The Power of Business Intelligence on the Decision-Making Process at Linkoping University

A Case Study

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English title:
The Power of Business Intelligence on the Decision-Making Process at Linkoping University (A Case Study)

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Publication type:
Master’s thesis in Business Administration Strategy and Management in International Organizations
Advanced level, 30 credits Spring semester 2018
ISRN-number: LIU-IEI-FIL-A--18/02856—SE

Linköping University
Department of Management and Engineering (IEI)

www.liu.se
Glossary:

**BI**: Business intelligence, a term used to describe gathering, storing and analyzing data for the purpose to facilitate decision-making.

**DMP**: Decision-making process

**LIU**: Linkoping University

**IPB**: Internal proficiency benefit

**ROC**: Reduced operational costs

**CRB**: Cost-reduced benefits

**SPB**: Staff productivity benefit

**Statement of authorship**

I declare that the work in this thesis has never been submitted before. All the information it contains apart from my research is cited in the reference list.
Acknowledgements:

This work represents the final achievement of my Master of Science in Strategy and Management in International Organization. It has been two challenging years, but great at the same time. I’m grateful to be part of the master’s program. I would like to extend a special thanks to my husband and family, who supported me throughout all of my studies.

I would like to express my gratitude to my advisor, Andrea Fried, for her guidance and support. Special thanks goes to the staff of the controllers in the Finance and Planning division in the administration office at Linkoping University, to the dean of the faculty of Arts and Human Sciences, and to the controllers of the four faculties at Linkoping University: Faculty of Arts, Faculty of Medicines, Technical Faculty and Faculty of Education. The personnel whom I cited contributed to my thesis and provide me precious information.

I’m especially thankful to my initial contact with the head of the Department of Computer and Information Science at Linkoping University. He provided me useful information and guided me in finding the right person with whom I begin my research journey.

Thank you all for your encouragement.

Linkoping, May 2018

Hoda Lahbi
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Abstract

The decision-making process (DMP) is based on two elements: Organizational and technical (Poleto et al., 2015). The organizational element is related to managers’ everyday decision-making based on the organization strategy (Poleto et al., 2015). Its aim is to set up specific actions for the planned objectives for the business (Rouse, 2018). The second element is the technical DMP. According to (Poleto et al., 2015), it is related the set of tools that are used as an aid in the DMP, which includes information technology and big data.

Business intelligence (BI) is the decisionmaking helping system (Ali et al., 2017). Consequently, BI helps make better decisions, and it has become popular in many organizations. As a result, it is important to show BI’s power over DMPs and to show how the tools used in BI facilitate the DMP.

“Higher education institutions worldwide are operating today in a very dynamic and complex environment” (Kabakchieva 2015, p. 104). As a result, universities that are within higher education are threatened because competition is serious (Barrett, 2010).

Moreover, higher education is another area that will potentially impact big data research (Ong, 2016). Consequently, the application and use of big data in higher educational institutions may result in better quality education for students and a better experience for the university staff (Ong, 2016).

As a result, HEI is adopting new technologies with the aim of sustaining its position on the market. DMPs at higher academic institutions require structured data from a sophisticated system, which can be only done through efficient and effective use of BI tools.

This thesis will investigate how the BI system is used at Linkoping University (LIU) and how its benefits have changed DMPs. We studied the BI tool (Qlikview) that has been used at LIU for 10 years.
To answer the research question, a theoretical framework was developed that was based on two models: Simon’s (1997) and Huber’s (1980) DMP models. The two models were combined with the BI benefits that were based in El Bashir et al.’s (2008) model. The research is done through a qualitative method of data collection and data analysis. At LIU, seven interviews were conducted with BI users and with strategic decision-makers. The findings show that the BI system, alongside Qlikview, has a positive effect on DMPs at LIU as a public HEI. The factors affected are the information gathering time, the quality of data provided and the accessibility to information by all BI users.

**Keywords:**

Business intelligence, decision-making process, framework, Qlikview, Linkoping University, time, accessibility, quality, higher educational institutions, efficiency, BI benefits.
1. Introduction

This chapter introduces decision-making process (DMP), business intelligence (BI), HEI and BI benefits. Moreover, it studies the research gap and why the topic is interesting. In addition, this chapter discusses the research question and the thesis structure.

“Information technology is a key success factor influencing the performance of decision makers specifically the quality of their decisions” (El Gendy & Elragal, 2016, p. 1071). According to El Gendy and Elragal (2016), digital technologies are changing how organizations function.

Indeed, with the ideological change and the technological revolution in a global competitive world, companies are building their presence by creating competitive advantages that ensure their continuation in the market and their survival among competitors (Gupta et al., 2008).

Moreover, with the quality of information provided, modern organizations are able to get the information needed from the large amount of data available to them, which offers a source of strength against other competitors (Fujitsu, 2016). According to Fujitsu (2016), since it is hard to convert data into information, modern technology provides the resources with which to obtain better results. In the same context, the effective use of a large amount of data enables the transformation of the organizations’ economies, giving them a competitive advantage against competitors (McKinsey, 2011).

With the new technologies, organizations are looking for better ways to possess information and to obtain value from the data provided for efficient decision-making (LaValle et al., 2011). In the same context, Gartner (2018) discussed the hype cycle for emerging technologies and how digital organizations are using this hype cycle to know where the organization is and what its needs will be in the future. Furthermore, Gartner (2018) explains the hype cycle, as is shown in Figure 1. The cycle is a graphic design that represents the development of the adoption of technologies and how relevant that adoption is to solving problems and finding new opportunities for organizations.
As a result of having the ability to turn data into information, organizations become able to store and analyze data, thus providing better decisions (Elgendy & Elragal 2016). Since BI is used to analyze big data, it is mostly used by businesses (Elgendy & Elragal 2016).

Since all large organizations are using BI and it is impossible to find a successful organization that is not implementing BI systems (Chaudhuri et al., 2011), “universities should not be just a neutral setting, but the place in which to create and share knowledge, an innovative and prolific actor in interaction with the economic, administrative, and cultural environment” (Bresefelean & Ghsoiu, 2014, p. 43). Therefore, the concept of BI is that of a field of research that focuses on practical and the theoretical part of getting the right information from data to make better decisions (Alexander et al., 2011). Moreover, “Business intelligence systems combine operational data with analytical tools to present complex and competitive information to planners and decision makers. The objective is to improve the timeliness and quality of inputs to the decision process” (Negash, 2004, p. 177).

BI tool use has many positive effects regarding business process performance and organizational performance (El Bashir et al., 2008). First, it provides better data and information quality (Wieder & Ossimitz, 2015). According to Wieder and Ossimitz, (2015), “The main objective of the BI system is to provide high quality information for managerial decision making” (p.1165). Second, the BI tools develop efficiency (Gardner, 2017). This means that once the right information is found, it is quickly assessed and turned into reports that help save time and boost efficiency (Gardner, 2017). Furthermore, BI tools provide open access to information (Gartner, 2018). Thus, the BI tools enable access to analyzing data and information to make better decisions (Gartner, 2018). As a result, BI aims to provide support for DMPs to improve performance (Ramakrishnan et al., 2012).
To answer the question of how BI is used to support DMPs at the university, the BI system should be discussed.

BI improves DMPs via processing, storing and analyzing data and turns it into insights through which managers make efficient decisions to improve the organization’s performance (King, 2016). In the same context, BI plays the role of leveraging critical information from the whole value chain to make better decisions (Avosys, 2016).

According to Avosys (2016) and to improve corporate performance, BI is accredited to enabling an organization to extract value from big data. However, the study of the power of the BI system in the academic field has been limited. The focus of the impact of BI over DMP has been reduced to the organizational life (Elbashir et al., 2008; Turban et al., 2011; Poleto et al., 2015; Ziora, 2015).

Consequently, since the BI system is an information technology tool that helps with decision-making and that has a positive impact on the DMP, there was limited research in the higher educational area. In that context, Gorgan (2015) discussed decision support systems in the academic field, arguing that “Decision support systems are software based systems that supports business or organizational decision-making activities. Although they are mature technologies that have proven their usefulness in business, their use in academic environment is only in an incipient phase” (p. 451).

Therefore, the aim of this research is to investigate and study how the BI benefits have changed the DMP at HEI. The study was conducted using a qualitative single case study at LIU, a public Swedish university, via semi-structured interviews. The analysis was done by analyzing the changes that occurred within the DMP based on the models by Simon (1997) and Huber (1980). After analyzing the results, the aim of this research paper is to show the factors that are positively affected due to the use of the BI system.
1.1 Research Gap

Literature and research have shown a gap in the use of BI in DMPs in general. Davenport (2006) argues that the focus on being an analytics competitor is on using highly sophisticated information and being more technology oriented. Although BI supports decision-making, research is this area is limited (Arnott & Pervan, 2008; Davenport 2006). Although many articles discuss DMPs and BI, the literature did not go into detail talking about the use of BI in the DMP (Shollo, 2011). In the same context, in their studies of 1,093 articles that were published in 14 journals, Arnott and Pervan (2008) explored decision support as an informatics system that improves managerial decisionmaking. However, the results showed that “Overall, 15.2% of published papers between 1990 and 2004 were in the decision support system field” (Arnott & Pervan, 2008, p. 660). Moreover, the results of another study of 103 articles related to BI from 1990 to 2010 showed that literature is focused on information technology rather than decision-making (Shollo & Kautz, 2010).

Indeed, the focus of the literature was on the technological aspect of BI (Kimbal & Rouse, 2002; Immon, 2005; Kleese & Winter, 2007). Furthermore, literature focuses on the competitive advantage of BI when creating a business intelligence competency center for organizations (Miller et al., 2006) and creating an effective BI in organizations (Gilad & Gilad, 1988). Also, it discusses the design of BI, including the organizational culture, structure, and the skills and competences required (Burton et al., 2010). The literature also discusses the BI tools (Heinrichs & Lim, 2003; Oyku et al., 2012; Rasoul & Mohammad, 2016), and it discusses the development of BI (Chandhuri et al., 2011; Chen et al., 2012).

The critical research gap also lies in the fact that there was little focus on the BI role in DMPs in the educational sector (Gorgan, 2015). Moreover, Hassan et al., (2016) state that even if universities are facing a new style of decision making based on BI, there is a challenge in the readiness to implement and to use a BI system. In that context, Hassan et al., (2016) state that “Currently, few published studies have examined BI readiness in HEI environment” (p. 174). Moreover, Kabakchieva (2015) argues that despite the data that are available at universities, managerial decisions are not always based on those data.

Since decision-makers make poor decisions despite the information technology they have access to (Martinsons, 1994), organizations should focus on their DMPs and how to use BI as an information technology for efficient decision-making (Kowalczyk et al., 2013). As a result, many organizations do not understand what the relationship between BI and DMP actually is (Hostmann et al., 2007).
1.2 Research Purpose

“Data can be the lifeblood of an organization if it is allowed to flow freely across the entire ecosystem” (Heyns, 2015, p. 7). The purpose of this study is to show some theories that were used in DMPs in the past and to show the current importance of BI and analytics.

In the past, decisions were made based on the balance sheet and on the assumptions of how much the company will generate as a profit (Heyns & Mazzel, 2015). On the other hand, big data and data analytics are used to create more value for the organization by providing a general overview of the needs of the customer and the market and the potential risks of future projects (Heyns & Mazzel, 2015).

“Proper processing of the data could reveal new knowledge about our market, society and environment, and enable us to react to emerging opportunities and changes” (Chen et al., 2013, p. 157). As a result and after generating the large amount of data, the data generated should be analyzed.

Indeed, Green et al. (2009) explained that “We recognize that there is no ‘one-size-fits-all’ approach to implementing BI strategy within universities” (p. 52). The reason we choose this study is to investigate the use the BI system and its tools at LIU and how its benefits have a power over the DMP. This study is motivated by the lack of research on the use of BI system in the academic field especially at LIU.

The research will be done in the four faculties of LIU and will analyze the use of BI in DMPs from an academic perspective. Moreover, it aims to suggest further research is necessary in the field of the BI tools used at LIU. The potential results are expected to show how the university is using BI tools and how its benefits have changed DMPs.
1.3 Research Question

The general goal of this paper is to answer the following research question: *How have the BI system benefits changed DMPs at LIU?*

1.4 Thesis Structure

**Chapter 1**
- This chapter introduces decision making process, business intelligence, Qlikview, HBI and BI benefits. Moreover, it studies the research gap and why the topic is interesting. In addition, this chapter discusses the research question and the thesis structure.

**Chapter 2**
- In this chapter, there is a demonstration of the literature review where DMP, BI, Qlikview, BI benefits were presented as well as the use of BI in HEI. Moreover, this chapter also tackles BI benefits. Finally, it describes the theoretical framework that will be used to answer the research question.

**Chapter 3**
- This chapter represents the research methodology followed in this thesis. It describes the research approach, and the research process. Furthermore, this chapter explains how the data was collected, and how the data was analyzed. Besides, it showed the sampling followed. Moreover, it shows the process followed to make the work more valid.

**Chapter 4**
- This chapter describes the findings. It includes the analysis of the data that we obtained from interviews that was conducted and from the internal documents that was provided from Linkoping university.

**Chapter 5**
- The discussion part represents a discussion about the findings and the results that was found. Moreover, the theoretical framework is presented.

**Chapter 6**
- In this chapter, a concluding analysis and an answer to the thesis research question was provided. Moreover, it showed a suggestion for future studies and the limitations confronted while dealing with the research paper.
Chapter Summary:

Since there was a gap between the use of the BI system and DMPs in an academic context, we have chosen to investigate the use of the BI system and its tools at LIU to develop the study of our case. Accordingly, we have prepared a question for the research paper.

2. Theoretical Background

In this chapter, the literature review where DMP, BI, Qlikview and BI benefits were presented, as well as the use of BI in HEI, is demonstrated. Finally, this chapter describes the theoretical framework that will be used to answer the research question.

When dealing with a research paper, the literature review is an important component, as it gives an overview of the direction the researcher follows (Kim, 2018). In the same context, Yin (2009) argues that the purpose of a literature review is to provide answers to the topic. Thus, in the following chapter, we will talk about DMPs. Moreover, we will provide a theoretical background for BI and its tools, architecture and benefits. We will then talk about the Qlikview tool and the use of BI in higher educational institutions. Finally we will provide a theoretical framework upon which answers to the research question will be provided.

2.1 Organizational Decision-Making

Decisions play an important role in an organization’s existence. Thus, “Decision making is the study of identifying and choosing alternatives based on the values and preferences of the decision maker” (Govindarajan, 2014, p. 690). According to Govindarajan, (2014), making a decision implies having many choices at hand.

According to Parkin (1996), the literature on decision-making is divided into three categories. The first category is the body of knowledge that describes the decision theories that help in the DMP. The second category is derived from psychological research, which includes models of decision-based behavior. Thus, it describes the limitation of the human mind in the DMP. The third category describes the DMP in organizations.
3.7.1 Decision-Making Review

Historically speaking, decision-making dates back to 1910 and Dowery: “Since 1910, when John Dewey first introduced the five-stage decision process, it has been a widely accepted concept” (Bruner & Pomazal, 1988). They classify the five stages as follows: the problem recognition, the information search, the alternative evaluation, the choice and the outcome (Bruner & Pomazal, 1988). Moreover, in 1938, “Chester Barnard, a retired telephone executive and author of The Functions of the Executive, imported the term ‘decision-making’ from the lexicon of public administration into the business world” (Buchanan & O’Connell 2006, p. 33).

In the same context, and according to Buchanan and O’Connell (2006), theorists such as James March, Herbert Simon and Henry Mintzberg continue the foundation for the study of decision-making.

3.7.2 Decision-Making Process

Throughout history, decision-making has been considered an act that has been influenced by past experiences, cognitive biases, commitment, age, believe in personal relevance and individual differences (Dietrich, 2010). Turban et al. (2011), on the other hand, explained the business pressures that make competition very high in such a globalized and digitalized world. They go further by arguing how organizations take advantage of their external environment and the information technology support for their decision-making, as illustrated in Figure 3.

![Figure 3: The Business Pressures Responses Support Model (Turban et al., 2011, p. 5)]
According to Turban et al., (2011), decisions should be more analytical, methodical and thoughtful. In the same context, Harris (1998) defines decision-making as a study-based process to identify and choose between existing alternatives and a process by which to reduce uncertainty about those alternatives to make better choices. Based on Simon’s (1977) work, there are two types of decisions: programmed and non-programmed (cited in Asemi et al., 2011).

The programmed or structured decisions are made when routines and repetitive problems occur, and thus standard solutions exist (Turban et al., 2011). For this reason, decisions are made according to the organization’s guidelines (Asemi et al., 2011). On the other hand, unstructured or non-programmed decisions are made with fuzzy, complex problems and when there are no cut-and-dry solutions (Certo, 1997, cited in Asemi et al., 2011). Thus, one-shot unstructured decisions are made (Certo, 1997, cited in Asemi et al., 2011).

Simon (1977) discusses the DMP as a process with three phases: intelligence, design, and choice (Turban et al., 2011). Later, a fourth phase was added the implementation phase. This phase is shown in Figure 4.

![Figure 4: The Steps of Decision Support, (Turban et al., 2011, p. 12)](image)

After Simon’s (1997) model, in Huber’s (1980) DMP model, we found the implementation and the monitoring phases, which are shown in Figure 5 (Asemi et al., 2011).
The five phases are defined as follows:

- **Intelligence**: This phase contains searching for conditions that make the call for decisions (Turban et al., 2011). It means that decision makers in this phase examine the existing realities to precisely identify and investigate problems (Marković, 2018). As a result, the intelligence phase includes defining the objectives of the organization, collecting data and then identifying and classifying problems (Marković, 2018).

- **Design**: This phase is the invention, development and analysis alternatives for solutions (Turban et al., 2011). Moreover, during the design phase, a model should be constructed based on defining the relationship between the variables that are found thus making possible choice for potential solutions (Marković, 2018).

- **Choice**: This phase contains the selection of solutions from the alternatives that are available (Turban et al., 2011). As a result, decisions are made.

- **Implementation**: During this stage and after decisions are made, the implementation phase involves adapting the selected solution to a decision-based situation (Turban et al., 2011). As a result, the implementation can be successful or unsuccessful (Marković, 2018).

- **Monitoring**: According to Cambridge (2018) dictionary, monitoring means to check something carefully. It means that after decisions are implemented, monitoring is important. To monitor decisions means to do the follow-up and check its efficiency.

To compare decision making between private and public organizations, Kim et al. (2014) stated that both sectors have different goals and values. The differentiation lies in that private
organizations are looking for profit while public organizations are looking for development and sustainability (Kim et al., 2014). Moreover, in the private sector, decisions are short term, while in the public sector, decisions are long term (Kim et al., 2014).

### 2.2 Business Intelligence

Decision-making can be properly done through the appropriate decision support systems (Dillon et al., 2010) and with the information provided (Watson & Wixom, 2007; Hočevar & Jaklič, 2008). As a result, using the information system will function as a competitive advantage for organizations (Rezaei et al., 2011). In the same context, Turban et al., (2011) argue that the use of information technology is vital for organizations in the way that it possesses capabilities that facilitate DMPs. Turban et al., (2011) went further by emphasizing the importance of computerized decision support systems, such as the BI tools.

In literature, BI has multiple definitions. According to Azvine et al, (2006), BI is not well defined; this means that some consider it to be data reporting while others talk about business performance management. Furthermore database analysts emphasize data extraction while analytics highlight the analysis of statistics and data mining (Azvine et al., 2006). In the same context, since decision-makers no longer trust the KPI nor the dashboards (Azvine et al., 2006), BI is changing the way companies are managed, decisions are made and employees perform their jobs (Watson & Wixom, 2007).

As a result, BI is “All about how to capture, access, understand, analyze and turn one of the most valuable assets of an enterprise—raw data—into actionable information in order to improve business performance” (Azvine et al., 2006, p.2).

![Figure 6: BI Turning Data into Information (Azvine et al., 2006, p. 2)](image-url)
The various definitions of BI, according to Singh and Samalia (2014), are listed in Table 1.

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<th>Definition</th>
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<td>The process of gathering and analyzing internal and external business information.</td>
<td>Okkonen et al., 2012</td>
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<td>BI is an architecture and a collection of integrated operational and decision-based support applications and databases that provide the business community easy access to business data.</td>
<td>Moss &amp; Atre, 2003; Papdopoulos &amp; Kanellis 2010</td>
</tr>
<tr>
<td>Information to better understand business to make more informed real-time business decisions</td>
<td>Raisinghani, 2004</td>
</tr>
<tr>
<td>An organized and systematic process by which organizations acquire, analyze and disseminate from both internal and external sources that are significant for their business activities and for decision-making</td>
<td>Lonnqvist &amp; Pirttimaki, 2006</td>
</tr>
<tr>
<td>BI includes technologies and applications employed in the use of several financial and non financial metrics, key performance indicators to assess the present state and the method of deciding future course of action for a business.</td>
<td>Hari, 2007</td>
</tr>
<tr>
<td>BI means leveraging information assets within key business processes to achieve improved business performance.</td>
<td>William &amp; William, 2007</td>
</tr>
<tr>
<td>BI refers to the various solutions for enhancing the overall business performance</td>
<td>Wang &amp; Wang, 2008</td>
</tr>
<tr>
<td>BI is the conscious methodical transformation of data into new forms to provide information that is business-driven and results oriented.</td>
<td>Ranjan, 2008</td>
</tr>
<tr>
<td>BI is a set of business information and business analyses within the context of key business processes that lead to decisions and actions</td>
<td>Popvic, Turk &amp; Jaklic, 2010</td>
</tr>
</tbody>
</table>

*Table 1: Different Definitions of BI (Singh & Samalia, 2014, p. 52)*
The definition that explains the concept of BI follows:

“Business intelligence consists of the processes, tools, and technologies required to turn data into information and information into knowledge and plans that drive effective business activity” (Eckerson, 2003, p. 49).

As a result and according to Eckerson (2003), BI is like an oil refinery that converts raw material—crude oil—into the refined material—gas oil. This means that BI converts data into knowledge and this is done through a process cycle (Eckerson, 2003).

### 3.7.3 The History of Business Intelligence

Based on Davies (2018) and shown in Table 2, from 1856 to 2018, there is a tremendous change in the meaning of BI.

<table>
<thead>
<tr>
<th>The Year</th>
<th>The Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1856</td>
<td>Richard Miller Devens talks about BI in his Encyclopedia of Commercial &amp; Business Anecdotes. He looks for how to obtain intelligence that will lead to a successful business. Thus, he knows about the market issues before his competitors.</td>
</tr>
<tr>
<td>1958</td>
<td>Hans Peter Luhn published an article called “A Business Intelligence System,” in which he outlined the basics of a BI system in a</td>
</tr>
</tbody>
</table>
sketchy diagram. When documents entered to the system, it undergoes a process before actions took place

1960

The data increased and became difficult to manage and to get knowledge from. Thus something new needed to be developed.

1970: Enter the Big Boy

Siebel and IBM entered the world of modern BI. At that time, BI became a must have for many organizations.

1990–2000: Business Intelligence 1.0

During these years BI became big money but unfortunately it needed to extract the most valuable knowledge from the big data.

2000 Onward: Business Intelligence 2.0

BI users extracted the valuable information from data. Moreover, more technologies were used that supported decision-making.

2018: The Tools of Today

BI nowadays represents a powerful tool that organizations have. BI has many functions and provides the organizations different benefits. As a result, BI information and knowledge are used for sales, marketing, finance, planning and decision making.

Table 2: BI History from 1856 to 2018 (Davies, 2018)

As a result, these definitions show how BI has a special architecture.
3.7.4 The Business Intelligence Architecture

Turban et al. (2011) define BI as “an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies” (p. 19). Rouse (2018), however, defines BI architecture as a framework by which the data, information management and the components of technology are organized for building BI systems. Moreover, Ong et al. (2011) argue that BI architecture includes the types of data that need to be collected and the method used to analyze those data to present the information needed. According to Ong et al. (2011), the layer of metadata should be included in BI architecture, as it is shown in Figure 7.

A good BI architecture should include a layer of metadata which is important to storing and monitoring data (Ong et al., 2011). Moreover, Table 3 presents the BI architecture according to Ong et al., (2011)

![Figure 7: BI Architecture (Ong et al., 2011, p. 4)](image-url)
<table>
<thead>
<tr>
<th>Layers</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Source Layers</td>
<td>Data can come from internal or external sources. An internal data source means that the data come from inside the organization. These data are related to information concerning customers, sales and products. External data sources are related to competitors, the market and the external environment of the organization.</td>
</tr>
<tr>
<td>Extract–Transform–Load (ETL) Layer</td>
<td>Extract means taking the most relevant data that support decision making. Transform means to convert data into a special format that is suitable for reporting. Load is the final phase. The data are loaded into the target repository.</td>
</tr>
<tr>
<td>Data Warehouse Layer</td>
<td>This layer contains three components: operational data store, data warehouse, and data marts. Operational data store integrates all data that come from the ETL and put it in a data warehouse. The data warehouse represents the central storage of data from internal and external resources. The data are stored for between 5 and 10 years and is updated regularly. Data marts play the support role for the data warehouse and provides specific departments with the needed information, which the data warehouse cannot do.</td>
</tr>
<tr>
<td>Metadata Layer</td>
<td>This layer describes the data. This means that it shows how data are stored, from where they were extracted, the changes that happen to the data and so on. Examples of metadata layers include the following: OLAP: This describes the structure, level and dimension of the data that Enable</td>
</tr>
</tbody>
</table>

*Table 3: Table 3: BI Architecture and Layers (Ong et al., 2011)*
the user to extract the needed data.

Data mining: Its role is to analyze the data to extract the most useful information from it (Witten & Frank, 2000)

Reporting metadata: It is used to store reports names and reports description.

| End User Layer | This layer shows the tools that are used to represent the information needed by the users. It describes the level where such tools are used. In each level, specific BI tools are used to extract information. |

### 2.3 The Business Intelligence Benefits

Since BI aims at focusing on creating value by looking for knowledge (Sabherwal & Fernandez, 2010), organizations use BI to achieve a variety of benefits such as profitability, reduced costs, and efficiency (Işık et al., 2013). In the same context, Sabherwal & Becerra-Fernandez (2010) grouped BI benefits into 3 major categories: improvement of operational performance, improvement in customer relations and the identification of new opportunities in contemporary organizations. Moreover, Eckerson (2003) discussed tangible and intangible benefits as is shown in Figure 8. According to Eckerson (2003), the majority of the benefits of BI are intangible.

![Value of Tangible and Intangible Benefits](image)

*Figure 8: Tangible and Intangible BI Benefits (Eckerson, 2003, p. 11)*

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Tangible Benefits</th>
<th>Intangible Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time savings</td>
<td>60%</td>
<td>59%</td>
</tr>
<tr>
<td>Single version of the &quot;truth&quot;</td>
<td>59%</td>
<td>57%</td>
</tr>
<tr>
<td>Better strategies and plans</td>
<td>57%</td>
<td>56%</td>
</tr>
<tr>
<td>Better tactics and decisions</td>
<td>56%</td>
<td>55%</td>
</tr>
<tr>
<td>More efficient processes</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>Cost savings</td>
<td>37%</td>
<td></td>
</tr>
<tr>
<td>Greater customer/supplier satisfaction</td>
<td>37%</td>
<td></td>
</tr>
<tr>
<td>Greater employee satisfaction</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>ROI</td>
<td>35%</td>
<td></td>
</tr>
<tr>
<td>New revenues</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Total cost of ownership</td>
<td>21%</td>
<td></td>
</tr>
<tr>
<td>Shareholder value</td>
<td>15%</td>
<td></td>
</tr>
</tbody>
</table>
Moreover, Turban et al. (2011) argue that the BI benefits of an organization lie in its ability to provide the suitable information that is the basics of decision-making. Accordingly, El Bashir et al. (2008) explore 22 BI benefits which are grouped under four factors. Each factor is related to specific benefits as illustrated in Figure 9.

However, for the purpose of this research, only factor number 3 with its 4 benefits is used. Based on the interviews that were done, only the internal processes’ efficiency benefits are present at LIU. Finally, only internal process’s efficiency was used in the research paper and it is presented in Figure 9 and based on El Bashir et al.’s (2008) work.

*Internal Process Efficiency:*

According to El Bashir et al., (2008), internal process efficiency benefits represent the benefits that arise from the development of internal processes, such as increased productivity and cost reduction.

- *The improved efficiency of internal processes:*

  “Key benefits that business intelligence aims to create are the increased efficiency and
effectiveness of the organization”

(Hočevar & Jaklič, 2008, p. 94). This means that BI enables the organization to improve its internal processes to have a competitive advantage and to thus meet the needs of the market.

- **Increased staff productivity:**
  BI enables the staff to work independently and with more autonomy. In that context, Carver and Ritacco (2006) argue that BI allows its users to access databases wherever it is stored and to have the ability to prepare reports to get to know the organization’s situation.

- **Reduction in costs of effective decision-making:**
  “With business intelligence, we can find the causes of certain problems as well as to identify and to analyze the key success factors” (Hočevar & Jaklič, 2008, p. 95). They go further by arguing that with the use of BI, effective decisions can be made (Hočevar & Jaklič, 2008).
  In the same context, Carver and Ritacco (2006) state that the quality of decisions has a direct relationship with the costs. As a result and to improve decision quality, organizations should provide their staff the appropriate means to make decisions (Carver & Ritacco, 2006).

- **Reduced operational costs**
  Williams and Williams (2003) state that “The business value of BI lies in its use within management processes that impact operational processes that drive revenue or reduce costs, and/or in its use within those operational processes themselves” (p. 3).
2.4 Business Intelligence in Higher Educational Institutions:

The main objective of organizations is to convert their global presence into a global competitive advantage (Gupta et al., 2008). Thus “Becoming a more knowledgeable, companies must be accompanied by developing the ability to make and implement smart decisions faster than competitors” (Gupta et al., 2008, p. 148). As any organization does, universities should maintain their position within a market in which information technology is spreading fast. In the same context and according to Verjel and Schmid (2015), to develop a sustainable business, some economical, social and environmental dimensions should be considered to get optimal solutions for the organization Barett (2010) state that “Universities were now using mechanisms such as marketplace analysis, managerial capacity, part time faculty, copyright, and information technology to create profit centers that linked them to a network of actors that included both other universities and corporations” (p. 26).

Thus, to be successful within the higher educational market, universities should extract power from the existing forces that can be relevant to their future (Barett, 2010).

Nowadays and due to the availability of solid information technologies, universities are collecting large amounts of data from their students, staff, and lectures. (Kabakchieva, 2015). Kabakchieva (2015) go further by arguing that for universities to remain competitive and to look for new opportunities, they need to be updated and to make efficient decisions via the use of advanced analytical technologies, such as data mining tools and BI systems.

However, Green et al (2009) say that “We recognize that there is no ‘one-size-fits-all’ approach to implementing business intelligence strategy within universities” (p. 52). Despite this, implementing and using a BI system has many advantages. First, it provides a better quality of the needed information (Wieder & Ossimitz, 2015). Second, it enhances the staff’s efficiency (El Bashir et al., 2008). Regarding time, BI facilitates searching for and gaining access to information for its users (El Bashir et al., 2008).
3.7.5 Qlikview

Qlikteck is a Swedish international company (Kabakchieva, 2015). After settling in the United States, the company offered a BI software solution called Qlikview (Kabakchieva, 2015). According to Qlik (2018), data are only one source of information; however, BI provides efficient solutions.

BI has many characteristics. The software is easy to manipulate and understand (Kabakchieva, 2015). Solutions and information are provided through graphics (Kabakchieva, 2015).

Before talking about the tool, it is important to talk about the history of the product. Based on a blog written by Cronström (2012), in 1994, the first version of Qlikview was introduced. Qlikview bridges the gap between the human brain and the machine as is shown in Figure 10 by Cronström (2012).

![Figure 10: The Gap Between the Human Brain and the Machine (Cronström, 2012).](image)

After that, Qlikview was called “the associative info mart program” because it became a tool with a subset of data (compared to the data warehouse). Many words are said to describe Qlikview; it is said to be intuitive data exploration and a revolution in BI, and now, it is described as business discovery. Moreover, Qlikview’s function supports the process of coming from a blank mind to attain knowledge. Qlikview’s functions include its ability to
explore new data, discover facts and answer questions related to a decision (Cronström, 2012). Furthermore, the software enables its users to access the data history and to develop applications (Qlik 2018). As a result, it enables users to create KPI reports and make decisions (Datawarehouse4u, 2009).

Qlikview is composed of three dashboards where the information is extracted and then presented using graphics (Kabakchieva 2015). The three dashboards are bar and pie charts, performance indicators and tables and list boxes (Kabakchieva, 2015). According to Visual Intelligence (2018), Qlikview is a BI platform that converts data into information. Moreover, Underwood (2017) discussed Gartner’s (2017) quadrant results. As is shown in Figure 11, Qlik, the vendor of Qlikview, is a leader in the market.
2.5 Theoretical Framework

The framework used is based on Simon’s (1997) and Huber’s (1980) DMP models, as well as El Bashir et al.’s (2008) BI benefits.

The choice to combine the three components is based on specific reasons. First, as the founder of research in decision-making, Simon is the key researcher in the area of decision-making (Pomerol & Adam, 2004). Pomerol and Adam (2004) go further by arguing about Simon’s (1977) contribution to decision-making and how the intelligent systems changed due to his influence. Second, El Bashir et al (2008) use 22 BI benefits in their research, which touched the most important elements of an organization. These elements are the external environment, which deals with customers and suppliers and the internal environment, which includes the business’s processes and the internal efficiency.

Furthermore, the models will be mixed to investigate the changes that happen in the DMP. Figure 5 illustrates the models by Simon (1977) and Huber (1980).
Figure 12: BI Benefits (El Bashir et al., 2008)

Figure 13: The Theoretical Framework
2.6 Literature Review Summary

In the literature review, history, definitions of DMP, BI, QLIKVIEW, BI benefits and the use of HEI were presented. Harris (1998) defines decision-making as a study process to identify and choose between existing alternatives and a process to reduce uncertainty about those alternatives to make the better choice. Moreover, Simon (1997) and Huber (1980) explain DMP. Simon (1997) writes about the three phases of DMP, which are intelligence, design and choice, and Huber (1980) adds the implementation and the monitoring phases.

Moreover, Eckerson (2003) defines the BI system as “the processes, tools, and technologies required to turn data into information and information into knowledge and plans that drive effective business activity” (p. 49).

Research on BI’s impact on organizations showed that the use of BI systems had many benefits. Thompson (2004), cited in Turban et al (2011), stated that among BI’s benefits, it facilitates reporting, improves decision-making, improves customer service and increases revenues. Moreover, El Bashir et al. (2008), discuss 22 BI benefits, which they grouped into four factor categories. The categories are the organizational benefits, supplier relation benefits, internal efficiency benefits and customer relation benefits.

Qlikview, as a BI tool, is easy to manipulate and understand (Kabakchieva, 2015). The BI tool provides its users access to the data history and allows them to develop applications (Qlik 2018). Consequently, it enables the creation of KPI and reports and thus allows for decision-making (Datawarehouse4u, 2009). It enables its users to create very useful, accurate KPI, measurement reports and performance dashboards and make accurate, strategic decisions (Datawarehouse4u, 2009).

On the other hand, universities are collecting large amounts of data on their students, staff members, lecturers and other groups (Kabakchieva, 2015). As a result, for universities to remain competitive and look for new opportunities, they need to be updated and to make efficient decisions via the use of advanced analytical technologies such as data mining tools and BI systems (Kabakchieva, 2015).
Implementing and using a BI system has many advantages. First, it provides higher-quality information (Wieder & Ossimitz, 2015). Second, it enhances staff efficiency (El Bashir et al., 2008). Regarding time, BI facilitates searching and access to information for all users (El Bashir et al., 2008).

3. Methodology

This chapter represents the research methodology that this thesis follows. It describes the research approach and the research process. Furthermore, this chapter explains how the data was collected, and analyzed. It shows the sampling methodology that was followed.

3.1 Research Approach

The term “research approach” is an umbrella term that refers to identical research methods (Järvinen, 2008). We adapted a qualitative method as a research approach for various reasons. First, it helps develop a theory after we study the real world (Järvinen, 2008). According to Rahman (2016), “A qualitative research is not statistical and it incorporates multiple realities” (p. 102). Second, with qualitative research, it is easy to interpret the participants’ points of view and experiences (Denzin, 1989). As a result, researchers can use the qualitative approach to describe a phenomenon (Flick, 2014).

Following Järvinen (2008), in the research paper, we empirically study the past and present using theory-developing methods, as we have a theoretical framework that guides our research paper. Using the theory developing method, the research approach ends with a theory-developing study where we rely on one case study.

Figure 14 illustrates how we use this research approach based on Järvinen (2008).
The grey boxes represent the selected areas in our research approach.

3.7.6 Qualitative Research

According to Kneebone and Fry (2010), qualitative research uses words to show how people act and answer without using numbers. Accordingly, in this thesis, a qualitative research method is adapted because it is suitable for our case study.

According to Rahman (2016), using qualitative research has some benefits: First, qualitative research enables researchers to detect the participant’s feelings and interpret them. Second, it allows for the study and understanding of the human experience. Third, it provides a clear view of events and meanings. Fourth, “the studies using qualitative approach can help us to understand the markers’ working assumption about what is to be assessed and the meaning of the score or grade” (Rahman 2016, p. 104). Fifth, through the use of qualitative research, researchers directly interact with the participants in interviews. Last, with qualitative research design’s flexible structure, complex issues can be understood without difficulty (Rahman, 2016).

Oates (2006) writes about the strategy as an approach to answer the research question. He goes on to write about the six strategies: survey, design and creation, experiment, case study, action research, and ethnography. Furthermore, Oates (2006) defines the case study single study of an organization to investigate its complexity and gain insight about it.
As a result, in the research paper, we adapted a qualitative method using a deductive approach. We used a single case study that included interviews. This choice of case study was based on Yin’s (2009) argument that case studies are the best choice when “how” and “why” questions arise and when the focus is on a contemporary subject.

Regarding time, case studies took various approaches (Yin, 2009). Yin (2009) identified three types of studies: historical, contemporary and long-term. The thesis discussed a contemporary case study as it was related to something that is happening in the moment not historically.

### 3.2 Research Process

The process began with a literature review, in which we first analyzed articles and then discussed the use of a BI system from organizational and academic perspectives. The purpose of the research was to discover something new and useful, which we did by studying the current state of knowledge (Maier, 2013). Maier (2013) developed a conceptual framework of the steps in writing a literature review.

![Figure 15: Conceptual “inverted pyramid”](chart)

**Figure 15: Conceptual “inverted pyramid”**

*Models of Steps in the Writing of the Literature Review (Maier, 2013)*
The first step was identifying the problem domain. The second step was searching for what previous researchers had accomplished. The third step was identifying the research gap and, finally, setting the paper’s objectives.

We believe that we covered the five steps. First, we had thorough knowledge about the area of our study and the problem domain. Second, we read about the history of the BI’s and DMP’s previous benefits and the use of Qlikview and BI in HEI. Third, we explored the gaps in the literature concerning BI’s uses, its DMP and its uses in HEI. Finally, we set the research paper’s objectives by developing a theoretical framework through which we would answer the research question.

3.3 Literature Review
In the research, we included the literature review concerning the BI system, DMP, BI benefits, BI tool, Qlikview and use of BI in HEI. After developing the theoretical framework, we contacted LIU staff members that were using the BI system for semi-structured interviews. Next, results were coded and analyzed. Lastly, we used the theoretical framework to answer the research question. The results show how BI benefits have changed with BI tools. The four factors were internal processes, staff productivity, costs of decision making and costs of operations

3.4 Research Design
Because the research paper’s aim was to extract meaningful results from the data, a qualitative method was adapted using a deductive approach. Moreover, we used a single case study and conducted semi-structured interviews.

3.5 Sample Selection
In the research paper, we followed a purposeful sampling approach and snowball sampling. According to Patton (1990), “The logic and power of purposeful sampling lies in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research, thus the term purposeful sampling” (p. 169).
Moreover, we used homogenous sampling as a technique of the purposeful sampling approach (Lund Research Ltd, 2012). The selected sample in our study should have some homogenous criteria:

- First, the organization had to be one of the BI technology users.
- Second, because our aim was to discover the changes resulting from use of the BI system, the organization should have used the BI system for many years to enable studies before and after the implementation of the BI system.
- To get a homogenous sample, the interviewee should know about the DMP and the BI system.

Moreover, in a qualitative study and to get a homogenous sample, we used a snowball sampling methodology to gather data from the interviewees. The snowball method “uses a small pool of initial informants to nominate other participants who meet the eligibility criteria for a study. The name reflects an analogy to a snowball increasing in size as it rolls downhill” (Given, 2008).

3.6 Linkoping University

Linkoping University (LIU) is situated in Sweden. It gained its status in 1975 (LIU A, 2017). According to the annual report (2017), in 2016, the university had 27,000 students and 4,000 employees with a total revenue of 3,700 M SEK (LIU A, 2017).

Linköping University has four faculties: the Faculty of Arts and Sciences, the Faculty of Educational Sciences, the Faculty of Medicine and Health Sciences and the Faculty of Science and Engineering (LIU B, 2017). Each faculty has its own function. Moreover, it has four campuses. The first campus is situated in Valla, Linkoping. The second campus is situated at the university hospital. The third campus is in Norrkoping, and the fourth is in Lidingo, Stockholm (LIU B, 2017).

As an international university, many students all over the world choose it as a place of study. In this context, LIU has an Internationalization Plan for 2013-2020 that includes measures to ensure the quality of the university services (LIU C, 2017). This plan has two aims, the first of which is to increase educational quality and the second is to boost itself competitively at the national and international levels (LIU, C 2017).
3.7 Data Collection

In the following chapter, we present the method and process used to collect data

3.7.7 Data Collection Method

Documents and interviews are the primary data sources used in qualitative research (Merriam & Tisdell, 2015). Moreover, interviews are beneficial because they yield data quickly in quantity (Marshall & Rossman 1999). Accordingly, in this research paper, some documents from LIU on BI tools and seven semi-structured interviews are used as data sources.

The number of interviews to be conducted must be defined. The saturation strategy is the one that we use to show an end to data collection. Saunders et al. (2017) define saturation as the criteria for stopping or discontinuing data collection.

We stopped conducting interviews when we noticed repetition. As a result, we may not reach the estimated number of interviews planned.

3.7.1.1 Interviews

The two types of interviews are standardized and nonstandardized (Saunders, 2007). In our thesis, we conducted nonstandarized semi-structured interviews. Figures 16 and 17 show how we selected interviewees.
Doyle (2017) defined a semi-structured interview as a meeting where the interviewer does not strictly follow a formalized list of questions but instead asks open-ended questions. With open-ended questions, the respondent feels free to express his or her full point of view because the questions always start with “how” or “what” rather than limiting the answers to “yes” or “no.”

In our interviews, we record the discussion to avoid missing any important points.

Respondent selection:

![Figure 18: Uses of Different Types of Interview in Each of the Main Research Categories (Saunders, 2007, p. 314)](image-url)
After investigating the university’s BI system users, I was guided to meet the interviewee 1 in the planning division of the dean’s office in the Faculty of Arts and Human sciences. For the other respondents, according to the snowball sampling methodology, I was guided to whom we should meet next. We stopped the interviews when we felt that the information was repeated and we did not need to conduct anymore interviews—in other words, when we reached the saturation point. Figure 18 includes an explanation of how the interviews were conducted. Furthermore, Table 4 contains the interviewees’ information.

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Job Position</th>
<th>Department</th>
<th>Interview type</th>
<th>Date</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewee 1</td>
<td>Controller</td>
<td>Planning and Finance</td>
<td>Face to face</td>
<td>19 March</td>
<td>Faculty of Arts and Human Sciences</td>
</tr>
<tr>
<td></td>
<td></td>
<td>division</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interviewee 2</td>
<td>Dean of Faculty of</td>
<td>Management</td>
<td>Face to face</td>
<td>22 March</td>
<td>Faculty of Arts and Human Sciences</td>
</tr>
<tr>
<td></td>
<td>Arts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interviewee 3</td>
<td>Controller</td>
<td>Planning and Finance</td>
<td>Face to face</td>
<td>27 March</td>
<td>The University Administration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>division</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interviewee 4</td>
<td>Controller</td>
<td>Planning and Finance</td>
<td>Face to face</td>
<td>28 March</td>
<td>The University Administration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>division</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interviewee 5</td>
<td>Controller</td>
<td>Planning and Finance</td>
<td>Face to face</td>
<td>4 April</td>
<td>Faculty of Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>division</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interviewee 6</td>
<td>Controller</td>
<td>Planning and Finance</td>
<td>Face to face</td>
<td>9 April</td>
<td>Faculty of Medicines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>division</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interviewee 7</td>
<td>Financial Accountant</td>
<td>Planning and Finance</td>
<td>Email</td>
<td>13 April</td>
<td>Faculty of Education</td>
</tr>
<tr>
<td></td>
<td></td>
<td>division</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 4: Details of interviews*
3.7.1.2 Internal Documents

According to Oates (2006), documents are not only written material but include other sources of data. In our case study, we used multimedia documents for the BI tool, Qlikview. According to Oates (2006), multimedia documents include visual data sources, such as the BI models and pictures.

We used a private internal document and the Qlikview vendor website for a general presentation of the product.

3.7.8 Data Collection Process

Regarding the data collection process, the first step was getting permission to conduct the study. We received permission in our first informal interview. After the informal interview, we created a questionnaire, which contained general and specific questions. Based on the theoretical framework, the specific questions were elaborated.

The objectives of the questions were to receive more information about the topic discussed in the research paper develop the framework and answer the research question. The specific questions concerned BI benefits, the DMP and its five phases. Its aim was to determine how, with the presence of BI benefits, the DMP has changed. Other questions concerned the organization and use of the BI system with the BI tool, Qlikview. Its aim was to describe DMP before and after the BI system’s implementation.

The semi-structured interviews were based on open-ended questions. Seven interviews were conducted, six face-to-face and one via email. The interviews were recorded and transcribed with the help of the Nvivo software to make the codification. To make the research more valid, we used secondary data, which included internal documents that described the use of the BI system at the university. The document was prepared with one of the BI experts in the university’s administration office and was reviewed by the financial manager. Because the document was in Swedish, the BI expert translated its key elements, allowing us to begin our data analysis.
3.8 Data Analysis

Data analysis is defined as the process of reducing a large amount of collected data to make sense of it (Kawulich, 2004). In the same context, LeCompte and Schensul (1999) argue that data analysis includes inscription, description and transcription of the collected data. From the documents that we got and from the interviews that we conducted, the first step in our research paper to analyze the data was transcribing the interviews and translating some of the document’s important elements.

3.8.1 Coding and Comparison

In the thesis, we developed a theoretical framework to answer the research question. In the theoretical framework, we had four BI benefits that were placed with DMP phases. To analyze data, we presented our findings and then compared the interview answers to the documents LIU provided.

According to Bernard and Russell (2012), the theory includes three steps: coding texts, linking coded texts into theoretical models and then validating the models.

First, coding involves naming the themes with the help of NVIVO (Bernard & Russell, 2012). In the same context, Strauss and Corbin (1990) talks about three types of coding: open coding, axial coding, and selective coding. Based on Strauss and Corbin (1990), open coding is where data is broken down analytically, and axial coding entails connecting these categories with their subcategories. Finally, “selective coding is when the categories are gathered into one core category while all the other categories that need explanation are filled with detailed description” (Strauss and Corbin, 1990, p. 14).

As a result, we followed the data analysis process based on the work of Hasa (2017). The first step was the collection of data through interviews. Second was the review of the records and extraction of ideas and concepts that were classified by codes. Third, these codes were turned into concepts, then into categories and finally, these categories were the sources on which a theory was based (Hasa, 2017).
In this research paper, we will present our findings to reach the conclusion. The next part, an analysis of the data gathered from interviews and documents we received from LIU, will be presented.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Internal Efficiency</td>
<td></td>
</tr>
<tr>
<td>Benefit</td>
<td></td>
</tr>
<tr>
<td><strong>Intelligence</strong></td>
<td>• Save time</td>
</tr>
<tr>
<td></td>
<td>• Faster process</td>
</tr>
<tr>
<td></td>
<td>• More flexibility</td>
</tr>
<tr>
<td></td>
<td>• Improvement in gathering data</td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td>• Many alternatives</td>
</tr>
<tr>
<td></td>
<td>• More facts</td>
</tr>
<tr>
<td></td>
<td>• Open sources of information</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **Choice**                       | - Reliable facts  
|                                  | - Reliable information                                                      |
| **Implementation**               | - Easy spread of information                                                 |
| **Monitoring**                   | - Easy access to information  
|                                  | - Easy checkup, extraction and monitoring of information                     |
| **Reduced Operational Costs Benefit** |                                                                              |
| **Intelligence**                 | - Accessibility to information  
|                                  | - Manage much more data                                                      |
| **Design**                       | - Costs are reduced due to the information provided                          |
| **Choice**                       | - Information is increasing                                                  |
| **Implementation**               | - Information is spread very quickly                                         |
| **Monitoring**                   | - Easy access to decisions                                                   |
| **Reduction of Costs Benefit**   |                                                                              |
| **Intelligence**                 | - Much cheaper to have electronic information                                |
| **Design**                       | - Decreases costs of searching for alternatives                              |
| **Choice**                       | - DMP has sped up                                                            |
| **Implementation**               | - Easy to spread the information with reduced costs                          |
| **Monitoring**                   | - More informative decisions                                                 |
| **Staff Productivity Benefit**   |                                                                              |
| **Intelligence**                 | - Increases productivity in the information searching  
|                                  | - Short time in gathering information  
|                                  | - Advanced jobs for the staff                                                |
| **Design**                       | - More alternatives to choose from                                            |
| **Choice**                       | - Fast and flexible reporting                                                |
### 3.9 Validity and Reliability

Strategies that are implemented to evaluate utility and trustworthiness are important in a qualitative research paper (Morse et al., 2002), which means that both are important criteria to attain rigor in a qualitative study (Morse et al., 2002). Moreover, Lincoln & Guba (1985) wrote about trustworthiness that is composed of four elements: internal validity, external validity, reliability and objectivity. The four components are used to assess the qualitative data.

#### 3.9.1 Internal Validity

Credibility or internal validity is the first element of trustworthiness (Lincoln & Guba, 1985). Credibility requires the researcher to connect the research findings with reality to show the findings’ truth (Statisticsolution, 2018). Moreover, it shows the consistency between the participants’ views and the researcher’s presentation of the findings (Ryan et al., 2007). To have internal validity and credibility, we used a triangulation method. Triangulation methodology is the use of various data sources to understand the issue well (Patton, 1999 cited in Carter et al., 2014). Moreover, we used triangulation of data sources (Carter et al., 2014). In the research paper, first we collected data through interviews until we reached a saturation point, and we used some internal documents. In that way, we relied on multiple resources rather than a single data source.

#### 3.9.2 External Validity

Transferability or external validity means the results can fit outside the study field (Lincoln & Guba, 1985). According to Kalu and Bwayla (2017), the results of all good research can be applied generally and easily. Therefore, if research has external validity, its context should be described properly so the reader can generalize the findings and apply them externally (Cirt, 2018).

---

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| Implementation | - Easy access to decisions  
|             | - More flexibility and adaptability             |
| Monitoring | - Easy access to information  
|           | - Self-monitoring                              |

*Figure 20: Coding Table*
In our research paper, we applied “rich, thick description,” which entails providing a rich description of the participants, setting and themes (Creswell & Miller, 2009). The aim of the “rich, thick description” was to provide readers with a detailed description of events and people involved to establish credibility from the reader’s perspective (Creswell & Miller, 2009).

As a result, we provided detailed descriptions of the interviewees. Moreover, we provided deep descriptions of the findings. Additionally, in our analysis, we provided some quotes from the interviews to make our work rich.

3.9.3 Reliability

Reliability means the consistency with which the findings could be repeated or replicated (Cirt, 2018). Reliability, or dependability, also refers to the information’s stability over time (Lincoln & Guba, 1985). However, Silverman (2016 cited in Kalu & Bwayla, 2017) argued that reliability is difficult to predict in a changing world. This was also true in our case. The study was replicable but the findings were different due to changing technology.

As a result, to make our findings reliable, we used “audit trails.” According to Creswell and Miller (2009), “In establishing an audit trail, researchers provide clear documentation of all research decisions and activities. Through this process of documenting a study and a review of the documentation by an external auditor, the narrative account becomes credible” (p. 128). In our research paper, we made a chronological order of the data collection and analysis processes.

3.9.4 Objectivity

Objectivity means how research findings were supported by data collection when examined by others (Cirt, 2008). Moreover, to show the research paper’s conformability, a detailed description of the research process should be provided (Kalu & Bwayla, 2017). Therefore, in our research paper, we used “rich, thick description,” as previously explained. We provided a detailed description of the research approach, research process, research design, sampling methodology and data collection and analysis. In doing so, we provided a clear vision of the process we followed.

3.9.5 Ethical Considerations

Some ethical issues must be considered throughout the research process such as respect for
persons (Scott, 2017). In a qualitative research study, the researcher should consider transparency in the way the research is conducted, especially when dealing with participants (Kalu & Bwayla, 2017). Therefore, in our thesis, we informed every interviewee about the interview’s purpose via email and then again during the interview. We also asked all interviewees whether they preferred that we use their full names or just their first names. Moreover, we asked for permission to record the entire interview.

By showing respect for the participants, we made our research more credible and ethical.

Chapter summary
The aim of the research paper was to answer the research problem. For this reason a theoretical framework was developed. The research method was composed of qualitative data using a single case study which was LIU. Moreover, the interviews and internal documents were the means through which the data was collected. The analyzed data was coded with the help of Nvivo software. After the codification, we will fill in the theoretical framework as an answer to our research paper.
4. Findings

This chapter represents our findings from the collected and analyzed data.

4.1 Business Intelligent System at Linkoping University

BI leverages critical information from the whole value chain for better decisions (Avosys, 2016). At LIU, the BI system provides an easy way to handle various administration systems, such as HR and accounting and to get more information, which interviewee 1 mentioned. He said that “BI is an essential system through which it becomes easy and fast to look for information and to shape it.” Second, it is used in decision-making, which interviewees 2, 3 and 7 mentioned. In that context, interviewee 7 said that “BI is a sort of system to collect data from different sources in order to present an indicator of the business (financial or other) or to ground decisions.” Third, it is a system where data from various sources are gathered and combined to serve the department needs. Interviewee 3 claimed that the “BI system takes different data in different ways and put it together in a friendly way.”

Overall, the BI system at LIU plays an important role in handling various administration systems, such as HR and accounting. Furthermore, it helps with decision-making, which means that it helps in the presentation of the needed data because it serves as a thorough generator of information from various data sources.

4.2 Positive Effect of Business Intelligence on Decision-Making

At LIU, the BI system is beneficial in many ways: First, it speeds up data gathering. According to interviewee 1, the BI system “helps to get data from different departments and it helps to package information easily.” Interviewees 1, 3 and 7 agreed that the system improves the quality of decisions. Regarding that matter, interviewee 7 said that “managers can rely on good information in order to make difficult decisions.” It also provides multiple users access to the same data at the same time as interviewees 4 and 7 stated.
In summary, and regarding decision making, the BI system helps the university speed up data collection for decisions. Moreover, the quality of decisions is improved due to the quality of information that is provided. It is a system that provides users access to necessary information, wherever they are.

4.3 Decisions Before the Implementation of the Business Intelligence

Decisions were made before the BI system’s implementation by the university board (interviewee 6), and according to interviewees 3 and 6, the information provided was based on the data that was saved in computers as everybody has his or her own way to save data. Finally, decisions were made without any detailed data (interviewee 1) and were based on previous decisions (interviewee 2).

4.4 Decisions After the Implementation of the Business Intelligence

After the BI system’s implementation, the information provided was more reliable (interviewee 7). Second, decisions were driven from the system (interviewee 1). Moreover, the information provided for decisions was gathered and summarized in the BI system (interviewees 3 & 4). However according to interviewee 2, relying on history is the basis of decision making and the BI system is a tool that facilitates gathering the needed data. Moreover, interviewee 6 said that “decision making is not changing at the university because decisions take time.”

In summary, some controllers stated that the BI system initiates change regarding decision-making, data reliability and the method of gathering and summarizing information in the BI system. The dean of the Faculty of Arts and the controller of the Faculty of Medicines stated that BI facilitates information gathering for decisions.

4.5 General Use of the Business Intelligence System

The BI system has many uses at LIU. It is used in multiple departments and at multiple decision-making levels. First, it is used to collect and gather data for reporting (interviewee 1). Second, it is used to follow up on decisions according to interviewees 3 and 7. Moreover, interviewee 2 said that as a decision maker, she is not using the BI system but she is receiving the information from controllers.

Consequently, the BI is an important system at LIU that is used to collect and gather data for decision makers and a follow up system that provides decision makers the needed information from the controllers.
3.9.5 The Use of Qlikview

Based on the interviews that were conducted, Qlikview is the BI tool that is used at LIU. It has many uses at the university. First, it is used to develop applications regarding the department’s needs (interviewee 1). Second, the HR department and the administration use it to follow up the number of students (interviewee 4). Third, it generates various reports combines data from various sources and generates one report, as interviewee 6 stated.

According to the BI management plan at LiU (2018), Qlikview is a supporting tool of the BI systems that is used for planning and follows up. It consists of Qlikview Server and Qlikview Publisher. It is also a decision support tool that is used to simplify research and complete follow-up in various departments. LIU uses Qlikview to take data from the information system. In the same context, Qlikview contains many applications its users can develop.
Between 2016 and 2017, the number of Qlikview users increased, as shown in figure 20.

As a decision support tool, one of Qlikview’s functions is to provide decision makers with needed information and knowledge. As a result, the BI tool is used first in research and education. Second, it is present in the process of supporting activities where statistics are required for decisions. Moreover, it is used in the planification department. Figure 21 explains further where Qlikview is used.

As an operations support system, Qlikview is a BI tool that contains various applications developed by its users, which means that it can be developed into applications according to decision-making needs. Moreover, with Qlikview, one can choose to view data either as a set of statistics or as graphs.

Other BI tools further support decision-making at LIU. Figure 22 shows a clear picture of the applications used with Qlikview and other BI tools.
Figure 23: Qlikview and Other BI Tools at LiU and Some Examples of Their Applications (Internal document from Liu).

The Information Technology Support System

Figure 24: Current Data Sources for Qlikview and the Sources for Rapport.liu.se.
The Information Technology department at the university manages operations in Qlikview’s two servers. Qlikview’s management and development take place in the finance and planification department. Ladok sources are managed externally. Moreover, the sources that are managed internally are HR Primula and Raindance. Consequently, support from data sources administrators is required in the development of new Qlikview applications.

5. Discussion

This chapter presents a discussion about the findings results and theoretical framework. It also presents a summary of the interviews.

5.1 The Power of Business Intelligence Benefits Over Decision-Making Process

According to Simon (1997) and Huber (1980), the DMP includes five steps: the search for information, the choice between alternatives, the choice of decisions, the implementation of decisions and the monitoring of decisions.

- Faculty of Arts and Human Science: Interviewee 1

Internal proficiency benefits and DMP:

In the phase of searching for and gathering information, the BI tools speed up the process of gathering data. It is more flexible and it saves time. For the choice of alternatives, there is a general understanding of the process. In the decision-making phase, the BI system provides models and graphs for decision makers. In the implementation phase, the BI system clarifies why decisions are made and their possible consequences.
**Staff productivity:**

For staff productivity, the BI system speeds up the process of searching for information and makes the reporting more flexible.

**Reduction in the cost of effective decision-making:**

The process of decision making is sped up, and in DMP all users are more informed about decision making.

**Reduced operational costs:**

Costs of operation are not greatly reduced because they are not measurable.

- **Faculty of Physics Biology and Chemistry:** Interviewee 5

  **Internal proficiency benefits and DMP:**

  Regarding the DMP’s internal proficiency, the BI system is used to gather information and compare periods to make a choice. The BI system is also used to make information more accessible to everybody and to monitor decisions.

**Staff productivity**

For staff productivity regarding the DMP, the BI system changed the staff’s productivity regarding their ability to search for information, and produce many options. Furthermore, the combination of many applications, enables users to make a choice and search for suitable decisions. The monitoring of decisions is much more efficient as the system provides its users access to the necessary information.

**Reduction in the cost of effective decision-making:**

The cost of decision-making was reduced due the availability of various electronic data. It becomes easy for everybody to implement decisions and to follow up on decisions.

**Reduced operational costs:**

With the presence of the BI system, operational costs were reduced due to data’s accessibility. Therefore, the user can manage more data. Second, because of the open accessibility, the user can have various data in one file, making it easier to make a decision that leads to reduced costs.
**Faculty of Medicines: Interviewee 6**

*Internal proficiency benefits and DMP:*

The BI system facilitates information gathering. It enables users to find multiple choices but it doesn’t help them make decisions, which would necessitate another process. The BI system is not used to implement decisions rather it provides access to monitor decisions.

*Staff productivity:*

The BI system has made the staff more efficient in data gathering in a short time and allows staff members to present a monthly report on decision follow-ups.

*Reduction in the cost of effective decision-making:*

The BI system reduces time costs in gathering information and presenting to decision makers.

*Reduced operational costs*

The BI system does not change operation costs.

- **Faculty of Education: Interviewee 7**

*Internal proficiency benefits:*

With the availability of information, the BI system has made the use of information more efficient. The BI system also provides many alternatives for better and more efficient decisions. Overall, the BI has changed the implementation of decisions and the way to follow-up on those decisions.

- **University administration: Interviewee 2**

*Internal proficiency benefits:*

The BI system has changed the data gathering process, as it provides many options. To make decisions, users rely not only on the BI system but also on past decisions. Moreover, with the BI system, more people are informed about decisions.
- **Staff productivity:**

  Use of the BI system has increased staff productivity in the entire DMP.

- **University Administration: Interviewee 3**

  **Internal proficiency benefits:**

  In the DMP, the use of the BI system has made the internal process more beneficial, and it has increased staff productivity. Moreover, with the BI system, the university has been able to save money on decision-making and operational costs.

- **University Administration: Interviewee 4**

  **Internal proficiency benefits:**

  The use of the BI system has changed the time it takes to collect and summarize data, and it has presented more alternatives to choose from. Therefore, decisions can be made based on facts. Concerning the implementation and monitoring of decisions, the BI system has provided employees access to the data and allowed them to extract and follow up on those decisions.

  **Staff productivity:**

  BI has changed how employees perform advanced jobs and more complex jobs than basic data collection. It has increased their adaptability and flexibility in implementing decisions and it has developed their sense of self monitoring when they follow up on decisions.

  **Reduction in the cost of effective decision-making:**

  The BI system has saved time in the information gathering process. It has also decreased the costs of looking for alternatives and of following up on various decisions and their outcomes.

5.2 The influence of Qlikview on Decision-Making Process

According to the interviewees 3, 4, 5 and 7, Qlikview reduces time spent gathering information. In summary, Qlikview fills various functions upon which university personnel rely. Although it doesn’t directly impact the DMP, it supports it.
### 5.3 Summary of the Interviews

- Faculty of Arts and Human Science: Interviewee 1

<table>
<thead>
<tr>
<th>General questions</th>
<th>Interviewee answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information about the BI system at LIU and its benefits</td>
<td>BI is an easy way to handle various administration systems, such as HR and accounting. BI is essential because it makes information searches fast and easy, and it is an easy way to shape information.</td>
</tr>
<tr>
<td>Positive effect on decision-making</td>
<td>It speeds up the time data gathering process by helping users get data from various departments. It also packages information easily. The quality of information is increasing rapidly. The use of information in decisions boosts the system’s ability to make the information more useful</td>
</tr>
<tr>
<td>Decisions before the BI’s implementation</td>
<td>Decisions were made without any detailed data</td>
</tr>
<tr>
<td>Decisions after the BI’s implementation</td>
<td>More decisions are and will be driven from the actual system.</td>
</tr>
<tr>
<td>The use of BI systems in DMP</td>
<td>It is used mainly in collecting and searching for data and reporting for the decision makers. The dean is not using the system but she knows that a system exists, that she can ask open questions about the faculty and that the system, will provide answers.</td>
</tr>
<tr>
<td>The uses of Qlikview</td>
<td>Controllers use Qlikview to develop applications related to the accounting and HR systems. Qlikview is user driven and is used to create applications based on the department’s needs.</td>
</tr>
<tr>
<td>The influence of Qlikview on DMP</td>
<td>The accounting application is an example of an influence on decision-making.</td>
</tr>
</tbody>
</table>

LIU Administration Office: Interviewee 3

<table>
<thead>
<tr>
<th>General questions</th>
<th>Interviewee answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information about the BI system at LIU and its benefits</td>
<td>The system takes data and puts it together in a friendly way to help decision makers.</td>
</tr>
<tr>
<td>Positive effect on decision making</td>
<td>It allows a quick start in looking for information. It provides all users access to the information.</td>
</tr>
<tr>
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</tr>
<tr>
<td>Decisions before the BI’s implementation</td>
<td>Decision makers were using Excel sheets and data mining.</td>
</tr>
<tr>
<td>Decisions after the BI’s implementation</td>
<td>Data mining is unnecessary, as the Information is already gathered and summarized</td>
</tr>
<tr>
<td>The use of BI system in DMP</td>
<td>Normally it is part of various processes. It is a part of small and large decisions Moreover, it is the background of some reports.</td>
</tr>
<tr>
<td>The uses of Qlikview</td>
<td>It is a program like Excel that manages extensive data and it is used for bookkeeping.</td>
</tr>
<tr>
<td>Qlikview’s influence on DMP</td>
<td>The influence occurs during information gathering.</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Faculty of Physics Biology and Chemistry: Interviewee 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>General questions</td>
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<tr>
<td>General information about the BI system at LIU and its benefits</td>
</tr>
<tr>
<td>Positive effect on decision making</td>
</tr>
<tr>
<td>Decisions before the BI’s implementation</td>
</tr>
<tr>
<td>Decisions after the BI’s implementation</td>
</tr>
<tr>
<td>The use of BI system in DMP</td>
</tr>
<tr>
<td>The uses of Qlikview</td>
</tr>
<tr>
<td>The influence of Qlikview on DMP</td>
</tr>
</tbody>
</table>
### Faculty of Medicines: Interviewee 6

<table>
<thead>
<tr>
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<th>Interviewee answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information about the BI system at LIU and its benefits</td>
<td>Not answered</td>
</tr>
<tr>
<td>Positive effect on decision-making</td>
<td>Not answered</td>
</tr>
<tr>
<td>Decisions before the BI’s implementation</td>
<td>It works more with Microsoft Excel.</td>
</tr>
<tr>
<td>Decisions after the BI’s implementation</td>
<td>Decision-making is not changing. At the university, changes take time.</td>
</tr>
<tr>
<td>The use of BI system in DMP</td>
<td>Management members do not utilize the tool but they get the information from the controllers.</td>
</tr>
<tr>
<td>The uses of Qlikview</td>
<td>It gathers information from the finance and HR departments. With Qlikview, one can combine the gathered data. It provides access to reports already completed by others.</td>
</tr>
<tr>
<td>The influence of Qlikview on DMP</td>
<td>Calculations are made in more efficient time. The quality has to be verified. No risk is involved because the university has a skillful developer</td>
</tr>
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</table>

### Faculty of Education: Interviewee 7

<table>
<thead>
<tr>
<th>General questions</th>
<th>Interviewee answers</th>
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</thead>
<tbody>
<tr>
<td>General information about the BI system at LIU and its benefits</td>
<td>BI is a kind of system used to collect data from different sources in order to present an indicator of the business (financial or other) or to ground decisions. It is an information technology-based system that puts information together to present it in an appropriate way.</td>
</tr>
<tr>
<td>Positive effect on decision making</td>
<td>One has access to the same data throughout the organization and they are constantly evolving. It gives managers a good basis for decision making. The most positive thing I can see is the transparency it provides the public sector, and the sense of security that decisions are well founded. Managers can rely on good information in order to make difficult decisions</td>
</tr>
<tr>
<td>Decisions before the implementation of the BI</td>
<td>Not answered</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Decisions after the implementation of the BI</td>
<td>The similarity between different parts of the organization has increased, since everybody has access to the same information. The reliability of the data is better, since it is harder to manipulate data to avoid showing certain things.</td>
</tr>
<tr>
<td>The use of BI system in the DMP</td>
<td>It is used to present statistics and trends in order to plan activities and necessary changes. Then we use confirmed data to evaluate results afterward.</td>
</tr>
<tr>
<td>The uses of Qlikview</td>
<td>Qlikview is a system that collects data from the administrative systems and presents reports and statistics afterward. It is used to get information about student volumes, and personnel costs and to collect financial data from the time before 2017, since we implemented a new economic information technology system that doesn’t have historical data loaded</td>
</tr>
<tr>
<td>The influence of Qlikview on the DMP</td>
<td>Decisions are more well-grounded and have a higher quality than before. Also, decisions are easier to follow-up with afterward.</td>
</tr>
<tr>
<td>General questions</td>
<td>Interviewee answers</td>
</tr>
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<td>-------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>General information about the BI system at LIU and its benefits</td>
<td>It is an easy way to gather information and become more informed for decision-making</td>
</tr>
<tr>
<td>Positive effect on decision-making</td>
<td>There are no changes after using BI systems.</td>
</tr>
<tr>
<td>Decisions before the implementation of the BI</td>
<td>It relied on the history of decisions</td>
</tr>
<tr>
<td>Decisions after the implementation of the BI</td>
<td>The decision regarding the budget for example is a mixture of history. Looking into the year that proceeds and the information statistics are very important. We rely much on the past history.</td>
</tr>
<tr>
<td>The use of BI system in the DMP</td>
<td>I’m not just using the BI system to receive the Information</td>
</tr>
<tr>
<td>The uses of Qlikview</td>
<td>Qlikview is not used to buy decision makers such as deans; rather, they see the results from the system that are represented in figures and diagrams. Compared to other companies what comes from systems like Qlikview is not that transparent because we saw many economic data. It has an influence on the process of decision-making.</td>
</tr>
<tr>
<td>The influence of Qlikview on the DMP</td>
<td></td>
</tr>
<tr>
<td>General questions</td>
<td>Interviewee answers</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>General information about the BI system at LIU and its benefits</td>
<td>It is an easy way to get information, rather than going to the host system such as the business system or HR. It is easy to present things and understand the information</td>
</tr>
<tr>
<td>Positive effect on decision making</td>
<td>Decisions will be better if there is a lot of information present.</td>
</tr>
<tr>
<td>Decisions before the implementation of the BI</td>
<td>Not answered</td>
</tr>
<tr>
<td>Decisions after the implementation of the BI</td>
<td>More information is available and it is easier to make decisions.</td>
</tr>
<tr>
<td>The use of the BI system in the DMP</td>
<td>The system is used to know how many students the university has and to know how much money the university receives from the government. It is easy to follow the number of students for example and to make decisions. It is a good way to follow-up on decisions.</td>
</tr>
<tr>
<td>The uses of Qlikview</td>
<td>Qlikview is used for HR, business administration, students and so on.</td>
</tr>
<tr>
<td>The influence of Qlikview on the DMP</td>
<td>It is a user-friendly system, a combination of data sources and it is easy to distribute information. Moreover, time is reduced and risks are reduced because we have more facts. For quality, there are more correct figures and data sources.</td>
</tr>
</tbody>
</table>
### Power of BI Benefits Over DMP

Faculty of Arts and Human Science: Interviewee 1

<table>
<thead>
<tr>
<th>Decision-Making Process</th>
<th>Intelligence phase</th>
<th>Choice of alternatives phase</th>
<th>Choice of decision phase</th>
<th>Implementation phase</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal proficiency benefits</td>
<td>It saves time. It is a faster and flexible process. It takes data from the accounting system and changes the structures to provide new ones. It reduces the administration</td>
<td>It is one way to get better information. It is an open source for decision makers.</td>
<td>It presents different kinds of models that can be produced with the existing processes. BI gives us an idea of how our accounting system functions.</td>
<td>It might help people to understand why decisions are made and where they may lead. BI is not promoted with the top management.</td>
<td>Not answered</td>
</tr>
<tr>
<td></td>
<td>costs. It matches data from the HR system and the accounting system</td>
<td>It speeds up the process of reporting and it influences its flexibility</td>
<td>Not answered</td>
<td>It changes the speed and the flexibility of reporting</td>
<td>Not answered</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>--------------</td>
<td>----------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Staff productivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction in the cost of effective decision-making</td>
<td>Not answered</td>
<td>Not answered</td>
<td></td>
<td>The actual DMP is somewhat sped up. The changes are not big.</td>
<td>There is no change.</td>
</tr>
<tr>
<td>Reduced operational costs</td>
<td>It is not possible to measure the reduced operational costs.</td>
<td>The costs was not reduced.</td>
<td></td>
<td>Costs are reduced to some extent.</td>
<td>Not answered</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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# Faculty of Physics Biology and Chemistry: Interviewee 5

<table>
<thead>
<tr>
<th>Internal proficiency benefits</th>
<th>Decision-Making Process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intelligence phase</strong></td>
<td><strong>Implementation phase</strong></td>
</tr>
<tr>
<td>The system is used to gather information and to compare between years</td>
<td>Not answered</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Staff productivity</th>
<th>Before the system, the staff has more</th>
<th>No idea</th>
<th>In the system, it is easy to</th>
<th>It is much more efficient.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Reduction in the cost of effective decision-making</th>
<th>Wherever the users are, they are able to access to the information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information was hand written, not every body have the access to the same document</strong></td>
<td><strong>alternatives to choose between and this is due to the system</strong></td>
</tr>
<tr>
<td><strong>Reduction in the cost of effective decision-making</strong></td>
<td><strong>access to the decision that was done and organize decisions</strong></td>
</tr>
<tr>
<td><strong>Much cheaper to have the electronic information</strong></td>
<td><strong>No idea</strong></td>
</tr>
<tr>
<td><strong>There was a reduction of costs</strong></td>
<td><strong>Easy to spread the information with a reduced cost</strong></td>
</tr>
<tr>
<td><strong>There was a reduction of costs</strong></td>
<td><strong>There was a reduction of costs</strong></td>
</tr>
<tr>
<td><strong>I have no figures in mind but it is reduced. With the accessibility , a person can manage much more data.</strong></td>
<td><strong>I think it is Reduced with the accessibility to the information when the information is gathered in one file , it is a reduction of costs</strong></td>
</tr>
<tr>
<td><strong>There was a reduction of costs</strong></td>
<td><strong>There was a reduction of costs</strong></td>
</tr>
</tbody>
</table>
## Decision-Making Process

<table>
<thead>
<tr>
<th></th>
<th>Intelligence phase</th>
<th>Implementation phase</th>
<th>Choice of decision phase</th>
<th>Implementation phase</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal proficiency benefits</strong></td>
<td>It is easy and fast</td>
<td>It is easy to find alternatives by combining Data</td>
<td>The system does not help that much because it will be another process</td>
<td>We do not use Qlikview to implement decisions</td>
<td>It is easy to monitor when there is Easy access to Data</td>
</tr>
<tr>
<td><strong>Staff productivity</strong></td>
<td>The system has changed the staff’s productivity. The staff becomes more efficient in gathering data in a short period of time</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>It is represented in the presence of A Monthly Report</td>
</tr>
<tr>
<td><strong>Reduction in the cost of effective decision-making</strong></td>
<td>Time efficient</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>To spend time here and there, we save Costs</td>
</tr>
<tr>
<td><strong>Reduced operational costs</strong></td>
<td>No change</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not Answered</td>
</tr>
</tbody>
</table>
### Faculty of Education: Interviewee 7

#### Decision-Making Process

<table>
<thead>
<tr>
<th>Intelligence phase</th>
<th>Implementation Phase</th>
<th>Choice of decision phase</th>
<th>Implementation phase</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal proficiency benefits</strong></td>
<td>One thing I can define is the relation between the amount of students and the funds received to complete the courses we provide. This relation determines how much time the teachers can give to the students, for example. This also leads to more efficient use of our classrooms etc. (reduce costs), to give the students as much time as possible instead</td>
<td>Here I would like to say that the more reliable information we have as a basis dares the managers to make the necessary decisions that can be difficult. It is often necessary to make such decisions to achieve an effective organization</td>
<td>The implementation of decisions is more influenced by culture, composition of people, etc. I’m not sure BI has the effect that you would like.</td>
<td>The system reminds us about follow-ups</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Staff productivity</th>
<th>Not answered</th>
<th>Not answered</th>
<th>Not answered</th>
<th>Not answered</th>
<th>Not Answered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in the cost of effective decision-making</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
</tr>
<tr>
<td>Reduced operational costs</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not Answered</td>
</tr>
</tbody>
</table>
## University Administration: Interviewee 2

<table>
<thead>
<tr>
<th>Decision-Making Process</th>
<th>Intelligence phase</th>
<th>Alternatives phase</th>
<th>Choice of decision phase</th>
<th>Implementation phase</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal proficiency</td>
<td>Helps the organization to</td>
<td>Many alternatives are</td>
<td>We not only use data from</td>
<td>A short time that I hold this</td>
<td>It is the budgeting</td>
</tr>
<tr>
<td>benefits</td>
<td>react for improvement by gathering information and providing data</td>
<td>shown</td>
<td>Qlikview to make decisions but also from the history to make decisions more transparent.</td>
<td>responsibility. We are more informed about the information needed</td>
<td>which do the follow-up on how things are working</td>
</tr>
<tr>
<td>Staff productivity</td>
<td>It increases the staff productivity</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
</tr>
<tr>
<td>Reduction in the cost of effective decision-making</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
</tr>
<tr>
<td>Reduced operational costs</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
</tr>
</tbody>
</table>
### University Administration: Interviewee 4

<table>
<thead>
<tr>
<th>Decision-Making Process</th>
<th>Intelligence phase</th>
<th>Implementation phase</th>
<th>Choice of decision phase</th>
<th>Implementation phase</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal proficiency benefits</td>
<td>It came with a change</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
</tr>
<tr>
<td>Staff productivity</td>
<td>More productivity</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
</tr>
<tr>
<td>Reduction in the cost of effective decision-making</td>
<td>Reduction of costs</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
</tr>
<tr>
<td>Reduced operational costs</td>
<td>We could save money</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
<td>Not answered</td>
</tr>
</tbody>
</table>

### University Administration: Interviewee 3

<table>
<thead>
<tr>
<th>Decision-Making Process</th>
<th>Intelligence phase</th>
<th>Implementation phase</th>
<th>Choice of decision phase</th>
<th>Implementation phase</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal proficiency benefits</td>
<td>It saves time and summarizes the results and data</td>
<td>There are more chances to choose alternatives</td>
<td>People who are following up with students can decide with regard to courses and so on. It is more based on fact and not guessing. Thus, it is more objective than subjective</td>
<td>Instead of spending time, users know the results from using Qlikview.</td>
<td>We extract and check through the BI system.</td>
</tr>
<tr>
<td>Staff productivity</td>
<td>People have time to do an advanced job for the data collection instead of just doing the basics. People can do more complex tasks.</td>
<td>Not answered</td>
<td>Same answer for internal proficiency</td>
<td>Adaptability and more flexibility</td>
<td>Self-monitoring. People perform their monitoring themselves</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>-------------------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Reduction in the cost of effective decision-making</td>
<td>Time is saved in looking for information</td>
<td>Decrease the costs in searching for alternatives. Alternatives are based on facts</td>
<td>Not answered</td>
<td>The follow-up of different decisions such as following up on the outcome of the finance department.</td>
<td></td>
</tr>
<tr>
<td>Reduced operational costs</td>
<td>It saves time.</td>
<td>Not answered</td>
<td>The information is increasing</td>
<td>Not answered</td>
<td>Not answered</td>
</tr>
</tbody>
</table>
The results have shown that for the internal proficiency benefit, in the whole process of decision-making, the data gathered from the system enable users to save time, to get more data and to have an easy spread of and access to information. Comparing the outcomes to the literature, the results are similar. The authors (Azvine et al., 2006; Watson & Winxon 2007; Hocevar & Jaklic, 2008) agree on the fact that BI is a system wherein users can understand, capture and access data.

As far as the reduced operation costs are concerned, the results showed that the information is increasing with reduced costs. In comparison with the literature, Eckerson (2003) state that with the use of BI system, there are tangible and intangible benefits represented in cost savings. Moreover, Isik et al. (2013) talk about value and profitability.

For the reduction in costs, the results showed that with the use of the BI system, there is a reduction in costs with regard to collecting data and choosing between alternatives. When compared to the literature, there are similarities. Williams and Williams (2003), Turban et al. (2011) and Eckerson (2003) stated that the use of the BI system increases the revenue and reduces costs. In the same context El Bashir et al. (2008) talk about productivity enhancement as the cost reduction.
As far as the staff productivity benefit is concerned, the results showed that productivity is increasing throughout the DMP. In comparison with the literature, we found similarities. Turban et al. (2011), Eckerson (2003), and Hocevar and Jaklic (2008) talked about work efficiency.

6. Conclusion

In this chapter, a concluding analysis and an answer to the thesis research question are provided. Moreover, a suggestion for future studies and the limitations confronted while dealing with the research paper are presented.

The aim of the research paper is to answer the question, “How have BI benefits changed the DMP at LIU?” Most of the sources used claim that the BI system has an influence on the DMP in general with a limited research on its influence on HEI. Our research at LIU revealed that the BI system benefits have a positive influence on the DMP. Qlikview as a BI tool enhances this change.

On the one hand, BI is an important system at LIU that is used to collect and gather data for decision makers and as a follow-up system. On the other hand, Qlikview acts as a developer of applications, a follow up system and a generator of data.

6.1 Answers to the Research Question

How have BI system benefits changed the DMP at LIU? The analysis part showed that the BI system and Qlikview as a BI tool are beneficial to LIU’s DMP.

The changes that occurred include the following: The amount of data collected in a short time, the availability of multiple information, the reliability of data and reporting for decision makers, cost reduction and efficiency and the access to information by all the users.
6.2 Thesis Contribution and Implications for Future Practice

The research paper will contribute to the theory as follows:

The study is new as it is related to LIU. It studied the changes that have occurred in the whole process of decisionmaking, and the theoretical framework can be used for further studies in the domain of HEI in Sweden or elsewhere.

For the implication for future practice, the thesis shows the benefits of implementing the BI system in an organization and especially in the HEI sector. As a result, organizations can take this thesis as an example of how the use of BI will bring many benefits.

6.3 Suggestion for Future Work

Throughout the interviews that we conducted, we found that the BI system at the university is a system through which developers develop many applications according to the needs of departments. As an example, Raindance is a financial system that was integrated into the university in January 2017. Another investigation can be made for the Raindance system and its power and usefulness toward finance and economics. Moreover, a quantitative method to collect data can provide further insight into how the BI system influences the DMP at the university.

6.4 Limitations

This work contains some limitations. First, the thesis is based on a single case of LIU that is situated in Sweden. As a public institution, the study was based on higher education in the public sector. Second, the thesis talks about the BI system as a mixture of technical functions. In the thesis we talked about the BI architecture but not with a deep explanation regarding its technical functionalities and the focus was on its functions regarding the DMP. Third, we did not talk about a special type of decision; rather, we talked about the process of decision-making as a whole. Moreover, the study is limited to one Swedish university.

The problem that we faced during our research is that the internal documents were in Swedish with no available translation. Moreover, some questions of the interview were not answered by the interviewees. Moreover, some decision makers did not answer our request for an interview, whereas others excused themselves due to their full schedules.
7. List of References


BI management plan at LiU (2018): Internal document from LIU.


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Online from: http://pediaa.com/what-is-research-design-in-qualitative-research/.

[Accessed: 12 May 2018].


8. Appendices:

Questionnaire:

Can you tell us something about yourself? (Name, job position, tasks, background, etc.) General questions:

1. How can you define business intelligence?
2. For how long has the company been using business intelligence?
3. How many employees have access to the information from the business intelligence system?
4. Is there any business intelligence system that the faculty uses?
5. If yes what is it and from when it has been used?
6. Can you describe how decisions were taken before the implementation of business intelligence?
7. Can you describe how decisions are made after the implementation of business intelligence system?
8. How does the company use business intelligence in the decision-making process?
9. What are the benefits of business intelligence for the university?
10. What are the positive effects of business intelligence for the decision-making process?

Questions for the decision-making process and the business intelligence benefits:

**Internal efficiency benefits**

- Q1: How have the internal efficiency benefits of business intelligence changed the process of gathering and searching for information?
- Q2: How has the internal efficiency benefits of business intelligence changed the development of alternatives?
- Q3: How has the internal efficiency benefits of business intelligence changed the choice of decisions?
Q4: How has the internal efficiency benefit of business intelligence changed the implementation of decisions?

**Q5: How has the internal efficiency benefits of business intelligence changed the monitoring for decision-making?**

**Staff productivity benefit**
- Q6: How has the staff productivity benefit of business intelligence changed the process of gathering and searching for information?
- Q7: How has the staff productivity benefit of business intelligence changed the development of alternatives?
- Q8: How has the staff productivity benefit of business intelligence changed the choice of decisions?
- Q9: How has the staff productivity benefit of business intelligence changed the implementation of decisions?

- Q10: How has the staff productivity benefit of business intelligence changed the monitoring for decisions?

**The reduction in the cost benefit**
- Q11: How has the reduction in the cost benefit of business intelligence changed the process of gathering and searching for information?
- Q12: How has the reduction in the cost benefit of business intelligence changed the development of alternatives?
Q13: How has the reduction in the cost benefit of business intelligence changed the choice of decisions?

- Q14: How has the reduction in the cost benefit of business intelligence changed the implementation of decisions?

- Q15: How has the reduction in the cost benefit of business intelligence changed the monitoring for decision-making?

The reduced operational costs benefit

- Q16: How have the reduced operational costs benefit of business intelligence changed the process of gathering and searching for information?

- Q17: How have the reduced operational costs benefit of business intelligence changed the development of alternatives?

- Q18: How have the reduced operational costs benefit of business intelligence changed the choice of decisions?

- Q19: How have the reduced operational costs benefit of business intelligence changed the implementation of decisions?

- Q20: How have the reduced operational costs benefit changed the monitoring for decision-making?