible only if managers are able to use the data effectively. Increasing amount of competition has made decision making in organisations more complicated. In addition, the intricacy of internal and external processes and the availability of greater information also contribute to the increased complexity of decision making. (Sabherwal & Berecca-Fernandez

2011, 9.) Typically BI is used to refer to a product or a process: (Lönnqvist & Pirttimäki 2006, 32.)

1. Relevant information and knowledge that describes the business environment and the organisation itself, and the organisation's situation in relation to its markets, customers, competitors, and economic issues.
2. An organised and systematic process by which organisations acquire, analyse and disseminate information from both internal and external information sources significant for their business activities and for decision making.

In addition, it is important to distinguish between BI tools that are developed by BI solution providers and BI solution that is deployed within organisations. Figure 3 depicts the relationship between these aspects of BI.

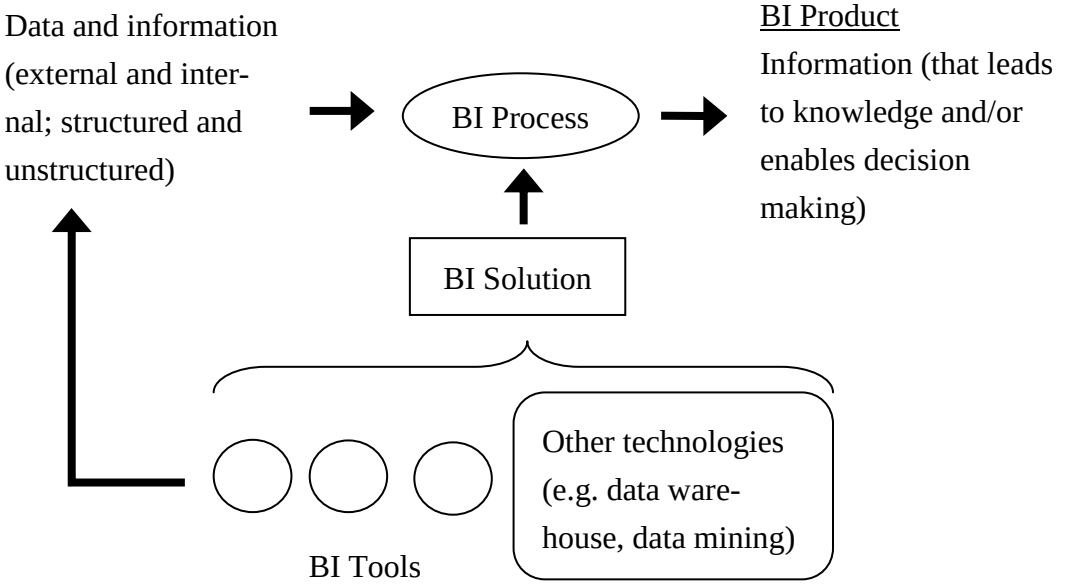

Figure 3 Business intelligence product, process, solution, and tools (Sabherwal & Berecca-Fernandez 2011, 7)

As illustrated in Figure 3 BI solutions use the BI tools acquired by the organisation, and draw upon the vast amount of data from existing data warehouses as well as information from other sources to provide information and knowledge that facilitate decision making. Therefore, the BI tools are used in BI solutions, and BI solutions support the BI process through which valuable information is provided. (Sabherwal & Berecca-Fernandez 2011, 6.)

BI cannot exist without the people who interpret the meaning and significance of the information and to act on their knowledge gained. The entire organisation must be committed to use the available information systems in the most effective way to obtain quality information for decision making. (Hočevar & Jaklič 2010, 92.) Data becomes BI

when it is in the hands of decision makers who know how to use it (Thierauf 2001, 4). An important element of BI is understanding what is happening within the organisation and its business environment and acting accordingly to achieve organisational goals (Popovič et al. 2010, 8).

In BI the relationship between data, information, knowledge, and intelligence is a key issue (Thierauf 2001, 7−9). They have different meanings for managers and decision makers (Figure 4).

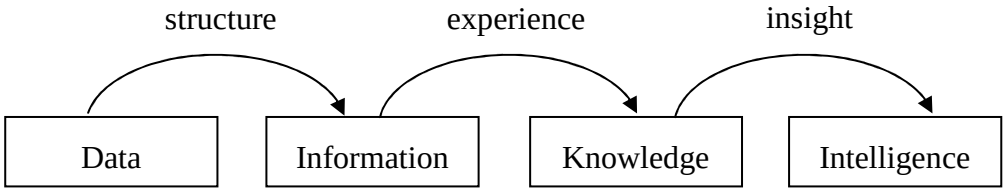

Figure 4 Relationship between data, information, knowledge, and intelligence (modified from Thierauf 2001, 7−9; Sabherwal & Becerra-Fernandez 2011, 4−5)

As illustrated in Figure 4 *data* represents the unstructured facts that have the least impact for a typical manager. *Information* is structured data that is valuable to managers in analysing and resolving critical problems. However, a major problem for managers is the volume of information crossing their desk. All that information organised into a coherent framework is the basis for knowledge creation. *Knowledge* is obtained from experts and is based upon actual experience. *Intelligence*, on the other hand, is a keen insight into understanding important relationships. The ability to understand the interrelationships between facts in a way to guide action towards desired goals is called intelligence. (Thierauf 2001, 7−9; Sabherwal & Becerra-Fernandez 2011, 4−5.)

The novelty of BI is its ability to present business information in a fast, simple and efficient way so that employees and managers can understand the logic and meaning of business information (Hočevar & Jaklič 2010, 89). BI means leveraging information assets within key business processes to gain profit. For every firm, the potential BI opportunities should be evaluated based on the industry, strategy and business design of the organisation (Williams & Williams 2007, 2, 5, 143). The gained information about the market, customers and operations assist managers in detecting important trends that further assist in decision making (Hočevar & Jaklič 2010, 91).

3.2 From Decision Support Systems and Data Warehousing to Business Intelligence Solutions

Although BI has recently become the subject of multiple researches, the quest for BI is not new. There are two early examples of BI which illustrate the desire of managers, executives, analysts, and knowledge workers to harness information to improve performance and profits: (Williams & Williams 2007, 5−9.)

- *Decision support systems (DSSs)*: Since the 1970s and 1980s, organisations have used business information and structured business analysis to make complex business decisions. DSSs have ranged from sophisticated, customised analytical tools running on mainframe computers to spread sheet based products running on personal computers. However, they have not systematically addressed integration and delivery of business information and business analyses to support the range of BI opportunities available to organisations today. (Williams & Williams 2007, 5.)
- *Executive information systems (EISs)*: Executive information systems were an early attempt to deliver business information and business analysis to support planning and control activities. These systems were designed only for use by upper management, and they were expensive and inflexible. (Williams & Williams 2007, 9.) Managers, who have limited amount of time for decision making, need a user friendly interface which EISs did not provide (Pick 2008, 74).

In the 1990s, data warehousing emerged as a means of harnessing the masses of data generated by transactional IT systems. Early efforts in data warehousing were concentrated on conquering the IT challenges related to leading, integrating and storing large quantities of data. Although some organisations acknowledged the potential that data warehousing held for obtaining new insights into their business which would provide competitive advantage, many organisations limited their data warehousing efforts to supporting better and faster reporting rather than using it to achieve BI. After years of making significant annual investments in data warehousing, many organisations began to question the value of their investments. The introduction of BI was an answer to this challenge. (Williams & Williams 2007, 1, 10.)

Data warehousing was a key enabler of BI because it assists the organisation to obtain value from its data sources by preparing and storing the enterprise data into a repository designed to support decision making (Sabherwal & Becerra-Fernandez 2011, 57). Because of rapidly declining data storage and processing costs, special purpose data integration tools, innovations in the way that data can be organised in databases, and innovations in the way that data can be converted into information data warehousing became feasible. In addition, it became technically possible to bring together data about

vast amount of daily transactions and turn it into valuable information. (Williams & Williams 2007, 10.)

Historically, data warehousing and BI industries have been driven by IT, and the focus has been on the technical challenges, technical methods and project management methods required to deploy data warehousing and BI successfully and to deliver information to the BI user community. However, the attention has shifted to expanding the ways in which BI can deliver value and to enhancing BI development methods to ensure the investments made pay off (Williams & Williams 2007, 11−12).

3.3 Requirements for Business Intelligence Solutions

Focusing on understanding the information and knowledge derived from data, BI solutions include tools that help managers and employees obtain required information efficiently and easily (Thierauf 2001, 3; Hočevar & Jaklič 2010, 92). The amount of available data increases all the time, but it is useless without an effective way to access and synthesise vast amount of information and knowledge derived from it. BI solutions aid managers in decision making by providing them with understanding of their operations now and in the future (Thierauf 2001, 3−4). These solutions support decision making process specifically at the analytical level (Popovič et al. 2010, 6). They provide the ability to take a proactive stance to the operations of the organisation rather than a passive or reactive one. BI solutions allow decision makers to focus on the creation of value which is the corner stone of a successful business. (Thierauf 2001, 4)

BI solutions include different types of tools and technologies of which the most important are data warehousing and data mining (Popovič et al. 2010, 6). Data warehouse is the central database for the entire organisation for storing and accessing data and an important component of BI (Hočevar & Jaklič 2010, 92; Ranjan 2008, 464). Data warehousing applications are used for cataloguing, indexing and cross referencing these raw data. In order to organise, analyse and communicate corporate data new BI tools are needed. Data mining enables organisations to select, filter, screen, and correlate data automatically, and therefore, capture important information about customers, suppliers and internal transactions. In addition, the effective use of data mining tools can help uncover various trends and relations from the data which then can be analysed and further refined. Thus, data mining is very important in creating a realistic view of the organisation’s situation. Data warehousing complements data mining in so that data stored there is organised in a form that is suitable for analysis using data mining methods. (Thierauf 2001, 3; Hsu 2004, 142.)

There are certain characteristics that a good BI solution should include in order for it to be valuable to an organisation. The following eight attributes of a BI solution are all

important, and compromising one of them reduces the contributions of the BI solution, at least in the long term. The first five characteristics are essential both in the short and long term, but the last three characteristics could be compromised without adverse short term effects. However, they are crucial for sustained performance in the long term. (Sabherwal & Becerra-Fernandez 2011, 223−224.)

1. *Alignment*: The BI solution should be aligned with the business strategy of the organisation as well as with the processes that assist in creating business value.
2. *Intelligence*: The BI solution should provide insights that are valuable and would not otherwise be available.
3. *Usability*: The BI solution should be easy to use. Usability is an extremely important requirement because a potentially valuable BI solution fails if it is not easy to use.
4. *Accuracy*: The BI solution should be based on clean data because otherwise it produces inaccurate reports.
5. *Connectivity*: The BI solution should have effective interfaces with the various other information technologies in the organisation.
6. *Flexibility*: The BI solution should be flexible because the current dynamic environment means that business changes are inevitable.
7. *Portability*: The BI solution combines software and hardware, but the software should be developed so that it is easily portable to other hardware platforms.
8. *Scalability*: The BI solution should be scalable, so that it is possible to expand the usage of the solution to a larger number of users and larger volumes of data without compromising performance.

3.4 Implementation Criteria

The BI literature suggests that much benefit can be derived from using BI. However, applying BI takes resources, and it is very difficult to precisely define its benefits. (Lönnqvist & Pirttimäki 2006, 32−33; Hočevar & Jaklič 2010, 89.) Thus, the economic justification of investment in BI is a difficult topic. The benefits of more effective decision making and management are complex and difficult to measure. (Hočevar & Jaklič 2010, 90.) In addition, the implementation of BI requires technology, but it is not enough by itself. If BI technology is implemented, but business processes are not altered to take advantage of it, the organisation cannot obtain real benefits from BI. (Williams & Williams 2007, 15.) However, one of the most important issues is to identify the internal and external informational requirements that have to be fulfilled to operate successfully.

Frequently there are gaps between the existing informational environment and these requirements. In most cases, the informational demand (represented by user behaviour), the real requirements (represented by the processes) and the offer (represented by systems available) only overlap to a certain extent (Figure 5). (Gartz 2004, 63.)

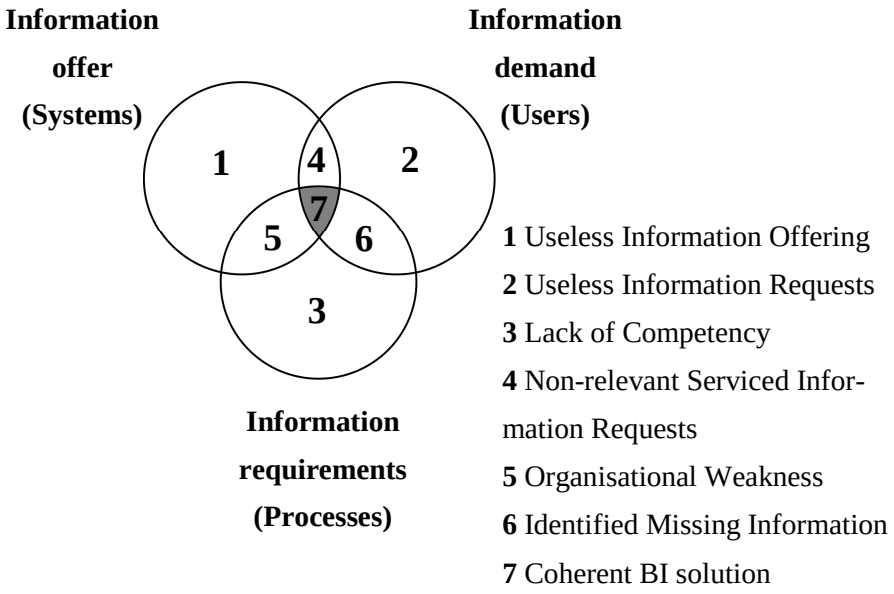

Figure 5 Information gap analysis (modified from Gartz 2004, 64)

In Figure 5 useless information offering (1) means that the information offered by the existing BI system is not needed in the processes nor requested by the users. Useless information requests (2) mean that users request and ask for non-relevant information that has not previously been available. Lack of competency (3) means that information needed in the processes is neither available nor requested. Non-relevant serviced information requests (4) represent reports available and used by employees but do not deliver any value to the processes or business objectives. Organisational weakness (5) indicates that the information needed in the processes is provided by the existing systems but never used by the users. Identified missing information (6) indicates that users are requesting information needed to execute a process, but this information is not provided by the existing systems. Finally, the intersection in the middle of the three circles (7) represents a coherent BI solution that is correctly used in the organisation. None of the other situations (1-6) are ideal, but can be improved by taking different measures. Organisations have to evaluate carefully which systems are really required, and turn off applications that are not needed. Training employees on various processes is also very important, so that they know which systems they should use and what type of information is required. It is also necessary to prioritise all needs so that the most important ones can be fulfilled first. In addition, using best practice processes and reference mo-

dels can help to realign processes and thus, improve the organisational performance. (Gartz 2004, 63−67.)

Before investing in BI, organisations should carefully assess whether the investment will result in increased revenues, reduced costs or both (Williams & Williams 2007, 12). In addition, a key criterion when deciding on the investment in BI is whether it supports the business strategy of the organisation (Carver & Ritacco 2006, 19). There is no business value in a BI investment if it does not result in increased after-tax cash flows and benefit the achievement of strategic goals (Williams & Williams 2007, 12). The ultimate purpose of BI investment should be to transform a business environment that is reactive to one that is proactive. BI is one way for organisations to predict and prepare for change. In a business environment that changes constantly, it is essential to have a system for establishing the status of the organisation at any given time in relation to its performance objectives. (Ranjan 2008, 461, 468.)

3.5 Opportunities and Challenges

In the highly competitive business world, the quality and timeliness of an organisation's BI can mean the difference between profit and loss. Managers and employees must be able to sort through an increasing amount of information and knowledge while maintaining operational efficiency. An ideal BI system allows managers and employees to easily access the information they need and share it with others (Ranjan 2008, 461, 469 473.) The true value of BI lies not only in better information quality but in improved business processes and thus better business performance (Popovič et al. 2010, 16). Business performance improves when BI is used in management processes that affect operational processes which increase revenue or reduce costs (Williams & Williams 2007, 13). Many organisations have vast amount of data and information, but they have no tools to put that into use for strategic decision making. This is why BI has a great growing potential. (Ranjan 2008, 470.)

BI solutions assist organisations by enabling the dissemination of real-time information by providing a single-point access to important information. They also enable the creation of new knowledge based on information about the past, and thus, help organisations to be more responsive and anticipative when making decisions based on current information. In addition, BI solutions facilitate better planning for the future through more effective use of information, through the use of past data for predictions about the future and through development of knowledge based on information about the past. These four contributions of BI and the consequent benefits in terms of organisational success are summarised in Figure 6. (Sabherwal & Becerra-Fernandez 2011, 14.)

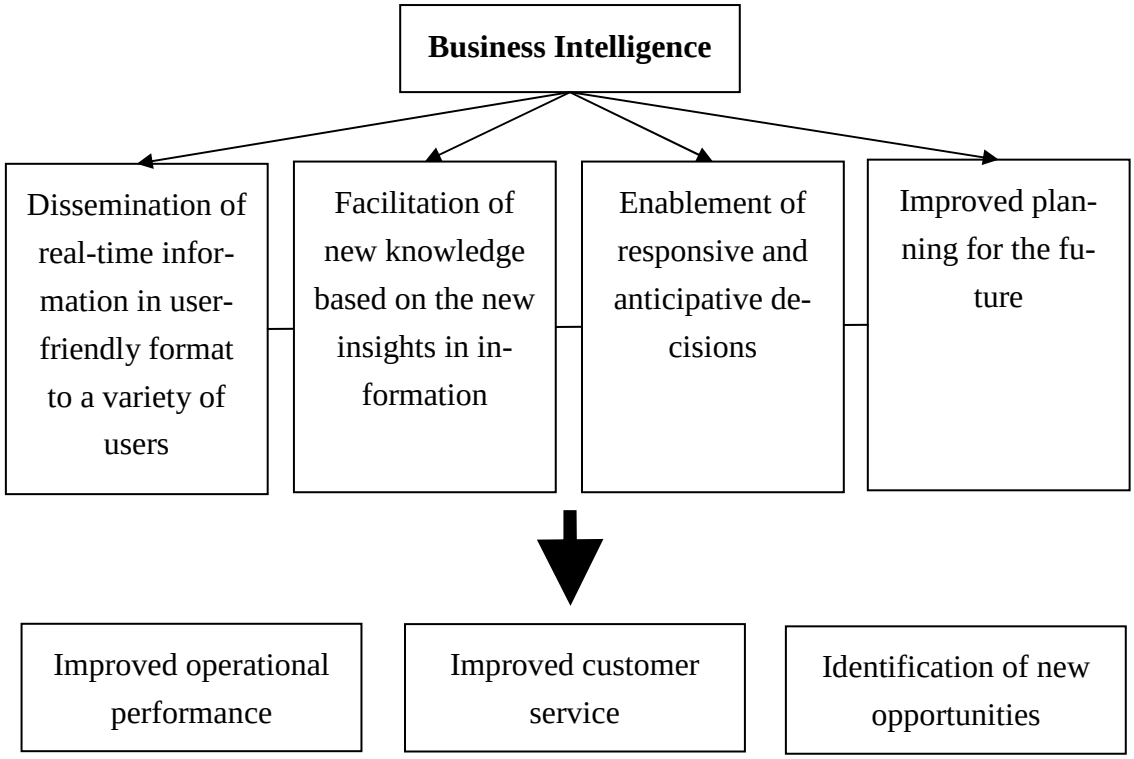

Figure 6 Impacts of business intelligence (modified from Sabherwal & Becerra-Fernandez 2011, 21)

As Figure 6 illustrates, by enabling decision makers to make more responsive and anticipative decisions using real-time information, BI solutions facilitate improvements in the operational performance of the organisation. These solutions also help managers to monitor trends in the business environment as well as within the organisation, and thereby respond faster and more efficiently to the challenges the organisation faces. BI solutions enable managers to use these trends to predict future events and make sound decisions that lead to improved organisational performance. By enabling decision makers to be more proactive and make more anticipative decisions related to customer request, BI solutions have a positive impact on customer service as well. This improvement is mainly due to the fact that BI solutions provide the organisation with better and more timely information. This information also enables organisations to identify new opportunities. BI facilitates new insights and knowledge through the discovery of previously unknown patterns, correlations and trends. The information BI solutions provide about markets, such as sales in different geographical regions, also assist managers in identifying opportunities for geographic expansion. By identifying and disseminating information on relationships discovered from data, BI solutions facilitate the development of new insights and knowledge. Such knowledge is particularly important when it

is based not merely on structured internal data but incorporates unstructured and external information as well. (Sabherwal & Becerra-Fernandez 2011, 14-19.)

One of the major challenges organisations face today is management of data, filtering the useful data and transforming the filtered data into valuable knowledge for decision making. BI means the conscious transformation of data from internal and external sources into new forms to provide information that is business-driven and results-oriented. Data can be seen as an asset for any organisation, and it can help build competitive advantage and ensure corporate success. Hence, the quality of that data plays an important role; data cannot be fragmented, incomplete or not readily available in a form that can be used effectively. To realise the benefits business data holds, it needs to be turned into information that can be used across the whole organisation. However, it has to be remembered that if everything in an organisation is going well and everyone can get the data they need, a BI solution may not be needed. (Ranjan 2008, 461, 467, 470.)

An effectively executed BI program ensures that the organisation can compete successfully by being better than competitors at leveraging information to improve profits and performance. There are many possible ways to use BI which creates opportunities for innovation and competitive advantage. However, the way that BI creates value must be specifically determined for each organisation. Thus, organisations guarantee the best possible return on their BI investment. (Williams & Williams 2007, 5, 11, 167.)

Even though the benefits of BI are difficult to define, some researchers have attempted to do so. The benefits range from easier access to information for decision making, to improved public relations and better reputation in the eyes of business partners (Hočevar & Jaklič 2010, 90). Increased revenue and cost savings are mentioned in various studies as important benefits of BI (Thompson 2006, 1; Carver & Ritacco 2006, 6; Atre & Moss 2003, 39). In addition, BI should improve organisation's decision making and internal communication substantially and result in faster and more accurate reporting (Thompson 2006, 1; Carver & Ritacco 2006, 6). BI has external benefits for the organisation as well. Customer satisfaction could be improved by using all the data available to the organisation (Thompson 2006, 1; Carver & Ritacco 2006, 6; Atre & Moss 2003, 39). All in all, these measures taken can lead to an increase in market share (Atre & Moss 2003, 39). The benefits gained from BI derive from improvements in management processes (such as planning, monitoring, controlling, and measuring) or operational processes (such as customer order processing, purchasing and accounts payable processing), so that revenues increase or costs reduce (Williams & Williams 2007, 13).

4 COMBINING GEOGRAPHICAL INFORMATION SYSTEM WITH BUSINESS INTELLIGENCE: LOCATION INTELLIGENCE

4.1 Applications for Location Intelligence

More than half of organisations' data has a location component (Franklin 1992, 12; Location intelligence 2010, 4; The location intelligent −− 2007, 1). In addition, organisations are increasingly able to absorb large amounts of data, and there are more digital maps and spatially-enabled applications available. This has created an opportunity to incorporate geographic elements into decision making processes and analyses. (Location intelligence 2010, 4−5.) Location affects almost all organisations in some way or another; customers, stores and offices, threats and opportunities can all be viewed and analysed spatially which can provide invaluable intelligence to organisations (Location intelligence 2010, 4−5; Location intelligence: The −− 2007, 5; The location intelligent −− 2007, 1). Largely available BI tools are good for analysing who, what, when, and how questions that characterise, for example, customers. However, where aspect of analysis is missing in these tools, and that is why location intelligence capability is needed; location intelligence combines the traditional BI with the addition of a location element to enable visualisation of business and location data simultaneously. (The location intelligent −− 2007, 3, 7; Location intelligence 2010, 4−5.)

As an emerging dimension of BI location intelligence describes the ability of an entire organisation to use the principle of location to organise, reason, plan, and solve problems (Transforming location intelligence −− 2007, 1−2). Geospatial tools together with databases and BI software result in location intelligence (Francica 2006, 37). Organisations are able to understand complex phenomena through the use of geographical relationships inherent in all information (Transforming location intelligence −− 2007, 2; Location intelligence 2010, 4.). This is achieved by combining location data with other business data, and as a result organisations gain critical insights, make better and more timely business decisions and optimise important processes (Location intelligence 2010, 4; Moloney 2001, 16; Location intelligence: turning −− 2011,1; Location intelligence: turning −− 2011, 5; The next big −− 2009, 1). Adding location capabilities to an existing BI platform ensures greater benefit from that investment (The location intelligent −− 2007, 1). Thus, location information is a component that should be incorporated into BI solutions in order to ensure better decisions, higher value services and more accurate identification of market potential (Location intelligence 2010, 3; Moloney 2001, 17). Common applications for location intelligence are presented in Figure 7.

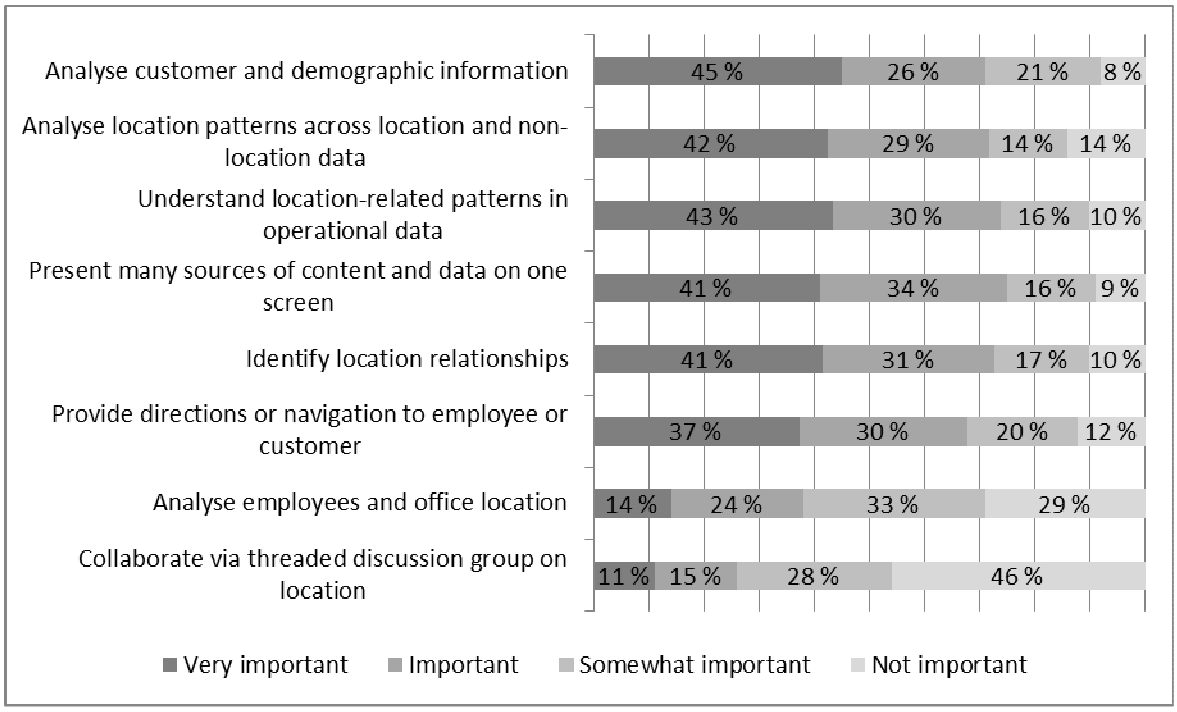

Figure 7 Common applications of location intelligence (The next big −− 2009, 2)

Figure 7 illustrates that location intelligence solutions can be used in many important processes. Organisations have huge amounts of data that needs to be presented in a way that it can be easily understood and analysed. One important aspect of this is that all of the information from various sources can be presented simultaneously. Map visualisations help users see the patterns in the information which can be extremely important when making business decisions. In fact, all of the applications of location intelligence aim at providing users with better and more timely information to use in decision making.

GIS and BI technologies have followed separate development paths. However, customers have begun to request a more complete operational picture and the ability to be more proactive. This challenge originally prompted the integration of GIS and BI technologies. Incorporating GIS to reveal spatial relationships that cannot be identified in a tabular view of data is a simple way to analyse and display existing but underused location data. In addition, a location intelligence solution is a relatively inexpensive approach to improving return on investment of a BI solution. (GIS and business −− 2006, 4, 11.) It is designed to take advantage of the geospatial information that is already stored within an organisation's database. Therefore, the location intelligence solution can operate within the existing BI environment, so the users can use the mapping function as part of their existing application without having to be GIS experts. Enhancing dashboards with mapping visualisation offers organisations the opportunity to bring

spatial analysis to a larger user group, and not only a tool for the GIS and BI specialists. (The location intelligent −− 2007, 7.) Location intelligence solutions also include a bi-directional interactivity between the map and report. This means that users can interact with both the map and data, with changes made to the report reflected in the map and vice versa. (Location intelligence: turning −− 2011, 7; The location intelligent −− 2007, 7.) The point has been reached where location information is recognised for its strategic benefits to firms that are able to use it effectively (Francica 2006, 40).

Location intelligence can a have a noticeable impact on an organisation if its marketing, planning, asset management, resource tracking, or service management are based even partly on geography (Location intelligence: turning −− 2011, 7). In the insurance sector, firms have to understand and mitigate risk quickly and effectively and be able to see long-term probabilities and trends. Risks analysts can accurately identify and analyse the accumulation of risk by geographic area by combining policyholder data and external reference data, such as weather data, and using visualisation capabilities of location intelligence (The location intelligent −− 2007, 8). Thus, by using location intelligence for short-term objectives, they can estimate the claims that will arise after a storm and plan a response accordingly. For long-term objectives analysts can develop risk management strategies and disaster response plan. In the retail sector, firms need the best possible information concerning store locations. Location intelligence helps retail firms to channel products to appropriate markets, understand regional requirements and maintain optimal inventory levels in stores and distribution centres. In addition, by displaying demographic information on a map, planners can forecast future selling patterns. (Location intelligence: turning −− 2011, 7−8.)

Innovative visualisation technology is needed to effectively synthesise detailed data into information because this allows the content to be presented in an understandable manner to users (Location intelligence 2010, 14; Location intelligence: turning −− 2011, 1). Visualisation helps detect patterns, risks and opportunities that would be hard to detect in a basic spread sheet analysis (Location intelligence: The −− 2007, 3). When visualisation is combined with predictive analysis, organisations can gain an insight in to the impact that location has on future business performance (The location intelligent −− 2007, 1, 3). The tools needed for systematically probing location data allow firms to observe and collect data describing business-relevant features, but also deploy this data to enhance the understanding of the impact of location. Therefore, this ultimately enables organisations to significantly reduce costs and increase revenues. (Location intelligence: The −− 2007, 5.)

It is always important to understand the reasons behind acquiring new solutions or making changes to the existing ones. The reasons for change can come from within the organisation or from the environment it operates in. This applies also in relation to location intelligence. Additionally, the consequences must be assessed. Organisation need

to understand the possible benefits and challenges the change presents. Therefore, the next three sections examine the factors motivating organisations to acquire location intelligence and the benefits and challenges of location intelligence.

4.2 Internal and External Drivers for Location Intelligence

Even if organisations understand the value of references to location, they can struggle with translating that understanding into activities that help generate profit. The difficulties stem from the challenges of combining business data, which is typically housed in relational databases, with geographic information. (Location intelligence 2010, 7.) GIS can be used to gain access to both sets of data and to categorize all data by their location. The result is a clean, current and consolidated view of the organisation's information revealing new insights to the business (Location intelligence 2010, 7). The three primary internal reasons for striving towards location intelligence are: (Location intelligence 2010, 7−8; The location intelligent −− 2007, 1.)

- *Better business decisions*
  Location intelligence can provide insights into optimal business strategy and operations which have a direct impact on decision making.
- *Improved customer-facing portals and activities*
  These include enterprise applications that provide CRM features such as customer service and self-service. Real estate, for example, has embraced location intelligence and has begun to explore its possibilities for sales, marketing, customer service, and self-service.
- *Consumer applications*
  Mash-ups are a good example of businesses focused on providing services to consumers. Growing consumer experience of mapping information is driving business awareness of location exploitation for commercial purposes. For example, retailers can execute store-specific promotions with more accuracy and profile and target their markets, resulting in the identification of higher value customers.

For decades, GIS was the only option for managing location-centric business processes and decision making. However, the market opportunity is expanding as firms such as Microsoft and Google have begun to make simple maps and location search accessible to the masses. (Location intelligence 2010, 7.) Everything began with consumer applications, and as they became more successful, the quest for commercial applications began to increase as well (Francica 2006, 38).

When successful the value of location intelligence is linked to the strategic and operational success of an organisation. As location intelligence can facilitate revenue gen-

eration and control expenditures, it can potentially also directly impact profitability. The three main external factors for organisations to gain location intelligence are: (Location intelligence 2010, 7; Transforming location intelligence −− 2007, 4)

- *Increasing awareness of location-enabled services*
  Location intelligence has been popularised by consumer applications, such as internet maps and GPS, and this increased awareness is now moving into the enterprise segment.
- *The availability of high quality, current and complete data*
  Commercial geographic data providers are becoming more sophisticated in their offerings, and organisations can receive geographic data that is maintained and developed on an on-going basis.
- *The rise of web services as a better, faster and cheaper deployment model*
  Web Map Service (WMS) is one of the most compelling innovations allowing for deployment of location intelligence that are cost effective and pervasive. Solutions are improving and can be adopted without any changes to the existing IT structures or data modelling applications of an organisation. Thus, the attendant risk and expense are reduced.

The decision to implement a location intelligence solution can be based on either the internal factors or it can be the combination of both internal and external factors. The external factors and their continuous development create favourable circumstances for the implementation of a location intelligence solution, but organisations also have to realise the benefits that the solution can bring to them. If the benefits and opportunities are not identified or considered significant enough, the external factors alone cannot create the need for the solution.

4.3 Benefits

4.3.1 Improving Decision Making

Frequently BI seeks to answer questions that are intrinsically geographical activities, such as exploring the potential demand for a new product or service in an area or deciding where to locate a new store. Therefore, BI solutions can be applied in risk analysis, customer analytics, site selection, territory management, market analysis, and customer relationship management. However, these solutions lack the capability to use the location component of data. (ArcUser Magazine 2005, 10−14.) Integrating GIS with BI can lead to greater value from both applications because they complement each other. The rudimentary charting capability of GIS is greatly improved by the business charting

abilities of BI applications. On the other hand, GIS brings unique charting capabilities to BI in the form of spatial relationships and distribution charts. (GIS and business −− 2006, 12.) In addition, GIS can include many layers of data into analysis and use tools that translate complex data into useful and understandable representations; the results of data analyses can be applied to optimise activities such as delivering products. BI analysis is also a very empowering tool for executives. Combining BI with GIS adds new analytical capabilities because knowing the location component makes other types of data accessible. Thus, integrating GIS with BI brings a new type of competitive advantage by allowing decisions to be based on more varied data and by communicating the resulting information in a way that is easy to understand. (ArcUser Magazine 2005, 10−14.)

People are visually oriented, so they most easily process information through visualisation (ArcUser Magazine 2005, 10−14). Visualisation is especially important in improving the understanding of spatial relationships (Pick 2008, 82). Traditionally the term visualisation has been used to describe the process of graphically presenting results (Blaser, Sester & Egenhofer 2000, 58). In relation to GIS, visualisation refers to the visual display of spatially arranged elements. Visualisation can be further emphasised and the outcomes of spatial analysis made more meaningful by displaying, for example, buffers, graphics and overlays. (Pick 2008, 82−83.) A map differs from standard table or grid reports and chart visualisations as it associates the data with a particular location, and allows organisations to see patterns otherwise hidden within the dataset. (The location intelligent −− 2007, 7.) Thus, maps are better and more efficient tools when trying to solve a problem, and are particularly valuable when traditional tables and grids and other analysis tools are not able to give sufficient information (Smelcer & Carmel 1997, 392; Location intelligence 2010, 8−9).

Map visualisations are the only way to quickly relate BI data with locations that are meaningful to the business (Location intelligence 2010, 8). They also enable decision makers to visualise multiple pieces of information simultaneously (Mennecke, Crossland & Killingsworth 2000, 602). Geographical visualisations are complete because they reveal where data is located and where it is not. As a result, organisations may detect trends such as customer clusters or outliers. This can help organisations see their position in the market, but also determine new potential markets. Maps may be used to illustrate the changes that have happened over time as well. This provides organisations with an understanding of how trends have changed and how different markets have developed. (Location intelligence 2010, 8−9.) Thus, spatial analysis has an important role as it can help measure past performance and results, predict future impacts, and thus, guide decision making. In the future, spatial data and tools will become more ubiquitous, embedded in business systems and transparent to more organisational members. (Holland 2005, 16−19.)

Location ties all other data points in an organisation's operations together (Location intelligence: The −− 2007, 7). Consumer demographics, sales figures and customer details among other data can be shown on a map and used to evaluate how the organisation should operate. Location based decisions are becoming increasingly important for both private and public sector organisations. This suggests that location intelligence is becoming an invaluable organisational intelligence that is important for understanding the organisation's operating environment. (Location intelligence: The −− 2007, 8.) However, it must be remembered that the value of location intelligence does not lie in the ability to see important data on a map, but rather in the incorporation of business information from within and outside the organisation to gain new insights and use that to improve operations at all levels (Transforming location intelligence −− 2007, 12; The location intelligent −− 2007, 7).

All organisations have opportunities for location intelligence which could be leveraged to realise significant improvements in profitability. These location intelligence opportunities vary according to industries, but all of them could transform organisations' business processes and create business opportunities. However, location intelligence has the greatest impact on industries where large amount of core BI has a geospatial component, and where "speed to insight" and depth of insight are critical attributes. (Location intelligence: turning −− 2011, 13.) A common problem with location intelligence is that organisations understand the value of references to location, but struggle to translate that understanding into meaningful profit-generating activities (Transforming location intelligence −− 2007, 4). Data itself does not have value for organisations if it is not analysed and thereafter used in decision making. Absolute data, such as a city's populations can be used for a rough estimate of a market's potential, but relative data, such as matching store locations to local demographics, can result in true location intelligence. (Location intelligence: The −− 2007, 4.) In addition, combining organisation's business data with data from external sources regarding, for example, population, road network or competitors enable organisations to better plan their marketing campaigns and store locations as well as determine risk exposure (The location intelligent −− 2007, 3). These types of activities are needed if an organisation wants to gain competitive advantage. (Transforming location intelligence −− 2007, 12.)

4.3.2 Improving Management and Revenue-generating Processes

GIS has great potential to improve management and revenue-generating processes where BI is already being used. Management processes are at the core of all businesses. If BI is used to improve those processes, it simultaneously improves the efficiency of the business and the accuracy of the decisions that drive it. For example, planning is a

future-oriented endeavour that relies on business information about past occurrences. (Williams & Williams 2007, 150−151.) GIS can visualise, for example, the sales figures of previous year by location which helps managers understand where the organisation has a strong presence and where there is unused market potential. Therefore, planning for changes that improve the market share or overall result of the organisation is easier when using GIS (Heywood et al. 2006, 17). This is also related to performance management which assesses the current state of an organisation to understand whether the performance is on target or not (Williams & Williams 2007, 151−152). BI brings relevant business information together with analytical techniques that enable fact-based decisions. Ultimately this leads to improved business performance and profits. (Williams & Williams 2007, 151−152; Hsu 2004, 169−170.) GIS can be used to achieve the same results, but it also includes the location aspect of the information used. The performance of the organisation can be visualised by region, so managers can quickly see where business is blooming and where challenges occur. This type of up-to-date information can be very valuable to decision makers.

BI was initially used mainly to improve revenue-generating processes. Many of these activities are related to marketing or customer segmentation. Organisations use marketing analysis to understand the revenue generation fundamentals, such as who buys their products or services, how often they buy and where. Marketing analysis can be done in real-time to see current trends, but also to analyse more long-term trends. With better information, organisations can be more effective in attracting new customers, retaining profitable customers and achieving sustainable revenue. BI is very useful in gaining the understanding about the relationship among customers, products or services and revenue generation. (Williams & Williams 2007, 159−160; Hsu 2004, 169.) Revenue generation fundamentals can be easily visualised on a map with GIS. This can help detect patterns or trends that cannot be seen from tables or reports. In addition, demographical data can be used to try to explain why the revenue generation is spatially diffused as it is. Therefore, also other potential markets with similar characteristics can be determined.

Detailed information about customer transactions provides organisations with the ability to improve customer segmentation. Demographic and geographic segmentation are used to analyse and predict the behaviour of organisation’s customers and sales prospects. By gathering data about the vast amount of individual customer transactions and combining such information with demographic and geographic information, organisations are able to understand the relationships between purchasing behaviour and, for example, demographic variables and product characteristics. With BI tools organisations can define narrower customer segments, understand the need of these segments and create products and services that better meet the needs of customers. (Williams & Williams 2007, 160−161; Hsu 2004, 196.) These tools provide the organisations with

the opportunity to define what demographic characteristics are typical for their customers, and find out where these types of customers are located geographically. This type of analysis may result in better understanding of the most important customer segments and their location. Therefore, the organisation can improve their efficiency by concentrating on serving these important segments rather than as many customers as possible.

BI driven market analysis and customer segmentation provides a sound understanding about customers and their purchasing behaviour. This information can be used when planning advertising, direct marketing and PR campaigns. BI can help measure the effectiveness of advertising and direct marketing that are directed towards increased revenues. (Williams & Williams 2007, 161; Hsu 2004, 169.) By using demographic and geographic data, GIS provides information about what type of marketing should be done in different locations. Therefore, marketing becomes more efficient which has an effect also on the revenues of the organisation. (Heywood et al. 2006, 17.)

4.4 Challenges

4.4.1 Implementation

Information technology, including GIS and BI solutions, presents major opportunities but also challenges to organisations in today's globally competitive environment. The problem of IT investment decision remains complex due to several organisational factors, including the lack of IT knowledge among management (Joshi & Pant 2008, 181−191.) The implementation of new IT is costly, disrupts business activities, puts strain on employees, and has uncertain payoffs (Anderson, Banker & Ravindran 2006, 1373). However, it is generally agreed that IT investments are beneficial to organisations, but it is difficult to evaluate and measure the contribution of IT to the bottom line. (Joshi & Pant 2008, 181; Pick 2008, 85.) This is due to the fact that many of the benefits are intangible. If the benefits have strategic value, they can be very important to an organisation. However, it is scarcity, not ubiquity, that makes a resource truly strategic. Organisations can gain an edge over competition by doing something that others cannot have or do. This applies also to having a superior insight into the use of new technologies. The potential of a technology for differentiating one firm from others declines as it becomes accessible to all. (Carr 2003, 42−43.) Therefore, as location intelligence solutions are still relatively new, they can help firms gain an edge over competition, but organisations can be hesitant about implementing them because the expected benefits are difficult to quantify (Anderson et al. 2006, 1373).

Despite the interest organisations have shown for the benefits of location intelligence, the actual implementation and investigation of required software has lagged behind. This may be because of budgetary concerns, the lack of solution expertise or IT resources or that the business value and return on investment of merging BI and GIS has not been adequately demonstrated. (Location intelligence: turning −− 2011, 11; Francica 2006, 39). Many organisations state that advanced technology is critical to their decision making and operational processes, but still fail to invest in technologies that are most suited to these tasks. This may be due to the fact that most organisations experience a variety of challenges in implementing more advanced technologies. Integrating a new application with multiple databases and platforms can be challenging. (Location intelligence: The −− 2007, 11−14.) The primary risk for organisations implementing location intelligence lies in not adequately defining the business, functional and technical requirements for the solution (Location intelligence: turning −− 2011, 1). In addition, after the integration has been completed, the adaption of existing business processes to use the new capability and getting the corporate culture to understand the benefits of the new application can take much time and effort. Even finding the room in the budget of the organisation to fund implementation and training of managers and employees is a major challenge in itself. (Location intelligence: The −− 2007, 11−14.)

Organisational support is extremely important during the process of integrating GIS and BI, and especially after the solution has been implemented. There are several reasons for this. First, business users might feel sceptical of the benefits of the solution, either to themselves or to the organisation. Therefore, some users may be reluctant to use the solution. Second, users might feel threatened by the solution due to the fear that their roles or responsibilities might be affected. Third, some users may prefer to make some decisions based on intuition rather than information and analysis. Finally, people are typically resistant to any change. Due to these and other reasons, location intelligence projects may not provide adequate returns on investment if organisational support is not maintained. (Sabherwal & Becerra-Fernandez 2011, 254.)

Organisational culture refers to the norms and beliefs that guide the behaviour of people in an organisation. The success of BI, GIS and their integration does not depend only on technology. (Sabherwal & Becerra-Fernandez 2011, 245.) It is even more important that the people in an organisation actively seek and use new opportunities and aim to make decisions based on the best possible information (Howson 2008, according to Sabherwal & Becerra-Fernandez 2011, 245). Thus, also location intelligence depends on an organisational culture that values data and its utilisation to pursue opportunities. Employees should recognise the importance of collecting and using quantitative evidence and making decisions based on reliable data for location intelligence project to be successful. (Sabherwal & Becerra-Fernandez 2011, 245.) However, high success with location intelligence can also lead to greater emphasis on data. As business users recog-

nise that using the solution leads to improved decisions, they are more likely to base their decisions on facts and analysis rather than intuition. (Howson 2008, according to Sabherwal & Becerra-Fernandez 2011, 245.) This puts great demands for the data used in an organisation.

Therefore, the success of integrating GIS and BI depends considerably on the data available in the organisation. Data quality is considered to be the most important technical factor for successful BI (Howson 2008, according to Sabherwal & Becerra-Fernandez 2011, 244) and GIS, so it applies to the integration of these two as well. This is understandable because the information contained in reports from GIS, BI or location intelligence solutions is directly based on the available data. Therefore, the data housed in different systems in the organisation should be of the highest quality. In this sense, data warehouse has a very important role as it is the foundation upon which a BI solution is based. Thus, before deciding to implement a BI solution, organisations should enhance the quality of data in their data warehouse. (Sabherwal & Becerra-Fernandez 2011, 244−245.) It is essential for the success of location intelligence that the components it consists of are of high standard, so that the end result is really usable.

4.4.2 Timing of Investment

Investments in location intelligence can be high, particularly because it is still relatively new. The process of combining GIS and BI is challenging for the solution provider and the customer as there are not too many experts on the issue yet. This contributes to the fact that organisations may want to see some development first before they want to invest in such a solution. There are also other strong reasons to put off investing in new IT solutions (Anderson et al. 2006, 1373). Given the rapid pace of technological development, delaying IT investments can be a powerful way to cut costs. The longer an organisation waits to make an IT purchase, the more they will get for their money. (Carr 2003, 48−49.) It is easier to wait while others bear the cost and risk of innovating, and it also reduces the chance of buying something that is technologically flawed or doomed to rapid obsolescence (Anderson et al. 2006, 1373; Carr 2003, 48). However, the advantages and disadvantages of being a first-mover are still under debate.

The first-mover advantage theory states that the first mover into the marketplace may acquire certain advantages over subsequent entrants. These may include very high profit returns and market share that can lead to sustainable competitive advantage. (Kerin et al. 1992, 33.) However, there is also sizeable literature in opposition to the first-mover advantage theory, outlining empirical evidence of first-mover disadvantages and later-mover advantages. Overall, empirical evidence shows that there is a market share advantage for first-movers, but pioneering has also a significant profit disadvantage.

(Frawley & Fahy 2006, 278, 280−281.) The pace of technological development directly affects the possibility of deriving first-mover advantage through technology leadership. Technological development may render the knowledge of an organisation obsolete, destroy existing competences and negate possible experience curve advantages. (Suarez & Lanzolla 2007, 382−383.) As location intelligence solutions are not very common yet, organisations may be hesitant about implementing this type of a solution because they do not know if they gain benefits from it. Many organisations may feel that it is not wise to be the pioneer because it may be quite expensive to develop these new solutions. Because there are not many reference cases, it can be more difficult to demonstrate the benefits of location intelligence.

IT is easily replicable and cannot provide sustained competitive advantage because best practises are quickly built onto software (Carr 2003, 47; Anderson et al. 2006, 1359). It can be wiser to stay well back from the cutting edge, waiting to make purchases until standards and best practices solidify. These organisations let their competitors shoulder the high cost of experimentation, and then they sweep past them, spending less and getting more. (Carr 2003, 49.) On the other hand, it can also be argued that IT may be used to leverage other firm-specific resource advantages or opportunities (Anderson et al. 2006, 1359). Therefore, IT may play an important role in creating competitive advantage.

One further reason that explains why location intelligence solutions have not become prevalent relates to their early growth stage. Richard Nolan (1979) has proposed six stages of information system growth, as measured by growth of computing budget (Figure 8).

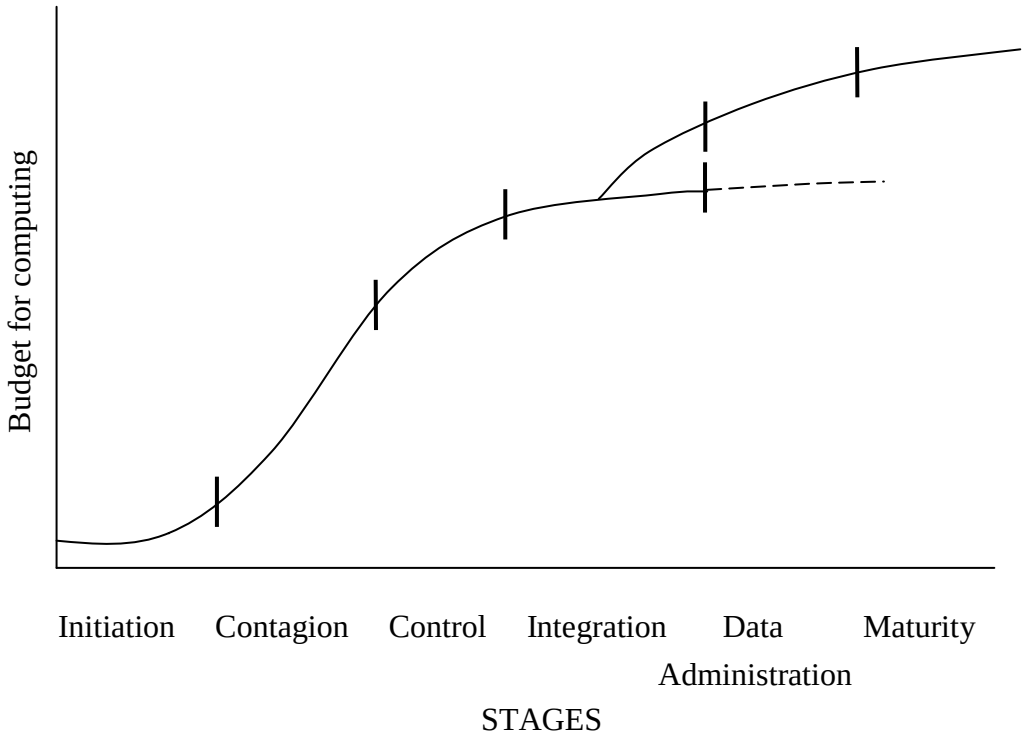

Figure 8 Stages in location intelligence solution adoption (modified from Pick 2008, 86)

As Figure 8 illustrates, the first stage is initiation where the technology is acquired. In the second stage, which is named contagion, the use of the solution is developed and the user base grows intensively. The third stage is control which is a reaction to contagion and imposes accounting controls. The fourth stage, integration, includes orientation towards user services. In data administration, the fifth stage, there is tight control of organisational computing resources, but some room to develop systems with added value. In the final stage, maturity, costs are under control and benefits are increasing. (Pick 2008, 85.)

Of these stages, location intelligence would be assigned to late stage 1 awaiting stage 2. As location intelligence solutions are still relatively new, having only been introduced five to ten years ago, they have not yet caught on. However, there are some newer spatial solutions that have already reached the contagion stage, such as Google Earth and related mash-ups. (Pick 2008, 86.)

5 RESEARCH DESIGN

5.1 Research Strategy

The purpose of qualitative research approach is to increase the understanding of firms' operations by analysing qualitative data (Koskinen, Alasuutari & Peltonen 2005, 16). The basis for selecting qualitative research as the means of studying GIS and BI was the interest in describing, exploring and understanding their real-life applications and complex dynamics (Hirsjärvi, Remes & Sajavaara 2001, 152). The purpose was to gain as much information and to study the research subject as comprehensively as possible (Hirsjärvi et al. 2001, 152; Koskinen et al. 2005, 265) which pointed to the direction of qualitative research as opposed to quantitative. Qualitative research also seemed to allow the interviewees to explain and discuss the essential issues related to the topic more freely (Hirsjärvi et al. 2001, 155). This is important because the acquisition of abundant and diverse data provides the basis for understanding the subject studied (Koskinen et al. 2005, 265). Therefore, it was also decided to analyse the topic from both solution providers' and customers' point of views. Retail and insurance sectors were selected to represent the customers because they are at different stages of using GIS. These sectors were also mentioned in the literature as potential beneficiaries of location intelligence.

The results from a qualitative research in this topic can be expected to be more valuable and broader than what could be achieved by a quantitative research. One of the reasons for this is that the number of answers for a quantitative research cannot be guaranteed. In addition, it was very important to allow the interviewees to express their opinions freely and minimise the role of the interviewer. It was beneficial to the research to hear nine experts discuss this topic from their own points of view to gain an extensive picture of the topic. Since it was important to hear people with different types of expertise, it would have been difficult to construct a survey that was able to capture the essential information from all respondents. In addition, some of the respondents also most likely would have felt that they are not capable of answering all questions and decided not to answer at all which would have presented a problem.

The problem with qualitative research is that results cannot typically be generalised because they are based on variables in a specific environmental context (Yin 1991, 21,38). The problem of generalisation in qualitative research is also due to the limited amount of empirical data. However, it is possible to make more general conclusions in qualitative research with the help of a general theory. (Koskinen et al. 2005, 167.) Alasuutari (1999, 237−243) has also suggested that even the simplification of the collected data is a type of generalisation. In addition, one criterion of generalisability is the conceptual deepness and problem solving ability of the research findings (Lukka &

Kasanen 1993, 375) which is something the researcher has control over. In this research generalisations can be made because the topic was studied from both solution providers' and solution users' side in Finland. The research questions were planned so that they would reveal more extensive trends and not only apply to the firms that were interviewed. Therefore, the results can reveal trends in various sectors and many of the opportunities and challenges mentioned can be applied to also all solution providers.

5.2 Data Collection

There are several ways of collecting qualitative research data either from primary or secondary sources. The purpose of the study and the research questions as well as the research approach are the guiding principles in deciding what type of empirical data should be collected. For this study collecting primary data was necessary and conducting interviews was the most appropriate method for doing that. One of the main reasons for this choice was that interviews are an efficient way of collecting information about issues that are not published in documents (Eriksson & Kovalainen 2008, 80−81). Another reason was the need to hear the opinions of experts with different backgrounds and positions in the GIS and BI market.

One decision that must be made when collecting primary data is what type of interview is used in the research. There are several possibilities which include structured interviews, semi-structured interviews, open interviews, and theme interviews. (e.g. Eriksson & Kovalainen 2008, 81−82; Hirsjärvi et al. 2001, 194−195; Eskola & Suoranta 1998, 87−88.) In this study a semi-structured interview was chosen. In this interview type the interviewer has a prepared outline of topics, issues or themes, but still has the option of varying the wording or the order of the questions in the interview situation (Eriksson & Kovalainen 2008, 82). The interview themes of this study are outlined in Appendix 1. It seemed appropriate to plan the interview quite carefully to avoid the possibility that some topics would not receive adequate attention. However, there are still several biases that may arise in semi-structured interviews. These include biases arising from the order in which the topics are addressed, from any unintended omission of the questions, from unrepresentative sampling, or from an uncontrolled over- or under-representation of subgroups among respondents. (Jankowicz 1995, 202.) To avoid these pitfalls the outline of the interview was carefully planned and the understanding gathered of GIS, BI and location intelligence solutions from the literature was used as a guideline in forming the questions.

The starting point for gathering interview data was that the people who have knowledge of the subject should be given the chance to contribute. They should have the possibility to discuss the relevant issues and bring their own insight into them (Yin

1991, 89.) Therefore, it was important to find interviewees from both GIS and BI solution providers, as well as from organisations that use GIS and BI solutions. Logica and Esri are both well-known GIS solution providers in Finland, so it was very clear that conducting interviews with experts from these firms would be useful. Logica is a business and technology service firm that has expertise in both GIS and BI which further supported the choice of interviewing its employees. For organisations that use GIS, it was preferred to choose private sector firms than public sector organisations. As the public sector has traditionally used GIS to a considerable extent, private sector firms were perceived to have more potential in revealing new information.

In total nine interviews were conducted in October and November 2011 (Table 2). All of the interviews were conducted in Finnish in order to rule out any language barrier problems that might have occurred if the interview had been conducted in English. The interviewees were very motivated and seemed interested in the research topic which made the interview situations very pleasant. A peaceful place was selected for each interview, and all interviews were tape-recorded with the permission of the interviewee to assist the later analysis of the data. After the interviews had been transcribed, they were sent to the interviewees. Thus, they had the option to add something they had not thought about during the interview or clarify something that he had explained somewhat ambiguously.

Table 2 People interviewed for the study

Interview Date	**Interviewee**	**Organisation**
6.10.2011	Emmi Jouslehto	Logica (GIS)
7.10.2011	Antero Törhönen	Logica (BI)
25.10.2011	Veli-Matti Kiviranta	Logica (GIS)
25.10.2011	Antti Mansikka	Esri
27.10.2011	Jari Pekkanen	Logica (BI)
2.11.2011	Insurance firm	A
4.11.2011	Insurance firm	B
7.11.2011	Retail firm	A
9.11.2011	Retail firm	B

The interviewees were also asked whether or not they wanted to appear in the research with their own name or preferred to stay anonymous. As Table 2 indicates, the interviewees in the insurance and retail sector wanted to stay anonymous mainly because they did not want their firm to be recognised, for example, by their competitors or did not want their name to be linked to a certain comment. Therefore, in the analysis they will be referred to as retail firms A and B and insurance firms A and B. However, it is important to mention that both interviewees in the retail sector are GIS experts who have worked with GIS and retail business for several years. The interviewee in insu-

rance firm A has also worked with GIS for many years, and in insurance firm B the interviewee is involved in their GIS pilot project.

In the interview situation the contact between the interviewer and interviewee was very direct and interactive. Thus, as a mean of gathering data interviewing was very flexible and presented the possibility of discussing issues beyond the original framework. (Hirsjärvi et al. 2001, 191.) This option was used in the interviews because some new issues outside the original outline arose during the interviews that seemed relevant to the topic.

5.3 Data Analysis

The objective of the analysis of qualitative research data is to clarify it and thus, produce new information about the subject studied. It aims at summarising the data without losing the information it contains. (Eskola & Suoranta 1998, 138.) The analysis is much dependent on the researcher's intuitive capacities, perceptiveness and creativity (Hart 1991, 195). In this study the data analysis process began with transcribing the interviews shortly after they were conducted. The high quality of the tape-recording and notes made during the interview facilitated the transcription process. It was important to do the transcriptions word by word because reading them several times is needed in order to understand the content of the interviews (Eskola & Suoranta 1998, 152).

Data analysis includes three different activities: data reduction, data display and conclusion drawing and verification (Miles & Huberman 1994, 10). However, it is difficult to indicate the exact moment when the data analysis begins (Kvale 1995, 71). It is suggested that it begins already during the interview as the researcher begins to comprehend the peculiarities of specific issues. The data analysis involves the explanation of the data keeping in mind the possible solutions to the research questions. This means separating the parts which are relevant to the research questions from the data. Thereafter, interpretations can be made from the information separated from the raw data. (Berg 2004, 252.) In this research, the interviews were listened to and the transcription was read multiple times to be able to identify key issues from the less important ones. The key words and themes were highlighted and notes were taken to emphasise the essential issues in the interview to assist in the analysis. This process of selecting, simplifying and abstracting the raw data concludes, according to Miles and Huberman (1994, 10), the data reduction phase of data analysis process.

Once the reduction phase had been carried out, the data display phase began. In this phase the information gained from the interview data was organised into a form which allowed conclusions to be eventually drawn. (Miles & Huberman 1994, 11.) According to Eskola & Suoranta (1998, 151) there are three possible ways of moving from the in-

terview data towards the analysis. Firstly, the data can be transcribed and thereafter, analysed immediately. This type of analysis puts emphasise on the interviewer's intuition. Secondly, the interview data can be coded or classified into themes after the transcription of the interview is done and consequently interpreted. Thirdly, the two previously mentioned methods of transcribing and classifying the data into themes can be combined and thereafter move on to analysis. (Eskola & Suoranta 1998, 151.) In this study, data display phase is carried out by classifying the interview data into different themes. The highlighting of key themes and notes taken during the data reduction phase enabled the identification of themes that were mentioned frequently. This made it easier to control the data and to find the most suitable theories to support the empirical data. (Koskinen et al. 2005, 231.) The final themes used in the analysis were created using the research problem and sub-problems as well as the issues that arose from the interview data.

The final phase of data analysis is the conclusion drawing and verification which includes the detection of regularities, explanations, patterns, causal flows, and propositions. These preliminary conclusions that are drawn from the research material may be vague at first and therefore, certain level of scepticism should be kept. Final conclusions may not appear before the process of data collection has been finished. (Miles & Huberman 1994, 11.) During the data collection phase some regularities were detected among the answers of the interviewees, so initial conclusions were drawn already then. However, the final conclusions were written after the whole data analysis process was complete. According to Miles and Huberman (1994, 11) the conclusions drawn should also be verified. In this study, the verification was the decision to second guess all of the conclusions and go back to the interview transcription and notes (Miles & Huberman 1994, 11). This is only one way of verifying the conclusions, but it was the most sensible choice regarding this particular study.

5.4 Evaluation of the Study

Qualitative research has received some criticism of the unclear guidelines for testing reliability of a research. However, this does not mean that the reliability of qualitative research cannot be evaluated at all. On the contrary, there are criteria designed especially for qualitative research which ensure the appropriate evaluation of this type of research. (Eskola & Suoranta 1998, 209−213.) These criteria are credibility, dependability, transformability, and conformability (Lincoln & Guba 1985, 300), and they are used also here to assess the trustworthiness of this study.

Credibility of the study means that the researcher is able to provide data that reflects the reality. It is essential to prove linkages between the purpose of the study, the theo-

retical framework and the empirical section of the study in order to justify the performed research and the credibility of it. (Lincoln & Guba 1985, 294−296, 312.) An operationalisation table was one of the most important elements of increasing the credibility of the research. It proved that the research problem, theoretical framework and the empirical research were all linked throughout the research process. However, the operationalisation table was only a tool for managing the research process, and it was not necessary to include it in the final study. Theoretical triangulation also aimed at making the study more credible by combining GIS and BI literature. Other issues that improved the credibility of the research were linked to the interview situation. By tape-recording the interviews there was the possibility to listen to them several times and as a result, better understand interviewee's replies. In addition, by choosing to conduct the interview in Finnish misunderstandings in language and terms were avoided.

Dependability of the research refers to the researcher's ability to present consistently truthful and reliable information about the subject. This can be achieved by proving that the process of research has been logical, traceable and documented. Dependability also refers to what extent the results depend on the research situation. There is no credibility without dependability, so the demonstration of the former is enough to establish the latter. However, to prove the quality of the study also dependability needs to be illustrated. A method to increase the dependability of the research is to describe the interviews accurately, and to evaluate the role of the researcher in the research process. (Lincoln & Guba 1985, 299, 316−317.) The research process has been described as carefully as possible to increase the dependability of this research. The interview situations were very comfortable and there were minimal to no interruptions, so there were no negative issues that could have affected the results of the research. However, the lack of experience in conducting interviews might have had a role in the research. For example, some of the questions in the interviews could have been differently formulated to gain deeper insight, and leading questions could have been eliminated altogether. In addition, the lack of interview experience led to the choice of a semi-structured interview rather than a theme interview, although the latter might have allowed the interviewees speak more freely about their thoughts on the topic. According to Lincoln and Guba (1985, 324) one additional way to assess the dependability of the research is to ensure that all reasonable areas are explored. This was achieved by covering all the important themes related to the theoretical framework in the interviews.

Transferability refers to the researcher's responsibility to demonstrate a degree of similarity between their research and previous research. In other words, transferability is about showing that the research findings can be, at least to some extent, transferred outside the researched subject to other theoretical and empirical contexts. (Lincoln & Guba 1985, 316.) The ability to transfer research findings from the primary context to another one depends on the similarity of these contexts. Therefore, this issue should be consi-

dered before transferring empirical research findings. (Tynjälä 1991, 390.) In this study, there was a limited number of organisations that were interviewed, but the results derived from them can be applied to other organisations, both on the solution provider and the customer side as well. Since this study combines GIS and BI literature, the results should interest both sectors, even though the study concentrated mainly on GIS organisations. In addition, some of the trends that were discovered in this study affect many organisations in various sectors, such as cloud computing. These results indicate that the research findings can be transferred to a certain extent to other empirical contexts as well.

Conformability is about linking the results and conclusions to the data in a logical way. This means that the results obtained could be reached also if another researcher conducted the same study at another time. (Lincoln & Guba 1985, 323−324.) As GIS and BI sectors change constantly, the research result could be different if the study was conducted again. However, the research findings were derived straight from the interview data, so if another researcher was given the data, the findings would most likely be very similar. In addition, the research process was described in detail which increases the conformability of the study. Conformability, in other words, is about the objectivity of the researcher. Reliability of the research is very much dependent on the researcher's ability to understand the essentials of the subject and view it objectively (Eskola & Suoranta 1998, 213). However, it should be recognised that the values and beliefs as well as the knowledge base of the researcher inevitably have a role in the research process (Hirsjärvi et al. 2001, 152). Even if the researcher aims to be objective, the basis for their understanding is still in their values and beliefs (Stake 1995, 45). This study was an assignment from Logica which may have had some impact on the views expressed in the research. However, the objectivity of the research was enhanced by interviewing another solution provider (Esri) besides Logica to gain a more extensive impression of location intelligence solutions in Finland.

6 LOCATION INTELLIGENCE MARKET IN FINLAND

6.1 Solution Providers – Promoting the Development

6.1.1 GIS – Continuous Upgrading and Diverse Applications

In the last ten years many technological changes have occurred in GIS as well as a conceptual change. GIS has developed from digitisation, to managing spatial data based on databases and to a web browser based GIS solution. (Jouslehto, interview 6.10.2011.) GIS has truly been revolutionised by the internet (Shahab 2008, 274). The conceptual change has happened in the clientele. In only a few years, organisations have suddenly begun to ask for maps. They have become more ordinary and common among other solutions and tools. People have begun to use maps more in their personal lives and thus, want them in their workplace as well. (Jouslehto, interview 6.10.2011.) Google Maps has had a great impact on this because Google created a map that was a mass market product and unlike anything that had been done before (Pick 2008, 4). Another significant factor has been GPS and in-car navigation systems which have become very common (Heywood et al. 2006, 381−382). These easy to use consumer products put pressure on enterprise products as people will become more demanding when it comes to the usability of an enterprise solution. (Kiviranta, interview 25.10.2011.)

GIS is used in a vast array of sectors for different purposes. Public sector has long traditions in using GIS (Jouslehto, interview 6.10.2011). They use GIS, for example, in planning, zoning and construction. In addition, the Finnish army and rescue service are important users of GIS. (Kiviranta, interview 25.10.2011.) In the private sector, firms concentrate on their core competencies, and many decide to outsource GIS services (Jouslehto, interview 6.10.2011). These sectors include, for example, real estate and logistics in which spatial data is critical. In addition, particularly large organisations in various sectors use GIS in their marketing efforts or contact centre services. Spatial data may be only a small element of a process, but it can have great impact on the end result. (Kiviranta, interview 25.10.2011.) Because there are so many sectors that use GIS, the user groups also vary. Analysts and experts typically use desktop products because they include all of the tools that these people need (Mansikka, interview 25.10.2011). In addition, there is a large user group whose work is not directly related to GIS, but it is still an important tool for them (Jouslehto, interview 6.10.2011). In these cases, it is important that the solution is not difficult to use and therefore, it generally is a web browser based solution (Longley et al. 2011, 43).

Many organisations use GIS to gain a clear picture of their situation, for example, in relation to an operation or a process, to assist management and planning (Kiviranta, interview 25.10.2011). By using GIS organisations aim at making their operations more efficient and gaining time, material and personnel savings (Jouslehto, interview 6.10.2011). However, without proper training for the use of GIS, these savings cannot be achieved (Göçmen & Ventura 2010, 176). Finding new customers can also be easier with the analysis and visualisation possibilities of GIS. As stated many organisations use these possibilities to improve their marketing efforts. (Mansikka, interview 25.10.2011.) GIS enables marketing personnel to combine different data to find geographically the segments they want to target (Jouslehto, interview 6.10.2011). In addition, one of the goals of GIS is to support decision making and solving day-to-day problems by visualising geographical data and providing tools for different analysis (Goodchild 2001, 6180; Sheppard 2001, 6182). Organisations want to have the best possible information to base their decisions on, and a map provides better and more timely information than, for example, tables (Jouslehto, interview 6.10.2011). Map visualisations assist organisations in transforming heterogeneous data into information and subsequently into knowledge (Hernandez 2007, 249).

Technology does not generally present obstacles for GIS, but organisations have very limited budgets and tight schedules which present challenges for GIS solution providers (Jouslehto, interview 6.10.2011). The time and money required to implement a sound GIS solution can be the reason for deciding not to implement one (Galati 2006, xxiii−xxiv). The most significant challenge, however, is that GIS is perceived to be a very difficult issue. GIS solution providers have not been able to explain the possibilities and benefits of GIS in a way that customers understand them. (Jouslehto, interview 6.10.2011; Kiviranta, interview 25.10.2011.) Management rarely understands all of the possibilities that GIS offers which is why it would be extremely beneficial to increase their awareness on these opportunities (Grimshaw 1991, 295). Solution providers concentrate too much on different technologies and processes when they should only discuss the benefits of GIS for a certain organisation (Kiviranta, interview 25.10.2011).

In addition, data still present challenges when it comes to GIS. Previously the challenge was that there were not sufficient data available, but now it is more concerned with their price and quality. (Mansikka, interview 25.10.2011; Kiviranta, interview 25.10.2011.) If the data is incorrect, it means that all the results gained from analysis are also wrong. Therefore, the high quality of data is essential. (Kiviranta, interview 25.10.2011.) However, data is also one of the greatest opportunities of GIS; new types of data, more complete data, higher-resolution data, and more timely data can be expected to decrease the amount of problems related to data in the future (Shahab 2008, 274).

The knowledge organisations have of GIS varies a great deal. Some organisations have very extensive knowledge about how they can benefit from using GIS. (Mansikka, interview 25.10.2011.) These organisations typically have a strategic need to examine geographic phenomena (Hartung & MacPherson 2000, 226). In the private sector, a good example is the retail sector which has used GIS for a long time and look for new opportunities continuously. However, in Finland it is possible be successful, at least to a certain extent, with merely sound local knowledge or expertise. (Mansikka, interview 25.10.2011.) This is one of the most considerable differences between Finland and, for example, USA or UK. In addition, there are sectors that have great potential, but either have not realised it themselves or have been reluctant to invest in GIS. Insurance sector has shown promise for the past ten years, but no major breakthroughs have occurred (Kiviranta, interview 25.10.2011). However, in the last few years the insurance sector has begun to show more interest in GIS, and continues to hold great potential in the future (Mansikka, interview 25.10.2011; Kiviranta, interview 25.10.2011). In addition, some sectors have very heavily rooted traditions and ways of doing different processes which may leave room for making these processes more efficient with GIS (Jouslehto, interview 6.10.2011). One example of this is the public sector where change is not always seen as an opportunity. (Mansikka, interview 25.10.2011). Applying GIS to unforeseen business problems can result in different types of impacts on business processes and the organisation itself which is why it is important to be open to various scenarios. (Pick 2008, 381

In addition, the retail sector continues to present opportunities for developing their solutions even further (Mansikka, interview 25.10.2011). Currently, they do many analyses so that they collect a great amount of information, do the analysis, get a result, and then base their decision on that. However, a solution that collects information continuously and does online analyses could offer these organisations more timely information to base their decisions on. Another sector that could use real-time GIS better is logistics. Logistics firms use GIS to a certain extent in planning routes, for example, to minimize costs, but they could use it better by optimising the deliveries online. (Kiviranta, interview 25.10.2011.) The restaurant business has also begun to show interest towards GIS (Mansikka, interview 25.10.2011). It is clear that location is extremely important in their sector.

Traditionally there has been a division between information systems (IS) and geographical information systems which is quite artificial (Jouslehto, interview 6.10.2011). In the future, the integration and interoperability of GIS and other enterprise solutions will be more seamless, and an increasing amount of solutions will have a built-in spatial functionality (Pick 2008, 382). Therefore, for example, an enterprise resource planning (ERP) solution could have a GIS component integrated in it automatically. This would make it easy to combine data from different, even external, sources and create new in-

formation. (Jouslehto, interview 6.10.2011; Mansikka, interview 26.10.2011.) Integrating GIS to other enterprise solutions would be beneficial also because overall, people generally like maps. They evoke emotions and even if a person is not a GIS expert, they can have a strong opinion about the colours or symbols of a map. Therefore, GIS generally receives a warm welcome in an organisation, and there is little resistance to using it. However, GIS should always bring added value to the organisation and support its operations. All organisations do not need GIS and therefore, and it should be implemented only when it is really needed. (Jouslehto, interview 6.10.2011.)

Cloud solutions are a trend that will definitely affect the GIS sector in the future as well (Mansikka, interview 26.10.2011). Cloud solutions allow organisations to buy capacity according to their own needs, so it may be a very good solution for smaller organisations that do not want to invest in their own GIS (Jouslehto, interview 6.10.2011; Kiviranta, interview 25.10.2011). The implementation costs of GIS in the cloud are significantly lower than of traditional GIS. Therefore, if optimisation and costs savings are important to an organisation, cloud computing may provide a very appealing option for GIS. (Bhat et al. 2011, 595.) Smaller organisations would benefit also from a generalised service to which they could bring their own data and which would allow them to see that on a map, make analyses and get reports (Jouslehto, interview 6.10.2011; Kiviranta, interview 25.10.2011).

It will become a wider trend that organisations outsource their GIS operations because it can be less expensive than maintaining a GIS of their own (Kiviranta, interview 25.10.2011). Using GIS requires certain skills, and by outsourcing the GIS operations organisations also save money by not having to recruit personnel with these skills (Pick 2008, 382; Grimshaw 1994, 117; Heywood et al. 2006, 344). Especially buying GIS as a service with, for example, a monthly payment will increase. So far this has not been a success among customers because they prefer to have a GIS in their own organisation and maintain it themselves, rather than change their organisational structure. (Kiviranta, interview 25.10.2011.) However, the usability of the information derived from GIS depends on the ability of the users to interpret it (Grimshaw 1994, 117). Therefore, organisations that have GIS, even as a service, need to have a certain level of GIS expertiseThere is always a risk of incorrect interpretation or even making an error in an analysis. Thus, there is a great responsibility attached to the use of GIS. (Jouslehto, interview 6.10.2011.)

GIS will become more widely available in the future as the price of software and data will decrease, and web browser based GIS will develop so that solutions will have more tools that are now only available in desktop products (Mansikka, interview 25.10.2011). The overall trend for GIS is transitioning to a more web-centric environment for GIS (Pick 2008, 382). All of these developments will make GIS more common, and it will

gain more users as the variety of solutions continues to increase (Jouslehto, interview 6.10.2011).

6.1.2 BI – Basis for Reporting

The readiness of organisations to use BI solutions varies considerably. The organisational culture has a great role in either supporting or hindering the implementation of a BI solution. (Törhönen, interview 7.10.2011.) If organisational culture encourages employees to seek and use new opportunities and make decision based on the best possible information, the readiness to use BI is high (Sabherwal & Becerra-Fernandez 2011, 245). During the last four years the demand for BI solutions has risen significantly. Before that it was mainly pioneer organisations that requested these types of solutions. The need for a BI solution generally stems from the need to have all of the data in the organisation in one place. (Pekkanen, interview 27.10.2011.) Different systems in the organisation can give executives very different financial figures. For example, an enterprise resource planning system (ERP) may not give an adequate idea about where the organisation is financially, and therefore, a separate data warehouse is needed. (Törhönen, interview 7.10.2011.) Data from all systems in the organisation are gathered into one data warehouse and thus, all organisational members have access to the same information (Pekkanen, interview 27.10.2011). Data mining is very important in creating a realistic view of an organisation's situation because data mining tools can help uncover trends and relations in the data which can then be analysed further (Thierauf 2001, 3; Hsu 2004, 142). The availability of increasing amounts of data improves the decision making process only if executives have the tools to utilize it (Sabherwal & Becerra-Fernandez 2011, 9). The BI solution allows executives to get reports based on the data stored in the warehouse to support decision making and planning (Pekkanen, interview 27.10.2011). With reports executives can, for example, decide on what level they want to follow financial figures and see how well their business objectives are being achieved (Törhönen, interview 27.10.2011).

BI solutions bring transparency to reporting through more developed technology and a clearer reporting model (Törhönen, interview 27.10.2011). Data warehouse is a central database for an entire organisation for storing and accessing data which is why it is an important component regarding transparency issues (Hočevar & Jaklič 2010, 92; Ranjan 2008, 464). Transparency, on the other hand, is important when it comes to corporate governance and audit trail issues; there are certain legal requirements that have to be addressed especially in financial reporting (Törhönen, interview 27.10.2011). By using a BI solution organisations can reduce the amount of manual work related to reports and spend more time actually analysing the content. There are examples where by intro-

ducing a BI solution the group of people making a report has been cut in half, the time spent on gathering data has been reduced from 80 % to 20 % and the time spent on analysing increased from 20 % to 80 %. Thus, implementing a BI solution frees human resources to concentrate on the most valuable tasks. (Pekkanen, interview 27.10.2011.) However, if the BI solution is not easy to use, these benefits may not be realised (Sabherwal & Becerra-Fernandez 2011, 223−224).

The challenges of BI solutions are generally related to the need of an organisation to report something that they do not have data about (Pekkanen, interview 27.10.2011; Törhönen, interview 7.10.2011). In addition, the data that the organisation holds may be fragmented, incomplete or not readily available in a form that can be used effectively (Ranjan 2008, 467). Therefore, a BI solution project may also include the collection of the missing data and the creation of a new hierarchy structure. Most of the challenges and restrictions concerning BI solutions are known, and thus, can be addressed and solved by the solution provider. (Pekkanen, interview 27.10.2011.) From the customer's point of view one of the greatest obstacles of implementing a BI solution is money. Many organisations do not have sufficient knowledge and experience on BI solutions, and therefore, they are typically perceived to be too expensive in relation to the possible benefits. (Törhönen, interview 7.10.2011.) This may be due to the fact that the benefits of BI solutions are difficult to define as they are mostly intangible (Williams & Williams 2007, 13). Organisations may invest millions in an ERP system, but remain hesitant about investing a fraction of that money in a BI solution. (Törhönen, interview 7.10.2011.)

For now, BI solutions produce reports on past or current occurences, but if it becomes possible to do scenario analyses it would enable managers to predict future trends. One step towards this would be to combine external and internal BI better than it is currently done. This means combining information from within the organisation with information from external sources to create completely new information. (Törhönen, interview 7.10.2011.) On a theoretical level BI means the conscious transformation of data from internal and external sources into new forms to provide business-driven and results-oriented information (Ranjan 2008, 461). However, on a practical level the concept for this is missing, although it is one of the future possibilities for BI (Törhönen, interview 7.10.2011). In addition, GIS could provide some opportunities for combining internal and external information because it can bring together different types of data from various sources and visualise them effectively. However, none of the current BI solutions support a map interface very well. (Pekkanen, interview 27.10.2011.)

Having extensive reporting is becoming increasingly important for organisations (Törhönen, interview 7.10.2011). Even when they are planning to acquire, for example, an ERP system, they may want to know how reporting could be handled. Typically it would mean building a central data warehouse. (Törhönen, interview 7.10.2011.) Data

warehouse applications can be used for cataloguing, indexing and cross referencing important data (Thierauf 2001, 3). The need for master data management will increase in the coming years as well. There are many separate operational systems in organisations that are not connected at all. With master data management the information stored in these systems can be used more efficiently; what is stored in one system, can be used elsewhere as well. (Pekkanen, interview 27.10.2011.)

6.1.3 Location Intelligence – State of the Market

All organisations are interested in what happens in their operating environment, and GIS is an extremely good tool for investigating that. There is such an enormous amount of information available from different sources that is is important to be able to analyse it as easily as possible. (Jouslehto, interview 6.10.2011.) As location intelligence combines traditional BI with the addition of a location element, it enables the visualisation of business and location data simultaneously (The location intelligent −− 2007, 7). By integrating GIS and BI, organisations also combine different types of information which can result in totally new information that they would not otherwise obtain. Some information may be sufficient if it is taken from a BI solution or only visualised on a map, but when new combinations are carefully generated, the result may provide deeper understanding and clearer visualisation opportunities (Jouslehto, interview 6.10.2011). In addition, one aspect where GIS is an excellent tool is combining organisational data with data from external sources. By visualising the data on a map the users are able to see the dependencies between the reporting objects. (Törhönen, interview 7.10.2011.) Organisations like solutions that present all information simultaneously in an understandable manner, and therefore, the visualisation opportunities of GIS definitely add value to those of a traditional BI solution (Jouslehto, interview 6.10.2011; Pekkanen, interview 27.10.2011). Location intelligence solutions help organisations gain critical insights, make better and more timely business decisions and optimise important processes (Location intelligence 2010, 4).

The integration of GIS and BI is still quite an unexplored sector in Finland (Jouslehto, interview 6.10.2011). There is definitely an interest to discuss this topic, but there has not been a major breakthrough (Törhönen, interview 7.10.2011; Kiviranta, interview 25.10.2011). Location intelligence can still be described as an emerging dimension of business intelligence (Transforming location intelligence −− 2007, 1−2). However, it can be claimed that there is great potential for this type of solutions in Finland (Jouslehto, interview 6.10.2011; Kiviranta, interview 25.10.2011; Mansikka, interview 25.10.2011; Pekkanen, interview 27.10.2011). Some solution providers have offered location intelligence solutions for years now, but the demand for them has not

increased significantly (Kiviranta, interview 25.10.2011). One reason for this may be the lack of knowledge in customer organisations about these types of solutions (Joshi & Pant 2008, 191).

Location based decisions are becoming increasingly important in both public and private sector organisations (Location intelligence: The −− 2007, 8). Public sector organisations have perhaps shown more interest towards the integration of GIS and BI than the private sector, but there are examples from both sectors of implemented location intelligence solutions (Jouslehto, interview 6.10.2011; Mansikka, interview 25.10.2011). The Finnish Transport Agency implemented a location intelligence solution few years ago as did a retail sector organisation (Pekkanen, interview 27.10.2011; Mansikka, interview 25.10.2011). In the Finnish Transport Agency, the location intelligence project began when they identified a need for a BI solution that includes a map interface and a picture database. The basic idea of the solution is that the information on the report can be visualised on a map (Figures 9 and 10). (Pekkanen, interview 27.10.2011; Kiviranta, interview 25.10.2011.)

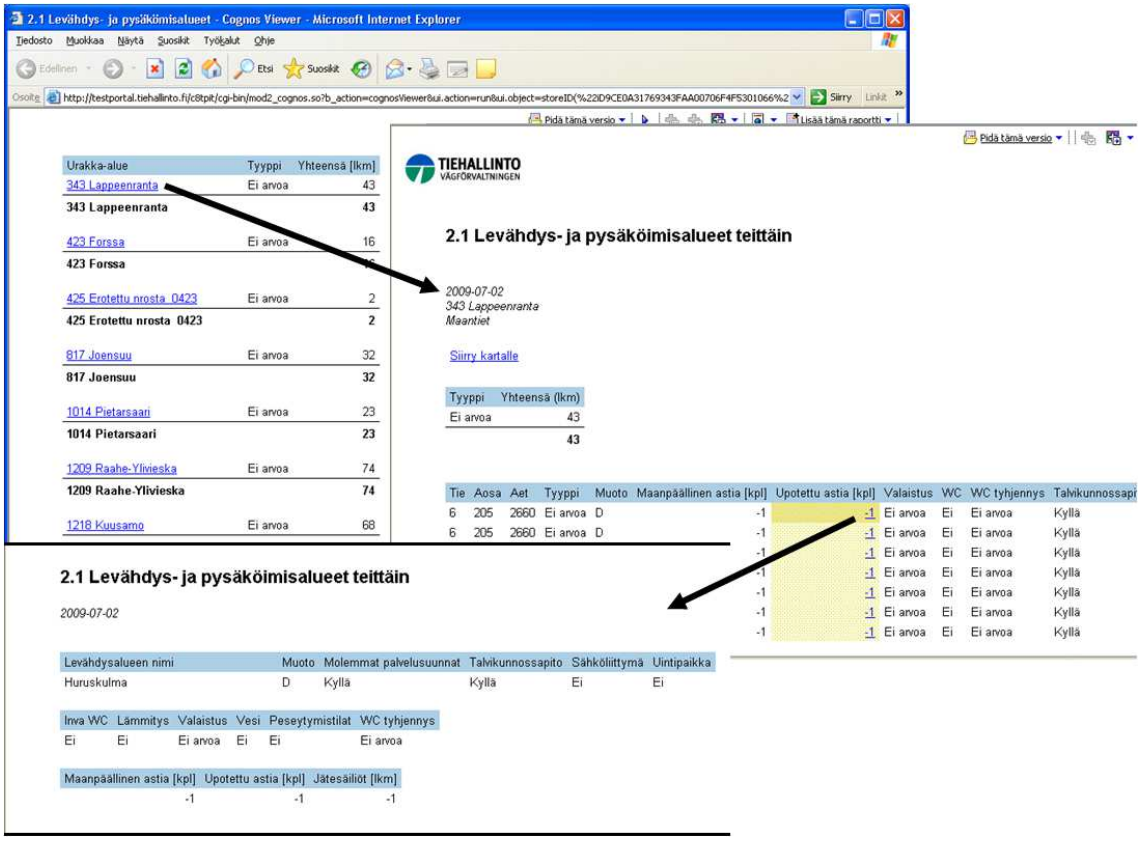

Figure 9 Reporting features of The Finnish Transport Agency's location intelligence solution (Logica Finland Oy)

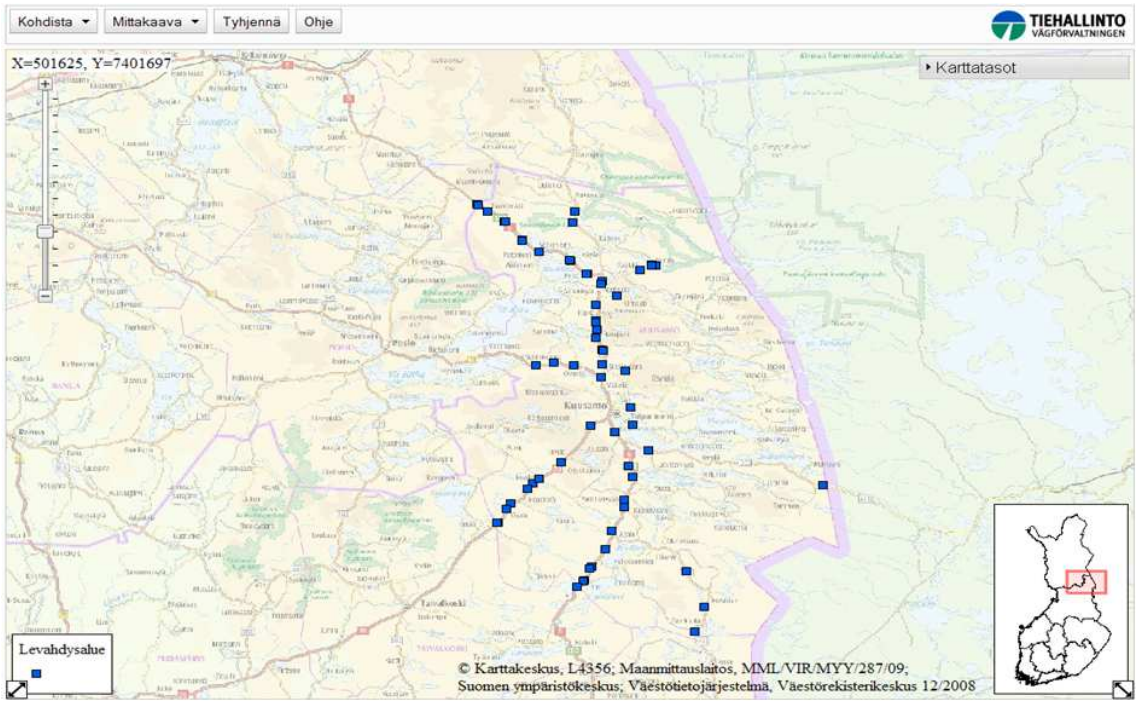

Figure 10 Map interface of The Finnish Transport Agency's location intelligence solution (Logica Finland Oy)

Figures 9 and 10 illustrate that the location information of the reports is much easier to understand on the map. The solution could also include a feature that when an item is clicked on the map, the report shows the corresponding information. (Pekkanen, interview 27.10.2011.) This type of bi-directional interactivity between the map and the report is one of the most useful features of location intelligence solutions (Location intelligence: turning −− 2011,7). When the Finnish Transport Agency began to use the location intelligence solution, the amount of manual work in different processes decreased significantly which allowed human resources to be used more efficiently. They have also calculated that they will gain the money they invested in the solution back in only a few years because it has worked as well as anticipated. When the solution was implemented a few years ago, IBM, who provided the Cognos reporting system for the solution, published an article about it worldwide in their own media and even CNN noted it. This global interest may be explained by the fact that location intelligence solutions were not common at that time. (Pekkanen, interview 27.10.2011.)

The fact that location intelligence solutions have been implemented in both public and private sectors suggests that there is currently a wide range of potential customers in the market. The Ministry of Environment and the Ministry of Agriculture and Forestry both currently have separate GIS and BI solutions and thus, are potential organisations for a location intelligence solution (Pekkanen, interview 27.10.2011). Large-scale industry and energy sector, on the other hand, are some good examples of potential location intelligence solution users from the private sector (Mansikka, interview

25.10.2011). Telephone operators have also great potential as they have masses of consumer clients whose behaviour is carefully analysed. They already have a considerable BI personnel that studies their customers, and adding the possibility to study them also from a geographical point of view could offer even more insightful results. (Törhönen, interview 7.10.2011; Kiviranta, interview 25.10.2011.) Insurance, bank and retail sectors are interesting because of the same reason that they have millions of consumers as customers. The amount of data is adequate for different analyses which produce statistically significant results. (Kiviranta, interview 25.10.2011; Mansikka, interview 25.10.2011.) These sectors that have consumers as customers hold great potential for location intelligence because the target of their analyses changes constantly and thus, continuous analyses are needed. In other private sectors it is harder to find operations that change or are done frequently. For example, business location planning is used in various sectors, but it is done quite rarely, so it is not something that location intelligence could be applied to in everyday business. Therefore, a solution that analyses data online constantly would be a great concept. The results of the analyses would be up-to-date all the time which would provide the best possible information for decision making. (Kiviranta, interview 25.10.2011.)

Location intelligence solutions do not eliminate the need for traditional GIS solutions. There are many GIS customers that produce data, such as National Land Survey of Finland, that use high end GIS solutions which cannot be replaced by location intelligence solutions. (Kiviranta, interview 25.10.2011.) Other organisations may use GIS in certain processes, and in some processes data from GIS may be combined with data from a BI solution to create new information. Thus, spatial data may be used in different forms for different purposes in different departments of the organisation. (Jouslehto, interview 6.10.2011.) However, it is extremely important to really understand the needs of potential customers, and offer the integration of GIS and BI to those who really need it. GIS should not be integrated into a BI solution if the organisation does not really need a map interface. (Törhönen, interview 7.10.2011.)

The time for the integration of GIS and BI has not been right so far (Jouslehto, interview 6.10.2011). The few implementations that have been done are the result of a very long sales process and simultaneous increase in the knowledge of the benefits of using GIS among customers (Mansikka, interview 25.10.2011). There has been interest in this type of solutions, but the need for them has not been so pressing that they would have been implemented (Jouslehto, interview 6.10.2011). The problem is that organisations understand the value of location, but struggle to translate it into meaningful profit-generating activities (Transforming location intelligence −− 2007, 4). However, an actual need for location intelligence solutions among the customers is now beginning to emerge. The solution providers, on the other hand, may have to be willing to take some risks if they want to be competitive in this sector. Smaller organisations are typically

more ready to take risks, so it is possible that they pass the traditional GIS solution providers in offering location intelligence solutions. (Jouslehto, interview 6.10.2011.)

6.1.4 Location Intelligence – Resolving Future Challenges in Finland

One of the most important aspects of location intelligence is that the GIS and other IT solution providers have to change their views on the solutions that they sell. Rather than selling the same type of a solution with different technologies, they should see that they have a chance to do something completely new for their customers by integrating different solutions. (Jouslehto, interview 6.10.2011.) Location intelligence offers possibilities for all organisations to transform business processes and create business opportunities (Transforming location intelligence −− 2007, 12). At the moment, there are different solutions that are separated from each other, such as BI, ERP and CRM, and then there is spatial data or GIS that can be fitted to all of the other solutions (Jouslehto, interview 6.10.2011). For solution providers the challenge is to convince different system experts of why GIS could be an important component of all solutions, and then develop a great concept around that which helps them distinguish themselves from other solution providers (Jouslehto, interview 6.10.2011). So far solution providers have not been able to sell the GIS and BI integration appealingly enough, and on the other and, customers have not requested these types of solutions (Törhönen, interview 7.10.2011). Customers may not even be adequately familiar with GIS and BI to know that it is possible to integrate these solutions (Mansikka, interview 25.10.2011; Pekkanen, interview 27.10.2011). This is again due to the lack of knowledge among management (Joshi & Pant 2008, 191). However, it is also important for the customers to first understand the benefits of GIS, and then begin to think about integrating it with other solutions. (Mansikka, interview 25.10.2011.) In addition, the development of a “killer application” would facilitate the wider introduction of BI and GIS integration (Kiviranta, interview 25.10.2011).

IT firms that have knowledge on both GIS and BI have the opportunity to formulate a clear concept for location intelligence, and sell BI integrated with GIS automatically (Pekkanen, interview 27.10.2011). If BI solutions would have the location component automatically in them, without emphasising to customers that they are buying a GIS, location intelligence solutions would most likely be received well (Jouslehto, interview 6.10.2011; Pekkanen, interview 27.10.2011). In addition, when a BI solution is sold to a customer, a standard set of spatial data, such as demographical data, road network data and postal code data, could also be provided or offered as a service. When all of this is offered as a complete set, it provides the organisation with the ability to do certain analyses and costs a certain amount and therefore, is easy for the customer to understand.

Solution providers should always concentrate on communicating the benefits of this type of a solution and give concrete examples on how it could improve work processes. This guarantees that a location intelligence solution does not sound too complex for the customer. (Kiviranta, interview 25.10.2011.) The challenge, however, is whether the customer organisations realise that geographical reporting is what can solve some of their problems (Törhönen, interview 7.10.2011).

Particularly in organisations that operate globally, country or region managers could benefit greatly from the opportunity to see a report on a map. Thus, the integration of GIS with BI is useful when the operations of an organisation have a spatial element, and the amount of information is so vast that it is necessary to bring that to a simple user interface. (Törhönen, interview 7.10.2011.) People are quite impatient with new solutions, so it is essential to have a simple interface even if there is a very complicated solution behind it (Kiviranta, interview 25.10.2011). In addition, organisational support is essential to minimise the possible negative feelings among the personnel about the new solution (Sabherwal & Becerra-Fernandez 2011, 254). The users of a location intelligence solution are generally people that do not otherwise work with a GIS because they do not have time to learn how to use a desktop solution or do not need all of the features in it. Therefore, it is even more important that the map interface in a location intelligence solution is user friendly. (Mansikka, interview 25.10.2011.) The users may also be included in the development process because they know best what type of an interface they would like to use (Kiviranta, interview 25.10.2011). As the location intelligence solution typically operates in the existing BI environment, the users do not have to be GIS experts (The location intelligent −− 2007, 7). Organisational members are generally familiar with the BI solution, so when GIS is brought into the same interface, people find it easy to use (Jouslehto, 6.10.2011). For example, QlickView is a BI solution that has recently grown its market share significantly, and its success is based on a very simple user interface. Therefore, location intelligence solutions should have the same goal of a simple interface. (Törhönen, interview 7.10.2011.)

The innovative visualisation technology of location intelligence solutions is needed to effectively synthesise detailed data into information because this allows the content to be presented in an understandable manner (Location intelligence: turning −− 2011, 1). Customers typically want to see information from different sources simultaneously, and a map is a very effective tool for visualising and finding dependencies between pieces of information. In data mining, SAS or SPSS programs can be used to find dependencies in the data, but when the data is presented on a map, the users can see themselves which issues need further attention and what might cause the differences in the data. (Pekkanen, interview 27.10.2011.) One of the greatest opportunities of GIS and BI integration is the ability to use the obtained information for predicting the future (Kiviranta, interview 25.10.2011). Combining map visualisation with predictive analysis

organisations may gain an insight into the impact that location has on future business performance (The location intelligent −− 2007, 1, 3). This holds enormous potential, but at the moment there is not a good solution for this. Analysing the current market situation is useful only to a certain extent, even if the geographical aspect is considered (e.g. regional sales), but predicting future trends could impact decision making remarkably. (Kiviranta, interview 25.10.2011.)

Customers are generally first interested in the costs and added value of a location intelligence solution. This presents challenges to solution providers as it is difficult to calculate the monetary benefits of location intelligence. (Jouslehto, interview 6.10.2011.) It is generally agreed that location intelligence solutions can bring added value to organisations, but it is difficult to evaluate their contribution to the bottom line (Joshi & Pant 2008, 181; Pick 2008, 85). In addition, the investment on GIS and BI integration can be substantial which is why it is even more important to know the returns on the investments beforehand (Mansikka, interview 25.10.20911). Organisations are also hesitant about being among the first ones to implement a location intelligence solution if it turns out to be a mistake (Törhönen, interview 7.10.2011). It is perceived to be expensive to be a pioneer. However, if the organisation already has a BI solution, adding location capabilities to it can ensure greater benefit from the existing investment (The location intelligent −− 2007, 1).

The integration of GIS and BI can be challenging also for the solution providers. As this kind of integration is still in its infancy in Finland, there is not much experience of it which means a great deal of pioneer work, development and testing. In addition, GIS has to adapt to the existing IT infrastructure which means it has to be flexible and scalable. (Mansikka interview 25.10.2011.) From the sales perspective the greatest challenge for solution providers is to find the right contacts in organisations. GIS experts can be found quite easily, but in terms of BI the contact person should be quite high in the organisational hierarchy, so that they would know the real needs of the organisation; what are the needs of middle management, top management and supervision of work, what type of reporting is needed, and how spatial data or a map interface would help in providing the required information. Global or Finnish references would also make it easier to convince customers that location intelligence solutions really work. (Jouslehto, interview 6.10.2011; Mansikka, interview 25.10.2011; Pekkanen, interview 27.10.2011.) On the other hand, if there is an identified need in an organisation, and it is recognised that a location intelligence solution would solve it, references do not have such an important role (Törhönen, interview 7.10.2011).

In BI data is collected from several systems to one data warehouse (Kiviranta, interview 25.10.2011). Without GIS, spatial data cannot be combined with other data in a BI solution (Mansikka, interview 25.10.2011). More than half of organisation's data has a location component, so excluding that information from analyses can mean poorer qual-

ity decisions (Franklin 1992, 12; Location intelligence 2010, 4). Therefore, spatial data should be incorporated to the data warehouse by geocoding all data. Once this is done, the organisational data can be combined with any other data based on location which presents an endless amount of opportunities to create new information. (Kiviranta, interview 25.10.2011.) It also enables the visualisation of a project and how it influences its surroundings (Mansikka, interview 25.10.2011). However, a major challenge concerning the integration of GIS and BI is the geocoding of organisational data. The quality of the data is one of the factors that may prevent the completion of geocoding. For example, if only 60−70 % of all the data in the organisation can be geocoded, all organisational data can still not be used in decision making. Another challenge is how to combine data from different sources to meet the needs of the organisation because the amount of available data is huge. (Kiviranta, interview 25.10.2011.)

Because there have been discussions about location intelligence among solution providers for a long time now, but the solutions have not begun to evolve, a clearer driver may be needed in order for location intelligence solutions to begin to develop. (Jouslehto, interview 6.10.2011.) It may also require the development of a great solution; one that is fast to implement and easy to use and understand (Kiviranta, interview 25.10.2011). Solution providers should concentrate on presenting the advantage of location intelligence solutions which is that the reporting objects can gain important information from spatial data. Solution providers should ensure that the discussions revolve around the business problem of the customer and not emphasise the fact that they would buy GIS. The knowledge solution providers have about GIS and BI, and the knowledge the customer has about its business and needs should all be considered when planning the solution. This is where some of the most significant challenges lie; solution providers and customers do not understand each other on a deep enough level. (Mansikka 25.10.2011.) Therefore, it is important to ensure that the customers understand that the solution is easy to use, and not concentrate on, for example, all the analyses that can be done. If the benefits cannot be identified, the solution is too complex or suitable data is not available, the wider adoption of location intelligence solutions is not possible. (Kiviranta, interview 25.10.2011.)

6.2 Retail Sector – Decades of Experience

6.2.1 GIS in Retail – Long Traditions

Both of the retail firms that were interviewed have long traditions in using GIS. It was first implemented in these firms in the 1990s, but the solutions and users have varied

over the years. One of the challenges has been that there are only a few GIS experts in the firms who are mostly responsible for using spatial data. However, in both of the retail firms in addition to a desktop solution used by GIS experts, there is also a browser based web map service that is used very widely in the organisation. (Retail firm A, interview 7.11.2011; Retail firm B, interview 9.11.2011.) This indicates again how considerable influence internet technologies have had on GIS solutions, and what type of effects it has had in organisations (Pick 2008, 4). The web map service in the retail firms provides a common information base for all employees, so the quality of work does not depend on a person's eagerness to study different variables (Retail firm A, interview 7.11.2011). In other words, information is more readily available for the personnel and it is also more up to date (Heywood et al. 2006, 344; Pick 2008, XIII). The web map service includes information about store locations and population which can be used in different processes. Before the web map service was implemented, there was much more manual work related to studying these issues, and before GIS was used at all in the retail sector, all the information was based on different registers such as the store register and Nielsen's register. (Retail firm A, interview 7.11.2011.) These include information, for example, on store locations based on postal codes, sales figures of stores in the previous year and market trends (Retail firm A, interview 7.11.2011; Mitä teemme 2012). However, when this type of information is presented as tables or text, it is more difficult to absorb it than when the information is shown on a map. (Retail firm A, interview 7.11.2011.)

GIS is an extremely efficient tool for conveying information because people can see information on a map that tables, graphs or text do not convey. For example, studying connections between regions would be considerably more difficult if maps could not be used. GIS also enables the users to view different data simultaneously which is convenient in many processes. In other words, by using GIS people can gain new information that they would not otherwise get. In addition, spatial analyses and functions cannot be carried out without spatial data which makes GIS a necessity. (Retail firm B, interview 9.11.2011.) Therefore, GIS can enable the conversion of heterogeneous data into information and subsequently into knowledge (Hernandez 2007, 249). The retail sector has numerous operations that are directly related to location, even though internet shopping is increasing. Store network planning is traditionally one process where GIS is highly valuable, but spatial data is used in the whole value chain. (Retail firm B, interview 9.11.2011.) In store network planning several analyses are made, but one of the most important ones is the Huff model. It is used to predict sales figures of a store in a potential location which is important in comparing different locations. Retail firms also evaluate how well the predictions based on the Huff model correlate with the reality after the store has been opened. (Retail firm A, interview 7.11.2011.) In addition to store network planning, selection planning, store planning, customer relationship ma-

nagement, marketing allocation, logistics, and purchasing are activities where GIS is used. Some of these activities may include so many calculations that they cannot be done without GIS, or if they are done, important information may be lost because they have to be simplified. Therefore, it is absolutely necessary to use GIS in the retail sector, and these firms understand that. (Retail firm B, interview 9.11.2011.)

Because retail firms have used GIS for over a decade and they follow what is happening in the GIS sector, they have extensive knowledge about what type of solutions can be implemented. In addition, the technical problems associated with GIS implementation are mostly solvable (Heywood et al. 2006, 293). Solution providers have also made great advances in their offering over the last few years. (Retail firm B, interview 9.11.2011.) Therefore, every time they offer new solutions to retail firms, the potential of that solution is examined carefully (Retail firm A, interview 7.11.2011; Retail firm B, interview 9.11.2011). However, retail firms cannot buy generalised GIS solutions, but they have to be customised to fit into their existing infrastructure. One of the retail sector representatives also stated that they have some visions where GIS could be used more, but solution providers cannot offer a good enough solution for them yet. On the other hand, they also hoped that solution providers would present more ideas to them to help them think outside the box and possibly identify new opportunities. (Retail firm A, interview 7.11.2011.)

When a new store is build, a retail firm invests millions in a location. Therefore, it is essential that the location is good, and the sales figures do not fall below the predicted ones. When using the Huff model, the predictions are generally very accurate. (Retail firm A, interview 7.11.2011.) In these situations it is clear that spatially referenced data represents a large proportion of data processing which makes the use of GIS necessary (Nedović-Budić & Godshcalk 1996, 554). Thus, using GIS to assist in making the right decisions on store locations is its greatest benefit for a retail firm. (Retail firm A, interview 7.11.2011.) Some benefits of GIS are perhaps more difficult to detect such as savings in work time. 10-20 years ago much more time was spent in the field, going to different potential store locations and evaluating the environment. Now it is possible to use maps, satellite images and street views to do the same. It is obvious that this saves time, but the monetary benefit is more difficult to estimate. Another issue that makes it difficult to estimate the benefits of GIS is that because the use of GIS is spread around the firm, it is impossible to know how many users there are exactly and how much they use GIS. (Retail firm A, interview 7.11.2011.)

The challenge in retail firms is that the utilization of spatial data, doing analyses and visualisations, has relied on a few experts (Retail firm A, interview 7.11.2011; Retail firm B, interview 9.11.2011). Now that GIS is beginning to be integrated with different solutions also other people than GIS experts are able to use it. As these users do not have deep knowledge of GIS, the solutions have to be very easy to use. (Retail firm B,

interview 9.11.2011.) In addition, it would be useful to have more automated visualisation that would update constantly and not be so tied to the features of software. This would decrease the amount of manual work. (Retail firm A, interview 7.11.2011.) However, the benefits gained from GIS always depend to an extent on the personnel's ability to interpret the information that is displayed on the map no matter what type of a solution is used (Grimshaw 1994, 117).

One of the goals in retail firms is to make GIS like any other tool in the organisation. Therefore, the web map service that both retail firms have is important because its interface can be made so simple that everyone can use it. Because location has such an important role in retail business, the personnel in these firms even expect that they have a tool that can show them, for example, the locations of stores. As people become even more familiar with using maps, also in their personal life, analysis tools can be added to the service, but for now the use is focused on visualisation. (Retail firm A, interview 7.11.2011; Retail firm B, interview 9.11.2011.)

When it comes to using GIS, both of the retail sector representatives had very similar point of views. GIS is used in both firms in the same activities, and they have same type of solutions in use (desktop and a web map service). GIS has been used for so long in these firms that they have found the most suitable solutions for their use, and because they operate in the same sector, it is not surprising that they appear to be very similar. However, the integration of GIS with other solutions is where more differences occur.

6.2.2 Location Intelligence in Retail – Prospects and Challenges

In retail firm B GIS and BI are integrated to enhance reporting capabilities (Retail firm B, interview 9.11.2011). BI tools are good for analysing who, what, when, and how questions of a certain issue, but the where aspect of analysis is missing in these tools. That is why location intelligence capability is needed. (Location intelligence 2010, 4−5.) In retail firm A, on the other hand, GIS is integrated with a store location enterprise resource planning system which has some elements of a BI solution as it is used to manage external information such as competitor information. They are, however, interested in exploring what possibilities GIS and BI integration could offer, but they feel that they do not have sufficient information about location intelligence solutions, and solution providers have not really approached them about this. However, it is a large firm, so the interviewee could not say for sure that no one in the firm has studied the topic, and stated that it is a definite possibility that GIS and BI integration is done in the future. (Retail firm A, interview 7.11.2011.)

The idea for the integration of GIS and BI in retail firm B came from the business itself, not GIS experts, and the solution was implemented few years ago. The operations

that it can be applied to were so important to the retail firm that the added value to decision making was perceived much higher than the costs. BI alone is mostly about reporting past sales figures, and spatial data adds more visual and easily understandable information to that. (Retail firm B, interview 9.11.2011.) GIS generally provides a much needed framework for approaching, supporting and making spatial decisions (Heywood et al. 2006, 272). In addition, combining GIS with BI can lead to greater value from both solutions (GIS and business −− 2006, 12). The time was also right as the solution providers have developed the integration technologies greatly in recent years; previously integrations were cumbersome, but they have improved to be more seamless. The personnel's reaction to the location intelligence solution has been positive. (Retail firm B, interview 9.11.2011.) This is most likely due to the fact that people are visually oriented, so they most easily process information through visualisation (ArcUser Magazine 2005, 10−14). In addition, new needs have surfaced and more features are required to the location intelligence solution. Therefore, it is necessary to keep up with the developments and improve the implemented solution. (Retail firm B, interview 9.11.2011.)

Solution providers may have discussed location intelligence solutions for some time now, but for many firms the idea is still quite new and unfamiliar. Therefore, solution providers should realise that they could present firms with different ideas, so that their awareness on the topic would increase. (Retail firm A, interview 7.11.2011.) All organisations have opportunities for location intelligence, and as retail business is heavily dependent on location, location intelligence solutions can have great impacts (Location intelligence: turning −− 2011, 13). Reference cases are always great, but they do not have to be from the retail sector because firms can identify the features from the references that apply to their business. It is also important not to limit the information flows to the GIS experts, but to ensure that it reaches also the BI personnel. GIS experts cannot identify all potential uses for GIS in a large firm; naturally they concentrate on improving their own processes first. Therefore, there is most likely unused potential in retail firms because of lack of knowledge. (Retail firm A, interview 7.11.2011.) Organisations understand the value of location, but may struggle with translating that understanding into profit-generating activities (Transforming location intelligence −− 2007, 4). However, if solution providers offer solution to different departments they should remember that all new solutions should be linked to the existing infrastructure and not be separate from them. Another challenge is that solutions should be flexible and not difficult to implement, and solution providers sometimes offer too robust solutions. (Retail firm A, interview 7.11.2011.)

Especially managers like visually clear and easily understandable reports (Retail firm B, interview 9.11.2011). Therefore, in retail firm A it would be a good start if someone from management level identified the need for maps in reporting. Not all managers even think that a map would help their work, but if they were offered more information, they

might be able to recognise business benefits from spatial data. (Retail firm A, interview 7.11.2011.) This demonstrates again what type of impacts lack of knowledge in management can have (Joshi & Pant 2008, 181−191). Firms are very careful with their investments that they actually gain benefits from them, so facts, pilots and calculations are necessary before investing in a location intelligence solution (Retail firm B, interview 9.11.2011). Because location intelligence solutions are still relatively new, they can help firms gain an advantage over their competition. However, some firms may be hesitant about implementing them as the expected benefits are difficult to quantify. (Anderson et al. 2006, 1373.) In retail firm B the location intelligence solution is used in all levels of the firm, so it also increases the awareness of GIS. The people that do not use the location intelligence solution or GIS are beginning to demand similar features for their reports as well. Experts and managers use the location intelligence solution the most to guide in decision making, but the use of the solution is monitored and shows use on all levels in the firm. (Retail firm B, interview 9.11.2011.)

In the retail sector reporting includes very detailed spatial information that is not understandable if it is listed in tables. When this spatial information is visualised on a map, the user can gain important insight to the information. (Retail firm B, interview 9.11.2011.) Therefore, location intelligence solutions can provide insights into optimal business strategy and operations which has a direct impact on decision making (Location intelligence 2010, 7). Spatial data can be the most important information in some reports. The proximity and location of different elements are very important in the retail sector, and GIS provides the best tools for examining these. In a location intelligence solution the users can visualise the reporting objects on a map, and figures on the report change according to the region that is shown on the map. In addition, GIS brings added value to BI with, for example, scenario models because BI solutions are mostly designed for reporting. (Retail firm B, interview 9.11.2011.) Predicting future impacts is one aspect where spatial analysis can really improve the insights gained from organisational data (Holland 2005, 19). The location intelligence solution has also streamlined the process of making reports in retail firm B; previously it took around 30 minutes to produce a report, but now the users can create the report themselves in one minute. As there are about 1600 operating sites where these reports are used, the time savings are considerable. (Retail firm B, interview 9.11.2011.)

The implementation of a new solution can be costly, disrupt business activities, put strain on employees, and have uncertain payoffs (Anderson et al. 2006, 1373). The challenge with location intelligence solutions is that there is not much experience on GIS and BI integration, so firms face many new obstacles. However, in retail firm B the process of integrating GIS and BI went surprisingly smoothly. The goal was to minimise the amount of applications and to make the solution as simple as possible. It required much knowledge from within the firm as well as from the solution providers. The GIS

sector has evolved so that many solution providers now have project management skills and general IT skills which are important in an integration project. It was challenging to create a solution that produces reports that serve all situations, branches and regions and that produces a visually informative map which shows the essential information. Creativity and problem solving skills had a significant role in the project. (Retail firm B, interview 9.11.2011.)

In retail firm B the applications of the location intelligence solution were quite difficult to use in the beginning. But as the integration technology has evolved, the integrations are now more seamless. The goal for the future is to develop the map reporting functionalities to add more analytical capabilities; now the use of the location intelligence solution is mostly limited to visualisation. However, if analytical capabilities are added, it increases the responsibilities of the users because they have to know the data, analysis methods and business challenges more thoroughly. (Retail firm B, interview 9.11.2011.) On the other hand, mere visualisations leave much of the actual decisions to the user. By adding analysis tools to the location intelligence solution it is able to suggest optimal outcomes which mitigates the variability between decisions made by different users. (Location intelligence in −− 2009, 5.) GIS is still the best solution for analysing spatial data, and it also produces better looking maps, but the capabilities of GIS and location intelligence solutions will move closer to each other. It is possible that some firms would not need GIS at all if they had a location intelligence solution. (Retail firm B, interview 9.11.2011.)

Retail firm A has integrated GIS with their ERP which has some elements of a BI solution. Therefore, they have not identified the need for a separate location intelligence solution. The reason for integrating GIS and ERP was the need for a map interface that was easy to use and could be used without separate software; the data can be visualised on a map by one click. The integration has made it easier to update data because it can be done in one solution as opposed to two. It is also easy to ensure that the data in ERP is correct as it can be presented on a map. (Retail firm A, interview 7.11.2011.) On the other hand, in retail firm B the ERP is used mainly in purchasing and the integration of GIS and ERP is in its infancy. The retail firm B representative stated that GIS may also be easier to integrate with BI and other analytical solutions than with ERP which is more straightforward. However, ERP has leverage, so if GIS could be integrated well with ERP, it would most likely make operations more efficient and generate cost savings. (Retail firm B, interview 9.11.2011.)

Lack of knowledge about location intelligence solutions is one significant reason why firms have not adopted these solutions more widely (Retail firm A, interview 7.11.2011; Retail firm B, interview 9.11.2011). Another important issue are the costs. Firms can imagine what the benefits would be, but do not believe in them enough to invest. If GIS comes automatically with a BI solution, and firms do not have to buy an

additional component, location intelligence solutions will begin to become more common. (Retail firm B, interview 9.11.2011.) The idea of location intelligence solutions is to leverage the existing BI investments to maximise the benefits, and the goal is to take advantage of the spatial data that is already stored within an organisation's database. (The location intelligent −− 2007, 7.) The implementation is further expedited when reference cases arise, and firms hear about them. However, in sectors where location is not as important as it is in retail, it can take a very long time that GIS and location intelligence solutions are implemented. Spatial data should be seen like any other data only with some specialities. Therefore, GIS experts are still needed to some extent to use spatial data to its full potential and to develop better solutions. GIS will not be integrated into all solutions if it does not bring added value, but ERP, CRM and BI are good examples of solutions which can be improved with GIS. (Retail firm B, interview 9.11.2011.)

6.3 Insurance Sector – Search for Possibilities

6.3.1 GIS in Insurance – Unused Potential

Insurance firm A has used GIS for approximately five years now. The first more considerable application was designed for customer service personnel to improve customer service as well as make it more efficient. Marketing department uses GIS to a considerable extent to segment customers in order to direct their marketing and sales efforts to the right people. In addition, different figures related to medical expense insurances and animal insurances are examined on a map. (Insurance firm A, interview 2.11.2011.) On the other hand, insurance firm B began a GIS pilot project only in the spring of 2011. The firm is evaluating the potential of GIS from the point of view of risk assessment; spatial data is analysed in relation to a specific risk to figure out which areas pose more risks than others. However, they have identifies more potential uses for GIS such as targeting marketing efforts better and improving the location selection process of a new office. (Insurance firm B, interview 4.11.2011.) These differences in the stage of using GIS within a certain sector support the claim that many managers are unaware of the opportunities GIS offers to their business (Grimshaw 1991, 295).

Insurance firm B had discussed a GIS pilot project even before the spring of 2011, but it was not prioritised high enough. One reason for this has been the lack of resources and another one that the benefits of GIS are difficult to evaluate before time and money have to be invested in its use. (Insurance firm B, interview 4.11.2011.) Therefore, GIS may still be seen mainly as a cost and not as an opportunity (Grimshaw 1991, 295).

Many benefits have been identified, but it is challenging to evaluate their monetary value; how many people would use GIS, how many people would gain benefits from it, and how many would save time or money. It is seen that investments on GIS pay off on a general level, but it is hard to evaluate how significant the opportunities and benefits are. In addition, as there are numerous possibilities related to GIS, it is difficult to pick the ones that are the most beneficial. A "killer application" for the insurance sector is yet to be developed. (Insurance firm B, interview 4.11.2011.) Even in insurance firm A, where GIS has been used for five years, there are still difficulties in justifying the investments in GIS. The lack of information causes delays in adopting GIS because people are busy with their current workload and do not have time to think about new ideas such as GIS. As it is not understood how GIS relates to one's own work or will result in monetary benefits, even smaller investments are denied. Therefore, it would be extremely important to raise the awareness of the benefits of GIS in the organisation. (Insurance firm A, interview 2.11.2011). The lack of knowledge about the potential of GIS hinders its use significantly (Göçmen & Ventura 2010, 176).

The need for GIS has become from within the insurance firms and their business needs rather than from solution providers (Insurance firm A, interview 2.11.2011; Insurance firm B, interview 4.11.2011). References from other sectors foster the understanding of the opportunities GIS could provide also for the insurance sector. Solution providers can give new ideas that insurance firms do not think of themselves, and they possess technical expertise about the solution the insurance firms do not have. In addition, solution providers know what type of models can be developed to figure out how certain conclusions can be drawn from certain data. (Insurance firm B, interview 4.11.2011.) In Finland the problematics of the insurance sector are not known as well as, for example, in the UK where GIS is used more extensively. Therefore, solution providers may not offer solutions that are specifically right for the insurance sector, and insurance firms are not able to request for them because of their insufficient knowledge. (Insurance firm A, interview 2.11.2011.) However, solution providers are eager to learn about the sector to improve their expertise (Insurance firm B, interview 4.11.2011).

In the insurance sector many risks are related to a certain location which is why it is important to know what type of statistics are related to that location as well. GIS is a good tool for this because it allows firms to combine their organisational data with data from external sources and examine that in one solution. The visualisation possibilities are excellent especially when the dataset includes a large area, for example, whole Finland, because it is impossible to absorb that amount of data from a table. (Insurance firm B, interview 4.11.2011.) Therefore, GIS can support decision making and solve day-to-day problems by displaying data in an understandable manner and providing tools for doing different types of analyses (Goodchild 2001, 6180; Sheppard 2001, 6182). When the same data is shown on a map, it may take only one look to see which issues need

further studying. A map can reveal relationships between different data which is one of the best features of GIS; it is easier to understand the data, and conclusions can be drawn much faster when the data is presented on a map as opposed to a table. However, the challenge is that GIS does not produce absolute answers to a question, but the users have to make their own conclusions from what is presented on the map. (Insurance firm A, interview 2.11.2011.) GIS can transform raw data into information, but its usability depends on the personnel's ability to interpret it correctly (Grimshaw 1994, 117). This can be very difficult if the users lack adequate knowledge on GIS. The knowledge on GIS improves constantly as it is used more, but the information about GIS should be spread more across the whole firm. That would make it easier to find new processes where GIS could be used. (Insurance firm A, interview 2.11.2011.)

Insurance firm B has identified some potential benefits of GIS if it would be implemented after the pilot project. Because they approached GIS from the point of view of risk assessment, the potential benefits are also related to that topic. (Insurance firm B, interview 4.11.2011.) Risk related information is considered a fundamental resource, and it is useful to examine that information with GIS (Nedović-Budić & Godschalk 1996, 554). As GIS enables the users to combine different information, it is possible to find out new information about risks. It can also reveal what type of and how many accidents there may be in an area within a certain time frame. There is a great amount of information that is related to risk assessment which means that it is extremely important to present it in a simple way. Thus, GIS has much to offer because users can easily see what issues need further attention. These benefits also assist the insurance firm in planning their operations better because it is the common benefit of the insurance firm and its customers that risks are under control. (Insurance firm B, interview 4.11.2011.)

Both insurance firms also plan to use GIS in office location planning in the future because currently the locations are not analysed very thoroughly. Another important benefit of GIS is related to marketing and sales. (Insurance firm A, interview 2.11.2011; Insurance firm B, interview 4.11.2011.) Insurance firms can save considerable amounts of money if they direct their marketing efforts only to the really potential segments. By making the target marketing more efficient they can also select the type of customer profiles that they want. However, it is very important to continuously evaluate the value of GIS. The current economic situation forces firms to critically evaluate all the investment they make. (Insurance firm A, interview 2.11.2011.) The pressure for improving performance is high which is why GIS may be perceived attractive if its benefits are recognised (Nedović-Budić & Godschalk 1996, 554). For example, in insurance firm A a benefit calculation is done for all work that takes more than five days, and if the monetary value is not significant enough, the investment is not made. So far GIS has been seen in a positive way which has resulted in the continuous development of applications. In addition, new applications are planned to expand the use of GIS and to exploit

all of its potential. Currently insurance firm A is piloting flood modelling because in 2014 the state does not compensate households for flood damages, but insurance firms offer their products for this purpose. Therefore, insurance firm A is examining with GIS how the properties they have insured are located in relation to flood risk areas. Another interest are forest insurances. The amount of storms and trombies in Finland has increased, and particularly the routes of trombies are well known. Therefore, they could be viewed on a map to help in making compensation decisions. This would result in cost savings because currently someone has to go see the damages on site. (Insurance firm A, interview 2.11.2011.)

The main challenge related to GIS in insurance firm A is the lack of knowledge throughout the firm. The people that are interested in GIS adopt it quickly, but because the benefits of GIS are mostly intangible, it is difficult to find and understand them as well as justify that they exceed the costs. GIS is also perceived to be quite difficult to use which does not motivate potential users. (Insurance firm A, interview 2.11.2011.) However, as GIS is still not used in all of the organisations that it could be, it can bring competitive advantage to those that use it (Heywood et al. 2006, 344). In insurance firm B, the challenges identified are more related to the availability and cost of data. The trend is evolving towards more open data, but currently the availability of sufficient data poses challenges. In addition, the combining of internal and external data with spatial data requires much time and effort and is still quite expensive. (Insurance firm B, interview 4.11.2011.) But it has to be remembered that a map can covey much more of the important information than tables or text do (Insurance firm A, interview 2.11.2011).

6.3.2 Location Intelligence in Insurance – Not There Yet

Since GIS is only at its pilot stage in insurance firm B, its integration to other solutions has not been discussed. The pilot project is designed to find different use cases for GIS, to confirm the ideas the firm has and to generate new ones. The scope of the pilot project is limited to these topics on purpose. However, if GIS is implemented in the future, its integration with BI will be considered as well. (Insurance firm B, interview 4.11.2011.) By using a location intelligence solution risk analysts can identify and analyse the accumulation of risk by geographic area by combining internal and external data (The location intelligent −− 2007, 8). In insurance firm A, it most likely has not been a conscious decision to keep GIS and BI solutions separate because the decision makers do not have sufficient information about the integration of these solutions (Insurance firm A, interview 2.11.2011). Thus, the lack of knowledge about location intelligence solutions among the management hinders their implementation significantly

(Joshi & Pant 2008, 191). However, the integration of GIS and BI is one direction that will be studied in the future, and some solution providers have already approached the firm concerning this topic. There are also personnel in the insurance firm A who understand that the use of GIS should be spread more across the firm because it brings benefits and new points of view to different processes. There has even been one person who worked with SAS, and tried to incorporate GIS into reporting, but it did not lead to any real results. (Insurance firm A, interview 2.11.2011.)

If GIS and BI were integrated and reporting included a map interface, the amount of GIS users would grow considerably (Insurance firm B, interview 4.11.2011). More importantly, it would involve personnel in higher positions who are currently involved with BI, but may not see the benefits of GIS. If they realised the benefits of GIS, it might convince others as well. However, GIS is seen quite separate from other solutions in the firm. It is not understood that even if it is not integrated into all other solutions, it can still be used to support different processes. It is possible that GIS is not even visible to the personnel using the location intelligence solution. For example, if someone wants to buy an insurance for their property, GIS can be used to place the property on a map, the flood modelling can analyse the related risks and give a risk factor as a result. (Insurance firm A, interview 2.11.2011.) It has to be remembered that GIS can be used for so much more than simply visualisation. Insurance firm B has actually discussed whether they even need the visualisation possibilities of GIS if they can merely analyse the spatial data and receive the most important information as a result of the analysis. However, if the analysis is done carefully, why would it not be displayed on a map because after all it is the best interface to view spatial data. The cost savings gained from not having the visualisations capabilities of GIS are not greater than the benefits that can be gained. (Insurance firm B, interview 4.11.2011.)

Organisations are still somewhat hesitant about integrating GIS with BI. One of the reasons for this is that the business value of this type of integration has not been adequately demonstrated. (Francica 2006, 39.) There are quite few studies or reference cases that solution providers can present to potential customers to convince them of the benefits of the integration (Insurance firm B, interview 4.11.2011). The reason that money plays such a significant role in the decision whether to use GIS is that its monetary value is so difficult to prove. Managers do not want to invest in something they do not understand. (Insurance firm A, interview 2.11.2011.) In addition, if the data warehouse where the location intelligence solution retrieves its information is the same as for other basic solutions, it should not affect the functionality of these solutions. However, in the best case scenario GIS would be as integrated as possible into all solutions that benefit from it, and so databases would include spatial data as well. (Insurance firm B, interview 4.11.2011.) In insurance firm A, where GIS is already being used, the idea is to use GIS in as many processes as possible to maximise the benefit of their investment.

The problem is that their personnel do not even know all the processes where GIS is used, so they do not know its potential including the possibility to integrate it with BI. (Insurance firm A, interview 2.11.2011.)

Master data management is an important factor when it comes to the integration of GIS and BI solutions. Master data is the common denominator in all databases. The same master data has to be included in the databases where GIS and BI, and possibly also CRM and ERP, solutions get their data. Therefore, some type of integration is always necessary. In addition, if reporting included a map interface, which would enable users to move from the report to the map by clicking a certain figure and vice versa, it would bring new insight to the information and would be a good reason for integration. (Insurance firm B, interview 4.11.2011.) In fact, one of the most important features of location intelligence solutions is the bi-directional interactivity between the map and the report; the changes in one of them are reflected in the other one (Location intelligence: turning −− 2011, 7).

The challenge that insurance firm A faces when solution providers come present ideas for them is that the amount of information in those presentations is overwhelming. Because GIS is still considered a new solution in the firm, the users find it difficult to notice the information about solutions that would actually be helpful in their work. (Insurance firm A, interview 2.11.2011.) Therefore, users may be sceptical of the benefits of location intelligence solutions to themselves or to the organisation (Sabherwal & Becerra-Fernandez 2011, 254). Solution providers frequently also use terms that are unfamiliar to insurance sector workers which makes it even harder for them to understand the benefits. Shorter presentations with fewer topics would be better because the information would be easier to adopt. It is understandable that the solution providers want to show all of their areas of expertise and present all of the latest technologies, but if they are not directly related to the insurance sector, they are only confusing. The problem in the insurance sector is that because GIS is still used quite little, the knowledge they have also develops quite slowly. (Insurance firm A, interview 2.11.2011.)

7 CONCLUSIONS

7.1 Benefits and Challenges of Location Intelligence Solutions

This study was carried out to answer the question about the advantages and challenges of location intelligence solutions for organisations in Finland. There have been discussions about location intelligence for some time now, but the number of implementations has remained quite low. This study revealed some factors that most likely have influenced this. Because the interviewees were selected so that different expertise and backgrounds in location intelligence were represented, the results revealed broader patterns in the sector and not just in the interviewed organisations. Therefore, the discovered benefits and challenges of location intelligence solution can be applied to different types of organisations in Finland.

Before discovering what type of advantages location intelligence solutions offer for organisations, it was important to clarify what these solutions actually are. Literature suggests that location intelligence means consciously using the principle of location to guide decision making and help in solving day-to-day problems. It is still considered an emerging dimension of BI because it is currently not widely used in organisations. The basic idea of location intelligence solutions is that they are very easy to use, and thus, all organisational members can use them in their daily work. Reports are made more understandable by the map interface which can also result in better insights to information. This is achieved by combining the location data with other business data in order to take full advantage of the information resources organisations have. All organisations can benefit from location intelligence, but it can be especially beneficial to organisations in which location plays an important role in major business decisions.

Many of the benefits and challenges of location intelligence solutions are related to the fact that they are still quite new in the market. Both solution providers and customers are somewhat hesitant about implementing these solutions because the returns on investment can be difficult to determine. This is one of the greatest challenges of location intelligence solutions; as the benefits are to a certain extent intangible, it can be difficult to calculate the business case for location intelligence solutions. Managers typically want to know the monetary value of a solution before making an investment decision, and therefore, benefits such as better information or more efficient working methods are not alone adequate. Table 3 presents the benefits and challenges that solution providers and representatives from the retail and insurance sectors mentioned in their interviews. However, these results can be generalised to apply to other sectors with similar characteristics as well.

Table 3 Benefits and challenges of location intelligence in Finland

	Benefits	**Challenges**
Solution providers	- Chance to build new knowledge on integration technologies - New business opportunities and potential customers - Wider range of customers increases awareness of GIS - Competitive advantage by - unique solutions	- Unexplored sector - Pioneer work needed - Finding the right contacts in firms - Lack of knowledge among customers - Lack of references - Convincing customers of benefits - Understanding the customers' business needs - Speaking the same language as the customer - Seeing the chance to do something actually new - No killer application developed - Geocoding all business data
Retail sector	- Demonstrated added value to decision making - Greater value from both BI and GIS solutions - Competitive advantage by having superior information - Insights into information - Utilising all information - Working more efficiently - Scenario models to predict future - Possibility to analyse, not only visualise	- Lack of information - Large organisations → not knowing what other departments do with GIS - Increasing the awareness of management and BI personnel - Having simple enough a solution - Benefits difficult to quantify - Challenging implementation process - Costs perceived higher than the benefits
Insurance sector	- Better analyses of risks - Would result in more extensive understanding of benefits of GIS - Better information for decision making	- Not much experience of GIS - Lack of knowledge - GIS seen as separate from other solutions - Monetary value difficult to prove - Solution providers use jargon that is not understood

Location intelligence solutions allow users to see organisational data in a clearer format and have more complete information to support decision making. Thus, the importance of location data is typically recognised, but organisations still struggle to see how it can help them gain profits. It is clear that location affects various business processes, and ignoring that attribute in decision making can mean losing to other companies that do take it into consideration. Therefore, solution providers face the challenge

of convincing their customers of the value of location intelligence. As there currently are quite few solutions implemented, solution providers do not have many references to show potential customers. References would be important since they give more concrete examples of what location intelligence solutions can offer organisations. Without references it is more difficult for the customer to understand the impact the solution can have on various processes. References also demonstrate that the solution provider has the knowledge required to integrate GIS and BI. Therefore, it would be beneficial for both solution providers and customers if there were models on how to evaluate the value of GIS or location intelligence. The ROI methodology presented in this study is one example of this type of a model, but it is quite extensive and thus, may require too much resources. Firms do not want to invest too much time or money on evaluating something they are not sure about implementing. In addition, it is important that solution providers encourage firms that have implemented location intelligence solutions to evaluate the benefits they have gained. This helps them understand better how well the predicted benefits and costs were realised, and they can use that information when planning future projects.

A large number of managers and other organisational members use reports regularly in their work. Thus, location intelligence solutions could be a great way of spreading knowledge about other opportunities of GIS in organisations that do not use it extensively. If reporting included a map interface, it would help managers understand the benefits of map visualisations and possibly identify other processes where GIS could be a valuable tool. However, the main obstacle is that managers may not realise that showing reports on a map could be the answer to some of the challenges they face. In addition, managers are hesitant about investing in something they do not fully understand. Therefore, if the value of location intelligence solutions could be demonstrated better to an organisation’s management, their willingness to invest in other GIS solutions could increase as well.

All organisations should be interested in knowing what is happening in their business environment in order to make best possible decisions. However, this can be challenging as BI solutions do not currently combine internal and external information very effectively. A location intelligence solution could be a simple and effective answer to this need. Maps provide a good interface for examining different types of information simultaneously. Users can see possible dependencies in the information that may not be apparent if the information is presented in a different format. The improved visualisation possibilities that location intelligence solutions offer are certainly one of the greatest advantages organisations can gain from using them. All of this helps organisations use the information they have to its full potential and thus, make sound business decisions.

Solution providers face the challenge of deciding whether to begin to offer location intelligence solutions or not. As the solutions are quite new in the market, there is much development work that has to be done, and the benefits and opportunities gained can still be quite difficult to predict. Some solution providers may decide to wait until the solutions are better known in the market, and there is more information about best practises. Smaller organisations may be more willing to take risks and do pioneer work and thus, become market leaders in this sector. With that said, if location intelligence solutions become common in the future, potential customers may prefer to buy a solution from these initial market leaders because they have references and the knowledge required for the implementation. This means that larger solution providers would be left behind in the development. Therefore, all solution providers have to evaluate carefully how important location intelligence solutions could become for their business before deciding whether to invest resources into developing the solutions.

Many of the challenges of GIS and location intelligence solutions are recognised among solution providers and customers, but for some reason it has been a struggle to resolve them. Customers do not have adequate information and knowledge within the organisation about GIS or location intelligence; they do not know about the benefits and opportunities that these solutions could offer them. In addition, using GIS or location intelligence solutions is perceived to be difficult and would require too much time to learn because of busy work schedules. Therefore, GIS and location intelligence are not prioritised high enough, but are an option only if the needed resources are available. On the other hand, solution providers are eager to demonstrate their knowledge about GIS and location intelligence for their customers. They want to tell about the newest developments and current trends in the market, and not necessarily concentrate on the issues that are relevant to the customer. In addition, solution providers may assume that the customer has a certain amount of knowledge about GIS or location intelligence and do not begin from basic enough issues. This is a problem particularly in organisations that are still in the early stages of using GIS. If solution providers use technical jargon, the problem becomes even greater.

That solution providers and their potential customers do not always speak the same language results in solution providers talking about different technologies and not acknowledging adequately the business side which is important to the customer. Solution providers should always take into consideration the readiness of a potential customer for a location intelligence solution. Firms that have used GIS for decades and understand its benefits, for example, retail firms, are generally open to new ideas and technological solutions. They have their own GIS experts who can evaluate the potential of new solutions, and it is important for them to be informed about ongoing technical developments. Therefore, solution providers are able to present more advanced solutions to this type of firms. However, solution providers could take even more of an active role in

feeding these firms with new and innovative ideas on what to do next with location data. Even though they have much knowledge on GIS related issues, they still like to learn more from solution providers.

When it comes to organisations that are less advanced users of GIS, solution providers should take a different type of role. These organisations may not be interested in hearing about the newest trends or most up-to-date technologies, but they want concrete examples on what type of solutions could be beneficial in their business. It is important for them to hear how, for example, a location intelligence solution could improve their daily work processes or help them save on resources; the benefits of location intelligence solutions are the most important issue, not the technology behind it. Therefore, solution providers could approach these types of organisation with consulting services. Consulting would allow free discussion about the technological or business challenges the customer has, and not only a presentation from the solution provider. More importantly, when the goal is to find out the needs and requirements of the customer, the discussion should be carried out using terms that the customer understands rather than technical jargon. As a result of the consultation, the solution provider knows the challenges and the requirements that the customer organisation has and can recommend a suitable solution for them.

There are numerous challenges related to location intelligence solutions which may seem greater than the benefits. The challenges described are more concrete and thus, easier to understand than the benefits. However, none of the challenges mentioned are unsolvable. More efforts are required from solution providers than from customers to solve many of the presented challenges. As solution providers understand that location intelligence solutions could be very valuable in many sectors, the main challenge is to find the resources to develop clear concepts around these solutions and to find interested customers. Location intelligence is definitely something that solution providers cannot afford to ignore completely.

7.2 Future Prospects for Solution Providers and Customers

The location intelligence market in Finland is still in its early stages of development. Therefore, it holds great growth potential and offers new business opportunities for solution providers. It is also a great time to study the challenges of location intelligence because they are currently quite well acknowledged. When location intelligence solutions reach the maturity stage, it may be more difficult to identify the challenges in their implementation. However, the benefits of location intelligence are more difficult to examine as the number of reference cases is very limited. In countries where location intelligence solutions have been used longer, such as USA or UK, there would be more evi-

dence on the advantages. Consequently, it would be useful for solution providers to study the best practises foreign firms have established concerning location intelligence solutions. This would help prevent solution providers in the Finnish market from repeating the same mistakes that have been made elsewhere. Information concerning best practises could decrease the amount of pioneer and development work that has to be done in order to offer appealing location intelligence solutions. They could also clarify what type of organisations would most likely be interested in implementing location intelligence solutions. However, if solution providers settle for studying and following best practises, it can be more difficult for them to become the market leader. Therefore, solution providers have to decide whether they want to take more risks and be among the first ones to offer location intelligence solutions or wait for the market to grow and integration technology to develop and then begin to offer these solutions.

Currently location intelligence solutions are not actively promoted in Finland. This may be due to the lack of demand from customers or lack of resources at the solution providers' end to develop this new area of business. However, organisations that have already heavily invested in BI would most likely be interested in hearing about possible improvements on their existing solution. This could also result in GIS solution providers finding completely new customers that would not be interested in buying a more traditional GIS solution. Therefore, it is extremely important to raise the awareness of location intelligence in the market. Some of this responsibility lies with solution providers that have previously not done this adequately. Other organisations, such as The Finnish Funding Agency for Technology and Innovation, could also take more of an active role in raising the awareness of location intelligence solutions. If potential customers had more information about location intelligence solutions and their advantages, there would most likely be more organisations interested in implementing one.

More cooperation between GIS and BI disciplines is also needed for location intelligence solutions to become more common. This applies to both solution providers and potential customers and includes cooperation within the organisation as well as with partners and other organisations. Due to the knowledge and experience from both GIS and BI solutions large IT firms may have an edge over GIS solution providers when it comes to offering location intelligence solutions. These IT companies have the opportunity to integrate GIS and BI when a customer decides to buy either of these solutions. If a BI solution automatically had a map interface, the customers would most likely respond better to it than as a separate integration project. However, this is possible only if the GIS and BI personnel work well together and see location intelligence solutions as an opportunity to do something completely new for their customers. For customers the requirement for cooperation is not only limited to the GIS and BI personnel. Especially in large organisations departments may not know what others are doing and what type of solutions they use or are even available in the market. Therefore, good communica-

tion ensures that the existing solutions are used to their full potential and that management is aware of the unmet needs.

One way for solution providers to begin to build a clientele interested in location intelligence solutions is to target organisations that have long traditions in using GIS. These customers understand the value that location data has and that a map is the best interface for examining it. They are able to predict the benefits a location intelligence solution would bring to them better than organisations that have very little experience with GIS. They could also be offered more advanced location intelligence solutions, for example, with analysis tools, because they have previous experience in using GIS. Public sector organisations are one great example where the potential of location intelligence has been acknowledged. As discussed, also the retail sector has realised the the potential of location intelligence solutions in adding value to decision making. These two sectors have long traditions in using GIS for different purposes, so they know the benefits of map visualisations and thus, have also began to use it to support their BI activities. Therefore, it may be suggested that organisations that already use GIS in various processes possess the greatest potential for location intelligence solutions.

7.3 Avenues for Future Research

Currently, there is quite few researches done on location intelligence, but as the market begins to grow and the topic becomes better known, the amount of studies will increase as well. There are several research themes that could offer useful results for solution providers. One of the most important ones would be to examine closer the benefits of location intelligence solutions because these are what customers are ultimately interested in. Therefore, it would be extremely useful if solution providers had more concrete evidence on what type of improvements organisations achieve by implementing a location intelligence solution. Customers are also probably more convinced by research results than by solution providers' sales presentations. Therefore, in the future, the location intelligence research may not be very much theoretically inclined but rather focused on generating results with practical value.

The benefits of location intelligence solutions could be studied by conducting case studies in organisations that have implemented one. It would be useful to interview organisations in different sectors and geographical markets and of different sizes to gain insights into possible variations these characteristics cause. This would allow researchers to draw conclusions that apply to a wide range of organisations which would have real value to solution providers. The challenge in this type of research is to find organisations that are willing to reveal the information required to gain useful results. In addition to these managerial implications, this type of research could aim at creating a mod-

el for evaluating the benefits of location intelligence. This type of a model would allow organisations to evaluate themselves whether they need a location intelligence solution or not, and solution providers could use it when they are consulting potential customers. If there was a good model for evaluating the benefits and costs of location intelligence solutions, it would certainly resolve many of the current challenges that both solution providers and customers face.

In this study, only one person in each of the retail and insurance sector organisations was interviewed. These are all large organisations, so it is impossible for one person to know to what extent GIS is used in different departments and processes. Therefore, especially retail firms, which currently show more potential for location intelligence solutions than insurance firms, could be studied more extensively to gain insights into how they use GIS in their processes and whether there are needs that are not met with current solutions. This could also facilitate cooperation within the retail firm if they knew better what other departments are doing and what kind of solutions they are using. The same type of case studies could be done for public sector organisations to examine the potential they hold for location intelligence solutions. However, the challenge again is that these organisations may consider this type of information confidential and do not want to reveal that to their competitors.

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APPENDIX 1 INTERVIEW THEMES

Geographical Information System

1. What types of GIS applications are used?
2. What type of benefits can be gained from using GIS?
3. What types of challenges are there related to GIS?
4. What are the areas of work or processes where GIS could be used (but is not currently used)?
5. Are there any shortages in the current GIS applications?
6. How is GIS perceived in firms?
7. What types of future trend are there for GIS?
8. What is the role of solution providers in GIS solutions?

Business Intelligence

1. For which purposes are BI solutions used?
2. What type of benefits firms hope to achieve by using BI solutions?
3. What types of challenges are there with BI solutions?
4. What types of issues hinder the use of BI solutions?
5. What are the future prospects for BI solutions?

Location Intelligence

1. Is there enough information about location intelligence solutions in firms?
2. How big of a market could there be for location intelligence solutions in Finland?
3. Why would a firm decide to keep GIS and BI as separate solutions?
4. What type of possibilities would location intelligence solutions present?
5. What type of benefits can be derived from a location intelligence solution?
6. Could location intelligence solution make other GIS applications obsolete?
7. What issues foster and, on the other hand, hinder the implementation of location intelligence solutions?
8. What do users think of a location intelligence solution?
9. How do the applications of location intelligence solutions differ from the applications of GIS?
10. What are the future prospects for location intelligence solutions?
11. How are the benefits of a location intelligence solution evaluated?