JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL
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Business Intelligence

The impact on decision support and decision making processes

Bachelor's thesis in Informatics

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Abstract

Introduction
Historically, decision support systems have been used in organizations to facilitate better decisions. Business Intelligence has become important in recent years because the business environment is more complex and changes faster than ever before. Organizations have started to realize the value of existing information in operational, managerial, and strategic decision making. By using analytical methods and data warehousing, decision support can now be used in a flexible way and assist decision makers in decision making processes.

Problem
Increasing investments in Business Intelligence indicate that it can bring value to organizations. Benefits such as the ability to access relevant and timely decision support when it is needed can be of tremendous value when the use of existing information has become more a question of survival or bankruptcy for an organization, than profit or loss. Thus, it would be interesting to see how decision support and decision making have changed in organizations after implementing a Business Intelligence system.

Purpose
The purpose of this thesis is to investigate if and how Business Intelligence has changed decision support and decision making processes.

Method
A deductive approach using a qualitative method has been used with semi-structured elite interviews. The thesis aims to investigate the manufacturing industry located in the Jönköping region in Sweden. The interviewed organizations are Husqvarna AB, Fläkt Woods AB, Myresjöhus AB, and Kinnarps AB.

Conclusions
Our analysis shows positive effects of Business Intelligence in organizations with improvements of decision support due to timeliness, accessibility, quality, and better control of organizational information. As improvements in decision support has occurred, decision making has become better. Complicated problems are now easier to interpret by decision makers. Our research also concludes that intuition still has a major impact in decision making processes.

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1 Introduction

In this chapter we introduce the reader to the phenomena of decisions and parts of the historical evolution of computerized support for decision making. We describe and problematize the phenomena of Business Intelligence and thereafter state our research questions and present the purpose of this study. We also delimit the problem, determine major stakeholders, briefly describe some other studies concerning Business Intelligence and some fundamental concepts.

The field of Business Intelligence (BI) has become a popular area in recent years as a new approach to gather and analyze data for business use. We believe there is a lack of research conducted within this field. Since we have an interest in the area of BI and the fact that the phenomena is fairly new, we believe we have a good opportunity to contribute with new knowledge within this topic. Werner (2007) argues that BI is one of the most popular areas for IT management to invest in, which makes BI an even more interesting topic.

1.1 Background

Humans have always been forced to make various decisions in different situations. Decisions can be very simple, without major impact and consequences, or be of a very complex nature, with a huge impact on millions of people. In organizations, managers have always been making decisions concerning operational, managerial, and strategic matters and these decisions can have an impact on the organizations' stakeholders, ranging from the employees to the government. Managers often try to predict and understand the outcome of different decisions they make. This could be extremely difficult because speculating in a future context is always a daunting task. However, a successful prediction can be very helpful in order to select the right decision to achieve the desired outcome or best alternative.

Already in the 1950s, organizations realized the potential of computers and they began to play an important role. Between the mid 1950s and the early 1970s, the use of computers and information systems (IS) in organizations grew tremendously but few of these systems had an impact on mangers' decision making. In the 1970s, new systems were developed to support managers in accessing relevant business information needed for decision making (Gorry & Scott Morton, 1989). These systems provided business managers with static, two dimensional reports without any analytical capabilities (Turban, Aronson, Liang & Sharda, 2007b). In the 1980s, the systems evolved and started moving away from static reports. Instead, focus was shifted to monitoring the organizations' progress and performance towards critical goals (Burkan, 1991). Organizations did not only need information systems to support their ongoing operations, they needed systems that could assist managers with value added information in their decision making processes (Fernandez, Labib, Walmsley & Petty, 2003). McNurlin and Sprague (2004) describe decision support systems (DSS) as a management information system (MIS) in conjunction with analytics. To be able to cope with the huge information flow, DSS have moved towards an attempt to create an intelligent DSS. This attempt provides a great promise to improve both individual performance and organizational performance and is designed to support, not replace human decision makers (Dalal & Yadav, 1992). The Gartner Group introduced the term BI in the mid-1990s but the concept has evolved from MIS, used to support reporting in the 1970s (Turban et al., 2007b). Today, the term BI is widely used when discussing support in organizational decision making, instead of traditional terms like MIS and DSS.

1.2 Problem Discussion

Today, the organizations' business environment is becoming more complex and changes faster than ever before. This generates pressures on the organizations and forces them to respond quickly. To be able to respond to these pressures in an appropriate manner, organizations have to make quick, operational, managerial, and strategic decisions, which can be of a very complex nature and may require timely and relevant information, data, and knowledge (Turban, Sharda, Aronson & King, 2007a). To be able to improve processes and create additional business value, organizations have started to realize the value of existing information. As a result of the increasing demand, the number of BI vendors and tools has increased substantially in the past years. Using analytical tools and data warehousing, BI is extracting and analyzing relevant information and making it accessible to the right member as a support in decision making processes. In this process, data is gathered from different systems, which leads to large amounts of organizational data. To support decision makers in their decision making process to make more informed decisions this data needs to be analyzed, distributed, and accessed by the right person, at the right time (Turban et al., 2007a). The number of implementations and organizations using BI has increased during the last years (Miller & Reinke, 2007). This might imply they have become more aware of the usefulness of business information. Turban et al. (2007a) argues that providing updated and accurate business information, which we address as decision support throughout this study, is more a question of survival or bankruptcy for an organization than profit or loss. BI's major benefit is the ability to access relevant decision support when it is needed. Based on this, it would be interesting to see how decision support and decision making have changed in organizations after implementing a BI system.

- How has decision support changed after a BI implementation?
- How has BI changed the way organizations make decisions?

1.3 Purpose

We will investigate if and how BI has changed decision support and decision making processes.

1.4 Problem Delimitation

To be able to generalize our study in one business sector, we will focus on one industry; *manufacturing*. According to Werner (2007) manufacturing organizations are currently one of the most frequent investors in BI. The region of Jönköping has a relatively high number of manufacturing organizations (SCB, 2005), therefore this region is appropriate for this study. This study will only focus on two aspects, decision support and how it is considered to have changed after a BI implementation. The second aspect is how decision making processes have changed after implementing BI. We do not intend to include anything regarding technical or human-computer interaction (HCI) aspects of BI.

1.5 Interested Parties

Organizations with an interest in implementing a BI system could gain understanding of how decision support and decision making have changed after BI implementations. Organizations that create and market BI systems may have an interest in seeing what the user experiences are and how the systems have affected decision support and decision making.

In the academic world, researchers and students with an interest in BI might find this thesis interesting when searching for new areas of research. Organizational managers could see how decision support has changed and therefore develop an understanding of BI and how it could affect their organization in the daily work and long-term planning.

1.6 Positioning

BI is currently a discussed topic in the Swedish business world (Werner, 2007). Exido (2007), a Swedish research analyst company, predicts a 14 percent increase in BI investments in Sweden for 2007. The global BI market is increasing at a similar rate. Gartner (2007) predicts the BI market in Europe, Middle East, and Africa (EMEA) to increase with 10 percent in 2007. Despite its popularity, Swedish research in this field is lacking. Our study will therefore be based mostly on American literature. We do not believe there are any major differences between BI systems in the US and Sweden and we therefore consider our choice of literature appropriate. However, we have found a few studies conducted in Sweden. Karlberg and Karlsson (2006) discuss BI from two perspectives, the concept and the phenomenon. Similar, Biberic and Hodell (2007) evaluate BI from a rational decision making model to understand how companies use BI. Olsson (2007) discusses the history behind BI and describes current and future BI trends from a business perspective. Dagman and Wigsten (2007) identify causes that constrain organizations to efficiently utilize a BI process and they discuss how to create higher efficiency in a BI process.

1.7 Definitions

Business Intelligence – Using data warehousing and analytical tools, BI is extracting and analyzing relevant information and making it accessible to the right member as a support in decision making processes.

Data Warehouse – Central storage of data to support decision making in organizations.

Decision Support – BI generated information supporting decision makers in decision making processes.

Decision Support Systems – Systems used to directly support specific decision making processes.

ETL – Extract, Transform and Load is the process of extracting data from different sources, converting it into an appropriate format and loading the data into a data warehouse.

Key Performance Indicator – A financial or non-financial measure of how well an organization is performing.

Management Information Systems – Information systems used to analyze and solve business problems.

2 Method

The data necessary to perform this study will be gathered through qualitative methods. The empirical findings will be collected from primary sources through in-depth interviews with selected organizations. Data from secondary sources will be collected from literature. The choice of methodology for this study will be presented and argued for below.

Goldkuhl (1998) argues a researcher who wants to develop knowledge must plan and design the process of acquiring knowledge. This process can be divided into two phases. The first phase is *planning and defining* and the second phase is *realization of the planned activities*. Development of knowledge starts when a researcher is interested in a phenomenon and wants to know more about this specific area. Based on this interest, preliminary research questions are formulated. The researcher thereafter tries to articulate pre-knowledge about the phenomena. This pre-knowledge in conjunction with other knowledge in the area helps the researcher to reformulate and determine the research questions. Thereafter, the researcher determines the demanded knowledge - what knowledge to develop. The demanded knowledge is the determinant of what strategy and what method to use to conduct the study (Goldkuhl, 1998). The major objectives in this research are to understand how decision support and decision making processes have changed after implementing a BI solution in an organization. Therefore, the research group needs to understand current literature about human and computer in conjunction in decision making processes. Our research questions are based on discussions in order to fulfill the purpose and give appropriate guidance of the thesis. The research questions have been affected, determined, and adjusted based on literature the group has studied.

2.1 Categorization of Knowledge

Determining what type of knowledge to develop is referred to as *categorization of knowledge*. Goldkuhl (1998) argues a researcher needs to determine what kind of knowledge to develop. This is a process to establish the value of the developed knowledge and to determine the appropriate strategy for the study. Goldkuhl (1998) presents different types of knowledge which are appropriate in different research situations. Deciding on a strategy is necessary to determine what type of knowledge to create and the chosen strategy should follow the categorization of knowledge (Goldkuhl, 1998). In this study explanatory knowledge will be created using an explorative strategy.

- *Explanatory knowledge* is an approach where the researcher explains why a phenomenon is in a certain manner and mention causes, foundations, reasons or prerequisites for the resulting relations. Often, explanatory knowledge means to test hypothesis but there are other cases as well. One approach within explanatory knowledge is to study effects which originate from a certain event (Goldkuhl, 1998).

- *Explorative strategy* is a research strategy where the researcher does not test hypothesis but is an attempt to get better knowledge within a specific area. This approach is likely to generate hypothesis (Goldkuhl, 1998).

To conduct this study in a suitable manner, the most appropriate type of knowledge is *explanatory knowledge*. One of the approaches within this type of knowledge is to study effects which originate from a certain event (Goldkuhl, 1998), in this case a BI implementation. The *explorative strategy* aims at generating knowledge within a specific area and since existing literature does not cover the intended research objectives we have to use the explorative strategy.

2.2 Method Approach

Holme and Solvang (1997) argue that explaining a phenomenon or a situation using theories is not always easy. Even though it is a complex task, it is necessary in order to create understanding and develop new theories. There are two approaches researchers use; *inductive* and *deductive* (Holme & Solvang, 1997). The two approaches are illustrated in figure 2.1. Using an inductive approach, the researcher collects empirical material. The empirical data is analyzed and generalized and new theories are generated from the generalizations. The deductive approach is more formalized. Unlike the inductive approach, it starts in theory where the researcher derives a testable hypothesis or a theoretical proposition. Through analysis of the collected empirical data, the hypothesis is accepted or rejected (Bailey, 1996).

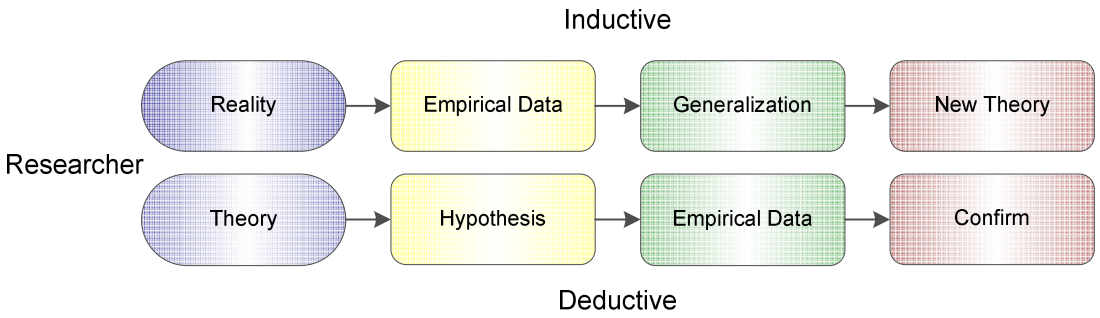

Figure 2.1 - The inductive versus the deductive approach

The thesis work will start with a comprehensive literature study, to familiarize ourselves with the concept of BI, systems for decision support, and areas related to decision making processes. From the findings in the literature study, we will develop our research questions and define the purpose of this thesis. The next step in our research process will be to gather empirical material through interviews with manufacturing organizations using questions related to existing theories. An analysis of the findings using these theories will follow and the results aim to provide answers to our research questions. Based on this description of planned activities, we argue that we follow the deductive approach.

2.2.1 Qualitative and Quantitative Research

The reality of today's society is of complex nature and it is impossible to seize the reality of this environment using only one method. There are two different categories of methods, *qualitative* and *quantitative* methods. Both methods have their strengths and weaknesses and the selection of which method to use should have its starting point in the purpose. The primary focus of qualitative studies is explanatory and implies less standardization. Creating a deep understanding of the study objects is one important feature of this method. The other important aspect is to describe the whole of the context. One characteristic of this method is to be close to the studied objects. Quantitative methods are characterized by a higher degree of standardization and they imply higher control for the researcher but also pre-determine possible answers. The planning and selection in quantitative methods is characterized by distance to the research objects (Holme & Solvang, 1997).

The qualitative approach generates an overall picture of social processes and contexts. Because of time restrictions and to be able to get an overview of the information, a limited

number of research objects are often selected. The qualitative approach also generates an understanding of the total situation. The strengths of quantitative methods are their ability to result in generalizable outcomes. The outcomes can lead to opportunities for the researcher to make statistical statements. There are some characteristics associated with these methods as well. Qualitative methods are flexible and the questions can be revised during the meeting with an object and can be changed during the study. This is both a strength and a weakness, since it can be difficult to compare the outcomes of different interviews. Quantitative methods on the other hand are fixed and cannot be changed during the study, it must be standardized. This gives the researcher control and the ability to generalize (Holme & Solvang, 1997).

To gain deeper understanding in how decision support and decision making have changed after an implementation of BI, a close interaction with the study objects is needed. This interaction will take place during personal interviews with a low degree of standardization. The objective is to get an overall picture of BI usage in manufacturing organizations, both how it is utilized and what that impacts are on decision making. Based on this, the qualitative approach was found to be the most appropriate for this study since we will focus on qualitative changes which have occurred after a BI implementation.

2.3 Data Collection

There are two different types of data, primary and secondary data. Primary data is information gather by the researcher using a certain method. Holme and Solvang (1997) argue that primary data is gathered when the researcher is close to the study objects and the interviewed object has experienced the situation itself. Secondary data is information gathered by other researchers in earlier studies (Lundahl & Skärvad, 1999; Holme & Solvang, 1997).

To gather information using qualitative methods four approaches are typically used. First, the researcher can participate in a setting. Secondly, a researcher can conduct a direct observation. The third and fourth approaches to gather information are personal interviews and analyzing documents and material culture (Marshall & Rossman, 1999). In this study we are going to use literature studies and conduct personal interviews.

2.3.1 Literature

When a researcher describes the context and history of a phenomenon, an important part of research work consists of reviewing documents. This approach can be seen as supplementary to other qualitative approaches to gather information. Research journals concerning the topic are one example if they are relevant for the study. One obvious drawback using literature in a study is the need for interpretation by the researcher (Marshall & Rossman, 1999). The sources used in this study have all been processed in a way suggested by Holme and Solvang (1997). They describe four steps to analyze a source; observation, source, interpretation and usefulness. In the first step, observation, the researcher tries to find sources which enlightens the questions determined in the problem discussion and also tries to get an overview of relevant existing literature. In the second phase, source, is important to determine who the author is to establish the source's trustworthiness. The third step, interpretation, deals with the problems of interpreting what the source describes and try to analyze the information. In the last step, usefulness, the researcher determines how useful the source is to fulfill the purpose (Holme & Solvang, 1997).

Since we will use a deductive approach in this study and have the starting point in literature it is of great importance to asses the sources used. The observation step was conducted

early in the study and the reliability of sources used are high since most of the literature used within the report are written by well-known writers or published in well-known research journals. The third and fourth steps are more problematic since we need to interpret what the author meant and determine how useful the information is. Hence, we believe to have understood the context and meaning of the literature and that it is applicable to the study. To fulfill our purpose we intend to use literature regarding BI, decision support, and decision making.

2.3.2 Personal Interviews

Interviews have, like most methods, strengths and weaknesses. Interviews generate large amounts of data quickly and the ability to follow up the result immediately. An interviewer needs participation and cooperation from the interview object, and a problem may be the interview object's unwillingness of answering all questions. The interviewer can also have problems when it comes to understanding a certain behavior because of differences in cultures, languages or the interviewer's lack of skill. The interview object can also have reasons for not being truthful (Marshall & Rossman, 1999).

One common approach to distinguish between interviews is the degree of standardization. If the questions have a high degree of standardization the questions and the order of the questions is the same for all interviews in the study. If the interview is unstandardized, the outlining of the questions is different from interview to interview but as long as the need for information is covered, this type of interview can be a good alternative. Many interviews are not either of these types, which can be seen as extremes, but somewhere in between these interviews types. Lundahl and Skärvad (1999) argue these interviews can be addressed as semi-standardized interviews. In semi-standardized interviews, the interviewer asks certain questions to all respondents and then asks attendant questions to get a deeper understanding. Unstandardized interviews are appropriate when the researcher conduct qualitative studies where the researcher wants to develop an understanding of a respondent's situation or its motives and ideas about a certain phenomena. Standardized interviews are appropriate when the researcher needs more quantitative data (Lundahl & Skärvad, 1999). We will use semi-standardized interviews since we want to cover certain question areas. However, we do not want to be tied to asking questions in a certain order and we want to be able to ask attendant questions to get a deeper understanding of BI usage.

In this report we will use what Marshall and Rossman (1999) addresses as *elite interviewing*. This type of interviewing aims at interviewing individuals with a certain amount of influence in an organization. The interview objects are selected based upon their knowledge or expertise in a certain area. Elite interviewing gives the researcher opportunity to gain valuable information because of the interview objects' position in the organization. They can also give an overview of internal and external relations as well as legal and financial aspects. There are problems with this type of approach. Elites can be hard to interview since they have limited time and the interviewer may be forced to adapt the interview based on the elites' wishes. To conduct a successful elite interview puts pressure on the interviewer to develop competence in related topics. However, if the interviewer is well-prepared, this type of interview generates quality information (Marshall & Rossman, 1999).

Using a tape recorder is desired to minimize the amount of notes and direct full attention to the respondent (Ritchie & Lewis, 2003). We intend to use a tape recorder during the interview since we do not want to miss important information. Bailey (1996) argues the researcher needs to explicitly clarify the use of tape recorder for the interview object and ask for its permission. One of the reasons to conduct a face-to-face interview is the possibility

to observe the body language of the respondent. Bailey (1996) claims this is very important. To be able to cope with the difficulties with elite interviewing we have studied a large amount of literature related to BI to be prepared for the interview situation. Time is an important issue and we intend to contact our interview objects early in the research process.

2.3.2.1 Outlining of Interview Questions

Lundahl and Skärvad (1999) argue that personal interviews build on confidence between the respondent and the researcher. Further, interviews should start with questions of less controversial nature. Holme and Solvang (1997) also presents this view on interviews but they also argue that the interview should end with unproblematic questions because this gives the respondent and the researcher time to neutralize tensions which may have occurred during the more controversial part of the interview (Holme & Solvang, 1997).

The outlining of the questions has been influenced by the authors mentioned above. The starting questions concern the respondent's background within the organization and what position they have as well as questions regarding the organization. These questions are general and easy to answer. This will be done to build a confidence between respondent and interviewer and the fact that position can influence the answers. After these opening questions, the interviewer will move on to BI and the questions asked will be based on the theoretical framework. The final questions will be of less controversial nature and we have decided to let the respondent speculate in the future of BI. When the interviews take place, the interviewers will always ask the questions like *how* and *why*. This approach was chosen to get a deeper understanding of each organization's specific view of their own BI system and to get a clearer picture of the respondents' thoughts about their BI system. We also believe when *how* and *why* questions are asked, respondents will give more comprehensive and detailed answers and richer descriptions of each question.

Before the interviews are conducted, we will send the questions to the respondents. This will be done so that the they can familiarize themselves with our research and prepare answers to our questions. There are drawbacks using this approach, such as the fact that respondents may prepare the answers they think we want to receive and we might not get spontaneous reactions to our questions (Thomas, 2004). We believe the answers will be more valid and more complete if the respondents get the opportunity to prepare.

2.3.3 Interpretation of the Empirical Findings

According to Fischer (2007), researchers often discover two contradicting problems when analyzing research material. The first problem is the *law of the missing middle*. Researchers who start writing their results right after collecting empirical material often miss out the intermediate stages of sorting and sifting and miss the line of argument. The second problem is the *dilemma of drafting*. Researchers never really understand their empirical material until they write it up. It is the process of writing that forces researchers to really understand the material. This implies an iterative process of sorting and sifting followed by writing (Fischer, 2007; Starrin & Svensson, 1994). These interpretations and understandings are based on knowledge and experience but also imagination and creativity. According to Starrin and Svensson (1994) this is legitimate when a researcher tries to interpret interview material.

To be able to cope with the huge amount of data we will gather during the interviews we have decided to only present and analyze the material which directly relates to the research questions and the theories presented below. After each interview we will listen to the recorded material once and then listen a second time to get a deeper understanding of the

context and the respondents' answers. During the second listening notes will be taken. The recording will be stopped and rewind several times to assure nothing important is left out. This to assure that the presented empirical material is correct and presented in the right context. To be able to compile the empirical findings in a sufficient text, where no important information is left out, we will take notes and divide the answers between our research questions. We have also chosen to present important quotes from the conducted interviews. We believe this approach will be helpful since we do not want to have too long texts with information not related to our research questions. The information presented in the empirical findings will not follow a chronological order, since we think that the interview questions will probably not always follow the intended outline. This is due to the fact that the respondents may answer questions before they are asked or the respondents might answer questions similar to other questions and therefore it will not be necessary to present these answers twice.

2.4 Selection of Respondents

Statistical generalizations are not central purposes within qualitative studies but nonetheless, the selection of respondents is an important process in the study. Since the purpose of qualitative studies is to create a deeper understanding of a phenomenon, the selection process is not random. The selected respondents must fulfill certain criteria which are theoretically or strategically determined (Holme & Solvang, 1997). We will base our selection of respondents on convenience sampling. There are drawbacks with this type of sampling. For example, Holme and Solvang (1997) claim conclusions from research based on convenience sample may be misleading. We argue we have good reasons for using convenience sampling since both the distances to the possible respondents and the time constraints will not allow us to conduct personal interviews to the same extent if we randomly select organizations from the entire population. The benefits of using convenience sampling exceed the drawbacks and we therefore argue that this approach is appropriate in this study.

To select respondents, the *Affärsdata* database will be used to search for manufacturing organizations. To limit the number of hits and only show manufacturing organizations, our searches will be filtered using Svensk Näringsgrensindelning (SNI) codes, which follow the *General Name for Economic Activities in the European Union* (NACE) standard. The appropriate SNI codes will be found using the search criteria "Manufacturing". We are only interested in manufacturing organizations in the region of Jönköping and therefore the results will be filtered by using Jönköping's län and Västra Götaland's län. Furthermore, we are only interested in organizations with more than 300 employees since we believe these organizations have been working with BI for a longer time. We also intend to only interview organizations with more than one year experience of using BI. We believe those organizations have matured in their usage and therefore contribute with more interesting aspects of how the organization has changed after the implementation. To be able to generate sufficient empirical findings we will interview between four and seven organizations.

2.5 Method Validation

A study should, to be trustworthy, have a high degree *reliability* and *validity*. Those two aspects have a close connection. Reliability is determined by how accurate the researcher has processed the information. Is the information the researcher presents reliable? Often there is no problem to determine in qualitative studies since the respondent can participate and give its opinion on how the researcher has interpreted the things the respondent described during the interview. Validity is dependent on what we will research and measure and if

that is clear in the purpose of the report. To gain valid information is easier in qualitative studies than in quantitative studies because the researcher is closer to the respondents and the respondent gets the opportunity to control its participation. One problem to get valid information is when the researcher does not understand what the respondent describes. It can also be hard for the researcher to determine whether to be active or passive during the interview. In different interviews it can differ in how valid information the researcher gains depending on being active or passive. Another problem can be the relationship between researcher and respondent. The respondent believes it should act in a certain way (Holme & Solvang, 1997). To be able to generalize a study is very important since the study should represent the reality and the result should be applicable to the entire population (Lundahl & Skärvad, 1999).

To deal with the problems regarding *reliability* we will assure we are well-prepared before conducting the interviews. Both the concept of BI and interview techniques will be studied. We believe when we know the concept of BI well, and the respondents realize this, they will give better and more advanced answers to our questions. After the interviews, we will compile the interview material and send it via email to the respondents to assure that the empirical material is correct and interpreted in the right context. We also believe this will solve any translation mistakes that might have occurred, since the interviews will be conducted in Swedish. *Validity* is harder to determine but since the interview questions clearly are adapted to the research questions we believe we have high validity. During the process of developing the interview questions we will have the difficulties concerning validity in mind and try hard to adapt the interview questions to fit the purpose of this study. Also, the selection of respondents will be carefully conducted. We will only interview respondents with extensive knowledge and insight in how BI works to increase validity. To be able to *generalize* our study we intend to conduct interviews until we have reached the point of sufficient knowledge which means very few new statements and thoughts regarding BI are discovered during the interviews. We will not be able to generalize our study for all industries in Sweden, but we believe generalization of the results from this study will be possible in one business sector; the Swedish manufacturing industry. Working with reliability and validity during the entire research process we believe will increase generalization of this thesis.

3 Frame of Reference

In this section we present some relevant theories for our study concerning Business Intelligence. We will also focus on describing what decision support is and different levels and aspects of decision making.

The connections between the theories in the frame of reference are shown in figure 3.1 and aims to clarify different parts in this chapter. It also illustrates different elements and the relationship between them. Gorry and Scott Morton's (1989) well-known framework for management information systems (MIS) , which is widely present in the literature, serves as the core base. Elements that are included to support this framework are; Anthony's (1965) description of managerial activities and Simon's (1960) decision making model and decisions.These parts are explained more in depth for a better understanding of the framework.

Eckerson's (2003) BI environment is used to give an understanding of BI and its components. It is divided into two parts, one technical side and one analytical side. The data warehousing environment contains data compiling from different source systems (also referred to as ETL), information quality, and a data warehouse (DW). On the other side, the analytical environment describes decision support which is the outcome of BI systems (Eckerson, 2003). Intuition has also been identified because it has a great impact in decision making processes (Hayashi, 2001). The final decision, made by a decision maker, is shown on the right side of the model.

BI is applied on top of Gorry and Scott Morton's (1989) framework. By doing this, we will analyze if BI has contributed to changes in decision support. We will also examine if BI has had any impact on organizational decision making from an operational, managerial, and strategic point of view.

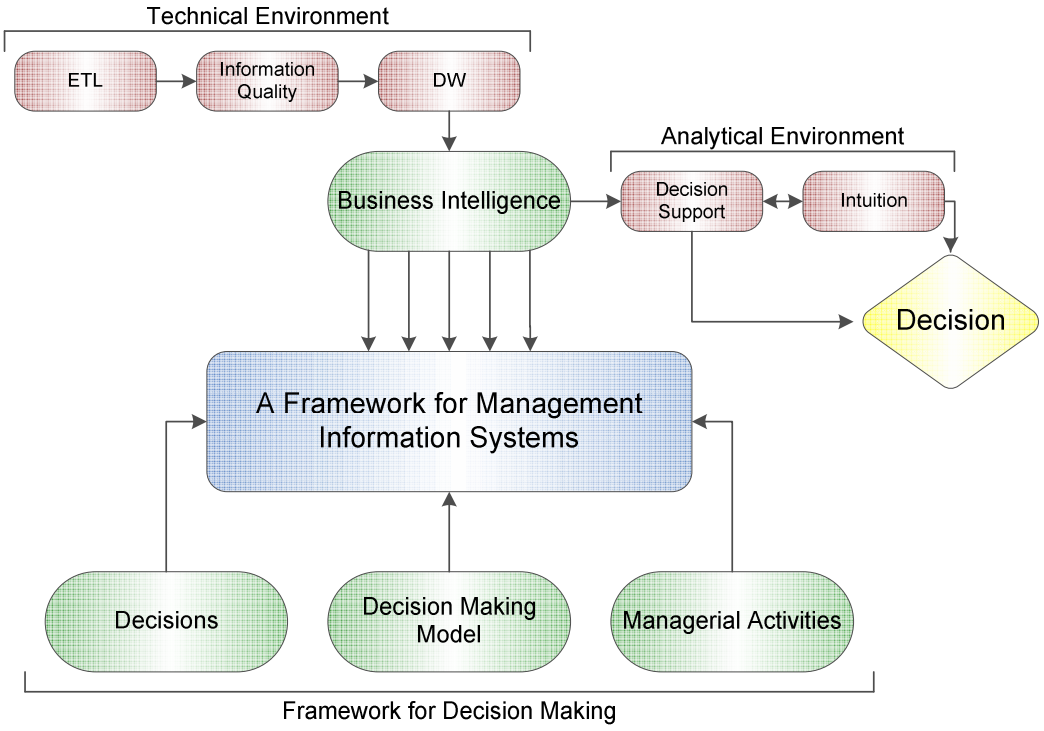

Figure 3.1 - The connection between theories in the frame of reference

3.1 Business Intelligence

Today, BI is used as an umbrella term for describing computerized decision support systems. However, BI evolved from DSS, a concept researchers started working on in the 1960s as computerized systems to assist in decision making and planning. As the development of new types of DSS continued, the scope of the concept expanded and branched into several different categories (Power, 2007). Power (2007) states that *data-driven DSS* involve access and manipulation of organizational, sometimes external and real-time, data. It could be simple files on a local machine or more advanced systems with additional functionality, such as a DW. These systems generally enable analytical functionality and analysis of historical data for support in decision making processes. *"In general, business intelligence systems are data-driven DSS"* (Power, 2007). The Gartner Group introduced the term BI in the mid-1990s (Turban et al., 2007b). However, Watson (2005) states that BI is the result of a continuous evolution. *"Just because it has a new name doesn't mean it is necessary new"* (Watson, 2005, p. 4). Davenport and Harris (2007) conclude the entire field of systems for decision support is referred to as BI.

However, Turban et al. (2007b) argue that BI evolved from DSS and their architectures have some similarities, but there are some differences between BI and DSS. First, BI is built with a DW and DSS do not need to include such a feature. BI is therefore better built to support larger organizations but DSS can support any organization. Second, BI is designed to support decision makers with timely and accurate information but indirectly while DSS is designed to directly support specific decision making. Third, BI was developed by software companies and DSS methodologies were mainly developed in the academic world. Fourth, BI is constructed to fit the organization and is constructed with commercially available tools while DSS targets unstructured problems and lots of programming is needed to support those complex problems. Fifth, BI focuses more on executive and strategic problems and DSS is constructed to support analysts. However, they are similar and consist of similar features such as data mining and predictive analysis. BI software has been changing and more decision support tools are built into the system. At present, BI and DSS are not the same but they have a close connection (Turban et al., 2007b). Based on the discussion above, we agree with Turban et al. (2007b) and consider BI and DSS similar but not completely the same.

The definition of BI is also heavily discussed in the literature. We have found four different definitions of BI. Eckerson (2003, p. 1) defines BI as *"BI solutions create learning organizations by enabling companies to follow a virtuous cycle of collecting and analyzing information, devising and acting on plans, and reviewing and refining the results. To support this cycle and gain the insights BI delivers, organizations need to implement a BI system comprised of data warehousing and analytical environments"*. In this definition Eckerson (2003) emphasizes collecting and analyzing data as well as using BI in an organization-wide setting. Eckerson (2003) has the only definition that includes data warehousing as the source for the data to be analyzed, which he claims to be crucial to gain the insights BI delivers. Bräutigam, Gerlach, and Miller (2006, p. 2) uses a similar definition but leave out data warehousing, *"Business Intelligence is defined as getting the right information to the right people at the right time. The term encompasses all the capabilities required to turn data into intelligence that everyone in your organization can trust and use for more effective decision making"*. Bräutigam et al. (2003) put emphasis on turning data into intelligence for all users in the organization to assist in more effective decision making. The third definition is from Turban et al. (2007a, p. 9), "*BI's major objective is to enable interactive access to data, enable manipulation of these data, and to provide business managers and analysts the ability to conduct appropriate analysis",* which has a lot in common with Eckerson (2003) and Bräutigam et al. (2003). Turban et al. (2007a) discusses both the analysis of data for different users, on different organizational levels and

the use of the output. Loshin (2003, p. 6) uses a somewhat different definition, *"The processes, technologies, and tools needed to turn data into information, information into knowledge, and knowledge into plans that drive profitable business action. Business Intelligence encompasses data warehousing, business analytic tools, and content/knowledge management",* leaving out the organizational aspect. Based on the characteristics of these definitions we have developed our own definition of BI:

*Using data warehousing and analytical tools, BI is extracting and analyzing relevant information and making it accessible to the right member as a support in decision making processes.*A BI systems involves four different components: A *DW*, which contains business data extracted from different sources in the organization; *business analytics* (BA), a collection of methods used to perform mining, manipulation, and data analysis; *business performance management* (BPM) which involves business monitoring and performance analysis; and finally *user interfaces* e.g., dashboards and reports (Turban et al., 2007b). Another dimension of the BI environment proposed by Eckerson (2003) illustrated in figure 3.2 show data sources that feed the BI system with appropriate data.

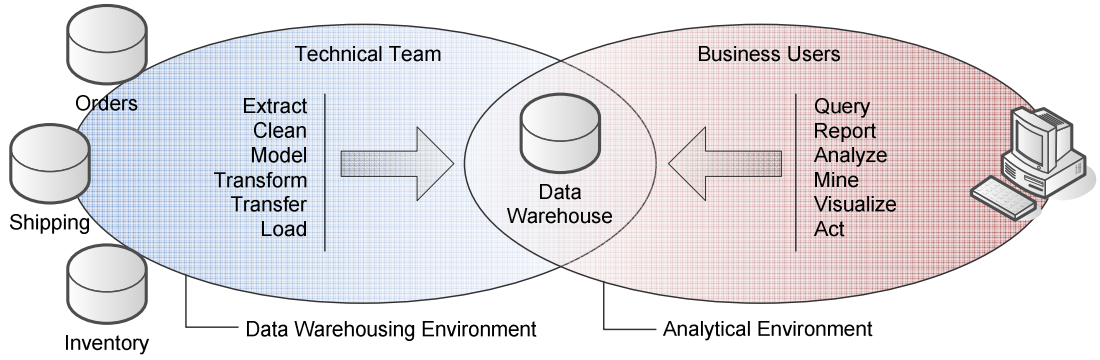

Figure 3.2 - The BI environment (Eckerson, 2003)

3.1.1 Data Warehousing Environment

The data warehousing environment shown in figure 3.2 in the left circle describes the BI environment from a technical point of view. Technical aspects such as retrieving information from different sources, the extract, transform, and load (ETL) process, and a DW (Eckerson, 2003). There are different sources that are used to retrieve data in order to feed the DW. Most commonly, data is sourced from multiple independent operational systems but also from external providers. It can also be retrieved from online transaction processing (OLTP) or an enterprise resource planning system (ERP). In some cases, even web data in the form of web logs is used to provide a DW with data (Turban et al., 2007a).

As a critical component in any BI, information quality plays a superior and important role. English (1999) asserts that there are two significant definitions of information quality, *inherent* and *pragmatic*. Inherent information quality is data accuracy and to what degree data represents the real-world objects. In contrast, pragmatic information quality is the usefulness and value of data used to support processes and enable organizations to accomplish their objectives. Based on the two perspectives, English (1999) defines information quality and describes the phenomena as *"consistently meeting knowledge worker and end-customer expectations"* (English, 1999, p. 10). In order to understand what information quality is, English (1999) asserts it is important to understand the concepts of data, information, knowledge

and wisdom. Data is basically raw material from which information is derived and it can be viewed as entities, attributes or facts. Information is when one knows the meaning of data and it becomes understandable. However, information quality in itself is useless, but understood, it leads to value for users. English (1999) describes that knowledge is when information becomes assimilated and has a meaning in a certain context. Wisdom is applied knowledge and an understanding how the knowledge can be applied in different settings (English, 1999).

The center of Eckerson's (2003) data warehousing environment consists of ETL processes, used to prepare the DW with useful and appropriate data. In ETL processes, *Extraction* concerns gathering information from different databases and systems. *Transformation* is the process where the extracted data are converted into a form which can be placed into a DW or another database. *Load* concerns putting the data into a DW (Turban et al., 2007b). The core of BI is ETL since the process brings together and combines data from multiple source systems into a DW. This approach enables all users to work with a single set of data referred to as *"a single version of the truth"* (Eckerson & White, 2003, p. 4). If the ETL process is well-designed and executed, the organizational information is stored in one central location and organizational members do not need to argue whether the information is correct (Eckerson & White, 2003). Therefore, organizations can use the information to improve key processes and as a competitive weapon. However, any issues regarding data quality need to corrected before loading the information into the DW. Poorly designed ETL processes are difficult and expensive to maintain, change, and update (Turban et al., 2007b). The ETL process must be carefully planned and highlight that this is a critical and important part since the ETL design and development work consumes approximately 70% percent of the time spend in a BI project (Eckerson & White, 2003; Turban et al., 2007b).

In the center of Eckerson's (2003) BI environment, a DW is placed in order to store data for decision support. The DW can appear as a number of smaller data marts consisting of data for a single subject or area. Another repository for data is an operational data store (ODS) with constantly updated data that is aggregated from business operations. One of the most common repositories used is an enterprise data warehouse (EDW) which is a large scale DW that is used for decision support across the entire organization. The main purpose of a DW is providing consistent, integrated, nonvolatile collection of data in supporting managers in decision making processes (Turban et al., 2007b).

3.1.2 Analytical Environment

The right side in Eckerson's (2003) proposed BI environment refers to business user activities with a non-technical approach. The DW is used to support decision-makers with information in different variances depending on types of area and use. Business users can visualize, query, report, mine, analyze, and most importantly act on data in the DW. In some cases, more advanced ad hoc (on-demand) exploration of the DW can be performed by business users (Eckerson, 2003). Business analytics can be based on basic exploration of data or more advanced analytical environments for qualified users (Turban et al., 2007a).

3.1.2.1 Decision Support

Visualization is used to make data more understandable and clear to end users. Decision makers can browse the interface and analyze data in real time and examine organizational performance data (Eckerson, 2003). Spreadsheets are one of the most common end-user tools and it is often supported by three-dimensional visualization tools. Dashboards and scorecards are two important components in business performance management (BPM)

systems, also called corporate performance management (CPM) systems. Both concepts have a broader context in which organizational strategy is included and BI is a part of. A dashboard can consist of key performance indicators (KPI) which are pre-defined measures critical and important to monitor. Scorecards are used to compare actual results with planned results, depending on pre-specified measures (Turban et al., 2007a).

Reporting can be divided into two categories, routine reports and ad hoc reports. Routine or standard reports are generated and distributed to relevant subscribers periodically. Further exploration of the data presented allows business users to perform analysis with methods such as drill-down in order to find problem areas. However, reports can also be performed ad hoc. Meaning that significant, specified, and relevant data can be compiled and retrieved by business users (Turban et al., 2007a).

In the analytical environment, methods for drill-down, data mining, and queries can be supportive for decision makers. Drill-down analysis is a process where the level of granularity will result in more detailed data, excluding irrelevant and unnecessary data. Data mining is used where reports and queries are inapplicable. The data mining process is used to discover patterns that are impossible to interpret by humans, that can be of relevance and guide decision making. Queries can be performed with structured query language (SQL) and retrieve specific information determined by business users (Turban et al., 2007a).

3.2 Decision Making Processes

In the wide range of different decision types, Simon (1960) distinguishes two extremes, *programed decisions* and *non-programed decisions*. The term program is borrowed from, and used in the same way as in the computer world (Simon, 1960). A program is essentially a list of instructions or strategies executed in a certain order (Schneider, 2003). Thus, programmed decisions are repetitive and routine. They follow definite processes or procedures which are well-known, defined, and do not have to be treated as new every time they occur (Simon, 1960). Examples of programmed decisions are: sending out invoices; reorder supplies; paying a vendor. Non-programmed decisions on the other hand are unstructured and unusually consequential. No best practice for handling the problem exists because the problem has not occurred before, the problem is of such complex nature, or the problem has such high importance that it requires additional attention and handling (Simon, 1960). The decision to move manufacturing abroad or outsource the IT department are typical non-programmed decisions. Simon (1960) points out how decisions exist in every shade of gray in this spectrum and programmed and non-programmed are simply the far extremes.

Although the scope and impact of a decision varies greatly from one level in the organizational to another Simon (1960) argues that some generalization is possible. According to Simon (1960), decision making includes four distinct phases. The first phase is finding situations for making a decision, *intelligence*. The second phase is referred to as *design*, where different courses of action are investigated. In the third phase, one of the available courses of action is chosen. Simon (1960) calls this the *choice* activity. The fourth phase is a *review*, in which previous choices are evaluated. These phases are illustrated in figure 3.3 below.

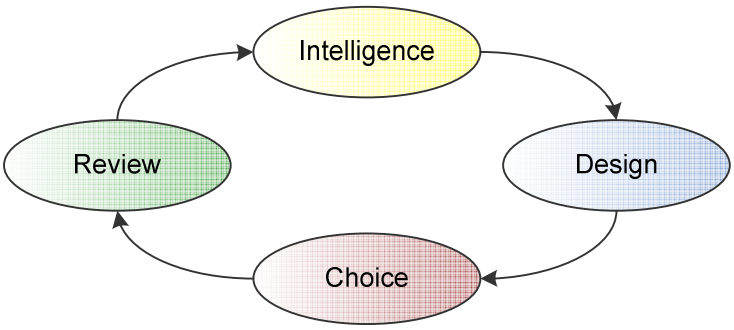

Figure 3.3 – The decision making model (Simon, 1960)

3.2.1 Managerial Activity

Anthony (1965) describes managerial activities in two different divisions, *planning* and *control*. The planning involves deciding what direction to take and the control means assuring that desired outcomes are obtained. Based on these two main divisions Anthony (1965) suggests three categories of managerial activities that he claims requires different approaches when developing systems. The first category *strategic planning*, involves the process of deciding objectives; changes for the objectives; resources needed for the objectives and policies that govern acquisition, use, and disposition of resources. *Management control* is the process in which managers assure that resources are obtained and used efficiently in order to achieve the organizational objectives. The third category *operational control* encompasses that specific tasks are carried out efficiently. The main difference between management control and operational control is that management control is concerned with people and operational control with tasks (Anthony, 1965).

3.2.2 Management Information Systems

Gorry and Scott Morton's (1989) framework for management information systems (MIS) suggest that such system is best used from a decision making perspective. MIS work does not always use a comprehensive approach, excluding organizational aspects that prevent full appreciation. This generates temporarily solutions and inefficient allocation of resources. The role of information systems in organizations is now focused on how systems can capture parts in the human decision making process. As a result, organizations have realized the potential of information systems, supporting sophisticated unstructured decisions (Gorry & Scott Morton, 1989).

The framework is based on managerial activities and should not be used to describe information systems. It is used only as a way to understand decisions made in organizations, information systems should only exist to support decisions (Gorry & Scott Morton, 1989). The framework (figure 3.4) illustrates Anthony's (1965) and Simon's (1960) in combination which provides two perspectives used to examine problems and purposes of information systems activity.

The left side represents Simon's (1960) programmable and non-programmable decisions. Gorry and Scott Morton (1989) call these two categories structured and unstructured decisions. The unstructured decision is where none of the three, intelligence, design or choice in Simon's (1960) decision making model (figure 3.4) is structured. The complete structured decision is where all three parts are structured and assists satisfactory decisions to be

made. Gorry and Scott Morton (1989) have added another dimension, semi-structured decisions that encompasses that one or two of the phases are unstructured. The conclusion is that above the horizontal line, largely structured decisions can be made with MIS. Decisions below the horizontal line are largely unstructured and supported by decision support systems (DSS) (Gorry & Scott Morton, 1989).

The top of Gorry and Scott Morton's (1989) framework (figure 3.4) represents Anthony's (1965) managerial activities. Strategic planning involves predicting the future of the organization, consisting of a small group of high-level people in a non-routine environment which makes it difficult to assess quality in planning processes. Management control involves interpersonal interaction often driven by the strategic planning process. The operational control category consists of execution of tasks, with less judgment and this is what distinct it from management control. It is important to be aware of that the distinction between operational control, management control, and strategic planning is difficult to determine (Gorry & Scott Morton, 1989).

Managerial decisions that are below the line have a greater impact on the organization because they normally deal with unstructured decisions. Improvements in understanding decisions will move the decision and it can be moved above the middle line and free up managers for other tasks. Structured decisions are as Gorry and Scott Morton (1989) describe them "organizational independent" which means they are almost the same in every organization although details may differ. As decisions become semi-structured or unstructured the absence of routine procedures and lack of formalization between the parts in Simon's (1960) decision making model increase. In order to improve quality of decisions it is important to have the right information input or change the entire decision process, or both. By improving quality of information input, quality of managerial decision making may increase. However, it will not have any major enhancements, since they rather need new understandings or methods, to understand the information that is already available (Gorry & Scott Morton, 1989).

Gorry and Scott Morton's (1989) implication of their framework suggest three different perspectives, system design differences, different organizational structure, and model differences considering Anthony's (1965) managerial categories in mind. The first, system design differences implies that since operational control and strategic planning have different objectives it is unnecessary to connect systems across boundaries since they do not have similar objectives. Secondly, organizational structure involves defining problems and must be dominated by managers involved in that specific area. Managers must also be analytical and reflective rather that procedural and communicative. Third, strategic decisions do not occur frequently and operational occur daily. This prove that models for decisions need to be different and work efficient, have access to current data, be structured, and be easy to change (Gorry & Scott Morton, 1989).

It should be mentioned that the activities within Gorry and Scott Morton's (1989) framework in figure 3.4 are only examples of different activities. The activities do not have anything to do with the framework and organizations can apply its own activities as they wish. In this study we will use the original activities as examples to provide an understanding on what the framework could look like, when used in an organization.

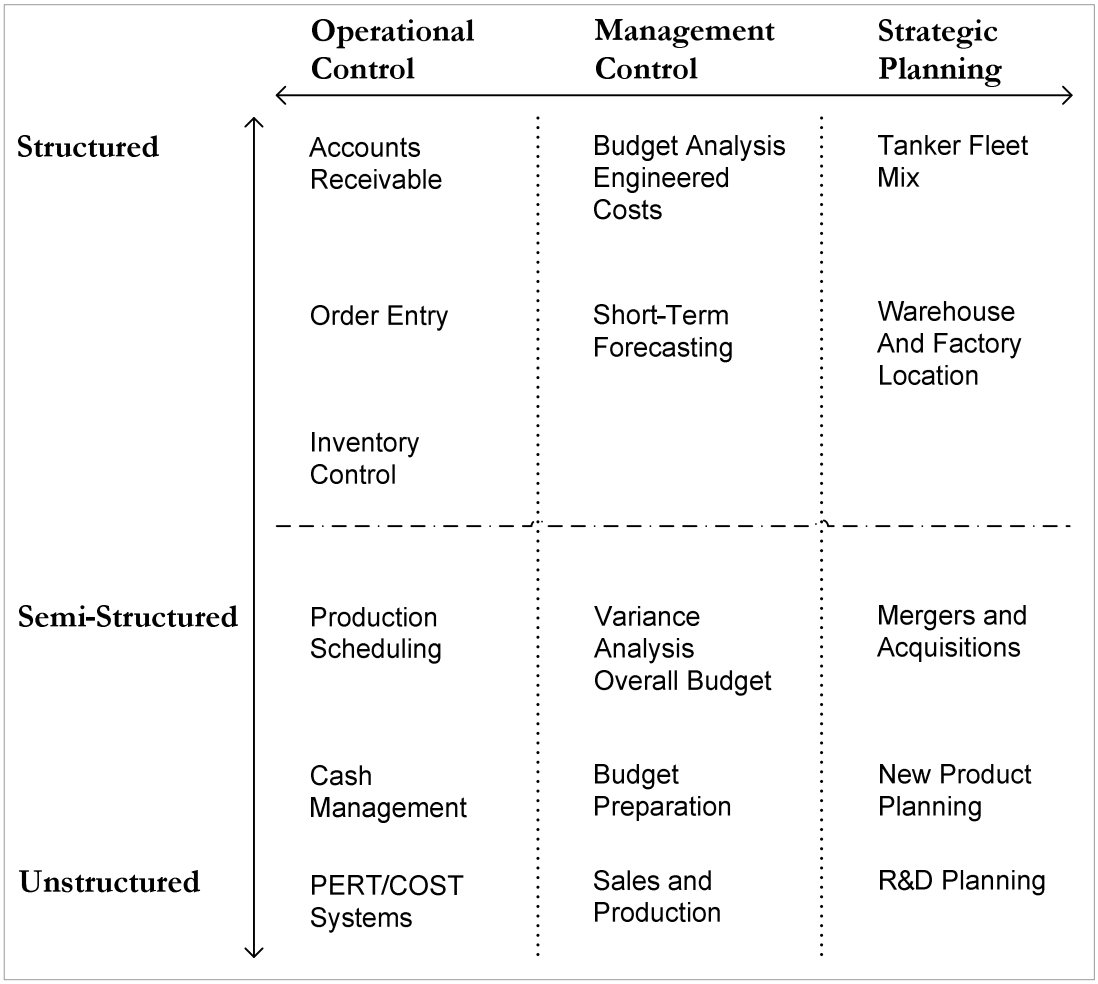

Figure 3.4 - A Framework for Management Information Systems (Gorry & Scott Morton, 1989)

3.2.3 Intuition

Decision makers are sometimes excluding any form of logical analysis or rely only on information. Instead, different modes, referred as "intuition", "inner voice", "gut instinct", or "hunches" are used but decision makers have problems explaining the phenomena more in detail. Emotions may be essential and supportive in order to filter various options quickly, even if decision makers are not consciously aware of the screening themselves. However, human nature can easily obscure by observing and recognize patterns where none exists (Hayashi, 2001). According to Hayashi (2001), humans use patterns to find a pattern and refers to Herbert A. Simon who proves that experienced people chunk information so they can retrieve and store it easily. This because experienced and experts have the ability to *"see patterns that elicit from memory the things they know about such situations"* (Hayashi 2001, p. 179). Hayashi (2001, p. 179) further explains the phenomena by quoting AOL's former president Robert W. Pittman *"Staring at data is looking at a jigsaw puzzle. You have to figure out what the picture is. What does it all mean? It is not just a bunch of data. There is a message in there. Every time I get another data point I have added another piece to the jigsaw puzzle, and I am closer to seeing the answer. And then, one day, the overall picture suddenly comes to me."*

Humans have to review themselves because they have a tendency toward overconfidence. This implies that humans overestimate their ability in just nearly everything. It is therefore important to find out if decisions and judgments were accurate, and the use of feedback

can be very important. Otherwise, we do not know if we made any mistakes and cannot learn or do anything about them. Because of this problem, it is very common that decision-makers use self-checking procedures to ensure that intuitive decisions are successful (Hayashi, 2001). Another common method for intuitive decision making is cross-indexing. This means that information can be combined from different sources. Hayashi (2001) state that the amount of material used and can be cross-indexed enhances intuitional process. In order to clarify Hayashi (2001, p. 181) refers to former CEO Michael Eisner of the Walt Disney Company who explains cross-indexing as *"When you see a gas station sign or a certain formation in the clouds"* intuition tells you something. Further on Eisner explains intuition as *"You use reams of historical information about yourself that you remember from when you were a child can pop into your mind. Gut instincts are the sum total of those experiences – millions and millions and millions of them. And that sum total enables you to make reasonable decisions."* (Hayashi, 2001, p. 183). Hayashi (2001) concludes that intuitive feelings guide our decision making to a stage until our conscious mind is able to make good decisions.

4 Empirical Findings

In this part of the study we will present the empirical findings. All information from the interviews will not be presented since the introduction questions are not relevant for the study. The main focus in this chapter is to cover the interview questions (Appendix 1) related to our research questions and the purpose of our report. We have conducted four interviews. Two interviews were conducted with system owners and the other two were conducted with people who work with IT management. Relevant part of the interviews will be presented below. After three of the interviews we got the opportunity to see the systems used and can therefore use this experience in our conclusion and analysis since we consider this as a relevant part of the empirical findings.

4.1 Husqvarna AB

Respondent and Position	Lennart Dorthé, CIO Jan Winblad, Application Manager – BI
Place and Date	Huskvarna, 2007-11-22

Husqvarna offers products for consumers and professionals within three main product areas: forestry, lawn and garden, and construction. With a presence in over 100 countries, Husqvarna employs more than 11,400 people world-wide. Their IT department, located in both Sweden and the US, is responsible for Husqvarna's IT in every operating area throughout the entire organization. IT is divided in application areas with global responsibility for that application or concept. Huqvarna uses a "best of breed" strategy and buys the system they think will fit the organization's needs best.

BI is nothing new in the Husqvarna organization. As one of the first organizations in Sweden, Husqvarna started working with extraction of operational data from different sources and systems to an environment optimized for analysis, the foundation of BI. The IT department first discovered the BI concept and saw the potential business value. They demonstrated it to a group of business users who became interested and wanted it implemented. Dorthé explains that they in the early stages focused on improving and streamlining supply chain processes, since these processes use units and quantities which are less complicated to deal with. The next step was to include financial processes in their BI solution, a more complex task with more factors to consider such as exact definitions of financial measures, fluctuating currencies, and bonuses for sales people. "*Providing decision makers with incorrect numbers that they use in their analysis and decision making is extremely dangerous"* Winblad explains. Dorthé points out that defining and agreeing on financial measures and KPIs is time-consuming and involves people all across the organization. Today, the most frequent users of their BI system are executives and controllers who use BI for strategic decision making. However, BI is also used in different supply chain functions to analyze optimal replenishment levels.

Further, Dorthé explains that BI has changed Husqvarna's business model. Before the BI system was implemented, reports were created throughout the organizations, in the factories and sales companies, a manual process that in some cases took up to three months to complete. Now, this data is refreshed once a day and some data is refreshed as many as seven times daily. Production line managers have even expressed their wishes for expanding the solution to show real-time data. Winblad claims that this is not needed in most situations. By analyzing financial information in the DW, top management gets a full picture of

how well different sales companies and branches perform. This makes it easier to help local branches and sales managers focus on certain areas, countries, or products with higher profitability. Using their BI system Husqvarna's executives can now follow long-term trends, which earlier was impossible.

One of the main objectives with Husqvarna's BI investment was to get everyone to "speak the same language". To be able to implement BI, sales companies world-wide were forced to decide on item codes. Earlier, the same item code could be used for a chain saw in one country and a lawn mower in another, which made item-level audits impossible and the decision support consisted of high level summaries without any ability to show details, Dorthé explains.

Dorthé claims that the information generated in the BI is correct, current, and relevant. However, both Dorthé and Winblad agree that the information from the BI will never meet everyone's needs. *"IT systems evolve and change and business users have new KPIs to track"*, Winblad explains.

Dorthé states that BI is limited to gather and show information but never make decisions for the user. The outcome depends on the person making the decision. *"The more useful information you have access to, the higher it the probability for making a better decision"* Dorthé claims.

Husqvarna's strategy is not to push data and reports to the business users using email, even though this functionality exists. Instead, they want users to use the system themselves to get the information they need in their job and make them aware of additional tools for deeper analysis. Dorthé claims that the BI system is used frequently and it has received great appreciation from the user community. One reason might be that the user friendly interface. *"In 10 years, BI is probably used by everyone throughout the entire organization"*, Dorthé says.

4.2 Fläkt Woods AB

Respondent and Position	Esbjörn Sjögren, Controller and System Owner – BI
Place and Date	Jönköping, 2007-11-22

Fläkt Woods is a global supplier of air solutions. They employ more than 3,000 people and have a local presence in 95 countries. In their Jönköping branch, Fläkt Woods has used computers in their business since the 1970s, mostly Manufacturing Planning Systems (MPS). A couple of years ago they started seeing a need for BI in their organization. Sjögren explains how business users needed help from IT or employees with advanced programming skills to run reports. The information was available in their system but it could only be accessed using SQL programming which most business users did not know. Also, having different users accessing data in the database without an appropriate user interface was not the best solutions since mistakes could easily be made in live production data. The production systems also predicted an increase in performance if the data was moved outside the system, into a DW, to facilitate data analysis. A BI system based on Microsoft's tools was implemented in the Swedish organization.

Fläkt Woods uses the BI system the way it was planned, within two main areas: finance and sales. However, Sjögren states that the marketing department uses some information from the BI. The BI assists business users to prepare financial statements and reports and in finding the root cause to errors and mistakes, such as incorrect margins, in situations where the specific order is unknown. The user interface enables fast access to the numbers and

time is saved when reports can be reused with data refreshed to show current numbers by pressing a button. Also, Sjögren explains that it is easy to drill-down among orders to find the one that is incorrect. The marketing department uses the BI system to see how well different markets perform. Predefined dimensions in the DW enable presentation of products sorted by time, units, or margins etcetera.

The information from the BI system is used all across the organization. The users know how much more information they have access to and that it can be compiled faster than before. Sjögren explains that some users now have higher demands for access to reports. They also have higher demand for detailed information such as sales numbers for specific products. Problems occur when the users accept the system generated numbers without challenging or critically examine them. Sjögren states that it does not matter if the system works well when the input is of poor quality. You could say *"garbage in, garbage out",* Sjögren explains.

Sjögren experiences the BI generated decision support relevant, correct, and up-to-date. The general data in the DW is updated every night, some data even more often. Access to the data is easy in the Excel-based environment the BI solution provides. However, Sjögren expresses the importance of data quality and the need for continuous work with quality assurance. *"With experience in your role, you develop a feeling for when the computer generated numbers are correct and when they are off"*, Sjögren explains. If the decision support lacks information or important numbers, you know where in the systems to get these numbers from. Since the BI system uses year to date (YTD) data, progressively build up during the year, analysis is limited during the first months of the year. *"If you only have one order to analyze, it is hard to know if the margin is right since it is based in limited information and statistical analysis is impossible",* Sjögren explains. The user selects the information to be displayed and Sjögren does not think the BI system provides too much information. "*However, if you select to have a lot of information displayed at the same time, of course it will be hard to work with"*, Sjögren concludes.

Even though the BI system provides business users with better decision support, Sjögren claims that intuition is used in all decision making. "*Decisions are made for future and the information in the BI system is historical information*", Sjögren states. As an example he uses the forecast, which always is slightly off. Taking this into consideration, the forecast is useful even though it is slightly off.

Fläkt Woods has realized the potential of BI and plans further investing in new functionality. Sjögren states that it could be graphically improved and include more features.

4.3 Myresjöhus AB

Respondent and Position	Lars-Göran Wiss, Manager, ERP
Place and Date	Myresjö, 2007-12-10

Myresjöhus employs more than 600 people in Sweden. They market, produce, and build smaller residential houses in wood for the Nordic market. The organization consists of two subsidiaries, Smålandsvillan and a company handling land, Myresjö Mark. Myresjöhus has used computer systems to improve their business for more than 30 years. The accounting and finance systems were the first systems to be implemented. In the early 1980s, the first production and manufacturing systems were introduced.

Wiss explains that the business users constantly need to know how well they perform. They are interested in total sales numbers, but also how total sales are divided between house sales and land sales. Management is interested in how well the organization and different sales offices perform. Myresjöhus' ERP had these numbers but it was difficult and time-consuming to collect them in reports. They needed a better tool to measure three critical indicators: *"How much do we deliver?",* "*What are our sales?",* and *"What is our backlog?"*. The solution was a BI system that was implemented during the first quarter of 2006.

The BI system provides good answers, faster, to all those questions. *"The main goal with the investment was to provide the business users with faster reporting"*, Wiss explains. Not only is the decisions support generated faster, the business users do not have to rely on Excel to the same extent as they used to. All the source systems feed the DW with data and it is easy to see when something is incorrectly entered into the system.

The decision support generated in the BI system is easy to understand and use. Depending on position in the organization, the BI system is used differently. Some users, such as employees within sales, use the system daily. Other functions, such as management, use it more on a weekly basis. Wiss explains that the most users use the improved reporting functionality. "*Experienced users tend to use the drill-down capabilities more"*, Wiss explains. Since the implementation, no one has expressed any complaints.

Wiss claims that the system is used the way it was planned. However, some functionality and reports have been added that was not planned for such as automated tracking of the number of errors completed houses have, which should be zero. Some users have requested to change the time between receiving reports, which is easy for the system owner. The information in the DW is refreshed every night which, according to Wiss, is enough. "*It is more a question of business user not being able to enter the numbers in to the source systems fast enough*", Wiss explains.

It is hard to say whether the business users make better decision today compared to before the BI system was implemented. However, decision makers have access to better decision support, faster, and the information is more complete. With more complete information, decisions that earlier were unstructured now are more structured. However, decision support has a great impact on decision making but is only a support.

Wiss states that in the future, BI could help improve manufacturing processes. *"It is a question of maturity. The users understand that they can get more information from existing systems which results in new requests and higher demands"*, Wiss explains. However, Myresjö has no plans in further investing in BI at the moment. Focus is to build on the current system and improving and adding reports. Further, Wiss states that it is important to get more users to use existing BI tools, not only the reporting functionality.

4.4 Kinnarps AB

Respondent and Position	Pierre Condradsson, IT Manager
Place and Date	Kinnarp, 2007-12-13

Kinnarps is one of the largest suppliers of office solutions in Europe. Their headquarters, along with five factories, are located in Sweden. Kinnarps employs 2,000 people and they are present in 34 countries. They started working with computer systems in the early 1970s. During that time they also implemented their first ERP system. In 1996, Kinnarps imple-

mented a new ERP system. The new system worked very well with Kinnarps' business processes but had a poor user interface and the reporting capabilities were even worse, which created a need for a complementing tool for analysis and reporting. In 1998, Kinnarps started working with Cognos and together they implemented a BI system.

Kinnarps has a horizontal organization and they always try to have as much decision making as far down in the organizations as possible. Conradsson states that BI plays an important role in enabling this and the BI system is used throughout the entire organization. *"BI is used in different functions from financial reporting for top management and CFO, to associates working in production, to sales statistics sales in different sale companies",* Conradsson explains. According to Conradsson, the BI system is used in every business process, including sales, production, supply chain as well as finance and accounting.

Earlier, business users could look at the same numbers but see different values. This was in many cases due to timing, which was an issue before the DW was implemented. Having a single version of the truth makes it easier to agree that the decision support is correct. The decision support generated in the BI system is current thanks to daily updates in the DW, which is frequent enough for the organizational needs. However, production associates have requested more frequent updates and in some cases, information is extracted straight from the source, the ERP system, into the BI system.

After the implementation of the BI system, the need for decision support changed. Users now know that improved decision support is available and new requirements and needs have arisen. *"Better tools for analysis and reporting have led to increased need for better decision support"*, Conradsson explains. Also, the BI system has enabled top management to monitor how the organization performs using new KPIs. Conradsson claims that more decisions are made based on solid facts compared to before the BI system was implemented. Business users and top management want to know underlying causes to business problems and understand cause-effect correlations, something the BI system has made possible.

Conradsson states that most employees have a feeling for when numbers are off. *"The numbers generated by the BI system are double checked on a regular basis to make sure that decision makers have as correct decision support as possible"*, Conradsson explains. The BI system enables presentation of information from different sources in both tables and graphs, which is easier than finding the number in different source systems. Another improvement is the system's ability to present number aggregated. Conradsson believes the BI system will never be completed. *"The BI system is constantly improved and extended as new systems are implemented in the organization and demands for new needs and KPIs arise"*, Conradsson explains.

Conradsson claims that the decision maker makes the final decision. However, the BI system enables efficient and continuous reporting, which allows business user or top management to agree on certain actions when different KPIs are met. *"This is an increasing phenomenon, especially in the sales organization. I believe this is related to the improved information sharing, which makes it easier to set up rules such as 'If the discrepancy is this much, this person makes the decision. If the discrepancy is larger, this person makes the decision'"*, Conradsson explains.

Conradsson states that the need for analytics will increase in the future. *"Being able to find patterns in data and understanding what impact 'this change will have on that'"*, Conradsson explains. However, no further investments are planned. Conradsson explains that their BI environment is very flexible and scalable. The only BI related investment would be more licenses as subsidiaries are integrated and more and more users start using the system.

4.5 Summary of Empirical Findings

All the interviewed organizations use BI extensively. They explain how BI provides them with correct and updated data. Decision making has become easier when everyone has access to the same data, something that was a problem before the implementation. With one centralized data source, the data quality has improved and so has control. Also, it is easier to access decision support when users do not need to search in multiple source systems to find relevant information. Organizations report better decision support and new opportunities to use data, that has been available before but not accessible, easier and faster. The improved analytical capabilities have made it easier and faster to find problem areas and errors. New functionality, such as drill-down and aggregation of data has made presentation of data better and easier. Decisions have become more structured due to more complete information. Making strategic decisions are complicated since more unstructured variables influence such types of decisions. The organizations all agree that humans are involved and influence decision making, in the end humans make the final decision. The BI investments are seen as on-going processes. All interviewed organizations reported they will increase their use in the future.

5 Analysis

In this chapter, we apply the theories presented in the frame of reference on our empirical findings to find differences and similarities. The chapter is divided in two parts, one for each research question.

To not lose focus during the analysis, we have divided this chapter into two sub-chapters, which aim to answer one research question each. In each sub-chapter, our frame of reference will help us reflect over and discuss our empirical findings. The first sub-chapter, decision support, concerns the research question; *"How has decision support changed after a BI implementation?"* and the second sub-chapter, decision making processes, concerns; *"How has BI changed the way organizations make decisions?"*.

Using theories and empirical findings in an iterative process, we will analyze reoccurring statements and try to find similarities and differences between interviews. We will first study our empirical material and then use theories from our frame of reference to try to explain the phenomena. During this iterative process, we strive to better understand the empirical findings and add our own reflections and thoughts. This process is illustrated in figure 5.1.

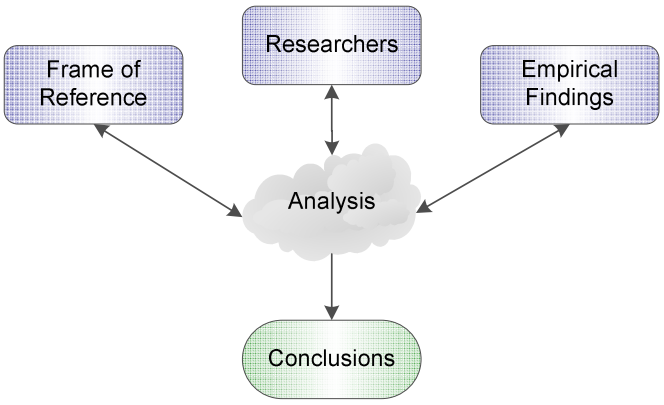

Figure 5.1 - Analysis model

5.1 Decision Support

Eckerson's (2003) BI environment consists of two parts, the DW environment and the analytical environment. The data warehouse environment consists of ETL processes, which combine data from multiple source systems, to prepare the DW with useful and appropriate data. Comparing this to our empirical findings, we have found that organizations run this process at least on a daily basis. However, if necessary, the ETL processes feed the DW several times a day since decision makers may need current and updated decision support. For example, Winblad (J. Winblad, personal communication, 2007-11-22) explains that some data in Husqvarna's DW is refreshed as many as seven times daily. Our opinion is that the more often data is updated, monitoring organizational performance and acting upon abnormal variation becomes easier.

A DW enables users to work with a single set of data. Eckerson and White (2003) refers to this as a single version of the truth. The results from the conducted interviews show that organizations use this approach. Conradsson states that having a single version of the truth makes it easier to agree that the decision support is correct (P. Conradsson, personal communication, 2007-12-13). Similar, Husqvarna's main objectives with their BI investment was to get a common data set for decision support through a DW (L. Dorthé, personal

communication, 2007-11-22). However, we think it is important for organizations to have clear procedures and guidelines for external data collection, such as what source to get current exchange rate from, to achieve a single version of the truth. Another reflection is that arguing about numbers, KPIs and other measures can be limited and time can be saved when organizations have decision support based on a single version of the truth.

Eckerson and White (2003) argue that to be able to use decision support in decision making, data quality is crucial. ETL processes are a natural part in any BI system to ensure that high data quality is obtained. English (1999) argues that data quality is meeting business user and end-customer expectations. Since ETL processes try to assure data quality, this may not necessarily imply that the end-users are satisfied since opinions of what quality is may vary. Our empirical findings show that organizations are aware of this issue and work actively to minimize mistakes and poor data quality. Sjögren (E. Sjögren, personal communication, 2007-11-22) states "*garbage in, garbage out*", if data input is incorrect, it does not matter how well the system works, the output will still be incorrect. Winblad (J. Winblad, personal communication, 2007-11-22) states that "*providing decision makers with incorrect numbers that they use in their analysis and decision making is extremely dangerous*". To minimize the impact of incorrect data, Kinnarps even double checks numbers generated by the BI system on a regular basis to ensure that decision makers have as correct decision support as possible.

The general impression among all the interviewed organizations is that the data in their DWs is correct and up-to-date. We think it would be interesting to examine to what extent their organizational data actually is correct. However, we think it is impossible to have completely correct data. The fact that our respondents believe they have correct and current data might imply that organizations spend appropriate time and resources in developing and maintaining ETL processes for even better decision support. Eckerson and White (2003) and Turban et al. (2007b) claim approximately 70% of time spent in a BI project should be spent designing and developing ETL processes. Organizations may not realize the importance of developing and maintaining ETL processes which requires a lot of resources.

Our definition of BI states that decision support should be accessible to the right member in the organization. This implies that organizational members do not need to spend time searching for decision support in different source systems. Instead, necessary information should be available using the BI interface, which is extremely time saving (Turban et al., 2007b). All respondents agree that gathering data for decision support used to be a manual and time consuming process. They describe a new situation where decision support is accessible in a timely manner. Fläkt Woods states that the information has always existed but now, with a central storage, it is easier to gather relevant information from the source systems (E. Sjögren, personal communication, 2007-11-22). Using BI, Turban et al. (2007a) argue that both routine and ad hoc reporting is easy. This enables easy access to decision support for every decision making situation. Our interviews show that organizations use both routine and ad hoc reports, as Wiss puts it, *"business users constantly need to know how well they perform"* (L-G. Wiss, personal communication, 2007-12-10).

Eckerson (2003) claims that visualization makes data easier to understand. The user tools provided in BI systems enable users to interpret data and perform data analysis. According to Turban et al. (2007a) drill-down functionality could be used to analyze data and find problem areas. All respondents mention improved decision support with ability to both aggregate data and drill-down among data in order to fit different decision situations as well as possible. Sjögren (E. Sjögren, personal communication, 2007-11-22) explains that it is easy to drill-down among orders to find the incorrect one. Our empirical findings imply

that BI systems provide improved decision support. Users now have better overview when numbers from multiple source systems are presented in spreadsheets and dashboards, tables, and graphs.

According to the respondents, the decision support is considered to be easier to use when users decide information to be displayed. Information not relevant for the specific decision making situation can easily be opted out and not displayed (Turban et al., 2007b). Even if the respondents claim it is easy to gather and display information, it is of course a situation were the users need to mature in their usage of the BI system. We believe users who have matured in their usage are starting to realize the benefits BI generates. With an increased level of maturity new exciting areas of use will probably be discovered. It may also depend on computer skills, an experienced computer user will probably use more BI functionality for generating ad hoc decision support at an earlier stage, compared to a user with limited computer experience.

5.2 Decision Making Processes

Gorry and Scott Morton (1989) base their framework on decision making processes and they point out that the framework should not be seen as a way to describe information systems. Since BI systems' main objective is to assist decision making, we believe Gorry and Scott Morton's (1989) framework is useful to describe how BI could support and change decision making. Gorry and Scott Morton (1989) argue that when organizations understand the underlying parameters of decisions, it is possible to make them more structured, and save time for other tasks. This because decisions can be supported by the system itself with less influence from decision makers and therefore, decisions become more structured. We argue that BI systems, using its analytical environment, could transform either semi-structured or unstructured decisions to become more structured.

As described in 5.1, BI enables faster access to decision support, which has a direct impact on time spent in decision making processes. This may imply that more efficient processes can be achieved due to time savings. Husqvarna reports improved processes with instant access to information, a process that used to be manual and took up to three months to complete (L. Dorthé, personal communication, 2007-11-22). Conradsson (P. Conradsson, personal communication, 2007-12-13) states that Kinnarps' BI system has made decision making processes more structured such as predetermined action when different KPIs are met. Myresjöhus mentions that unstructured decisions have become more structured due to more complete information (L-G. Wiss, personal communication, 2007-12-10).

The top of Gorry and Scott Morton's (1989) framework includes Anthony's (1965) categories of managerial activities; operational control, management control, and strategic planning. The time horizon and complexity concerning decisions between these categories differ. Strategic decisions involve activities with a longer time horizon and they do not occur frequently whereas operational decisions are made on a daily basis and concern simple tasks (Gorry & Scott Morton, 1989). According to Gorry and Scott Morton (1989), decision making on each organizational level requires different decision support. In Myresjöhus, the BI system is used differently depending on position in the organization. Some users, such as employees within sales, use the system daily whereas other functions, such as management, use it more on a weekly basis (L-G. Wiss, personal communication, 2007-12-10). Turban et al. (2007a) state that BI supports decision making on every hierarchical level. We argue that BI is applicable to Gorry and Scott Morton's (1989) framework and could assist any member of any organizational level. This is also in line with the results of our empirical study. Our empirical findings show that BI is mainly used for operational and

management control. However, Husqvarna and Kinnarps also use BI to support strategic planning. We believe the limited use of BI in strategic planning is due to the more unstructured and complicated parameters strategic decisions tend to concern. Both Husqvarna and Kinnarps have a high maturity level of BI, which we believe might be the reason why BI is so wide-spread.

We have found similar areas of BI usage in our empirical findings. Most frequently, BI is used to assist decision makers in financial and sales departments to generate reports and enable analysis. However, some differences have been noticed. Husqvarna uses BI in most departments to support decision making. Kinnarps even claims they use BI in every primary process. *"[In Kinnarps,] BI is used in different functions from financial reporting for top management and CFO, to associates working in production, to sales statistics in different sale companies",* as Conradsson (P. Conradsson, personal communication, 2007-12-13) explains. From our empirical findings we conclude that Anothony's (1965) categories of managerial activities are covered. All respondents believe their BI investment is an on-going process where new areas of use constantly are discovered, connected, and included in the BI system. Husqvarna believes, in 10 years, BI will be used by everyone throughout the entire organization. Kinnarps believes BI usage will increase as affiliated companies are integrated in the system. Fläkt Woods and Myresjöhus have a different focus and believe they will add more functionality and get the existing users to better use the analytical functionality of their BI systems.

Any decision making process involves humans to make the final decision. All respondents point out their BI system is only supportive in this process and the decision maker puts the decision into action. Further, the respondents explain that BI generated decision support has a great impact on decision making processes, but indirect and supportive, which Turban et al. (2007b) agree with. Indirect decision support does not provide an answer to a problem but provides support to solve it, such as numbers or graphs (Turban et al. 2007b). Dorthé (L. Dorthé, personal communication, 2007-11-22) states that *"BI is limited to gather and show information but never make decisions for the user. The outcome depends on the person making the decision"*. We think human ability to make decisions and systems' ability to provide decision support is the best combination for effective decision making. As Hayashi (2001) explains, the main objective with cross-indexing is to gather information from different sources, which also is the main purpose of a DW. Therefore, we conclude that BI easily can be applied to cross-indexing and support intuitive processes. When a decision maker uses cross-indexing, in this case BI and the generated decision support, Hayashi (2001) argues that intuition tells you something, feelings that guide the decision making until satisfactory decisions are made. Decision support or BI systems cannot replace human intuitive ability. Decision makers have the ability to apply previous experiences combined with decision support as they may see patterns they recognize from similar situations (Hayashi, 2001). Fläkt Woods states that "w*ith experience in your role, you develop a feeling for when the computer generated numbers are correct and when they are off"* (E. Sjögren, personal communication, 2007-11-22).

6 Conclusions

In this chapter, we present the outcome of our analysis in a few concluding statements. The results are presented and divided between our research questions.

Our analysis show positive effects on organizations after a BI implementation. As we discovered, BI is wide-spread in manufacturing organizations and is becoming more integrated in the organization.

How has decision support changed after a BI implementation?

Control: We have identified that BI improves the control of decision support. This because organizations can unify source systems meaning that the input of the decision support is stored in one place. This also enables quality control of information gathered from source systems throughout organizations. Another aspect is that BI improves the ability to analyze decision support with more flexibility compared to before the implementation. Only relevant data for decision making is presented which allows better decision support and better decisions.

Time: BI has proven to save organizations time by enabling decision support to be easily accessible in a timely manner. Decision support can now be used by members routinely or by performing ad-hoc analysis, with correct, updated, and sufficient information. Earlier, this process was complicated and time consuming as information was scattered throughout different location in the organization.

How has BI changed organizational decision making?

Improved decision making: BI provides faster and easier access to decision support which has a direct impact on decision making. Organizations experience improved and more efficient processes. This is a result of BI's ability to provide more accurate and current data for analysis. Since decision makers have a unified data storage, insight in other functions or areas increases the ability to make better decision.

Unstructured decisions are now more structured: By using BI, decisions that earlier were unstructured or semi-structured are now more structured. Especially in financial and operational functions as such functions involve specific procedures, which are easier to structure. With less time spent in decision making processes, decision makers now have more time for other activities. This means, variables that are below the horizontal are referred to as unstructured decisions are moving upward and become more structured with BI.

Intuition in decision making: Even though BI has improved quality of decision support substantially, humans will always make final decisions influenced by intuition and experience. BI has the ability to reduce the unstructuredness in decision making processes by transforming decisions to a lower level of unstructuredness. When decisions are less unstructured, intuition becomes less important. However, intuition can also support decision makers when past experiences provide new ideas or explain patterns.

7 Final Discussion

In this chapter we reflect on our work and give suggestions for further research concerning Business Intelligence. We also acknowledge people that have supported our thesis work.

7.1 Reflections

Writing about BI has been interesting and we believe this thesis has contributed with new knowledge. Our approach with recognized theories and new concepts is interesting and may contribute to new viewpoints and thoughts. Turban et al. (2007a/b) are highly present in our thesis. We would have preferred having other references but have concluded during our literature study that Turban et al. (2007a/b) are well-known and highly represented and referred to in BI literature. The qualitative approach was appropriate for our study since it provided deeper understanding of our research topic, something a quantitative approach could not. Using a quantitative approach, the characteristics of the empirical findings would have been different and we might have discovered other aspects and come to different conclusions. When selecting respondents, we decided to have between four and seven interviews. However, after conducting four interviews we felt we had sufficient information to fulfill our purpose. Our interview method, semi-structured, suited our thesis well and it would have been difficult to fulfill our purpose using a different method. A better connection between our theoretical framework and the interview questions could have improved our empirical findings and analysis. However, we feel we have answered our research questions and fulfilled our purpose.

A different sampling method could have provided higher generalization of our study. However, using convenience sampling to select our respondents, we contacted 11 organizations. Five used BI systems according to our definition and had more than one year experience of BI, hence fulfilled our criteria. One did not want to participate since their BI system included sensitive information. The other four agreed to participate in our study. Even though our sampling technique may be a weakness in our study, we believe the similar results from our empirical findings allow us to generalize our study within our presented problem delimitation.

7.2 Suggestions for Further Studies

During the process of writing this thesis, we have discovered that there is limited research concerning BI and this area needs to be further explored. Accordingly, we have many suggestions of research topics. We believe it would be interesting to investigate the amount of time a BI system could save an organization and which functions that benefit the most from BI initiatives. Another topic could be the connection between BI and financial returns with its problematic aspects of measuring intangible benefits. From a vendor's perspective, to investigate how organizations and users would like to improve their BI solution and why. Our respondents pointed out that decision makers use BI for support in decision making and further studies could concern intuition and its role in decision making processes. From a technical point of view, future sources of data and other areas that can be integrated in BI systems for better decision support is another research topic. We believe it would be interesting to research if there is a need or interest for organizations to connect to suppliers' systems to perform data analysis for better planning and process performance, as new technologies for distributed data processing evolve. This thesis has not focuses on HCI and another area for further research could be how to improve the user interface of BI systems.

7.3 Acknowledgements

We would like to conclude by thanking the people that have helped us through this thesis writing process. Our tutor Jörgen Lindh, for guidance and valuable feedback. We would also like to thank Hiren Jansari and Johanna Reinholtz at SYSteam for demonstrating BI products and providing us with valuable insight in the BI concept. All our respondents for taking their time and participating in interesting and very informative interviews. Furthermore, we would also like to thank our fellow students for good advice during seminars.

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Appendix 1 – Interview Questions, English

Personal
Position?
Tasks and responsibilities?
How long have you had your current position and how long have you worked in this organization?
Previous tasks and responsibilities?

Organization
Could you briefly describe your organization?
How long have you used computer systems?
What have the computer systems historically been used for?
What is the hierarchical structure like?

Business Intelligence system
Why did you invest in BI?
Which BI system are you using?
Who implemented the system and who is responsible for maintenance?
In what areas do you use BI?

- For which decisions do you use BI? (Operational, Managerial, Strategic)?
- Who uses your BI as a support in decision making?

Has BI changed you organization and if yes, how? (Positive and Negative)
How frequently is BI used in decision making?

- Are you using BI as planned?

Has BI improved your decision support and if yes, how?
What sources are used for the decision support? Which are the most important?
Do you think the decision support is relevant, correct, up-to-date, and enough?

- Are decisions made with insufficient decision support?

Is the decision support available in a timely manner?

- How and why?

Is it easy to understand and use the decision support generated from your BI system?

- How and why?

What are your thoughts on the amount of decision support?
To what extent are decisions made, based on decision support from your BI system?
Does your organization make better decisions now; compared to before the BI system was implemented?

- Can the decision support be improved and if yes, how?

Has the degree of intuition in decision making decreased since the implementation of BI?
What do your future needs for BI look like?
What pros and cons do you see with your BI system?
What are your plans for future BI investments?
Do you believe your BI system fulfill expectations?

Appendix 2 – Interview Questions, Swedish

Person
Befattning?
Uppgifter och ansvarsområden?
Tid i befattning och företaget?
Tidigare uppgifter och ansvar?

Organisation
Kan du kort beskriva er verksamhet?
Hur länge har ni använt datorsystem?
Vad har datorsystemen använts till historiskt?
Hur ser den hierarkiska strukturen ut?

Beslutsstödsystem
Varför har ni valt att investera i BI?
Vilket BI-system använder ni?
Vem implementerade, och vem ansvarar för driften för BI-systemet?
Inom vilka områden använder ni BI?
- Till vilka typer av beslut används ert BI (Nivå s, t, o)?
- Vilka använder ert BI för beslutsfattande (Nivå s, t, o)?

Har BI medfört förändringar i ert företag och i så fall vilka (positiva, negativa)?
Hur frekvent används BI som beslutsunderlag?
- Utnyttjas BI-systemet som det var tänkt?

Hur såg ert beslutsunderlag och ut före implementeringen?
Har beslutsunderlaget förbättrats och i så fall hur?
Vilka källor används till beslutsunderlaget och vilka är viktigast?
Känns beslutsunderlaget relevant, korrekt, aktuellt och tillräcklig?
- Tas beslut med ett otillräckligt beslutsunderlag?

Finns beslutsunderlaget tillgängligt på ett tidsmässigt tillfredsställande sätt?
- På vilket sätt och varför?

Är beslutsunderlaget lätt att utläsa och använda?
- På vilket sätt?

Vad anser ni om mängden beslutsunderlag?
Hur stor del av besluten baseras på beslutsunderlaget genererat av ert BI?
Tas bättre beslut genom beslutsunderlaget nu än innan BI-systemet?
- Kan beslutsunderlaget förbättras och i så fall hur?

Har mänskligt beslutsfattande minskat med BI-implementeringen?
Hur ser behovet ut framöver?
Vilka fördelar och nackdelar tycker ni BI medför?
Finns det tankar om ytterligare investeringar i BI?
Stämmer ert BI med förväntningarna?