Master Thesis

Self-Service Business Intelligence success factors that create value for business

Author: Jonida Sinaj
Supervisor: Behrooz Golshan
Examiner: Associate Professor Dr. Päivi Jokela
Date: 2020-10-01
Course Code: 4IK50E, 15 credits
Subject: Information Systems
Level: Graduate
Department of Informatics
Abstract

Business Intelligence and Analytics have changed the business needs, but the market requires a more data-driven decision-making environment. Self-Service Business Intelligence initiatives are currently providing more competitive advantages. The role of the users and freedom of access is one of the essential advantages that SSBI holds. Despite this fact, there is still needed analysis on how business can gain more value from SSBI, based on the technological, operational and organizational aspects. The work in this thesis serves to analysis on the SSBI requirements that bring value to business. The paper is organized starting from building knowledge on the existing literature and exploring the domain. Data will be collected by interviewing experts within the BI, SSBI and IT fields. The main findings of the study show that on the technological aspect, data is more governed and its quality is improved by implementing SSBI. Visualization is one of the features of SSBI that boosts quality and governance. On the digital capability aspect, the end-users need training and there is found a rate of impact of SSBI on the main departments in an organization. It is discussed how SSBI implementation affects the companies that do not have BI solution. The final conclusions show that in order for SSBI to be successful, a solid BI environment is necessary. This research will provide future suggestions related to the topic and the results will serve both, the companies that have implemented SSBI and the ones that want to see it as a perspective in the future.

Keywords: SSBI, BI, Big Data, Analytics, key requirements
Acknowledgements

I would first like to show my gratitude to my supervisor Behrooz Golshan for his support and assistance during all the phases of this research. His guidance has been very valuable in continuing the work and reaching the goal of this thesis. Gratitude goes to Anita Mirijamdotter and Päivi Jokela for their advices and helpful comments during seminars and for always being willing to answer any question regarding this process. I would also like to thank all participants involved in the interview process. Their expertized answers were the key of the findings of this thesis. Sincere gratitude goes to the staff of Informatics department. There are reflections in this work from the knowledge they have shared during this academic year.

Finally, I must express my acknowledgement to my family, my parents and my sisters. They have supported me since the beginning of my studies and have encouraged me in this journey. They have a big part in this accomplishment. Thank you.
List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>BA</td>
<td>Business Analytics</td>
</tr>
<tr>
<td>BD</td>
<td>Big Data</td>
</tr>
<tr>
<td>BDA</td>
<td>Big Data Analytics</td>
</tr>
<tr>
<td>BI</td>
<td>Business Intelligence</td>
</tr>
<tr>
<td>BPM</td>
<td>Business Process Management</td>
</tr>
<tr>
<td>DSS</td>
<td>Decision Support Systems</td>
</tr>
<tr>
<td>DW</td>
<td>Data Warehouse</td>
</tr>
<tr>
<td>ETL</td>
<td>Extract Transform Load</td>
</tr>
<tr>
<td>GDPR</td>
<td>General Data Protection</td>
</tr>
<tr>
<td>HR</td>
<td>Human Resource</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
</tr>
<tr>
<td>MIS</td>
<td>Management Information Systems</td>
</tr>
<tr>
<td>ML</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>NDA</td>
<td>Non-Disclosure Agreement</td>
</tr>
<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
</tr>
<tr>
<td>SLA</td>
<td>Service Level Agreement</td>
</tr>
<tr>
<td>SSBI</td>
<td>Self Service Business Intelligence</td>
</tr>
<tr>
<td>SST</td>
<td>Self Service Technology</td>
</tr>
</tbody>
</table>
List of Tables and Figures

Tables
Table 1. Summary of advantages and challenges of SSBI .................................................. p.12
Table 2. Participants’ introduction ......................................................................................... p.23
Table 3. Summary of transcribed data for BI setting ............................................................ p.26
Table 4. SSBI tools mentioned by the interviewee ................................................................. p.29
Table 5. Evaluation for SSBI impact on main departments .................................................. p.33

Figures
Figure 1. Four objectives of SSBI .......................................................................................... p.11
Figure 2. Big data analytics ................................................................................................. p.16
Figure 3. Big data analytics and web services ..................................................................... p.17
Figure 4. Explanation for SST attributes ............................................................................ p.19
Figure 5. Process of conducting the findings ........................................................................ p.26
Figure 6. Schema for SSBI operational ............................................................................... p.31
Figure 7. Impact of SSBI on the departments ...................................................................... p.33
Figure 8. Summary for the key requirements for SSBI that create business value .......... p.38
## Table of Contents

Abstract .......................................................................................................................... 2  
Keywords .......................................................................................................................... 2  
Acknowledgements .......................................................................................................... 3  
List of Abbreviations ........................................................................................................ 4  
List of Tables and Figures ................................................................................................. 5  

**Chapter 1: Introduction** ............................................................................................... 7  
1.1 Introduction .................................................................................................................. 7  
1.2 Purpose Statement and Research Questions ................................................................. 8  
1.3 Topic justification ......................................................................................................... 8  
1.4 Scope and Limitations ................................................................................................. 9  
1.5 Thesis Organization ..................................................................................................... 9  

**Chapter 2: Literature Review** ..................................................................................... 10  
2.1 Design Techniques and search procedures .................................................................. 10  
2.2 Literature review Analysis .......................................................................................... 11  
2.2.1 Self-service BI – technological aspect .................................................................... 11  
   2.2.1.1 Business Intelligence – BI .............................................................................. 13  
   2.2.1.2 Big Data ........................................................................................................ 14  
   2.2.1.3 Cloud Computing ......................................................................................... 15  
   2.2.1.4 Data analytics ............................................................................................... 16  
2.2.2 Digital capability (organizational context) ............................................................... 19  
2.3 Summary of the literature review .............................................................................. 20  

**Chapter 3: Methodology** ............................................................................................ 22  
3.1 Methodological Approach .......................................................................................... 22  
3.2 Methods of data collection ......................................................................................... 23  
3.3 Methods for data analysis ......................................................................................... 24  
3.4 Validity and reliability ............................................................................................... 24  
3.5 Ethical considerations ................................................................................................. 25  

**Chapter 4: Empirical Findings** .................................................................................. 26  
4.1 The current BI environment ....................................................................................... 26  
4.2 SSBI environment ....................................................................................................... 28  
   4.2.1 SSBI Technological aspect ................................................................................ 28  
   4.2.2 SSBI Operational aspect .................................................................................... 31  
   4.2.3 Companies that do not apply SSBI ................................................................... 36  
4.3 Other empirical findings ............................................................................................ 37  
4.4 Summary of the findings ............................................................................................ 38  

**Chapter 5: Discussion** ............................................................................................... 39  
5.1 Reflections on the research ....................................................................................... 42  

**Chapter 6: Conclusion** .............................................................................................. 43  

References ......................................................................................................................... 44  

Appendix A ....................................................................................................................... 51  
Appendix B ....................................................................................................................... 52
Chapter 1: Introduction

In this chapter, there will be given an introduction about the overview and background of the investigation. In addition the research questions will be presented together with topic justification. In the end scope and limitations about the topic will be discussed.

1.1 Introduction

Data is the primary asset for organizations, which generates essential information after being collected and processed (Demirkan & Delen, 2013). Business is operating in an analytics-driven environment where there is a need for data-based decisions made from the employees (Daradkeh & Al-Dwairi, 2017; Passlick, et al., 2020). Analytics is becoming progressively important for competitive gains. It provides a transition in the technology (Cörte-Real, et al., 2020) which is “increasingly considered for organizational learning and adjustments, improving operational efficiency, and strengthening organizational intelligence” (Božič & Dimovski, 2019, p. 93). The need for integration of new data and analytics create the need for new architecture that comes with a new suggested approach, which is Self-Service Business Intelligence (SSBI) (Alpar & Schulz, 2016).

SSBI refers to a technology innovation that enables users to be less dependent on IT department and become more self-reliant on their own actions (Imhoff & White, 2011). SSBI systems provide new potentials for companies due to the advantages that they hold. Since SSBI systems’ main aim is to enhance traditional Business Intelligence (BI), the benefits of this approach stated by Alpar & Schulz (2016) include: gaining of new competitive advantage by making more data-driven decisions, helping IT department with the ‘weight’ of responsibility and having a more governed information. The concept of SSBI is related to traditional BI. BI is defined as an “umbrella term that combines architectures, visualizations, analytics, applications and methodologies” for decision making, which will serve at its best the objectives and strategies of the companies (Sharda, et al., 2014; Tešendić & Krstićev, 2019). Chen, Chiang, & Storey, 2012 (cited in Niño, et al., 2020) highlight that BI should be promoted by the top management in order to be useful. Alpar and Schulz (2016) discuss that there are two main changes that BI has undergone recently: 1) new data are generated by new sources that are being used and 2) the scope of BI has shifted from strategic to operational. In addition, Imhoff and White (2011) claim that from a survey 78% of technical business professionals stated that BI needed to change and new alternatives which require less intervention with IT should be found. Eventually BI needs to be developed, because of the emerging of the data sources and SSBI offers a more advantageous environment in this aspect (Alpar & Schulz, 2016).

It should be understood that SSBI is not just a program that is installed and then the work is done automatically. “It’s not a one-size-fits-all program” (Eckerson, 2012, p. 2). Instead, it requires adoption and organizational change in order to generate the profitable results. In the report of Imhoff & White (2011), there are given a set of recommendations to technical and business professionals to understand the environment, its advantages and challenges so they can help in making a more critical approach in their SSBI perspective. Most of the knowledge generated by the literatures are focused on the general features of SSBI, leaving a lack of understanding in how the
approach is made inside an organization and its operations. In addition, some of the provided literature reviews upon this issue mainly rely on the discussion about the architectures of SSBI applications. There should be provided a thoughtful analysis upon the key requirements for getting a SSBI environment up and running, its influence, challenges in companies that have implemented it and also the companies that want to implement it. Further understanding on SSBI needs to be conducted in a more generalized context.

1.2 Purpose Statement and Research Questions

The aim of this paper is to give a comprehensive overview of SSBI as a success factor in organizations. The purpose and focus of this work will be in trying to analyze the need for setting up a SSBI environment and the key requirements for SSBI. Even though some analysis are done related to SSBI, there is still needed further research to validate challenges found and find if there are new ones based on the patterns studied. A conceptual model as a summary should be provided based on the results of the study. The research question that will be answered in this thesis is:

1. What are the key requirements for self-service business intelligence in order to create business value?

In addition to this main question, there is generated another question related to the companies that have not implemented a BI solution yet. Since recent studies are mainly focused in existing companies that have already implemented a BI solution, this thesis will further provide answer on how companies without a BI solution can approach SSBI in the best way. The answer to this question will be better brought up as part of the discussion section:

1.1 How SSBI can be approached in organizations that have not implemented a BI solution?

1.3 Topic justification

Business Intelligence tools are a necessity in the hyper-competitive and dynamic business environment (Abelló, et al., 2013). They are undoubtedly an indispensable part of Decision Support Systems (DSS). BI’s focus is in the signals coming from inside of the company and in order to perform all the advanced data collection technologies, it relies on Business Analytics (BA). Furthermore, the new technological trends are shifting towards BI in clouds, because cloud solutions provide better infrastructure and elasticity for its support. (El Bousty, et al., 2018; Lim, et al., 2012) Stodder (2015) highlights that the implementation of BI tools is directly related with the IT department, as they hold the responsibility for maintenance. That is one of the main reasons why BI does not sound as overwhelming as new services that are rising as support to BI. Following the flow, new trends lead toward SSBI. SSBI satisfies the time value demands and facilitates the intervention between the tools and IT department by reducing it (Imhoff & White, 2011).

There are several existing reviews which focus on the SSBI, but there is space for further contribution. Lennerholt, et al. (2018) consider the main aim of SSBI to be the establishment of a BI system which will function in decision making without the need of ‘power users’. They further discuss the main challenges that the implementation of SSBI brings and categorize them into two fundamental groups: 1) access and use of data and 2) self-reliant users. Despite the detailed
analysis and literature review, still there is argued that the research in the SSBI issue is scarce. In addition, the challenges identified should be validated and interpreted. The findings of this thesis will serve as additional knowledge to the previous studies done in this area. In addition, the results will be useful to business professionals and to both the companies that currently have a SSBI environment set up, but need more knowledge upon it and also to the companies that have not implemented any SSBI system and want to use it to improve their business needs.

1.4 Scope and Limitations

The scope of this thesis will be exploratory in the investigation of SSBI success attributes in companies that have implemented it, together with the values and insights that it brings for those companies. It will tend to contribute to knowledge about the challenges that some researchers have concluded related to SSBI. The companies that have implemented BI and SSBI will be on focus, because those companies which have implemented the BI system are more vulnerable to the SSBI implementation. In addition in this thesis the scope will also include the companies that tend to implement SSBI in their systems.

The limitations in this scope include the technological aspect. Since the nature of this research is inside the information systems, then any technical aspect related to computer science, artificial intelligence or mathematics will be left out. Also the economic value as part of quantitative analysis will not be considered. Instead the values analyzed belong to the decision making domain. The scope is not limited to a geographical area. The cases taken in consideration are from developed and in developing countries. The participants of the study are experts who have knowledge and experience in BI and analytics. The size of the company is not a limitation, but it will be analyzed as a factor in the empirical findings chapter.

1.5 Thesis Organization

The flow of this thesis will be organized in 5 more chapters:

Chapter 2 will give an overview of the literature review to explore the main topics that are important, in order to understand the SSBI domain. The second part of the literature review will contain a discussion about the analysis done, in order to build knowledge on this issue.

Chapter 3 describes the methodologies used in the research. It is divided in subtopics that specify the methods, data collection, analysis and ethical considerations.

Chapter 4 provides empirical data. The section is divided into findings related to BI and SSBI environment. This chapter is also linked to the questions based in the Appendix B, which are the basis in doing the analysis.

Chapter 5 discusses the findings. This discussion in this section is based on the findings and also the comparison of the results with the literature review. It is both practical and theoretical.

Chapter 6 gives the final conclusions of the thesis, together with the recommendations for future research.
Chapter 2: Literature Review

A literature review will be conducted, as a framework in order to relate the work of other studies by extending the topic, underlying the importance and filling in gaps. In this thesis the literature review will focus on understanding the SSBI as a phenomenon and the flow continues with an overview on the BI environment and then some main concepts that are essential in describing SSBI and fulfilling its domain are presented. This literature review is essential in understanding the body of knowledge and the research gap that leads to a contribution of the research done on SSBI and its value in business.

2.1 Design Techniques and search procedures

The search procedure is an important step to follow while doing a systematic literature review. There were used the databases provided by Linnaeus University. The main databases used in this case are: ACM, EBSCO, Emerald, Institute of Electrical and Electronics Engineers Xplore (IEEE), Springer, Scopus, ScienceDirect, Taylor & Francis, Web of Science, Wiley Online Library. In addition to databases, there are used some open access search engines such as Research Gate and International Journal Of Advanced Research In Computer Science (IJARCS). The articles were filtered based on the timespan of 10 years and on a combination of the keywords related to “SSBI”, “BI”, “business” and “analytics”. It is important to highlight that search only by keyword creates the problem of having ‘buzzwords’ which create the confusion of not getting the needed scholarly literature (Levy & Ellis, 2006). Therefore in this research the method of backward and forward search were performed to advance the literature search. They helped in creating a more established search procedure related to the references and authors search.

There is a generalized way of capturing, evaluating and summarizing the literature (Creswell & Creswell, 2014). The next step toward this process is inclusion and exclusion criteria. This criteria according to (Rowe, 2014) is related to some procedures such as: querying in electronic databases by using keywords, selecting A-level journals based on the information they portray in their abstracts and introduction. In this thesis work there were analyzed journal articles and conference proceedings papers with topics focused on main keywords: SSBI, BI, big data, cloud analytics and big data analytics. In order to understand SSBI it is very crucial to have a good understanding of big data as a phenomenon, its characteristics and the main challenges that it brings. BI environment is also very crucial and will be taken into consideration. It is important to know the challenges that are faced and what is lacking in BI setting that leads to SSBI. The articles taken in consideration are in English.

In this process there are some exclusion aspects which should not be taken into consideration. These aspects include topics of the main subject but in public sector, in universities, healthcare and other domains that are outside the scope of a business. Because the SSBI tools are interrelated with security it is important to mention that in this study articles within the field of security and GDPR (General Data Protection Regulation) will not be the primary focus. There are also some articles that focus too much on the technical aspect, hence they shift from the information systems area of study and therefore they are also excluded. Because BI and SSBI environment are applied in a setting where AI and ML are also present. The relation between them has different aspects when
taken into consideration, which will not be part of this study.

2.2 Literature review Analysis

2.2.1 Self-service BI – technological aspect

Analytics as a service, serves as an umbrella for service oriented architecture and cloud infrastructure. Effectiveness of business analytics systems is really dependent on the amount of information generated from the data (Delen & Demirkan, 2013). This situation, has led to the rise of self-service analytics (Clarke, et al., 2016). Imhoff & White (2011, p. 6) define self-service analytics as “The facilities within the BI environment that enable BI users to become more self-reliant and less dependent on the IT organization. These facilities focus on four main objectives: easier access to source data for reporting and analysis, easier and improved support for data analysis features, faster deployment options such as appliances and cloud computing, and simpler, customizable, and collaborative end-user interfaces.” Some tasks that self-service can be applied to include access to reports, access to data or functions or creating new resources. (Alpar & Schulz, 2016)

![Figure 1. Four objectives of SSBI. Adapted from (Imhoff & White, 2011)](image)

The Figure 1 above, shows the four objectives of self-service BI. Because there is needed sophisticated analysis in the company operations, SSBI tools should be easy to use in order to improve the productivity. If SSBI tools become easier to use, then the environment used for the tools should be able to satisfy the second objective, making data warehouse\(^1\) solutions fast to deploy and easy to manage. The reason for this is because, SSBI tools should be ready to support an agile methodology and contribute to enhance administration and deal with workloads. The third

\(^1\)“A data warehouse (DW) is an integrated repository of data put into a form that can be easily understood, interpreted, and analyzed by the people who need to use it to make decisions”. Song IY. (2009) Data Warehouse. In: Liu, L. and Özsu, M.T. (2018)
objective relates to the source data, which should be accessible. Imhoff & White (2011) emphasize that actually not all the data should be stored in the data warehouse, but relevant and operational data should be accessible for use and permit the workflow in the proper way. Regarding the last objective, making BI results easy to consume and enhance, it is noted as the most important one, based on the business community perspective. The information should be easy to grasp and eventually helping the BI implementers create the right environment for adopting self-service.

Several authors discuss about the dimensions of self-service BI, which create an overview of a model framework for the issue. Passlick et al. (2017) discuss the technological aspect of SSBI, and result that there is a need for the semantic layer. Semantic layer is an architectural element, which is designed to connect different data sources and provide a unified access. There are five dimensions of SSBI identified: technology, data, presentation, social feature and overall requirements (Passlick, et al., 2020). The previous mentioned elements lead to business value for better decisions, collaboration (data driven communication) and business integration. Table 1 below will give a summary of features of self-service BI along with challenges and benefits.

Table 1. Summary of advantages and challenges of SSBI (author’s work)

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility (Imhoff &amp; White, 2011; Stodder, 2015)</td>
<td>Difficult to scale (Imhoff &amp; White, 2011; Eckerson, 2012)</td>
</tr>
<tr>
<td>Software architecture (Stodder, 2015)</td>
<td>Data governance and integration. (Imhoff &amp; White, 2011)</td>
</tr>
<tr>
<td>Saves resources (Lennerholt, et al., 2018)</td>
<td>User uncertainty (Weiler, et al., 2019)</td>
</tr>
<tr>
<td>Facilitates the access data (Imhoff &amp; White, 2011)</td>
<td>Access of source data to business users (Alpar &amp; Schulz, 2016)</td>
</tr>
<tr>
<td>Improves decision making, agility and efficiency</td>
<td>Business users lack the needed skills when using SSBI tools. (Johannessen &amp; Fuglseth, 2016)</td>
</tr>
<tr>
<td>(Schlesinger &amp; Rahman, 2015; Lizotte-Latendresse &amp; Beauregard, 2018; Alpar &amp; Schulz, 2016)</td>
<td></td>
</tr>
<tr>
<td>Less dependency on the IT department (Alpar &amp; Schulz, 2016)</td>
<td>Implementation challenges (Lennerholt, et al., 2018)</td>
</tr>
</tbody>
</table>

In the technological context the concept of data quality is a very important. Data quality is the capability of data to satisfy needs under certain conditions, provide various services for an organization to reach top services (Taleb, et al., 2016; Panahy, et al., 2014). The dimensions of data quality serve for better classification of the information, so it becomes more valid and goes
through a unified process for the company (Sidi, et al., 2012). The important parts of these dimensions include: **consistency** – the data is in the same format, **accuracy** – data is accurate when it is saved and has real value, **uniqueness** – data cannot be mistaken, **validity** – data is in the right format so the right information can be conveyed, **completeness** – the availability of data to be used and **timeliness** – the extent to which data is appropriated for the task (Sidi, et al., 2012).

**Data governance** is the other challenge that is listed in the Table 1 above. It is also related with the data quality concept. Riggins and Klamm (2017) define data governance as an enforcement of the policies for the operational technical personnel. In this way it provides the data to right people when they need it, to make the right decisions. Even though Stodder (2015) argue that governance issue is more related to IT as a responsibility, when it comes to SSBI, it is not regarded the same anymore. Instead, it is strongly related to security, privacy and because the amount of users accessing the information increases, then governance is also affected. The role of IT is to provide governance for all users (Stodder, 2015).

It can be understood that SSBI is composed of self-service and Business Intelligence. In this context it is important to also provide a review upon the BI environment and explore its domain. Furthermore, some very relatable concepts such as Big Data, cloud and analytics will be explained. It is significant to describing them, in order to get the knowledge how they affect SSBI and how relatable they are with SSBI.

### 2.2.1.1 Business Intelligence – BI

Information processing in the right way is the key factor in having a competitive advantage. Caseiro & Coelho (2019) define BI as a set of processes towards data that are needed in decision making. Big Data is very essential in making predictions due to the huge amount of data that is generated. “*BD is a BI booster*” (El Bousty, et al., 2018, p. 170).

There are certain reasons why BI is regarded as an advantage to the company. Sangar & Iahad, 2013 (cited in Caseiro & Coelho, 2019) claim that since BI helps in generating many reports, there is needed a lot of information exploitation and systematic analysis which BI tends to fulfill. Marjanovic (2015) brings into focus the fact that BI together with analytics supports the organizational context and business users. In section 2.2.3 there were presented the three types of analytics which Riggins & Klamm (2017) give a relation to analytics and the generation of reports of data from the part of BI. They assess that analytics is precisely helping in creating a better prediction environment for the future. The main functions of BI include: data collection, analysis, sharing and dissemination of the information (Cheng, et al., 2020). In addition to the main functions BI has its own components which Niño et al. (2020) define as: **system source** – collection of data from sources, **acquisition of data** – Extract Transform Load (ETL) process, **data warehouse** – the repository for ETL, **reporting and analysis** tools. The data is sensitive therefore it should be governed in the right way and have a high quality.

The key success factors of BI can be analyzed from three perspectives: 1) organizational, 2) IS perspective and 3) Users perspective. Group 1 includes management support, service quality, BI & business alignment, service quality and technology driven strategies. The second group includes the flexibility of IT infrastructure which is also related to the DW. It is also described that this
group includes factors such as BI and IT dependence. The third group is more related to the IT knowledge of the team, user involvement and absorption which is not that much present in the BI environment. (Ain, et al., 2019)

Considering all the definitions and how the components of BI work there is the question whether this environment is stable enough to comply all the work and if there is the need for another business opportunity. To answer this issue the challenges of BI should first be addressed. One of the starting challenges is Big Data (BD). The data generated in a company will continue to increase and then the issue of data fidelity may be questioned (El Bousty, et al., 2018). El Bousty et al. (2018) discuss that DW becomes also an issue. DW is really important in accomplishing the ETL process, but data is not only gathered around one data source. As the company grows, unstructured data is presented and there are also other sources needed. In this case either the DW should be modified or new ones can be created. In addition to the issue addressed this leads to a lack in having the data governance. Ain et. al (2019) argue that BI systems are critical and some of the challenges that are identified in the study include: insufficient service quality, low level of user acceptance and also knowledge: “lack of motivation, capabilities, ability to explore the system and system logics and system errors as key challenges at the user level”. In this presented context, there is the need for a new opportunity such as SSBI, in the BI environment which offers some solutions to the previous mentioned challenges.

2.2.1.2 Big Data

Big Data effects in a considerable way the self-service environment. Referring to its own name, Big Data represents big amount of data. This general term though has some other implications as different researchers try to attach various explanations and definitions to it. Researchers define big data as massive datasets with a size beyond a typical database (Manyika, et al., 2011; Davenport, 2014) which tends to take advantage from data and translate it to business value (McAfee & Brynjolfsson, 2012). The uniqueness of big data is in its characteristics: volume, velocity, variety. It was Laney, 2001 who proposed the model of these 3Vs as a Big Data paradigm. 3Vs have been analyzed by different researchers (Wamba, et al., 2015; Russom, 2011; McAfee & Brynjolfsson, 2012) who further describe them as follows:

**Volume** refers to the large amount of data that can be stored. Big Data allows these large data sets to be stored and processed by parallel computing. The data comes from different sources, for example McAfee & Brynjolfsson (2012) state that Walmart collects more than 2.5 petabytes of data from customer transactions. It is estimated that there will be generated 40 zettabytes of data by 2020 (Lam, et al., 2017). Getting all these data help companies in predicting customer behavior and different patterns. **Velocity** refers to speed or frequency of generating and processing the data and doing real time updates. As a defining attribute for big data, velocity can be illustrated by sensors, manufacturing machines etc. that capture a big stream of data. **Variety** refers to the different sources and types that data are collected. GPS sensors, online and off-line transactions are some of those sources.

Big data is emerging, as technology is advancing and that adds more characteristics or attributes to it. In the definition of big data it was mentioned that the goal of using it is to create value, which according to Gantz & Reinsel (2012) is another V added. In addition to that, White (2012) indicates that another V should be considered - ‘Veracity’. Beulke, 2011 (cited in Wamba, et al., 2015)
defines veracity as an attribute that highlights the need for data analysis in order to gain a reliable prediction. Since analytics continues to expand and big data is still ambiguous, there are also other Vs added to it such as visualization, variability etc., but it is really important to mention that the core Vs of big data are only three, because those are the three dimensions that define and describe data, the other ones are valid in describing in meticulous details the big data platforms.

### 2.2.1.3 Cloud Computing

In order to understand the concept of cloud analytics, first what is cloud computing will be explained and then its relation with analytics will be studied.

The definition given by the National Institute of Standards and Technology (NIST) (2011, p. 2):

“Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

Following this definition cloud is a model which has 5 main characteristics, 3 service models and 4 deployment models. As NIST concludes the 5 main characteristics are:

Cloud computing: is self-service: meaning that it is automatic and does not require human interaction, has broad network access: it can be offered for access through a number of different platforms such as mobiles, tablets etc., is resource pooling: it serves a large number of cloud consumers, has rapid elasticity: able to offer scalable services for its customers, has measured services: meaning that cloud systems control and optimize the resources automatically.

There are 3 service models which are cloud-based infrastructures:
- **Software as a Service (SaaS):** The applications are accessible from various client devices through an interface.
- **Platform as a Service (PaaS):** Offering the consumer to deploy into the cloud infrastructure using programming languages.
- **Infrastructure as a service (IaaS):** Offers the user a virtual infrastructure such as servers, storage etc.

Related to the four cloud deployment models, they are: **Private cloud:** it is used by a single organization for several customers, **Community cloud:** it is offered for the use of a particular community of consumer from organizations, **Public cloud:** it is open use for the general public, **Hybrid cloud:** is a combination of two or more distinct cloud infrastructures.

Why Companies choose cloud services?

In order to maintain their competitive role in the market and creating value, business need innovation. In order to achieve the innovation needed, cloud services come as a great solution. Balachandran & Prasad (2017) list six benefits of cloud services: **Cost efficiency:** basically they stop investing in stand-alone servers, **Continuous availability:** the end users can have access to the information wherever they are and cloud services make that information available even if there is a downtime, **Scalability and Elasticity:** cloud services offer many resources to organizations even though the workload increases, **Fast deployment and ease of integration:** the long waiting time to get the information is decreased, **Resiliency and Redundancy:** cloud systems offer many alternative
solutions in case of failures and also are adaptive systems to failures, Increased Storage Capacity: cloud services offer unlimited storage capacity.

### 2.2.1.4 Data analytics

The concept of analytics or data analytics is defined by Ravi, et al. (2018, p. 20) as “...the process of inspecting, cleaning, processing and modelling data with the aim of gaining useful patterns, insights, and conclusions that support decision-making.”. Analytics is about finding the patterns inside data sources that bring a meaningful output and serve a purpose. There is a distinction between data analytics and big data analytics. Sun, et al. (2015) refers to data analytics as a science for working on the data in order to learn, build conclusions and make predictions. Instead big data analytics is a concept which is wider and relies on big data and analytics altogether. So we can see data analytics as a composing part of big data analytics. Mikalefa et al. 2018 literature review (cited in Mikalefa, et al., 2020) defines big data analytics as a new generation of technologies designed for extracting value.

![Figure 2. Big data analytics, Adapted from (Sun, et al., 2015)](image)

Business operations in order to serve the goals that the companies have, need tools, safe models, statistics and other activities. Davenport and Harris, 2007 (cited in Phillips-Wren, et al., 2015) emphasizes that companies gain a competitive advantage by adopting analytics in their processes. The data-driven concept is an approach of using the analytics, interpreting the results and eventually taking strategic decisions. Big data analytics is defined by Kiron et.al cited in (Akter, et al., 2016, p. 114) as “competence to provide business insights using data management, infrastructure (technology) and talent (personnel) capability to transform business into a competitive force”. As described by Sharda, et al. (2014) there are three levels of analytics: **Descriptive**: understanding and analyzing data, **Predictive**: predicting the future based on data mining techniques, **Prescriptive**: it tries to give explanations and forecasting what to do to achieve the objectives of the business.

Big data analytics is also discussed as a process through frameworks. Phillips-Wren, et al. (2015) propose a framework for BDA, in order to understand the components that organizations and companies have to be aware of in order to effectively plan and allocate the resources. The components included in the process are: data sources, data preparation, data storage, analysis, data access and usage and management. Wang, et al. (2018) describes the dimensions of the benefits that BDA brings to companies which include: IT infrastructure benefits, operational benefits, managerial benefits, strategic benefits and organizational benefits. Despite this clear data-driven approach, Wegener and Sinha, 2013 (cited in Wang, et al., 2018) assert that 77% of companies surveyed by them, did not have clear strategies for using big data analytics effectively. In this

16 (53)
condition, there is needed more research and implementation for BDA in companies and organizations.

Cloud Analytics is a framework that is business use for solving operational issues. In order to perform better several analytical techniques need to be employed. (Ravi, et al., 2018) Ravi et.al (2018) explain that there is an interdependence between cloud and analytics. They divide this interdependence into two subcategories: a) analytics in cloud and b) analytics for cloud. The first one explains how analytics can be performed using cloud, while the second group explains why analytics is needed for cloud.

Cloud analytics is referred to analytics as a service because of its offerings (Fattah, 2014). Analytics in cloud actually comes as a service. The enterprises are growing rapidly increasing so the number of structured and unstructured amount of data. In order to help in producing actionable results for companies, the model of analytics as a service (AaaS) is being used.

Analytics-as-a-Service (AaaS)

Analytics as a service is being referred as Agile Analytics. Agile is an iterative process, which is really used as a set of principles in order to be more interactive and help companies to make improvements and adapt to the new environment changes and needs of the customers. The Figure 3 below describes the services that are supported by analytics.

![Figure 3. Big data analytics and web services, Adapted from (Sun, et al., 2014, pp. 4-5)](image)

Sun et al. (2012) mention training data, streams, predictive models etc., as analytical artifacts which can be stored in cloud and it is precisely this cloud that manages the server instances. Big data, analytics, hardware challenges, software complexity and cost are some series of events that bring the need for implementation of analytics as a service. Actually many authors link this concept to Business Intelligence (BI). There is a relation between Big Data Analytics and BI, which is analyzing of data, but there is a slight difference too. BI’s aim of analyzing the data is helping organizations in the decision making, while big data analytics focuses on solutions to make...
predictions. In both of these technologies cloud computing is essential in further development of the business operations.

In order to give a better explanations for the analytics as a service domain, several frameworks are proposed by researchers. The frameworks belong to two groups, the one that focuses mainly in the architectures and the other that analyzes the migration of analytical applications into cloud. Sun et.al (2012) proposes a technical framework for analytics in cloud with aim to: a) enable enterprise tenants to use analytics as a service for their solutions, b) to enhance the current existing analytical platforms, c) to design a Service Level Agreement (SLA) in order to satisfy the diversity of analytics that comes with tenants’ demands.

Naous et al. (2017) in their literature review emphasize that there is a lack of insights regarding the emerging categories of analytical cloud services. With their analysis they pinpoint two things: a) providing a classification scheme that supports in describing the phenomenon of AaaS, b) deriving archetypes for the AaaS that help in building innovative business models. Related to the first contribution, the authors analyze 28 cases based on Business Models (BMs) and categorize them as AaaS vendors, Value Proposition and Customer Segments. Through this classification, there can be generalized the results for the components of AaaS offerings that are analyzed, if they are partially or fully covered in each of the 28 cases.

The result gathered from the categorization schema, is valuable to be used in creating archetypes for the AaaS Business Models. There are 5 main archetypes that come as a result of the study from Naous et al. (2017): 1) Visualization as a service – targets end-users that are interested in visualizing their data to get valuable insights. 2) Self-service analytics as a service – it offers self-service analytics for business users and analysts and perform statistical modeling and description. 3) Analytics platform as a service – it offers advanced analytics algorithms and techniques related to machine learning in order to help in data modelling. 4) Big data AaaS – it provides a big data infrastructure for processing, managing sources and performing processes such as data mining and analytics. 5) Edge analytics as a service – it provides infrastructure for advanced analytical capabilities for IoT platforms.

Marjanovic (2015) states that AaaS as a science of research has become a service oriented thinking paradigm, which has made information system researchers see it as a new opportunity for decision-making. In general terms, Marjanovic (2015) considers it as a service-oriented decision support that results from the concept of data as a service and information as a service. The author further explains that AaaS was being more explored by the researchers towards organizational users rather than consumers. They use a case study on a platform for school usage as a BI&Analytics environment. The framework used for that BI environment had some specifics such as: users can create their own insights because of the analytical tools available, which in this case some as a form of public forums. Also, there was shared different data from the data repositories with different contexts. The users that were exposed to this framework were media, parents, teachers, school principles and industry analysts. What the work of Marjanovic brings to focus is the consumer-focused analytics in the AaaS area and it is stressed that this perspective of analytics adds more value to understanding the individual needs of both, specific consumers and the wider society. In this way the focus is a combination of services and needs.
2.2.2 Digital capability (organizational context) - Business needs and specifications for self-service BI

While understanding the concept of SSBI as a facility then the question raised is how do organizations find it currently?

Generally companies do not have this idea of SSBI widespread and Logi Analytics, 2015 (cited in Alpar & Schulz, 2016) predicted that approximately 22% of potential users put it into practice and some of them report failures. In this case, there should be understood what are precisely the business needs and specifications that make them apply self-service business intelligence.

Businesses are reliant on analytics because it makes them more efficient and increases their productivity. What they tend to analyze the most are transaction and demographic information, customer behavior, sales and marketing efforts. Many companies have positions such as Data Analysts/Scientists, but the necessity has made the organizations require self-service analytics tools. This form of adoption make people of a company perform their role of expertise (ex. Product Manager) while doing analytics for certain purposes. (Convertino & Echenique, 2017)

Further in the analysis Convertino & Echenique (2017), mention that there are two main needs that companies find essential: need for handling large and diverse datasets and the need for keeping track of combined datasets. Categorization of the people who deal with this is: Data Analysts, BI Analysts and Data Scientists. From a survey that Convertino & Echenique (2017) conducted, Data Analysts and BI Analysts spent more time in data preparation and organization. The gap found by the authors is that companies are pushing for more data based decision-making to maintain their competitive advantage. They further claim that there are needed more multi-tools which will help the current analysts in achieving their results and performing more complicated analytical actions, and at the same time the tools can also help companies which do not have current specific roles for data analysts.

Users of a BI environment are significant, but sometimes there are some ineffectiveness that occur due to limited BI capability. Stodder (2015, p. 11) mentions that “Self-service tools allow us to take different pieces of data from different sources that we’re trying to analyze and put them together without being confined to defined elements and just one particular data model.” In addition, with self-service support it is easier for managers to and executives to get the insights without IT interferation. In Bani-Hani et al., (2018) it is indicated that there are five main attributes that lead towards the success of self-service technologies (SST): co-production, autonomy, ease of use, control and trust. Their characteristics and explanation are summarized in the figure 4 below:

“Co-production

“It is the process where a customer uses a firm’s proposed service and integrates it with his or her personal resources such as skills, knowledge, time, etc. to generate personal benefits. (Oh et al. 2013 cited in Bani-Hani et al., 2018) It is a cost reduction strategy and meliorates time efficiency for employees.” (Bani-Hani, et al., 2018, p. 163)
This attribute is related to the adoption process, where employees try to serve themselves. (Evanschitzky, et al., 2015)

Users need to have control over the SST in order to boost efficacy.

Users have independence to conduct transactions, engage with the SST anytime they see it necessary without need of assistance. (Bani-Hani, et al., 2018)

Trust is described in two dimensions according to (Bani-Hani, et al., 2018): a) believe – being honest and competent and 2) intention – ability of the user to be exposed in terms of loss and behavior. In general they are related to consumer privacy. (Oh, et al., 2013)

Figure 4. Explanation for SST attributes (author’s work)

2.3 Summary of the literature review

In order to understand the context of SSBI, a detailed literature review was conducted, which is essential in reaching to the research question. There was followed a flow for getting to the main issue. This flow which started from SSBI and then deducting to its components: BI, big data and continuing with cloud computing, cloud analytics and analytics, was essential in creating a consolidated set of concepts without which the main topic could not be explained and comprehended in a complete way. The papers analyzed strengthen the fact that there is an existing research gap related to the value that SSBI brings to business. SSBI is considered as a new feature of BI and has not gained a big recognition on implementation due to the challenges that are faced, which were analyzed previously in Table 1. In addition to this, the value that it brings to operations are not analyzed in specific, but are left in a general context.

Lennerholt et al. (2018) discuss that the challenges gathered through a systematic literature review, should be further validated, because a deep understanding of how organizations interpret them should be gained. Furthermore, current analysis made on the SSBI area, are focused on SST, which corresponds to a more technological aspect. In the paper by Bani-Hani et al. (2018), it is highlighted that research in SST and SSBI fields has increased, but it is shifted towards a more quantitative approach, leaving so a gap towards the qualitative research method. Following this, there is still needed more analysis and research to be done for having a better understanding on how SSBI benefits the organizational and individual level (Bani-Hani, et al., 2018). Isik et al. (2013) give a research model for the BI success, where it divides it into three main groups: technology, organizational and decision environment. Because of the relationship and integration between the three previously mentioned components, Isik et al. (2013) concludes that there is a necessity to have the right BI capabilities when trying to implement it and further grow. Despite that, it is not mention how the expansion from BI to SSBI is done, but still the form of framework that they
provide with the research model composed of those 3 components, can be used as a basis when analyzing the SSBI model. Thus technology, organizational and decision context can serve as a base model for SSBI too, but apart from the attributes that Isik et al. specifies, new ones that were analyzed in Figure 4 and Table 1 should be taken in consideration. In addition the concepts of big data, analytics and cloud that are elaborated in the literature review, are important in understanding the big picture and how it effects both the technological and digital capability in SSBI environment.

Big data and analytics have brought a great power in BI and eventually in SSBI. Together with cloud analytics, the computing power is increasing, hence boosting the SSBI environment. The help in the technological aspect is that the tools are more analytical driven and users can freely use them potentially. On the organizational perspective, it is the managers’ responsibility to be able to differentiate the users and develop more policy guidelines. (Riggins & Klamm, 2017)

There should be given further recommendations, of how should SSBI be improved and at the same time what do organizations that want to implement it, find crucial in order to be able to adopt rapidly. In addition there should be also understood how long do those companies expect to reach SSBI in the context of technology, time, organizational and operational processes.
Chapter 3: Methodology

This chapter will describe the methodology used in analysis. It will start by providing an overview of the paradigms used in the methodological approach. Furthermore, data collection techniques and data analysis will be explained. Lastly there will be presented the ethical considerations.

3.1 Methodological Approach

Creswell and Creswell (2014) indicate that the philosophical assumptions and methods constitute the main components of the research approach. The research questions stated in this research, aim to explain and contribute to knowledge about the SSBI as a success factor for business. SSBI is a phenomenon which needs to be studied by a combination of systematic literature review, in order to provide a deep understanding of the phenomenon, description of the settings and environment and reaching to the gap that still exists and needs to be completed. To fulfill this objective qualitative approach is the proper type chosen for this research.

The philosophical assumptions have different notations by several authors but the appropriate term the will be used in this work is ‘paradigms’ (Lincoln, Lynham, & Guba, 2011; Mertens, 2010 cited in (Creswell & Creswell, 2014)). For the qualitative approach, Chua 1986 (cited in Klein & Myers, 1999) classifies the research into three main paradigms: positivist, interpretive and critical. Orlikowski & Baroudi (1991) describe them as follows: **Positivist** – is a study that is focused in theory testing, quantifiable measure of variables etc. in order to reach understanding for the phenomenon. **Interpretive** – is a study which “…assumes that people create and associate their own subjective and intersubjective meanings as they interact with the world around them.” **Critical** – is a study which seeks to be critique about the status quo of the phenomenon and aims in solving the contradictions that exist. Following this description, the scope of this study falls into interpretative paradigm. Rehman and Alharthi (2016, p. 56) assess that interpretative qualitative “requires a social phenomena be understood through the eyes of the participants rather than the researcher”. The goal is to gain a deep understanding of the social-technological setting through interacting with the participants of SSBI, BI and analytics environment. In this process the role of the researcher is to create a bridge of communication to the participants and to be able to use the methods that will be later on described in this chapter, in order to construct the knowledge according to the interpretivism paradigm.

As Klein & Myers (1999) states, there are two main sources for the set of principles in evaluating the interpretative research. The one that will be followed in this thesis is the hermeneutics nature. As the author describes, the hermeneutics philosophy revolves around a circle, which helps in broadening the nature of IT and have better interpretative outcomes. However there should not be a misunderstanding that the interpretative research is interchangeable with the qualitative. This whole description serve as guidelines for the researcher to conduct in the proper way the scientific work. Furthermore the research process is designed in two main parts: a) systematic literature review, which was explained in the second chapter how it was conducted and b) the empirical findings which will be further explained in chapter 4.
3.2 Methods of data collection

This section will provide information about the data collections used for the study. Qualitative research includes several data collection methods such as interviews, documents and observations (Creswell & Creswell, 2014). In this thesis semi-structured interviews will be the main data collection instrument. Interviews are an essential method for data collection, where the researcher aims to seek a better understanding of the specific phenomenon. That is the reason why the primary source of data collection will be the semi-structured interviews. The interview process includes the following steps: a) interview protocol, b) reaching the participants, c) interview process, d) transcripting. The interview protocol as stated by (Creswell & Creswell, 2014) is a guide that makes it easier to plan and develop the process. The interviews were conducted with the participation of specialists in the SSBI, BI and analytics domain and who also work in different positions, departments and companies. There were six participants involved and the process was held face to face with one participant in Sweden and remotely through Google Meet with the five other participants. The selection of the participants was done by contacting them via email. The 2 participants from Sweden worked in a company from which the author had previous working experience and with the other participants the selection was done based on a company background check and experience BI and analytics area. The duration of the interviews will not be conducted in a long term scope, but are scheduled within a time span of 2 months. The interview process includes also the time duration which does not exceed 60 minutes, as recommended by Gill et al. (2008). During the process of the interviews there are explained the description of the scope of analysis, confidentiality and ethical issues. As the researcher in this process, I will be having a neutral position by not participating. The interview guide is presented in Appendix B. It is organized in four main sections: 1) introduction – general knowledge about the interviewee background, 2) – BI context – to build knowledge upon the current BI environment functionalities and challenges, 3) SSBI context – includes questions about SSBI environment and 4) closing questions - include information about the future of SSBI and recommendations. The SSBI context section is divided into two main sub-sections: technological and organizational aspect. In order to conduct the interviews in the proper way, there is presented a form of consent to participate in the process and also record them. The recordings are only audio based and in addition to them some notes are taken to keep the track. The following table presents the individuals with the information gathered from the introduction questions.

<table>
<thead>
<tr>
<th>Alias</th>
<th>Title/Position</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Head of BI</td>
<td>Company A</td>
</tr>
<tr>
<td>P2</td>
<td>CEO</td>
<td>Company B</td>
</tr>
<tr>
<td>P3</td>
<td>Team Leader in the team responsible for extraction of data for analysis</td>
<td>Company A</td>
</tr>
<tr>
<td>P4</td>
<td>System Administrator</td>
<td>Company C</td>
</tr>
</tbody>
</table>
3.3 Methods for data analysis

Since the thesis is following a qualitative approach, then thematic analysis will be conducted. Data analysis will be carried on the interviews. Braun and Clarke (2006) discuss about the relations between the questions of a qualitative research. They discuss that the question should be not too broad, but instead narrowed down and eventually those narrow questions bring the big picture.

Based on the analysis done by Creswell and Creswell (2014), the data analysis process goes in a hierarchical approach but the steps can be interrelated and not in a fixed order. Following this explanation, the analysis steps in this thesis are based on the (Creswell & Creswell, 2014) guidelines: 1) transcribed interviews are prepared, 2) conceptual designing to generate the first information from the raw data, 3) coding technique, 4) themes generation, 5) main themes representation, 6) interpretation. In order to conduct an efficient data analysis on the interviews, basic coding technique will help, since it provides identification for the topic of SSBI and is valuable when organizing the information. The data analysis from the transcripts of the interviews is going to be categorized in relevance with the 3 main groups which include the main themes also: technological context, organizational and decision making. The process of analysis is classified as an inductive and iterative process. Knowledge will be gained which will be further used in reasoning to make broader generalizations from the data. Another important data analysis method that will be used is data condensation. Elo and Kyngas (2007) state that in order to attain a broad description of the phenomenon then content analysis is the best research approach. In this thesis the condensation will help in the process of selecting, simplifying and also transforming of the data from the interviews. The aim is to reach a good content analysis. Elo and Kyngas (2007) describe content analysis as a process which is both inductive and deductive. Since this thesis approaches more the inductive method, then the processes that describe it are: preparation, organizing and reporting (Elo & Kyngas, 2007). The analysis done in the upcoming chapters based on all the methods mentioned above, will come into certain forms of visualization: tables, graphs and charts. Furthermore the analysis process is also based on the systematic literature review done in the second chapter. It is important to make a comparison in the analysis between the experts and literature in order to reach the best conclusions.

3.4 Validity and reliability

Validity refers to the generalization of the findings of the study. According to Hernon & Schwartz (2009) validity can be seen in different aspects: external validity, internal validity or other aspects. In this thesis external validity, which relates to the explanation whether the findings can be generalized, will be achieved by interviewing the different people and set of groups previously described in the paragraph above. To reach the internal validity, which refers to the match of theory and observations, the literature review together with the findings gathered from the interviews will be discussed in the other chapters. In compliance, a form of triangulation is used in this thesis, which according to Creswell and Creswell (2014) complies the correct justification for the created
themes. Self-reflection is another practice which contributes in clarifying the bias that the researcher brings in the study through the interpretation (Creswell & Creswell, 2014). This form of evaluation will be presented in the discussion chapter.

Reliability is related to consistency of data. Hernon & Schwartz (2009) discuss 3 ways of estimating reliability: internal consistency, pretest, test and retest. In this thesis, internal consistency will be approached since it investigates the phenomenon through two different set of questions and analyses the correlation between them. The two different set of questions belong to the group of participants that have implemented SSBI in their organizations and the other one are the companies which have no experience with SSBI. Creswell and Creswell (2014) state that consistency in the coding phase is important in maintaining reliability. In the thesis iterative comparison was done between the data, codes and definitions to make the study reliable.

3.5 Ethical considerations

Ethics is related with the proper and right way of conducting a research. Ethical considerations are reflected through the whole process of conducting the research: prior conducting the study, beginning of the study, during data collection, data analysis and reporting (Creswell & Creswell, 2014). In this thesis, integrity of the participants is the first priority, so there will not be any ethical concern towards confidentiality. The transcription of the interview will be completed in accordance with the consent of the participants. There will not be experienced any violation about scientific misconduct. There is presented a form of consent to participants of the interview which is shown in the Appendix A. The information that will be gathered is not sensitive and revealing information therefore there was not needed a real non-disclosure agreement (NDA). In addition, the confidentiality issue is minimized as much as possible in the research, in order to not impact the participants in any form. The form of questions are based on the topic and there is no form of revealing any information about their private life. Another important point which is taken in consideration in this thesis is the transparency. The transcripts were sent to the participants who wished to have them and in addition the transcripts will not be available in the Appendix due to the rejection of participants. They gave their consent in using the information but not making public the whole interview process. The audio materials will also be very discrete and available to the author of this thesis.
Chapter 4: Empirical Findings

This chapter will provide the findings based on the interviews with the experts and following the discussion developed in the literature review chapter. The aim of the findings is to give answer to the main research question and also expand to the other sub-question. In the first part, the current BI context will be presented based on the experts’ point of view. In the second part, the technological aspect of SSBI will be evaluated, then in the third part the decision-making aspect will be presented. Lastly, how SSBI can be approached in companies that do not apply it, will be discussed based on the findings.

4.1 The current BI environment

In order to reach to valuable findings on the SSBI environment, then a good understanding of BI environment should be evaluated shortly in the first phase. Following this, the process of reaching the desirable results and rich findings would be presented in the figure 5 below.

![Figure 5. Process of conducting the findings (author’s work)](image)

The experts of BI had several years working in that environment. In order to better understand the SSBI environment, first there were some questions presented to them, with the aim to discover what was lacking in the current BI setting. Table 3 below, summarizes the main overview of the empirical findings of the first category.

Table 3. Summary of transcribed data for BI setting (author’s work)

<table>
<thead>
<tr>
<th>Question Position</th>
<th>Challenges in the current BI environment</th>
<th>The department that has the most necessity of BI support?</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td><em>Fetching data</em> from the right source and <em>Validation</em></td>
<td>Management and when going forward sales and marketing.</td>
</tr>
<tr>
<td>P2</td>
<td>Data quality</td>
<td>Operations and then Finance.</td>
</tr>
<tr>
<td>P3</td>
<td>The correctness of data, consistency and get all the people of different departments agree on one definition</td>
<td>Management and Economics are priority number one.</td>
</tr>
<tr>
<td>P4</td>
<td>Query performance, administrative problems, poor data governance and company politics rank</td>
<td>Operations then marketing.</td>
</tr>
</tbody>
</table>
P1 mentioned that in the BI environment where she had been working on for a long time now, “it is really important that we have started to see the data as something in business decision, marketing activities and giving customers a good offer or journey. We have moved from using data from just reporting to giving value to company.” In addition to this statement, P3 further explains that data consistency was an issue that many years ago they were not focused on. “Now we are most focused in that issue, we are able to analyze it in the same way, we want to make it more consistent, but is hard to let all the old system.” Caseiro and Coelho (2019) state that firms in order to stay competitive should gather the right information in order to improve their decisions, which is a hard task. This is directly related to data quality that P2 in the interview points out. Foster et.al (2015) discuss that one of the goals for companies is to have data quality processes proactive and reactive respectively meaning that the goal is helping in the improvement of the process in order for issues not to occur (proactive aspect) and getting a feedback for future resolving of the issues (reactive aspect).

“KPIs (Key Performance Indicators) can be used to evaluate the success of an organization, facilitating the detection of the deviations and unexpected evolution of the behavior of a company.” (Pérez-Ál, et al., 2018) P1 stated that validation of data was the easiest KPI that needed to be followed since in the beginning of the BI process. The process starts in finding the right data, validating the data, trying to combine the data sources so that the right data can be taken and then it provides the possibility to compare the data all the time. She mentions that fetching the data and validation are considered as challenges in the BI environment because it is not a priority when you get started in the beginning. Both those features are related to doing research about data. There are a lot of databases which hold a lot of data just for one customer, so finding the right and correct one, understanding and then fetching and validating is the most important process. All this process makes it possible to create the right customer dimension, which makes it easy for other tasks too. It is important that the research of the data is done in the correct way, so then the right customer dimension is created as a result and it is eventually the same for every customer. This also creates a joint in the point with the explanation of P3 about the consistency of the data.

P4 and P5 were part of a company in Albania, where they both mentioned that poor data governance and company politics ranks were some serious issues that they had experienced in their BI environment. Data governance is actually related to the whole 3 aspects: technological, people and processes. The fact that BI faces difficulties in the data governance aspect, this leads to several problems such as: data quality that P2 highlighted, security, accessibility and lack of knowledge which were previously explained from P1’s perspective. Altogether they create the ownership problem. Data is not owned in the right way, eventually creating a poor data governance environment.

BI is extremely essential in business because of its main aim of providing data for managers to support the main activities. In this context, it is important to know the departments that have more
necessity of BI support in the company. P6 states that every decision in the business area is based on the reports generated by BI. That is the reason why BI is important for every department. “The reporting chain starts with BI.” The other interviewers elaborated the BI importance on other departments in a ranking form. It was indicated that management is the first priority, then operations, finance/economics and then marketing. The reason for setting management as the top first priority based on the answers is because managers need to have more granule data and create deep knowledge based on the reports that are generated. Top management also needs to know about the customer patterns and how does the company reach to the final reports, analysis and graphs. P1 mentioned that the development team already has access to the data, so what is left is to shift forward to sales and marketing in the future. In marketing, the data was more used in the form of reporting and less analysis, so that is the upcoming step. Finance department already has deep knowledge about the data that it uses, so there is not needed a big effort in that part. These answers go in conformity with what Pérez-Álvarez et al. (2018) shortly emphasize on the BPM (Business Process Management). In their introduction they substantially define three aspects that should be followed at management level in order to make better decisions: 1) model the relations between the elements of the organization, 2) verification of the correctness for the model and 3) predict the future of the decisions in relation to the business evolution.

Based on the evaluation of the answers for the BI environment, it could be assessed that the usage of BI is generating the reports in order to gain insights from the data and use them in several main departments inside the organizations to reach the operations and serve the main management S.M.A.R.T (Specific, Measurable, Achievable, Relevant, Time bound) (Ogbeiwi, 2017, p. 326) objectives. In order to create better value, decisions and do them in a faster way, there is needed more analytics. As described in the second chapter in this paper, analytics is about getting value from the data, owing of the fact that factual decisions have to be based and proven in real data, so they can be objective and more accurate. Eventually, the BI environment needs a more innovative solution to approach the needs for creating better value within the organization. Self-service business intelligence comes as a crucial impacting factor in the BI setting. The need of shifting to SSBI is growing rapidly and it is becoming a real valuable necessity. In pursuance of the main research question of this thesis, now that evaluation of BI environment is accomplished, then an evaluation of SSBI needs to be done. To analyze the findings for the SSBI environment, the experts participating in the interview process were categorized in two groups: a) company applies SSBI and b) company does not apply SSBI. The findings will be presented in the next 4.2 subchapter.

**4.2 SSBI environment**

The evaluation of the SSBI environment and its findings are divided into two main parts: a) technological aspect and b) operational and organizational aspect that affect the value that companies gain. The interviewers participating in the process, were part of companies that either apply SSBI or not. Respectively five of the people belonged to the group that were using SSBI and one in the group that hadn’t implemented it yet.

**4.2.1 SSBI Technological aspect**

The Table 4 below will present the tools that were mentioned by the participants.
The group belonging to Qlik Sense SSBI tool, had chosen that one because the staff in economic control and the ones who worked with analytics had previous knowledge about the tool. P2 explained that in his company, they were more focused in using open source software because they find it more convenient. About 2-3 years ago they discovered some meta-layers which fit well their purpose for more personalized dashboards and creating their own reports: “...we send the data, the information to some very denormalized tables and so those tools help to retrieve the information and distribute the information among the users, especially also the customers, so we can share the customer data also...the data to the customer.” In the case of OBIEE and SAP Business Objects BI, both these tools empower the self-service environment helping so in communicating business insights to support decision-making, and the reason of working with them is just part of an agreement between the BI team based on the current needs of the business. When choosing the appropriate SSBI tool, training of the staff about it is a challenge that is commonly faced, but not too substantial. Generally the software that will be implemented, contains introductory materials, but still there is needed some sort of training to convey the special parts of it that analytics and other teams require to know. The manual work is one of the most problematic aspects that has made organizations shift to SSBI together with the independence of the users. The tools mentioned above, each one has unique features and also there are some other tools for SSBI such as: Sisense, Tableau Desktop, Google Analytics etc., but the reasons for choosing a specific tool according to the experts is previous knowledge about that tool, specific business needs, money invested on that tool together with time and effort for implementing it.

**Data quality** is a concerning problem in BI environment, yet it is present in SSBI again. Imhoff and White (2011) emphasize that it is not just about installing a software, but a solid infrastructure is needed which is essential in planning & design, data quality, data models for data warehouse and scalable databases. In the challenges mentioned in the table 1 of the literature review chapter, data quality is considered as an inhibitor to SSBI and Imhoff and White (2011) in their analysis
place it as the second highest inhibitor. The reason stands in maintaining the data quality which is a challenge that will not disappear by implementing SSBI. P6 considers data quality to be an existing challenge in SSBI that eventually comes of having all data sources in one source and controlling data distribution. P2 also accentuates that data quality is considered as the number one blocker, which is in relationship with data governance. The dimensions of data quality discussed by (Sidi, et al., 2012): consistency, accuracy, uniqueness, validity, completeness and timeliness are also discussed by the respondents. P3 phrases that “...if it presents a number and we have a definition of what it means and the others have other definition of what that is, then some decisions could be made based on wrong definitions and that is scary.” The definition in this case is related to the dimension of validity, accuracy which again is in relation with uniqueness and also with completeness. Considering the process that P1 described: 1) gathering data from different data sources, 2) preparation (including here data cleaning, processing), 3) analysis (including here analytics, BD analytics), 4) visualization and 5) interpretation for decision-making to create real value from data, SSBI environment leads to a better data quality setting. Comparing the challenges emphasized in the BI environment, service-oriented thinking is a growing phenomenon. It does not implicitly mean that moving towards service-oriented thinking data quality is great, instead data quality tends to be improving by SSBI tools. As all the participants highlight, more analytics is done on data, hence data quality improves only if this new advanced medium is well established and BI is very consolidated.

Data governance is another blocking issue in BI which was previously raised as a challenge by the experts and it is extended to SSBI too. When talking about data quality and its dimensions, it can be implied that there is relation between them obviously. As interviewees assert, data governance is about controlling of the data which denotes secure, consistent and available data. Data governance constitutes a strategy for the company, which is necessary in making business decisions (P4, P5). Each of the three mentioned concepts above, can be further analyzed in the SSBI context, because each one has its impact in governance.

When arguing if data is more secured in SSBI, P3 elaborated that: “The most secure system in the world is the one that has no users. But that’s not useful. So if there is data security then it is not bad to let everyone know how the data/values are coming and use them. ....Actually, not everyone should know it. You should have levels of confidence of what should each employee use and also trust them that they won’t misuse it. Because data enables in making better decisions more than analyzing teams. People have different viewpoints then you get more eyes. Not all people are data security friendly.” In addition, P6 stated that data is more secured and governed when information is centralized in a specified unit, “but knowing that SSBI allows user to interact with data without changing them gives security, even though thinking that it can be shared to anyone is challenging”.

Since data comes from many different sources as the BI P6 states, then inconsistency becomes a problem. In this case, data warehouse comes as a medium and solution. Sharda et al. (2014) imply that \( DW + DSS + BI = \text{business process} \). But the question that arises is whether data warehouse changes in SSBI?

P2 argues that it is really difficult to bring all the data for analysis into the DW and that is considered as a challenge in the implementation of SSBI: “The ETL process, bringing, moving all
the data, understanding where is the shadoware and data in your company, putting a point together and looking at the quality of data and bringing them into data warehouse, data lake or whatever is the most difficult thing." (P2). Related to this issue, P3 would claim that they built new data warehouses for SSBI. New data warehouses eventually mean new architecture or modification of it. P4 and P5 mention that it is not necessary to create new data warehouses from the beginning, instead it depends on the existing DW and how well established the existing environment is. They also make a distinction regarding the internal and external data, which in this case the second one does not necessarily have to be stored in DW. Actually it is dependent on the SSBI technology that is used. The traditional process of BI uses one DW as its central infrastructure, but a more modern BI environment should adopt better infrastructures that offer better real-time DW. It is not appropriate to say that DW are obsolete, because they are essential in data management in the BI environment. Despite the decision whether to keep the same data warehouses or modify them based on the needs and the SSBI tools used, what can be implied by the answers of the interviewees, is that there exists the same definition for the same thing and this makes data more valuable when taking decisions.

Coming again to the security issue, it is still an inhibitor in SSBI setting. All the experts interviewed agree that having a large group of people accessing the information is not secure. The need for more control together with the other reasons analyzed led to SSBI, so security was still not sufficient in the previous environment and all the experts assert in this point. P1 mentioned that in their company security as a very sensitive topic was kind of in the same phase as it was previously, with not a lot of change but still she mentioned that in their current phase they were pleased with the security politics that they had, but when moving to the future and further develop in their SSBI environment, then at that point they will need to take care of maybe some changes in their security politics. Generally the interviewees agree that data is more governed with SSBI, but there are still some inhibitors that block data for being 100% governed.

4.2.2 SSBI Operational aspect

In this section the empirical findings for the operational context will be presented. The questions categorized specifically for this section tend to get insights related to the users of SSBI, decision-making setting and effect on the main departments in a company. The Figure 6 below will illustrate an overview of the data collected.

SSBI environment helps in the operational level for better decision-making, improving the
effectiveness and efficiency. The interviewees mention that in SSBI setting it is important the users (employees) can have equally access of the information and the extend of BI in this phase is crucial for the tasks that are performed. Describing the main users of SSBI, the answers do not differ that much but are based in the size of the company. P2, who is part of an organization with less than 250 employees appointed the managers as the main users. Meanwhile, the rest of the experts claimed that generally controllers are the main users of SSBI including here: economic controllers, financial officers and as P3 describes: “It is more of the head of the departments, then everyone in the company.” In addition, P6 states that even though in her company they do not apply SSBI, the main users are the colleagues in the business department, because they need it more for decision-making and making predictions. It is important that she noted that the role of the BI members is to support them.

P4 and P5 describe their users based on two categories: the normal users and the users who are more experienced with BI. The normal users are the one who found it difficult to deal with the tools of BI and that was the main reason why the work was more dependent on the IT department: "With SSBI now more people inside the company are able to interact with data". Those users are also limited sometimes based on their level of education and as the P5 explains, “The user tasks are based all the time on the requirements but there are cases where the user wants to deal or has to with more advanced actions, including here more advanced data analytics preparation which may need the help in some cases of the data analysts experts”. Eventually the users who tend to do more analytics and belong to the second group, can easily deal with the SSBI tools, meanwhile it is not the same thing for the first group since there is needed a basic training. When it comes to the level of agreement and the level of adoption of SSBI by the part of the users, P4, P5 and BI P6 mention that it is not ‘a big deal’. Actually, they acknowledge that it is more convenient for users since they tend to be more involved in the process to get the data they want. Except training that it is not really the first blocking issue in SSBI, access of the data to a considerably big amount of users is what matters. This is related to the previous section of data governance. The process that the user goes through is the one described in the section 4.2.1 which was described generally by P1 with 5 steps: 1) get data from data sources, 2) preparation, 3) analysis, 4) visualization and 5) interpretation. Because the user does this activities by itself, then there is no need for the IT department that much. So, what is IT department really useful for in SSBI environment?

The role of IT department was really important in the BI environment, since the work was really dependent on them. SSBI has now changed this important role of them and the dependency on the IT department is diminished. Still, this does not mean that the IT does not have to do anything at all, actually they are still needed even though they have a lessened work to do now. P3 explains that for their company IT again supports the SSBI environment despite the dependency that existed previously: “We are building and enabling and filling stuff with data and we sometimes ask IT department to handle like database, clusters and other things.” Talking about this fact it is considered by the other experts as one of the good things that SSBI environment offers. It has helped a lot in facilitating the work for the users and for the company also. The data that is being processed is extremely sensitive, so the access levels should not be the same for the whole users, but as P3 further continues “it is good to divide things between the departments, so not every sensitive information is leaked to everyone”.

32 (53)
SSBI has different levels of importance based on the departments inside a company. As the number of departments increases with the growth of the company, in this analysis there will be covered the impact of SSBI in 6 departments. The departments have been rated by the interviewees on a scale from 1 to 3 where: 1 – low impact, 2 – medium impact, 3 – high impact. The impact for each department is shown in the Figure 7 below.

Figure 7. Impact of SSBI on the departments (author’s work)

The evaluation for each department from each interviewee is shown in the table 5 below.

Table 5. Evaluation for SSBI impact on main departments (author’s work)

<table>
<thead>
<tr>
<th>Department Position</th>
<th>Marketing</th>
<th>Finance</th>
<th>Operations</th>
<th>Management</th>
<th>IT</th>
<th>HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>P2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>P3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>P4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>P5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>P6</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>12</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>2 or 15%</td>
<td>2.67 ≈ 3 or 20%</td>
<td>2.67 ≈ 3 or 21%</td>
<td>2.67 ≈ 3 or 21%</td>
<td>1.67 ≈ 2 or 13%</td>
<td>1.3 ≈ 1 or 10%</td>
</tr>
</tbody>
</table>
The percentages are calculated by simple mathematical operations. In total there are given 78 answers for each department. So we have: 12 (Marketing) + 16 (Finance) + 16 (Operations) + 16 (Management) + 10 (IT) + 8 (IT) = 78 evaluations in total. The percentage for each department is evaluated as: 
\[
\frac{(\text{Department total points})}{(\text{Total evaluations})} \times 100\%.
\]
So, for Marketing department in this case we have: 
\[
\frac{12}{78} \times 100\% = 15\%.
\]
For Finance, Operations and Management we have: 
\[
\frac{16}{78} \times 100\% = 20.51\% \text{ which is approximately rounded to } 21\%.
\]
But because it is better to have a discrete value, then one of these 3 departments needs to be rounded to 20%. For IT department we have 
\[
\frac{10}{78} \times 100\% \approx 13\%,
\]
and for HR department 
\[
\frac{8}{78} \times 100\% \approx 10\%.
\]
From the evaluation done in the Table 7 above, it is revealed that SSBI has its main (high) impact on Finance, Operations and Management, the third of them have an average of 2.67 ≈ 3. Then Marketing and IT are affected on a medium impact, but Marketing is affected more compared to IT with a difference by 0.33 or 5% as can be implied by the Figure 7 and Table 5. The least impact is on HR by 15%. The reason for having all these results will be explained in the group below for each department.

**Group 1: High impact**

**Finance:** Finance has a rating of 3 by 5 of the respondents and 1 from P2. P3 explains that the impact of SSBI in this department is considered as high because it is crucial to know what the data tells about your company: “...you need to know about the impact on everything, or business decisions is finance first.” In addition, P1 states that BI is really important for the finance department and this importance continues in the SSBI environment also for supporting business decision. P2 evaluates the importance on this department as 1 because since this department deals more with reporting and the support of BI, then no big effort is needed for its users in the SSBI context.

**Operations:** Operations has a rating of 3 by 4 of the respondents and 2 by 2 of the respondents. P2 explains that in his company it is really important about managing the people to do the work towards their customers and SSBI has a very high impact on the operations sector: “...we use data to drive also the service towards the customers and such, having SSBI initiative and registering all the data and most important of all ensuring that the data is ok, is the most impactful area and it impacts the way we serve our customers.” P3 gave an evaluation of 2 because in his point of view it is essential in measuring all the work in numbers but that is not possible for every department or sector in the company, including here the people who work in the development teams. As an example P3 highlights that in this case measuring their work is hard to tell based on what to do it there if it is the number of commits or any other indicator: “...if you take measurements based on number of commits, then you will only commit 200 times per day and then you have to sink your productivity to the rest of the team because they have to read a lot. You cannot do that...so if the numbers are being used to evaluate how good you are is really tricky. There is the challenge to let everyone know what the definition of each measurement is. Some measurements are completely simple like: how many issues did you close this month or something like that. That would be very easy but it doesn’t say if you only go by numbers of error issues no one knows it. That is hard and very complex issue, it would take months even if it is the simplest yes/no answer.”
Management: Management is the department that mostly deals with organizational issues and planning & controlling of the resources. P3 mentions that it is highly important for the higher management to get the data and interpret the results for more factual decisions. Even though P6 states that the organization as an issue is dependent on the size of a company. She states that it is significant for a firm’s performance but it is not number one focus to give it a 3.

Group 2: Medium impact

Marketing: Impact on marketing has a rating 3 or 1. P1 evaluates it as 3 since she considers it essential in providing segmentation for their customers and sending the right data to the right people. She believes that as they move forward with working in the SSBI, marketing is going to be one of the next biggest stakeholders. P3 considers marketing as ‘tricky’ because it has to deal with potential customers of the company, brand strengthening, advertisements and other activities and it is tricky since sometimes it needs more analytics and sometimes less: “It is not where you start. You want to go there too, because it is more tricky is more psychology of what makes a potential customer want our product instead of other. It is harder to measure.” P4 and P5 explain that SSBI is linked as a chain to service quality then customer satisfaction and customer loyalty. They evaluate that SSBI is great at providing more governance for data and that affects the marketing department also in its operations, hence SSBI impact on this sector is 3. Meanwhile, P2 explained that in their company they are more focused on operations and not that much in the marketing and that is the reason why in the current conditions he gave a rating of 1.

IT: Based on the Figure 7 above, the impact of SSBI on IT department compared to the other ones is 1.67 or 13% by Table 5. The experts’ evaluations were either 2 or 1. The reason why it was ranked by all the experts as not too much affected by SSBI, is because self-service is about providing less dependency on IT. Despite this fact, some of the interviewees considered that still there was a slightly a medium dependency on IT. P3 emphasizes that IT department has a lot of measurements on their own and “they need to measure and keep track of a lot but have their own shift”. P5 mentions that based on their everyday work and experience, he considers the bond between IT and SSBI as a medium importance, as a matter of the fact that IT is still responsible for ensuring data quality and helping in the consolidation of the data governance inside the company.

Group 3: Low impact

HR: The human resource department is the one that was ranked with a low impact from SSBI with 10%. Most of the experts rated it as 1 because there is not too much need for self-service in that part. P1 and P3 mention that if there is the case of a small company then they may not need it since they need it focus more in other departments. Instead, in the case of the company where P1 and P3 work they find it slightly important the presence of SSBI in HR, because there are several reasons why HR needs it: “They need tools to know people are enjoying their work, are they happy at work, or if you are sick a lot that may be a sign of not a good performance”. In this context, the information is also sensitive and P3 explains that this kind of information provides social privacy and that is why not everybody inside HR should be able to access it and some levels of confidence should be applied.

The most important feature that SSBI offers and all the experts mention is visualization. P1 expresses that visualization is essential in helping the company related to their customers. She
further explains that the customers of her company are mainly small companies and they need support “because sometimes they do not have all the muscles to do everything on their own”. P2 also agrees on visualization, which has helped in improving their work in relation to their customers. P6 believes that visualization will help more on the strategic decision making environment.

SSBI operates in an environment that is not risk free, therefore there are some challenges that accompany companies in SSBI journey. The challenges of SSBI were actually introduced in the literature review chapter, table 1. P1 mentions that crucial for SSBI is finding the correct data because in the contrary the result would be catastrophic, which leads to the data governance issue. What P3 sees as a sensitive issue is the security part and the definition of the issues. He explains that it is a common sense of basing results in opinions and interpretations and that is not the way to start from: “People usually use to say that make your data prove me right, instead it should be all the way around. You start from data in order to reach the result, eventually making data driven decisions.” This explanation is also linked with the definition of things. In order to reach a specific result then everybody should have a description of what things mean, so the definitions are the same and the result is perceived in the same way and is understandable. P4 and P5 highlight that in their case the challenges were more related to the training of the staff, but that could be solved with not too much effort if the BI environment is well established: “Training is important for the user uncertainty that may come from the lack of knowledge. It is the responsibility of the managers to be able to equally distribute the needed knowledge for SSBI between the users.” The knowledge that they talk about is both some technical/functional one related to the usage of the tools and also introduction about the importance of SSBI in their daily tasks and the help in decision making. But as they further highlight this issue is not too much time consuming because the tools are user friendly, so they do not require too much effort in the IT context.

4.2.3 Companies that do not apply SSBI

SSBI is considered as a success factor for the decision-making environment and all the interviewees agree that it is a must in business. Despite this fact there are still companies that have not yet applied self-service BI and there are reasons why they operate like that. P4 takes in consideration the example of companies that are more reluctant in applying it, due to the lack of the maturity level of analytics in their business. In addition, P3 adds that another reason for not applying SSBI is because the BI environment of some companies is not well founded and that makes it harder for those companies to go the SSBI route.

P6 works in a bank, where BI environment is well established but they have not applied SSBI yet. She notes that the reason for the current situation is the time taken to reach a good satisfactory BI environment and lacking of the effort to shift to SSBI. Still, she believes that they are not far from applying SSBI: “...in a corporate like us it would be better to implement it. I think it will help more on strategic decision-making.” Among the reasons why they want to move to SSBI is because they face difficulties in handling all the requests in their BI, which is also mentioned in the table 3: “..., you should have very good knowledge to accomplish every request you get from different areas, not only inside the bank.” Following this issue, the users need tools for more personalized actions: reports, visualizations, query performing and eventually more analytics which is so important in
decision-making environment. This case above actually is the example of a company with current BI environment, but how does the situation change in a company where BI is not well established yet?

In the case of a company where the BI does not have a good foundation it is harder for SSBI to be directly applied, the challenges would be harder to deal with. P3 believes that: “If you don’t have BI at all, or just 1 or 2 person know how the data is extracted and goes on, then it is hard. They have to have a BI foundation before they go SSBI route. But I can’t say to what degree they must have a consolidated working BI environment before they start employ self-service.” Furthermore,

P3 states that BI is important in having economic control and some other insights that are truly needed. The BI foundation has a major impact in expanding to SSBI and all the interviewees agree. Even though the ease of SSBI is that the users do not have to be experts in statistics and analytics, so they can perform the operations they want, what traditional BI does is that it creates a bridge of collaboration between the users and IT. This cooperation needs to exists, because there needs to be an understanding and a good workflow in the company. P4 and P5 agree that it is hard to have a coexistence of BI and SSBI: “…SSBI environment maybe can be created without BI, but you need to have previous analytics environment and also a BI team that knows about the ETL process, which is important.” P6 highlights that SSBI is not a substitution for the BI, because there are data warehouses which are important and also other BI tools that are need. In this context SSBI tools come as a supplement of the current BI environment and are regarded as facilitators.

4.3 Other empirical findings

In this section, some findings will be presented which are related to the future of SSBI and some suggestions received from the participants in the interview process. To have a general definition of SSBI, the experts were asked whether they considered SSBI as the next generation of BI. The answers varied. P1, P3 and P6 expressed that it is now, it is happening now. Meanwhile P2 did not consider SSBI to be the next generation of BI: “No, there are other new fields where BI can help, like operational BI and some kind of co-operational”. He further straightened that SSBI is not history and either the edge of BI movements, but instead is something acquired in the market.

P5 mentions that big data is an option of diversifying the SSBI. The reason for this is directly related to the benefits and the values that are generated from big data. He further mentions that: “Self-service big data is really empowering the business.” Sharda et al. (2014) discuss the success factors for Big data where there are listed the following concepts: coexisting of the traditional DW with new platforms, visualization – getting the essential tool to monitor, empower – big data and SSBI go hand in hand, governance. SSBI offers precisely visualization, improves governance and also is built on new platforms without shading away the traditional DW. P4 also supports this opinion. He further adds that big data and the usage of analytics is more pervasive when the more people are involved in the process of being informed about the decisions made: “The more people and departments or branches, then more analytics is needed for a lot of actions, data measurements and other operations”. In addition, he considers this issue to also be very sensitive when it comes to data and also the usage of the tool by the end-users, so also for the future he suggests that there should be a level of agreement of universal standards.
4.4 Summary of the findings

The figure 8 below represents a summary of the findings. SSBI is dependent on two aspects technological and operational, which are both interrelated with each other. The reason is because one cannot function without the other. To understand this relation, all the main components of each aspect should be understood. In the findings there are discussed the concepts of governance, quality and visualization, which compose the technological aspect and are very important in maintaining the integrity and solving the challenges from BI. Based on the findings data governance depends on the data quality. Both of them are affected by the authority of the IT and user alignment.

The operational and organizational aspect is composed of departments, users and management. Each department depends on the users, who use the SSBI tool for specific reasons. Users are managed by the management, which has managers who have the responsibility to understand the users’ need regarding the SSBI tools, training of them and any other need that arises within the environment. SSBI environment with all these components that it holds, helps in better decision-making. It provides more analytics, clustering and other features which make possible to have more data-driven decisions.

Figure 8: Summary of the findings: key requirements for SSBI that create business value (author’s work)
Chapter 5: Discussion

In this chapter, discussion about the empirical findings will take place, in relation with the research questions raised in the beginning. In addition, some insights in relation to the literature review will be presented.

Technological aspect

In this thesis the identification of the gap in the literature raised the question of how businesses create value from SSBI. From the insights some knowledge was also built on the case of companies with no application of SSBI. From the literature review, SSBI is regarded as the new trend of BI which is essential in business operations and serves as a value generator. From this perspective, there were analyzed the challenges that BI brought, which led to SSBI.

An issue that is crucial and mentioned both in the literature review and the empirical findings is the data governance. In chapter 4, it was discussed that BI did not offer a good data governance, despite moving to SSBI, data governance still remains an important and challenging issue. Providing the right data to the right people is not easy. It is an essential generator for the data quality, security and as described by the Riggins & Klamm (2017) it is related to technology, people and processes. In the literature review, the concept of data governance is more analyzed in the context of challenges that it initiates if data is not governed in the right way. In addition, it is mentioned by different authors that governance is a success factor for SSBI. From the empirical findings, this concept is put in a broader perspective, in how it helps in creating value. The focus of the interviewees was in certain parts. P3 argues that security is a crucial issue, which has an increasing important as data becomes more accessible by users. P2 on the other hand, argues that data quality is a blocking issue and he regards the linkage of data security and governance as very impacting. What comes as a suggestion by all the parts is that there should be set levels of confidence between the users and the data that is accessed. Furthermore, as it can be implied by both the literature and findings, data governance can be improved at some sort of level by decreasing the user uncertainty. The more the user has knowledge about the tool and ‘knows the power in his hands’, then the security can be at a better state. In addition to the governance issue there is the usage of internal and external data. In the literature review, there is evaluated the big data phenomenon, its importance and how it relates with analytics within a company. As it is evaluated in this thesis, access rights and some levels of confidence are necessary in order to not have security breaches. Another factor which is mentioned in the literature review is the cloud analytics. SSBI operates in cloud because cloud is more efficient, agile and competitive. The experts, during the interview did not elaborate on this topic. Actually two of the interviewees worked in an environment where all the services were cloud based, despite that they did not mention any distinction on it. This may come as a result that cloud technologies are becoming a necessity in today world and especially in well developed countries. In all, it can be evaluated that cloud is a good solution in the technological aspect that solves a lot of issues and improves resources management. Big data analytics relies on cloud for enabling better governance on the information generating in a company.

Another important factor that is a success factor for SSBI and helps business in generating better
insights is visualization. In the literature chapter visualization is brought as an attribute of the Vs of Big Data. Visualization is considered as a service (Naous, et al., 2017) which is important for the users to understand the analytics. It is an important part in analytics as a service which definitely constitutes a crucial role in decision-making. The findings support the arguments set for visualization in the literature review chapter. In the findings visualization was considered as an impacting factor in data quality and strategic decisions towards customers. It is part of the service-oriented thinking practice.

What it was mostly concluded is that there was needed more independence of the users and not too much dependence on the IT department. As it is also stated by Imhoff & White (2011) SSBI makes it easier to access the data sources, hence making BI tools easier to use. This is also confirmed by the interviewees, who agree that the independence of the users is the good part of SSBI and creating a relief for IT. Another important point to consider again is the usage of analytics. It is discussed in the literature review that analytics is a very important part that is needed for value creation in a company. The problem in BI is that analytics and analysis of the aftermath are the responsibility of the data scientists, analysts and BI users. Regardless of this, with SSBI the success comes with the interaction of more users, which is supported also by the experts. In the empirical findings it was generally inferred that controllers are mostly the users of SSBI.

**Digital Capability**

One important factor which affects the SSBI environment is the staff training. Weiler et al. (2019) argue that there are no standardized training programs for SSBI. This is also supported by the experts, which is presented in the empirical findings. This issue is not regarded as a top inhibitor, instead it is discussed by the experts that some training is necessary to be done when the users start using the tools because it is related with the user uncertainty.

The users of SSBI defined by Alpar & Schulz (2016) and (Phillips-Wren, et al., 2015) are the business and power users (data analysts/scientists). In the empirical findings the controllers, including here economic controllers, financial controllers and then the other users in the company are regarded as the main users of SSBI. In this context they could be categorized in two groups: the one that are more oriented in analytics (expert users) and have a BI background and the users who are in the position of end-users, meaning that they are not specialists in analytics (normal users). Despite not being specialists in analytics, SSBI does the analytics by itself, hence end users can more easily use the tools and become more independent, get more insights on data and doing all the handling and manipulation of data by themselves. (Bani-Hani, et al., 2018) discuss the five main attributes that lead towards the success (SST): co-production, autonomy, ease of use, control and trust. Comparing each one of them with the findings lead to the result that most of them go in hand with the independency from the IT department that is discussed in the empirical findings. According to the interviewees the non-dependency on IT is one of the main advantages of SSBI, which is also supported by the literature. Eventually this non-dependency creates more autonomy, control on the data and ease of use. What it is added by the experts is the fact that the relation between IT and SSBI has not disappeared entirely. Instead, it is still needed because there are certain activities that IT carries, which serve as a support for SSBI users including here: supervision and monitor of the data quality, user requests for SSBI tools, cluster and DW
management and other high-priority activities.

One of the main contributions of this thesis, is how companies can create value by using SSBI. It was discussed in the literature review that making BI results easier to enhance and consume (Imhoff & White, 2011) is one of the objectives of SSBI. This is supported also by the experts who highlight that the creation of a more data driven environment is what boosts the business operations. In this work there is presented the effect of SSBI in main departments of a company, which is lacking in the literature review. As a results from the findings, finance, operations and management were the most highly affected departments by SSBI. The outcome differs from the size of a company and also the focus, but for the second one, finance is regarded as the department that shows the real situation of a company, gives the true insights, data and is valuable for making future predictions and planning of the next steps. The department less affected is HR. This department is evaluated as holding sensitive information about employees which should not be accessed by everyone in the company, but by the ones that are in a higher position in the hierarchy. Again, this evaluation depends on the size of a company, where a big sized one needs for certain reasons and evaluations which are argued in the empirical findings. Each evaluation of SSBI in certain departments, displays how each specific department uses SSBI for its own benefits, which are counted as value for the whole company. It can be stated that the organizational structure of a company affect the level of usage of SSBI.

**Companies that do not apply SSBI**

In this analysis, the second research question that has to be answered is the effect of SSBI in companies that do not apply it. In the literature review it is generally discussed SSBI as a phenomenon and Imhoff and White (2011) present a form of report which serves as a guide for business professional and informing them about the new trends of business intelligence. Since the information from the second chapter related to this issue is not elaborated to a considerable extent, from the empirical findings it can be concluded that the two directions that this research question takes are: having a previous BI environment and not having BI at all. In the first scenario, it is evaluated that when moving to SSBI, there is needed a form of training related to the staff and preparation in the technological, operational and organizational context. Even though P2 believes that SSBI does not change the user’s mindset, training remains an important factor. Then, related to the business needs and goals choosing the right tool depends on the time, resources, approach and investment.

The second scenario, from the empirical findings is evaluated to be the more difficult compared to the first one. The experts agree that there is needed some sort of BI foundation in the company. BI is important because it helps in understanding the business logic, ETL process, creates foundation through data warehouses, creates valuable reports which depict the steps of company’s operations. BI is especially important to data analysts and scientist as they perform all these reports and generate the right insight of data. Without BI at all it is hard for a company to know its way and leading towards SSBI directly, is needed a much greater effort and it may be also time consuming. Despite this fact, it is not for sure how it will affect, because when a case of a startup company or another case is not taken into consideration in this study, so further information could have been generated.
Related to the future of SSBI, it is not hard to say that its journey has not just started, but it is evolving more. SSBI in cloud can be the next move for companies. Experts state that SSBI is a phenomenon happening now and it is essential in a mass that all companies should start to use it. It is important in creating the competitive advantage and being in the market for a long time. But as some experts convey, SSBI is not the edge of BI because there are also areas that are essential and help in value creation such as co-operational BI.

5.1 Reflections on the research

In this section research evaluation will be carried to measure the quality of the findings and final remarks in this thesis. Evaluation of this research is conducted following the seven principles of evaluating an interpretative research by Klein and Myers (1999, p. 72):

1- Hermeneutics circle principle: In this thesis the SSBI phenomenon on two dimensions: technology and digital capability, was explored in order to develop an understanding of that environment. The human understanding of SSBI is done through an iterative process of using the data collection methods.

2- Contextualization: This principle was explained in the methodology chapter. The SSBI environment is discovered through the literature review and participants point of view.

3- Interaction between researcher and subject: The understanding of SSBI was done through comparison between literature review and findings and also the semi-structured interviews helped in having more comparison between SSBI and traditional BI environment to create a more completed background knowledge.

4- Abstraction and generalization: This principle relies on the interpretation done based on the exploration of SSBI through interviews and papers analyzed. Generalization is done based on the insights generated through concepts and literature.

5- Dialogical reasoning: In the discussion chapter constant comparison was conducted between the findings and literature review. There were not fundamental differences between them, except the fact that findings elaborated a more business point of view and considered the discussion of literature review some additional aspects: effect of SSBI on the main departments in companies and companies that do not apply SSBI perspective.

6- Multiple interpretations: This principle constitutes on the point of view of the participants. There were shared similar and different point of views. They were dependent on certain factor which were explained both in the findings and discussion chapters.

7- Suspcion: This principle relies on being critical and having a consolidated verification about the research. It is more related with reliability and validity of the study which was explained in section 3.4.
Chapter 6: Conclusion

SSBI is becoming a trending innovation for the current business environment. The purpose of this paper was to study the SSBI environment and how companies generate value from it. Additionally to the research question, a sub-question needs also an answer: “how the results can be approached in organizations that have not implemented a BI solution yet”. In the literature review there were found some gaps related to the deep understanding of the SSBI technological, operational and organizational context in a more qualitative approach.

To give answer to the research question a literature review was conducted for BI and SSBI environment. In order to reach SSBI, it was important to understand the current BI environment’s challenges, then continue with the analysis in the SSBI setting. The study from the literature review led to certain advantages and challenges for companies that applied it. BI showed to not provide more data driven decisions for the users, hence bringing a lack of user independence. In this context SSBI was a more beneficial approach.

Based on the three main aspects taken into consideration: technological, operational and organizational, the results of the study showed that SSBI is very important in supporting the business needs. It affects all the departments of a company. Decision-making environment can be improved because of the decreasing of user uncertainty. End users of SSBI are able to use the data independently and make better decisions for their actions. In order to succeed with SSBI in the operational and organizational level, the level of confidence is essential towards the users who hold the main position in relation to SSBI tools. On the technological perspective, data governance is an issue which is improved by SSBI, but there are still open issues such as data security in which a company needs to focus more, so better data quality can be provided. In addition, the visualization is a service option that SSBI tools offer to depict more data based and analytical graphs. As conclusion to other companies who do not have SSBI environment implemented yet, the factors they should be aware of are: the business needs, having a good foundation of BI environment so they know the path of the data in their operations and also time and resources. SSBI can be regarded as a necessity for the market which generates great values for business.

Contribution and Future Research

The results of this study can be valuable for companies and future studies that want to explore SSBI environment more. It adds knowledge to the current research about SSBI by validating what has been done by other researchers and also considering some other perspectives, more internal business based. For future research, the recommendations for companies which already have a SSBI environment implemented, there should be conducted a better exploration about their journey on a more quantitative approach. This paper offers a more qualitative point of view, so future studies can provide more analytics. In addition, a concept which is mentioned in the work is SSBI in cloud, which is not developed as a separate section, so it is also possible for other studies to include analysis for this topic by taking into consideration the main characteristics of cloud computing. This work offers also analysis for companies which have not implemented SSBI yet, but for future researches it is proposed to do a case study upon the recommendations given in this work.
References


Caseiro, N. and Coelho, A., 2019. ‘The influence of Business Intelligence capacity, network learning and innovativeness on startups performance’, *Journal of Innovation & Knowledge*, vol. 4, no. 3, pp. 139-145. Available at: https://doi-org.proxy.lnu.se/10.1016/j.jik.2018.03.009


Delen, D. and Demirkan, H., 2013. ‘Data, information and analytics as services’, *Decision Support Systems*, vol. 55, no. 1, pp. 359-363. Available at: https://doi.org/10.1016/j.dss.2012.05.044


Shopping Assistant’, *JOURNAL OF PRODUCT INNOVATION MANAGEMENT*, vol. 32, no. 3, pp. 459-475. Available at: https://doi.org/10.1111/jpim.12241


Hernon, P. and Schwartz, C., 2009. ‘Reliability and validity’, *Library & Information Science Research*, vol. 31, no. 2, pp. 73-74. Available at: https://doi.org/10.1016/j.lisr.2009.03.001


Johannessen, T. V. and Fuglseth, A. M., 2016. ‘Challenges of Self-service Business Intelligence’, *Bibsys Open Journal Systems*, vol. 24, no. 1. Available at: https://pdfs.semanticscholar.org/8a10/b71d700bbee1b7f95ed6ad16c8678a58d2b2.pdf


Marjanovic, O., 2015. ‘From Analytics-as-a-Service to Analytics-as-a-Consumer-Service: Exploring a New Direction in Business Intelligence and Analytics Research’, 2015 48th Hawaii International Conference on System Sciences, Kauai, HI, 5-8 January, pp. 4742-4751. Available at: https://doi.org/10.1109/HICSS.2015.564


49 (53)


Appendices

Appendix A: Protocol for the interview

(Creswell and Creswell, 2014)

General information

Interviewer:

Interview participant: __________________________
Department: __________________________
Location: __________________________
Date: __________________________

Introduction

Dear contact person,

My name is Jonida Sinaj and I am doing a master thesis at Linnaeus University, Sweden. I am conducting a research about self-service BI and the way in which it brings value to the business. Self-Service BI is one of the raising trends in the digital era. It has become a key feature in enhancing the business operations and helping in the marketing and management processes too. Through self-service BI business professionals can extract very useful information related to their users and operations, without needing the help of IT. Following this issue, it is of great importance to know how this process can be implemented and how can companies gain value from it. With this research my thesis aims to add more knowledge to the SSBI environment.

Recording:

During this interview the audio communications will be recorded via audio recording devices. Does this create any concern to you? If yes: Thank you, please let me know if there is anything you don’t want to keep on record, or if at any point that you want to end the recording of audio. If no: Thank you for your information. This interview, will be recorded using text editing software on a computer and transcripted later on.

The transcripts of the interviews in this study will be anonymized, if there are not any objections to this. Do you give your consent to this anonymization? Yes: Thank you, let me know if there is any detail that you would like to share. No: Let me know if there is any information you would like to anonymize.

I __________________________ give consent for Jonida Sinaj to use the information collected in this interview for her master thesis in information systems.
Appendix B: Interview Questions

**Group 1 – General**
- What is your position in the company?
- How long have you worked in the BI?

**Group 2 – BI context**
- What is most critical aspect related to data in your company?
- What is the importance of BI in your company?
- What is the most challenging part that you face in BI environment?
- Which department/branch has more necessity in your company for BI support?

**Group 3 – SSBI (Self-Service Business Intelligence)**
- Does your company apply SSBI?
- How do companies enable SSBI environment? Which is the most important factor?
- Which SSBI tool do you use?
- Do you have this tool integrated in your systems or you use external resources?
  - Part 1 – Technological aspect
    - What do you consider to be the most problematic aspect that makes you want to expand to SSBI?
    - Is data more secured and governed with SSBI?
    - What do you consider to be a challenge related to data in SSBI context?
    - What is the main advantage that the tool you use has, compared to other ones? (in the technological aspect)
    - What does the IT department need to do to the extension of SSBI and to use the tools?
  - Part 2 – Operational aspect
    - What issues do you face in the implementation of SSBI?
    - Who are the main users of SSBI system?
    - How does SSBI change the flow of the normal process that the user does in a BI environment?
    - How do you find it in fulfilling the needs of the users?
    - How does SSBI affect the users comparing it to BI?
    - Since SSBI tends to help the IT department in not holding the ‘burden’ of dealing with multiple tasks related to data, do you consider this to be an issue and to which extent? What is their specific role in here?
    - How does SSBI help in operational decision-making? (strategically and in operational level)
    - How successful do you find SSBI to be?
    - In your point of view, is the co-operation between a company that uses SSBI and its partner companies that do not use SSBI affected? If yes, in which aspect?
    - On a scale from 1 to 3 (low-medium-high) how will you consider the effect of SSBI in each of the following departments: **Marketing, Finance, Operations management, Human Resource**, and **IT**?
    - What are the main risks of SSBI?
- What do you consider to be the main success factor of SSBI in the organizational context?
- What do you think it is too critical for other companies to apply SSBI to their businesses?

**Group 4 – Closing questions**

- Is there any other thing that you would like to elaborate related to this topic?
- Do you have any recommendations for future improvements?
- How can the companies that have not applied SSBI yet enable it?
- Do you strongly consider SSBI to be the next generation of BI?