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The Impact and Power of Business Intelligence (BI) on the Decision-making Process in Uppsala University: A Case Study

Mustafa Nizamul Aziz

Abstract:
Business Intelligence (BI) is a specific type of Information Systems (IS). Research on BI uses in academia has been somewhat limited so far. Most decisions in a university are made based on large amounts of data from internal and external sources. So, a BI tool is necessary there in operational and strategic decision making, and also to compete well in the global environment. A case study has been done on the large BI tool at Uppsala University (UU), Sweden. The tool has been used for more than fifteen years with around five hundred regular users currently. The system is called **GLIS** (in Swedish: *Generellt Lednings Informations System*) for Generalized Management Information System. This study investigates how the adoption of this BI system may influence the decision-making process at Uppsala University, and thus it becomes the main purpose of this study. An inductive approach using a qualitative method was used in this study. The data collection was carried out by interviewing seven experts at Uppsala University and from some documents provided by them. Techniques from the grounded theory approach were applied for analyzing data. Data analysis shows the positive effects of GLIS at Uppsala University with big improvements in decision making. The study draws the conclusion that the BI tool does affect the decision-making process in UU as decision making activities take less time, provide better quality decisions, and are much easier using the tool.

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1. Introduction

According to Negash and Gray (2008), the term *business intelligence* was first used in 1989 by Howard Dressner, a research fellow at Gartner Group, as an umbrella term to describe concepts and methods to improve business decision making by using fact-based support. BI derived from the decision-making support technology in the 1970s, which later experiences a gradual and complex evolution including Transaction Processing System (TPS), Executive Information System (EIS), Management Information Systems (MIS), Decision Support System (DSS) and other stages (L. Cheng and P. Cheng 2011). According to Turban et al. (2011) "Decision making is the action of selecting among alternatives". Moreover, Herschel (2011) wrote "BI is an area ripe for research due to its impact on a business' and governments' decision-making activities. However, to date, the actual coverage of BI in academic journals has been somewhat limited." Most universities have some type of data management tools. Many universities in Sweden have their own BI or analytic tools. Any published research on the impact of BI tools in academia was not found after searching in the Uppsala University digital library, which is connected to a lot of databases. Lupton (2010) recognized in his article BI as an essential way for educational institutions to assess university processes. Assuming BI has vital roles in performing and assessing University decision making activities, it was realized that making a case study on a university's BI system would be a time demanding research topic.

GLIS is a Business Intelligence system in Uppsala University. It has a user interface for accessing and managing data. GLIS can be accessed through the internet on http://glis.uu.se. A history of the GLIS system is important to have a complete picture of the system. Olsson et al. (2012) mentioned that Uppsala University had already developed GLIS tool in-house in the year 2000. The authors added that more feasible alternatives had emerged in the market and a commercial product (The Diver Solution) had been used for these purposes since 2006. GLIS was aimed at mainly supporting the university management in the beginning. It was used to inform the annual process of planning and reporting at the central level of the university, then after transferring to the technological platform "The Diver Solution", it became clear that the system could be more developed and turned into a cost effective tool to be used for a broader range of purposes. GLIS stands for General Management Information System (in English) and contains data from the university's basic systems in terms of finances, staff, students, facilities, and publications. With GLIS, users can find everything in one place. According to Olsson et al. (2012), the end-users are constantly growing in parallel with an expanding number of data areas. Some users may consult GLIS almost every working day, while others use it seldom. GLIS from a user perspective is a portal on the web where users start by choosing an area of interest for example first and second cycle courses and study programs (Olsson et al. 2012). The authors added, when entering GLIS, people may choose to log in as a registered user or to enter as a guest. As a registered user he/she may have access to personal information confined to his/her unit that would be inappropriate to present to a broader audience. The author chose to do a case study on the BI system of Uppsala University. That is because Uppsala University has more than fifteen years of experience of GLIS, and IT based tools for extraction and presentation of management information (Olsson et al. 2012). Typical examples in using GLIS are the admission process and the planning of student intake, balancing of students among courses, follow up analysis of educational programs, and the bibliometric analysis of publication data." (Olsson et al. 2012). As Uppsala University has a large BI system with around 500 regular users currently (interview with Leif Eriksson), the experiences of these users would be very interesting for

other public and private organizations. It is also interesting to many to see the power of the BI system, GLIS on different decision making activities in Uppsala University.

As a relatively new field, BI suffers from a general lack of clarity as to what BI is and what it encompasses (Herschel 2011). For academic institutions, it is relatively more new compared to business organizations. Herschel (2011) also claims that to date the actual coverage of BI in academic journals has been somewhat limited. So, it is interesting to research the influence on decision making process after adopting a BI system in a university. The ultimate goal of this paper is to answer these following research questions: (1) why is it beneficial to adopt a BI system in a university?, and (2) how may the adoption of BI influence the decision making process in a university?

2. Methodology

In IS research, there are many ways to do research studies. Järvinen (2008, p.6) showed a tree-structure or top-down approach to show the research methods suitable for a certain class of studies. In this study, the author empirically studied some past and present events where he intended to develop a new theory grounded on the raw data gathered. The path ends with "Theory-developing studies" which include a normal case study, multiple case study, content analysis, ethnographic method, grounded theory, discourse analysis, etc (Järvinen 2008). There are many typologies of Qualitative Research mentioned by different authors over time. A research strategy is an overall approach to answering a research question. There are six common research strategies (Oates 2006, p.35): survey, design and creation, experiment, case study, action research, and ethnography. This study is "How" and "Why" questions based. When "How" and "Why" questions are the focus of the study, there will be three possible types of researches: history, case study, and experiment (Yin 2009, p.11). The author did a *case study* among other research types to answer the research questions. It is because the research area objects are similar to what Yin (2009) mentioned as "Case study is preferred in examining the contemporary context, but when the relevant behaviors cannot be manipulated." There are three basic types of case studies (Yin, 2009): exploratory, descriptive, and explanatory. An *exploratory case study* was done in this study as this type is used to define the questions or hypotheses to be used in a subsequent study (Oates 2006). It helps to understand the research problem deeply. Case studies also vary in their approach to time (Oates 2006, p.144): historical study, short-term or contemporary study, and longitudinal study; whereas the author did a *short-term case study* here to check or examine what is occurring in the case now and what is going on.

There are many data collection sources in doing case study research. No single evidence source has a complete advantage over all the others in the case study (Yin 2009). Yin mentioned that case study evidence can come from many sources. She maintained that the most commonly used sources of evidence are (pp. 101-113): documentation, archival records, interviews, direct observation, participant observation, and physical artifacts. To gather information using qualitative methods four approaches are typically used. First, the researcher can participate in a setting. Secondly, a researcher can conduct direct observation. The third and fourth approaches to gathering information are personal interviews and analyzing documents and material culture (Marshall and Rossman 1999). In this study, it was chosen to use the *documents* from Uppsala University on GLIS system and *personal Interviews* of experts as data collection sources.

In qualitative inquiry, there are several types of sampling strategies, like homogeneous, Theory based, Snowball, Opportunistic, etc (Miles 1994, p.28). *Snowball sampling* strategy goes most suitably with this research process to make the samples more purposive, rather than random. In this study, SSM (Snowballing Sampling Method) was used as a data collection strategy because it fits the research method and the research strategy used. "SSM is used in both qualitative and quantitative research" (Cohen and Arieli 2011, p.427). SSM is used primarily to access potential interviewees (Cohen and Arieli 2011). It has been suggested that SSM is probably the most effective method to access hidden and/or hard to reach populations (Valdez and Kaplan 1999). The strategy to indicate an endpoint in collecting data from interviews was the *Saturation* point finding strategy. Interviewing people was stopped when the analysis yields no new findings. As data collection gathers pace and interviews are carried out, a concurrent analysis may identify additional questions or areas for exploration. When the analysis yields no new themes, saturation is reached (provided a range of views has been sampled). At this point, the interviewing is likely to end, and the final number of interviews conducted may be greater or less than the original estimation. This part of the process must also be written up and explained in any published output." A degree of professionalism is needed to remove the lack of standardization of the interview questions which depends on the skill and experience in the interviewer (Robson 2011). If the interview questions have a high degree of standardization, the questions, and the order of the questions is the same for all interviews in the research. A commonly made distinction is based on the degree of structure or standardization of the interview (Robson 2011, p.279): fully structured interview, semi-structured interview, unstructured interview. Then Robson has defined semi-structured interviews as the interviewer has an interview guide that serves as a checklist of topics to be covered and a default wording and order for the questions, but the wording and order are often substantially modified based on the flow of the interview. Semi-standardized interviews were used in this research to cover certain question areas to get a deeper understanding of BI dominance on decision making in a university. Mostly *Open-ended* questions were asked rather than Closed questions. There were questions starting with 'what', 'how' or 'why' which would encourage the interviewees to provide extensive answers. Closed questions end with very short answers, often either 'yes' or 'no'. The interviewer tried to avoid this type of yes/no questions.

Conducting interviews in proper ways is crucial in qualitative research. To conduct interviews, suggested guidelines and recommendations by Robson (2011) were followed. Robson (2011) mentioned that face-to-face interviews offer the possibility of modifying one's line of inquiry, following up interesting responses, and investigating underlying motives in a way that postal and other self-administered questionnaires cannot. He maintained that non-verbal cues, like body language, voice tone, may give messages which help in understanding the verbal responses. Regarding the selection of respondents, firstly the interviewer was guided by the department to meet Leif Eriksson in the planning division, Uppsala University. Then according to Snowball Sampling Method (SSM), other next interviews were conducted one by one with concurrent analysis. When the expected saturation point was reached, the interviewing part was stopped there. Interview questions and details of interviewees are mentioned in Appendix A and B, respectively.
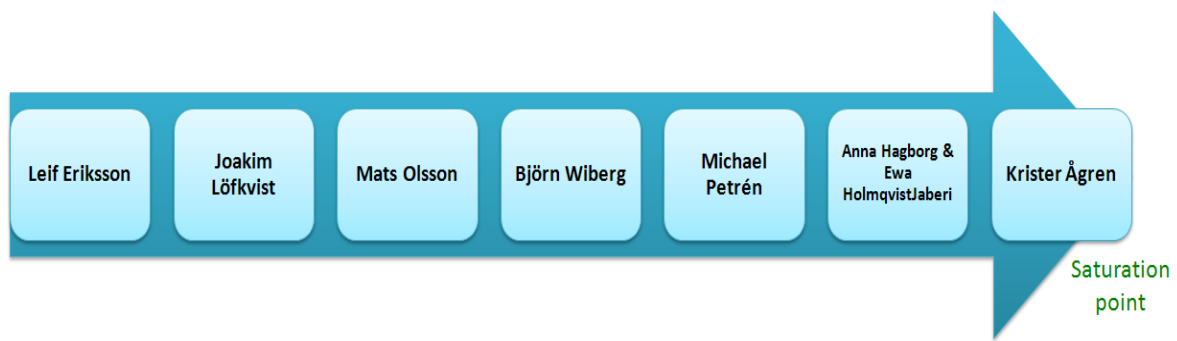
Figure 1: Progress of Interviewing according to SSM

Qualitative data analysis looks for themes and categories within the words people use or the images they create (Oates 2006). In similarity with Cheung and Kam (2012) and Ferguson et al. (2011), and as LaRossa (2005) mentioned that the grounded theory methods are not the only way to do qualitative research, but also, they are a valuable set of procedures for thinking theoretically about textual materials (i.e., intensive-interview transcripts, observational field-notes, historical documents, and so on), techniques from the *grounded theory approach* were used to analyze the data found from the interviews and the documents.

3. Findings
3.1 General Use of GLIS
GLIS is the main and general information system in the university. It has many uses at Uppsala University. In acceptance with what Olsson et al. (2012) mentioned "GLIS has been designed to serve various needs at all levels of the university", GLIS can be used at many different levels and for various tasks. Firstly, it is used in analyzing almost every aspect of the university activities, which was mentioned in the interview with Eriksson. He said, "GLIS is used to analyze all activities within the university". Secondly, it is used to make follow-ups, which was maintained in the interviews with Eriksson, and with Hagberg and Holmqvist. Thirdly, it is used as a ground for decision making as GLIS combines data from different systems. Löfkvist claimed that GLIS combines different systems in it, and it is used to generate nice looking reports. Finally, it is used as a data collector system as Ågren claimed that GLIS collects data from many different sources (mainly databases) and presents these data on a single site. As a result, GLIS is used as a general and the most important system in the university. It acts as a data repository, a follow up system, and a nice complex reports generator used as an aid for decision making.

3.2 Benefits of BI system (GLIS) in UU
GLIS, in Uppsala University, is beneficial in different ways as it has many functions. Firstly, GLIS combines data from many different systems according to Eriksson and Ågren, so it acts as a main data management system. Secondly, with GLIS the university personnel can do almost anything as Eriksson said that GLIS is a general and intelligence tool that can be used to generate reports, compare data, storage historical data, and many other things. Thirdly, GLIS does simplify administrative processes according to Petrén. This is because GLIS does digitize almost everything and GLIS has the functionality to simplify and present complex things to users, for example presenting things in the form of tables and graphs. Fourthly, it acts as an indicator for university activities as Hagborg and Holmqvist mentioned. This is because GLIS is the main and only indicator of the status of the university activities. Fifthly, it gives the ability to dive deeply into data according to Wiberg. That is because GLIS combines data from many sub-systems and has the ability to combine these different data to make

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something more useful. In summary, GLIS has different uses in Uppsala University, and it is the main tool that university personnel depend on doing many of their tasks. It is a huge support to the university management and the planning division.

3.3 Personal purpose of using GLIS

Olsson et al. (2012) claimed that GLIS turned into a cost effective tool that has been used for a broader range of purposes. Therefore, GLIS has different uses at different levels and positions. According to the interview with Eriksson, he uses GLIS mainly for publication reports and anything related to them, like reports on finances and other similar information. Löfkvist uses everything in GLIS, as he is responsible for making the university annual reports, which needs to have all types of data. According to Olsson, he has a use for all of GLIS tasks, as he is the designer of the system, and his work position in the university was as an analyst. For Petrén, his purpose of using GLIS is looking at the administrative processes. According to Hagberg and Holmqvist, they use it mostly for student admissions and finance reports, and also for monitoring the number of PhD students and gender issues. For Wiberg, he uses it mainly for gender indicators of Uppsala University. Ågren maintains the system and uses it for his own analysis. Hence, GLIS has various uses in diverse levels. It can be used as a data repository, report builder, historical data storage, and so on. Interview findings show that some are using GLIS daily, others use it weekly or monthly and that is depending on the person's Job position, tasks and needs of data from GLIS. Thus, all use and depend on GLIS in some or many of their tasks.

3.4 Influence of GLIS on decision making process in UU

After analyzing the data got from the interviews, some interesting findings regarding the influence of GLIS on the decision making process in Uppsala University have been found. Löfkvist mentioned that GLIS is extremely influential in the decision making process, but on the other hand, the other interviewees mentioned the opposite of that, by claiming that GLIS has no influence on the decision making rather it affects it in some ways. For example, Eriksson said that GLIS has no influence on decision making process; instead it acts as a tool to collect and supply the good basic data for the management. Another example is what Olsson told, "GLIS should affect decision making process instead of influencing it because GLIS, of course, has no agenda to influence the decision making". Also, Hagborg and Holmqvist commented that "It is more accurate to say 'affects' than 'influences' as GLIS is not the only base for decision making." It has been found that GLIS is a tool that has no influence on decision making, rather it affects the decision making process. According to Eriksson, when he argued regarding the effects of GLIS on decision making, GLIS is just a base. He said that the basic Figures are calculated in more secure ways. He maintained that GLIS gives a faster way to have basic data. GLIS gives a better data quality in comparison to that without it. Also, it makes the work much easier. So, according to him, GLIS acts as the decision making base. It also speeds up the whole process. Decision making works can be much easier with GLIS, and a faster decision process is a result of using GLIS. In accordance with Löfkvist, as employees can access data directly from GLIS, it would positively influence the decision making process in time. Also he mentioned that GLIS leads to better information quality. So to him, time and quality of data which will affect decision quality, are affected by GLIS. Olsson maintained that GLIS does certainly affect the decision making process in time and quality. Olsson strengthened that in an example how GLIS does affect the decision process- "with GLIS I can find many things in 5 minutes which took me several days before and also now with GLIS you can find out things that you dreamed for before, so time and quality are evident." Petrén also agreed on that by saying, "without GLIS you do not have access to combine and collect data from their resources, so GLIS affects decision making process in many ways: time, complexity,

and decision quality". Hagborg and Holmqvist emphasized that GLIS is perfect for them in the areas of time, quality, and ease. Also Ågren supported that by commenting that GLIS affects in the factors of time and ease, and it would be very hard and time consuming if you use a lot of different data sources. Ågren agreed on the fact that GLIS do positively affect decision making process minimizing analysis time and making better analysis and decisions, as he mentioned that GLIS cuts analysis time greatly when data is presented in an "easy-to-use" way. But he also maintained that people have a tendency to over-analyze things when data is easily accessible. In conclusion, GLIS does affect the decision making process in Uppsala university as decision making activities take less times, provide better quality decisions in much easier ways using GLIS. After the summary of the analysis, a framework has made below to show the impact of Business Intelligence (BI) on the decision making process (DMP) in academia. The reason to make this framework is to display the findings in a more general context. The framework shows an overview of a BI system, the uses, and benefits of BI in academia, and most importantly the impact of BI on the DMP in academia with possible outcomes. For example, the BI system is used as an indicator of the university activities all year round. The framework also shows how a decision making process works. In special cases, there can be no effect of the BI system in decision making. But in general, it has large positive effects on the DMP. The top affected factors in this case are time, quality, and ease as shown in the figure below.
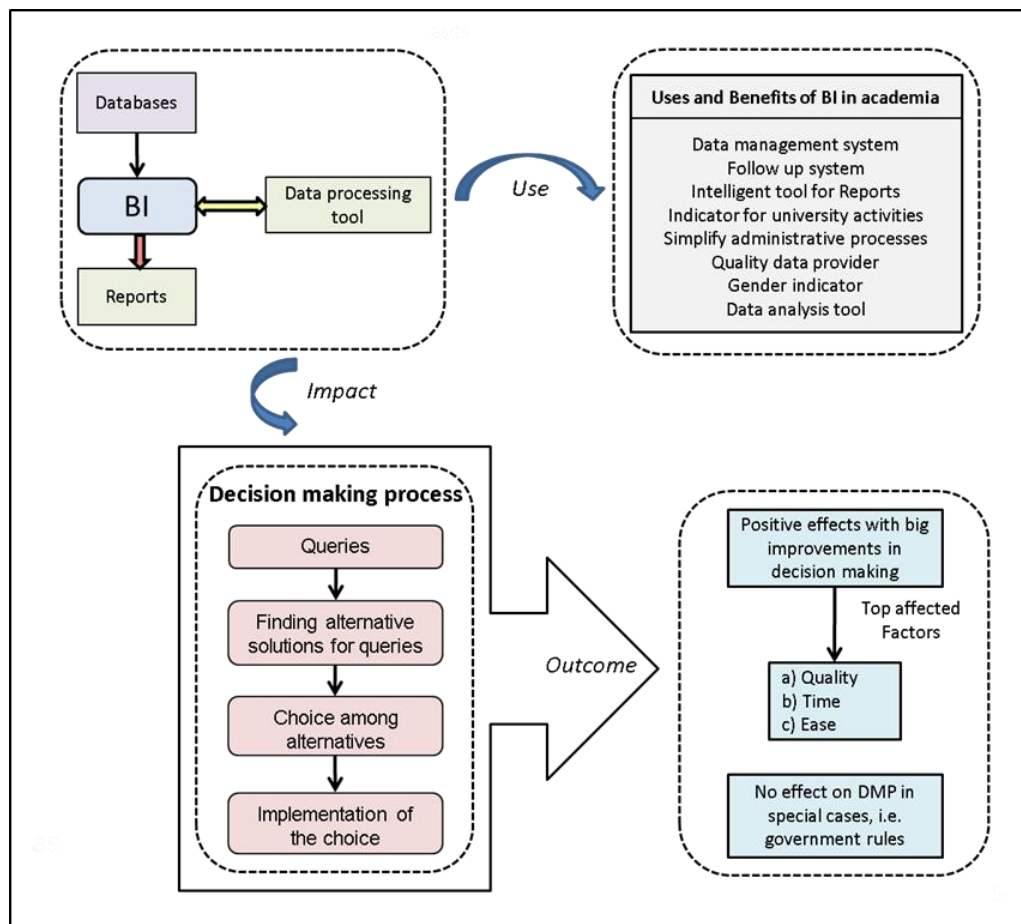

Figure 2: Framework for the impact of Business Intelligence (BI) on the decision making process (DMP) in academia

4. Conclusions and Future Work Direction

The analysis discovered a positive impact of the university BI system, GLIS, on the decision making process. Also it was clear both that GLIS is largely used in Uppsala University as a general information system, and some people use GLIS information as a base for making decisions in the university.

It has been found out that there are very limited researches on BI uses in academia. This area needs to be further explored. It would be interesting to see what specific functions get mostly benefited from the BI system in Uppsala University. Another investigation can be made on the sources of data integrated into GLIS. Another area for further research could be how to improve the user interface of GLIS. It would be very interesting to use another strategy to answer the research questions in this study, for instance to do the same research using the Survey strategy. Similar research can be done on the BI systems in other universities to see the effects in particular cases. It would be interesting to investigate similarly the impact of BI in business organizations too. The final suggestion for further research is to carry out a quantitative data collection on a good number of Business Intelligence systems in different universities in order to fully understand if and how BI is affecting the decision making process in academia, and how the system could be improved for a better functionality. This research, being a qualitative case study, has a low level of generalization, but it offers significant insights that can give a foundation for further researches.

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Appendices

A. Interview Questions:

1. Can you tell us something about yourself? (name, job position, tasks, background, etc.)

2. Can you tell us about the Use of GLIS?

3. For about how many years have you used it?

4. How frequently do you use it?

5. In what way it is beneficial to adopt a BI system, GLIS, in Uppsala University?

6. For which purpose do you use GLIS? (like Students admission, Education (Basic/Advance level), Education (PhD), Publication reports, Staff reports, Economy/Finance reports, University premises, Gender Indicators of Uppsala University, etc)

7. How may the adoption of GLIS influence the decision making process in Uppsala University? Which factors (like time, hardness, quality, etc.) are affected in what ways?

8. What are the decision making activities in decision making process?

9. What has GLIS historically been used for? From when decision making process has been a service/target of GLIS?

10. Who are the users of GLIS? Do all or some of them use it for decision making activities?

11. Do you recommend us any document to read related with GLIS?

12. Do you have any other comments?

13. Who implemented GLIS and who is responsible for the maintenance of it?

14. To what degree does GLIS fulfill your expectations? What is about the cons with it?

15. What are your future needs for GLIS?

16. Who are the next person(s) you recommend us to interview that helps us in this research?

B. *Details of interviewees:*

Person Name	Role	Place	Interview Form
Leif Eriksson	Analyst at Planning Division, *Planning Division*	Planning Division, *Planning Division*, **Uppsala University**	Face-to-face interview
Joakim Löfkvist	Controller at Planning Division, *Planning Division*	Planning Division, *Planning Division*, **Uppsala University**	Face-to-face interview
Mats Olsson	Analyst at Planning Division, *Planning Division*	Planning Division, *Planning Division*, **Uppsala University**	Face-to-face interview
Björn Wiberg	Technical system administrator at IT Division, *Office for operations*	IT Division, *Office for operations*, **Uppsala University**	E-mail interview
Michael Petrén	Project manager at IT Division, *Office for operations*	IT Division, *Office for operations*, **Uppsala University**	Face-to-face interview
Anna Hagborg & Ewa Holmqvist Jaberi	Senior faculty administrator at Faculty Offices, *Office for Humanities and Social Sciences* & Fakultetshandläggare utb. vet. fak. at Faculty Offices, *Office for Humanities and Social Sciences*	Faculty Offices, *Office for Humanities and Social Sciences*, **Uppsala University** & Faculty Offices, *Office for Humanities and Social Sciences*, **Uppsala University**	Face-to-face interview
Krister Ågren	Analyst at Planning Division, *Planning Division*	Planning Division, *Planning Division*, **Uppsala University**	E-mail interview

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