Journal of Ecohumanism
2024
Volume: 3, No: 7, pp. 4323 – 4338
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i7.4548

Identifying and Handling Implementation Challenges of Self-Service Business Intelligence

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Abstract

Self-service has recently become a defining feature of business intelligence (BI) and analytics platforms. Self-service Business Intelligence (SSBI) enables business users to generate reports and analysis of business data without the intervention of IT department. It responds to a need to quickly create reports and analysis to make business-critical decisions. However, introducing SSBI poses implementation challenges, and many of the companies that have introduced it became dissatisfied with the implementation results. The purpose of the study is to create an understanding of how challenges related to SSBI implementation are handled for enabling a successful implementation. This leads to the question: How the challenges related to SSBI implementations are handled? To answer the question, six interviews were conducted at an anonymous company with respondents who in various ways have a connection to the introduction of SSBI. The result of the study is a model of the user-related challenges of introducing SSBI and the recommendations identified in this work for how they can be managed. By using these challenges when introducing SSBI, businesses can provide users with good conditions, which increases the possibility of introducing a successful and sustainable SSBI.

Keywords: *Self-Service Business Intelligence (SSBI), Implementation, Challenges, Business Users, Organization.*

Introduction

In the analysis of business data, organizations use data-based decision support system, called Business Intelligence (Imhoff & White, 2011). Organizations use Business Intelligence (BI) to be innovative, competitive and creative (Lennerholt, van Laere & Söderström, 2018). With the help of BI systems, organizations can collect, analyze and translate large amounts of data into manageable information that supports an informed decision (Sharda, bulk & Turban, 2014). Well-informed decision making is an important part of the daily work of organizations and requires a solid foundation of data that is available in the entire organization (Lennerstrand Holt et al., 2018).

BI systems are changing in conjunction with organizations identify new needs (Imhoff & White, 2011). Organizations' IT departments have traditionally been responsible for providing users with data, because it requires a broad IT skills (Imhoff and White, 2011). Data that the IT department delivers to users is in the form of operational applications (eg availability of services or products), analytical applications (eg reports or dashboards) or collaborative applications (eg e-mail and information portal) (Imhoff & White, 2011). There is a demand for analytical tools and techniques that provide a larger group of users more access and use of data, as well as independent users (Imhoff and White, 2011). To meet these needs, vendors have developed the Self-Service Business Intelligence (SSBI).

In traditional BI solutions, users need to send a request to the IT department for re-drafting reports. As the requests to the IT department has increased, also increasing the waiting time for users, which ultimately results in bottlenecks that delay time-critical decisions (Lennerstrand Holt et al., 2018). SSBI is a BI solution that allows users to get more access to data while becoming less dependent on the IT department (Imhoff & White, 2011). SSBI enables a more independent work and facilitates the preparation of reports for decision materials. In a survey of 800 business and IT organizations, 84% planned to invest in SSBI between

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2014-2016 (Logi Analytics, 2015). A new survey shows that the introduction of SSBI tools has increased by 20% in 2016, but the proportion of active users has dropped by 20% (Logi Analytics, 2017).

One problem with SSBI is that many organizations do not achieve the expectations promised by suppliers (Eckerson, 2012). As a consequence of SSBI, a number of challenges are created that must be dealt with in order to enable a successful implementation. Lennerholt et al. (2018) conducted a literature review to identify the challenges that arise in connection with the SSBI implementations and create understanding, which makes it easier for organizations to avoid potential pitfalls. In Lennerholt et al. (2018) literature study, researchers identified ten challenges fall into two main categories: access and use of data, as well as independent users. Managing the identified challenges should result in users having more direct control over the information flow and the IT department instead becoming a support function for the users (Lennerholt et al., 2018).

The first step in the implementation process is that the organization understands the challenges of implementing SSBI tools (Lennerholt et al., 2018). When implementing information systems, organizations usually employ external consultants as support (Ko, Kirsch & King, 2005). Consultants are expected to transfer implementation knowledge to the organization, which is significant in developing and implementing these system implementations (Ko et al., 2005). The challenges that organizations face in SSBI implementations are well mapped (see, for example, Lennerholt et al., 2018). However, there is no insight into how these challenges can be addressed by consultants, who will support the implementation (Lennerholt et al., 2018).

The main objective of this study is to create an understanding of how the challenges related to SSBA implementation is managed for enabling a successful implementation. To this end, a qualitative approach, comprising semi-structured interviews with IT and data analysts was conducted. The content analysis of the interviews revealed that the implementation of SSBI at the organizational setting is confronted by a number of challenges that need to be handled and managed in order to succeed with the implementation process.

Related Literature

Self-Service Business Intelligence

BI combines applications and technologies used to collect and analyze data and information about organizations' business (Sharda et al., 2014; Watson, 2010). New systems emerge when organizations place new demands on BI tools. In order to meet the new requirements, a new type of BI has been developed, Self-Service Business Intelligence (SSBI). The purpose of SSBI is to provide the user with data for analyzes and reports without involving the IT department (Schuff, Karen, St. Louis, & Schymik, 2018). SSBI enables more independent work in which users gain greater access to data, to streamline the creation of reports for decision material (Schuff et al., 2018; Stodder, 2015).

SSBI enables business users to visually integrate and explore data, design and share interactive reports, and use a variety of user-friendly analytics capabilities for informed decision-making (Logi Analytics, 2015). Weber (2013, p.19) defines SSBI as "Self-Service business intelligence (BI) enables business executives, managers, operational decision makers, analysts, and knowledge workers to access the information they need whenever and wherever they need it, providing key data to support the decisions and actions that are critical to business success. " The researcher describes that SSBI enables continuous access to information for decision-making. Information visualized in the tools should support decision-making to be able to make business-critical decisions.

Imhoff and White (2011, p. 4) define SBBI as "Self-Service BI is defined 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 1) easy access to source data for reporting and analysis, 2) easy-to-use BI tools and improved support for data analysis, 3) fast-to-deploy and 4) easy-to-manage Data Warehouse options such as appliances and cloud computing, and simpler and customizable end-user

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interfaces. The researchers describe that SSBI systems enable more independent work and facilitate the preparation and creation of reports for the users. In a SSBI tool, the focus is on the user becoming more self-sufficient and able to create their own reports, without involving the IT department. Although users become less dependent on the IT department, the IT department will not be excluded from the SSBI environment (Imhoff & White, 2011). The IT department's tasks in the decision support process will be relieved and instead focus on monitoring the SSBI environment, applying governance and security measures when needed (Imhoff & White, 2011).

The Implementation Process of SSBI

Consultants can contribute crucial expertise to businesses that do not have sufficient knowledge or skills internally (Nevo, Wade, & Cook, 2007). Although external consultants are costly to the organization, it favors implementation in the form of critical and crucial knowledge as they have experience from previous implementations (Nevo et al., 2007; Yeoh et al., 2008). Consultants help evaluate and propose impartial measures without being influenced by other stakeholders (Yeoh et al. 2008). Consultants provide knowledge transfer to internal users to make them more technically knowledgeable (Nevo et al., 2007). SSBI is a complementary tool used in BI environments, which means that the implementation of the tool is based on the same step in the life cycle as a traditional BI (Weber, 2013). The difference is that in an SSBI implementation, certain elements need to be added to the life cycle (Weber. 2013). A BI system's life cycle consists of six different steps: pre-study, project planning, business analysis, design, development and implementation (Bara et al., 2009).

In a traditional BI, the feasibility study involves identifying opportunities with the implementation and presenting the costs in a report that is handed over to the customers (Bara et al., 2009). In the case of an SSBI introduction, the opportunities for the introduction always have to be set against a business context (Imhoff & White, 2011). Project planning involves planning the project's throughput (Bara et al., 2009). For SSBI implementations, time needs to be allocated to integrate both external and internal data sources (Lennerholt et al., 2018). Business analysis is a method for evaluating various aspects of a business with identification of ways to improve the business (Bara et al., 2009). In an SSBI introduction, the deal needs to be in focus for users to use the system (Weber, 2013). The design is divided into different steps, which are partly about designing interfaces but also how the ETL process of the data sources works (Bara et al., 2009). The consultant needs to translate the business requirements into a BI architecture (Yeoh et al., 2008; Weber, 2013). The development of the system requires system testing and building the application clearly so that it is ready to be implemented into the organization (Bara et al., 2009). The development of SSBI needs to find a balance between control and flexibility for users (Weber, 2013). Implementation is the final step in which the implementation takes place in the organization and that a BI system is implemented for the users (Bara et al., 2009). The training of the users should not only focus on the SSBI tool, but instead focus on interpretation and use of data based on the type of analysis that is necessary (Stodder, 2015).

Challenges in SSBI Implementations

In our literature study, we have reported on the knowledge available on SSBI implementations and the interpretive frameworks used in the study. In SSBI implementations, the literature has shown that there is a need to address the identified challenges in achieving the goals of the implementation (Lennerholt et al., 2018; Imhoff & White, 2011; Eckerson, 2012). Lennerholt et al. (2018) has identified two main categories of challenges: data access and use and independent users. Lennerholt et al., (2018) challenges form the basis for the chosen interpretation framework and consists of the following ten challenges:

- Access and use of data
- Make data sources easy to access
- Identify criteria for data selection
- Use correct data searches

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• Control of data integrity, security and distribution

• Define data management and data management policies

• Prepare data for visual analysis

• Independent users

• Make BI tools easy to use

• Make BI results easy to consume and improve

• Provide the right tool to the right user

• Educate users on how data is selected, interpreted and analyzed for decision making

Based on the interpretation framework, we will interpret the management of the challenges from a consultant's perspective in order to answer how the challenges are handled. We assume that the goal of the challenges is to achieve Imhoff and White's (2011) main goals with SSBI implementations: make data sources easy to access, make Data Warehouse solutions quick to distribute and easy to use, make BI tools easy to use and make BI results easy to consume and improve. The results of our literature study indicate that studies are needed that examine how the challenges are handled to meet the identified goals and therefore this study is then conducted.

Research Methodology

Our study aims to answer the question How are challenges related to SSBI implementations handled ?. Based on the problem, we have chosen a qualitative method to increase understanding about the problem area. A qualitative method means that emphasis is placed on the interpretation of words (Myers, 2013), which is important for our text analysis. There are different types of qualitative research that focus on people's experiences and try to understand a behavior or event based on individual frames of reference. We have chosen an interpretative approach to try to understand the underlying meaning of consultants' statements on management of challenges related to SSBI implementations. The goal of an interpretive approach is to understand the actors' interpretation and meaning-making of social reality (Orlikowski & Baroudi, 1991; Walsham, 1993). In interpretive research, the researcher tries to understand phenomena by accessing the meanings that interviewees have stated from their perspectives and experiences (Orlikowski & Baroudi, 1991). The significance of the interpretive approach to the study has meant that we have been able to understand the consultants' actions based on their understanding of reality.

Selection

In selecting interviewees, two selection criteria were set up to answer the study's question. By limiting surveys and enabling reasonable and accurate conclusions, selection is created (Denscombe, 2018). The first selection criterion meant that the respondent should have an insight into the consultant's work with SSBI implementations, which allows us to take part in different ways of dealing with challenges. The second selection criterion meant that the respondent should have previous experience in traditional BI implementations. The reason for this selection criterion was because we sought reflections on the challenges that arose in the development of the BI environment. The survey is based on a consultant's perspective that the consultants have experience in customer projects involving both newcomers and experienced BI organizations, which can validate and extend the identified challenges. The user experience usually consists of a single SSBI implementation. Starting from a consultant's perspective was an appropriate empirical source for achieving the study's purpose and gaining an understanding of the practice.

We conducted seven interviews with consultants from different consulting firms, where the contact was recorded via email contact from us. We found the organizations by starting from the various partners of

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the SSBI tools in Jordan. Upon contact with the organizations, we emailed a brief introduction about the study and then asked if they were willing to put up an interview. We have chosen to use fictitious names to anonymize the interviewees. Table 1 presents people who participated in the study, the role of the interviewees, the number of years of experience and how long the interview took place.

Data Collection

By interviewing consultants, we have taken note of their statements and tried to put it in a larger context, in relation to the literature. The data collection resulted in an empirical material. The empirical material is in the form of statements that describe the way to deal with the challenges, from a consultant's perspective. To create an understanding of the consultants' way of dealing with the challenges, we have identified different groups of approaches through an interpretation process. The meaning of an interpretation process is to interpret various actions and events described in the statements (Orlikowski & Baroudi, 1991).

Interviews are part of most interpretive studies and are described as an important way to access statements by informants (Walsham, 2006). We chose to use semi-structured interviews as we sought answers on how consultants deal with challenges in SSBI implementations. Semi structured interviews allow the interviewer to prepare questions and supplement with follow-up questions if needed (Myers, 2013). In Lennerholt et al. (2018) literature study, we identified ten challenges that arise in SSBI implementations, which formed the basis for the interview guide (see Appendix 1). The semi-structured interview method means that the interviewees could initiate new conversation topics and, for example, address other challenges in addition to those presented in the literature study. The interview process has required transparency to enable discoveries of important aspects during the process. We chose to have a passive role in the interviews so as not to influence the interviewees' story of reality. However, we complied with follow-up questions to create interview situations that encouraged interviewees to share their experiences and experiences on the subject. This is one of the advantages of semi-structured interviews, as the tone of the interview can go more in pace with an everyday conversation than a formal interview (Myers, 2013).

Data Analysis

In our interpretive study, we examined how consultants handle challenges related to SSBI implementations. We have chosen an interpretative approach for the analysis. An interpretative approach aims to provide insights into how an individual, in a certain context, relates to a certain phenomenon (Walsham, 2006). The interpretative approach has involved a gradual interpretation process of interviewers' handling of the challenges, where theories and concepts are used to elucidate and understand patterns and tendencies in the result. The interpretation process is based on what we understand, interpret and convey based on our own conditions, where we have had a critical approach to the interpretation itself. When interpreting collected data, the researcher should handle the material with openness, respect and with a certain awareness to disregard personal assumptions (Walsham, 2006).

We chose to use an open interview method that allowed us to provide follow-up questions and go beyond the scope of selected interview questions. Through an open interview method, the interviewer is open to new conversation topics that create added value and additional relevant data for the survey (Myers, 2013). Through the interviews, the study received answers from the interviewees' perceptions and experiences of SSBI implementations. The recorded interviews were transcribed to facilitate analysis of the statements. In order to understand the meaning of the interviewees' responses to the management of the challenges, we have worked in parallel with data triangulation to understand the answers.

Results

On the basis of the interview guide, the interviewees expressed their views on the different management of the challenges in order to succeed with SSBI implementations. For each challenge we have interpreted that there is a variety of approaches to dealing with the challenges (see Table 1).

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Table 1. Summary of Challenges Identified from Interviews

Category	Implementation challenges
Make data sources easy to access	• Prepare the data • Refining Process • User-friendly data libraries • Specifications
Identify criteria for data selection	• Requirement phase for business development opportunities • Standardize data retrieval • Standardize the use of data • Format the data
Use correct data searches	• Connections adapted for the user • Predefine data • Restrict the use of data • User-friendly data models
Control of data integrity, security and distribution	• Define permission • Create clarity • Strategies for cloud-based systems
Defining policies for data management and data governance	• Develop policies by organization • Identifying the owners of processes and data management • Identify existing policies
Prepare data for visual analysis	• Predefined formulas and structures • Build building blocks • star Models • Aggregate data • Static and mathematical models
Make BI tools easy to use	• Automatic coupling • Standardize working methods
Make BI results easy to consume and improve	• Create standard templates that are refined • Business issues and educational needs • Integrate to existing systems
Provide the right tool to the right user	• Identification of stakeholders • Characteristics of the users • The degree of utilization of the system
Educate users on how data is selected, interpreted and analyzed for decision making	• Training early and along the project • forums Training • Train Superusers • Build data-driven culture

Make Data Sources Easy to Access

Most analysts stated that Self-Service does not mean that users should connect to the source systems. Axel described that the consultant needs to prepare data in a Data Warehouse. The reason why users should not have direct access to the data sources is to avoid inconsistent data. Furthermore, Bert explains that organizations can only make data-driven decisions if the data they use is correct. Whether the data is accurate or not described depends on data quality. Poor data quality is described as harmful to the business. Sam explains that preparing data involves processing data and describing the process as a process where the consultant needs to convert data to another medium or format. The processing process is described to

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place data in a new context, where data is both cleaned and standardized. Some participants respective descriptions of the handling are illustrated with the following quotations:

"Data Warehouse needs to go from a technical nomenclature and technical architecture to a star chart that is virtual or materialized."

"I think it's important to find a way to control it. If we are going to put together a Self-Service solution then I think you need to maintain some kind of control over what the users are looking at."

"In principle, the users are never inside the data sources but always access all data via the tool."

Another participants stated that the data model on which Data Warehouse is based needs to be understandable and useful, so that a user without a technologically advanced background can read data from it. David described another step in the process where data is to be further processed from Data Warehouse to different Data Marches, so as not to mix up key figures from different departments. An analyst expressed the following: "We work to build Data March to make it easier for end users." Another analysts stated that: "In my opinion, the process of gathering information is quite complicated in order for the general user to be able to retrieve information directly from the data sources. Instead, we need to collect data and facilitate use in the Data Warehouse "

Two participants stated that users in the organization need a certain degree of maturity in order to be able to retrieve data from the data sources correctly, which is unusual in today's organizations. One analyst explains that a requirement specification needs to be developed to enable the data being processed, in the Data Warehouse, to be relevant to the users. Furthermore, another analyst explains the process as developing strategies for collecting, storing, handling, migrating and processing data through SQL and its dialects. they expressed the following: "Depending on the degree of maturity of organizations, the processing of data varies. The processing of data means that the consultant, somewhat simplified, needs to identify and ask questions to the data sources in advance."

"We work with fixed analysis models or traditional reports and in cases where the customer has a high degree of maturity we can also make data available"

Identify Criteria for Data Selection

Some analysts stated that the consultant needs to go through a requirements phase, together with the organization, to set criteria for data selection. The requirements phase means identifying requirements that lead to business development opportunities and business development. Some analysts' respective descriptions of the handling are illustrated with the following quotations:

"Since the customer starts breaking down into invoice lines, order lines, stock transactions and purchase orders, aggregated data needs to be based on the transaction."

"In concrete terms, we try to dial in a business process, this is a long story, we try to find what is most important to the customer that we know can be done"

"It is in interviews with the customer that we look at what is important, what way they want to share data, existing applications and what they analyze"

Two analysts stated that criteria for data selection should facilitate the user to base reports and analyzes on as much standardized information as possible. The consultant needs to build a logic around data and data that is not structured requires a more advanced logic. Standardization of data retrieval enables the organization to avoid Data Overload. Bert and David's respective descriptions of the handling are illustrated with the following quotes:

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"Use as much standardized information as possible. I do not believe in giving users access to information that is built up manually "

"We are working on conducting reviews, because I think the important thing is not to have multiple data sources for about the same thing."

Sam explains that, with the help of the business system owner, the IT department and the system supplier, the consultant needs to develop definitions that are permeated throughout the organization. Using the definitions in a standardized way allows the consultant to interpret the data in the same way over time. An analyst expresses the following:

"There is a basic rule in BI systems: It really doesn't matter what you measure, but just everyone knows what the definitions are and that you do it the same way over time."

Glenn explains that users need to understand the process of how data becomes information. The most common type of data handled in BI environments is structured data that, for example, comes from the business system and covers the basic needs. Glenn further explains that the content of the data selected must be in the correct format. The organization is responsible for ensuring that the data coming from the business system is up-to-date and purely technically integrated with SSBI.

Glenn expresses the following: "Sometimes I can get a basis to verify against but in the end it is still the customer who has to take responsibility and make a sign off."

Use Correct Data Searches

Some analysts explained that managing data searches is an important part of making Data Warehouse solutions quick to distribute and easy to use. The consultant is described as having to model cubes that lie between the Data Warehouse and the application, where the connections are adapted for the user. An analyst expressed the following:

"The conditions for drag and drop to work mean that we consultants need to make use cases for each self-service profile and information models need to be adapted so that the user can retrieve the data themselves"

Two analysts stated that the consultant needs to pre-define data with the organization before it becomes available to the users. Bert explains that the consultant needs to shape and clear data before it becomes available to users. Glenn explains that it is not possible to secure users' data searches, but what the consultant can do is make sure that data in the form of key figures, dimensions and measurement points is correct in the system. Bert and Gamma's respective descriptions of the handling are illustrated with the following quotations:

"It becomes unsustainable for users to build analytics from the ground up, without data having to be cleaned and predefined"

"I cannot ensure that users are using the information correctly, what I can assure is that data is correct"

Both David and Sam stated that the consultants need to limit the users through different methods to ensure, for example, that the key figures are not mixed from different departments. David described a method that is based on building blocks in the form of Data March, Measure Libary and finished dimensions. Sam described that the consultant needs to distinguish connections depending on the context in which the data is to be used. David and Sam's respective descriptions of the handling are illustrated with the following quotes:

"Building blocks should provide users with the data they need to create their own reports and analyzes. The building blocks should contain ready-made components for users to use. "

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"I think it's one of the most important things that you make sure that the tools don't, in themselves, allow you to mix things that don't belong together"

An analyst explains that the consultant needs to transform all identified data into more user-friendly data models. The more user-friendly data models consist of fact tables and dimension tables that make data available to the user in a Data Warehouse. The analyst expresses the following: "Building a report against an ERP system can be many days of work, while a user who has access to an adequate model can do it himself in a minute." Another analyst explains that it is difficult to make sure that end users enter correct data searches, what the consultant can make sure is that the data used is correct. The work done by the consultant is to ensure that the Data Warehouse solutions are user-friendly and that different key figures cannot be mixed. He/she expresses the following: "We cannot ensure that users use accurate data searches. What we can do is train them properly and make sure the data is correct"

Control of Data Integrity, Security and Distribution

A number of analysts expressed the management of authorization models as a method for defining who can do what and what data may be presented to the user. Axel explains that authorization models should stop the distribution of sensitive information and need to be adapted for each end user. Glenn explains that data collection needs to be guided by permission models to avoid inconsistent data. Axel and Glenn's respective descriptions of the handling are illustrated with the following quotations: "We work with permission models to secure role-level security so that an end user, despite editing possibilities, cannot reach sensitive information" - Axel "Usually, there is a set-up around permission to avoid wrong people getting access to sensitive data "

Sam stated that users can work around the distribution of sensitive data, but the penalties for this were described as a business issue. Sam explains that it can be about both external and internal data. Sam expresses the following: "The dissemination of information can happen in any case, but there is not much the consultant can do, but only inform about the risks." – Sam

Per stated that the development of the user's rights needs to be developed together with the clients. Per explains that permission models are linked to the users, which means that access to the data sources is linked to the user ID. Per expresses the following:

"It often happens that you share an application of 10 people. But each individual of these 10 has their own data to look at. We solve this by using the user ID, so when you log in to Qlik's server so you can only access what you are authorized to do. "- Per

Both Bert and David expressed a different type of method used in both traditional BI and SSBI tools, to deal with the challenge. Bert explains that in traditional BI, the method is primarily about pre-defining and preparing data, but even more important in an SSBI is that users should be able to add data. To succeed in this, the consultant is described as having to make sure that the data integrity is not lacking and that the users have set rules to turn to. Bert explains that what makes it complex for the consultant is to prepare the tools so that users can integrate data from larger systems. Data in simpler form, for example from excel format, are not described to be any major problems. Bert expresses the following:

"We need to make sure that the user understands that any info can be inserted into the system, but that it affects reliability" – Bert

David explains that the consultants, together with the customers, need to develop a review process that describes how the user should add data and determine requirements for data quality. The review process needs to contain standards and in some cases even be available in the BI environment. David expresses the following: "One of the most important things about SSBI is that users should be able to return ideas through a clear process" – David

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Defining Policies for Data Management and Data Governance

Analysts also explains that when sharing information between users, there are certain things that consultants technically cannot handle. To deal with this challenge, the consultant needs to use already set policies or set up new ones with the organization. Axel described that policies should help the organization to control data and data quality, regulations, auditing, accessibility and security. Axel expresses the following:

"Together with the customer, we need to identify what kind of information the users should have access to and who they can share the information with. We do this by identifying different use cases and identifying the risks that may arise in the use case"- Axel

Elof explains that when using policies, the organization needs to have clear owners in the organization. Furthermore, Elof explains that the organizations rarely have designated owners for the organizational processes and no conscious data management strategy, which makes work with policy difficult. Elof expresses the following:

"Unfortunately, they often do not have a conscious data management strategy, nor do they have designated owners for processes and data, so it is difficult to set policies if I am to be honest." – Elof

David explains that access to data is controlled from the source systems, but that policies also control how the user executes reports and analyzes. Furthermore, David explains that in both traditional BI and SSBI, the user has a personal responsibility for the dissemination of reports and therefore rules and policies have the same function. The consultants are usually based on existing rules, in the organization's existing system that affect users' access to sensitive information. David expresses the following: "Managing sensitive data and rules around the area is often not a huge problem, but the organization usually has existing policies from which we can draw inspiration" – David

Both Bert, Sam and Per stated that this is a business issue and does not have to do with the consultant's work. Instead, the interviewees described an approach that is about informing the organizations about the consequences that can give users free access to data. Sam and Per's descriptions of the handling are illustrated with the following quotes:

"If there are established policies then we suggest that you use them, it would not be so we usually inform about the risks of not having policies." - Sam

"Small companies often talk to other employees when they encounter problems and deal with them from there. Larger companies usually have their own policies and this is something that must be had today for GDPR in particular. We think this issue is up to the business itself to be responsible for. "- Per

Prepare Data for Visual Analysis

Analysts expressed the role of nomenclature in preparing data for visual analysis. Axel explains that a correct nomenclature, which is built in the back-end, enables a functioning drag-and-drop. Glenn described the need for a common nomenclature adapted to the users' business languages and not formulated according to database technical terms. Axel and Glenn's descriptions of the handling are illustrated with the following quotes:

"Drag-and-drop places great demands on back-end work in order for it to work in a front-end. We need to create ready-made calculations and then make sure that the users understand the formula, in order not to be misunderstood when using the objects "- Axis" The degree of refinement becomes higher in traditional BI as it may require post-corrections when naming different fields, due to the nomenclature not right. At SSBI, the consultant must make sure that the nomenclature is correct from the start for users to be able, for example, to use drag-and-drop. "- Glenn

Journal of Ecohumanism
2024
Volume: 3, No: 7, pp. 4323 – 4338
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i7.4548

Bert explains that the consultant needs to prepare data for visual analysis by building data models that consist of business-related attributes. In SSBI implementations, it is important that the consultant builds the data models right from the beginning, it needs to be both simple and keep together to facilitate the user. The database is built as a library of Master Items, in other words dimensions and metrics. The dimensions consist of fields and the measured values of prepared formulas. Through this process, the consultant develops a working drag-and-drop, where the user can decide, for example, what type of object, diagram or table to present in the SSBI tool. Bert expresses the following:

"Although in some cases we prepare tabs, customers still need to be able to create their own tabs and visualizations on the data that is based on the Master Items we have set up" – Bert

David expressed two ways to deal with the challenge. Initial management was described as starting from building blocks with dimensions or dimensions for the Self-Service solution. The second way is to build Data March on top of Data Warehouse to improve visualization. David expresses what follows: "To implement the best visualizations, you build building blocks where you have ready dimensions and dimensions in the solution" – David

Elof explains that in visual analysis the consultants use star models just like in traditional BI. The consultant prepares data through fact and dimension tables, which allows the user to build their analyzes based on these. Elof expresses what follows

"We prepare data models containing fact tables and dimension tables to facilitate use" – Elof

Sam explains that preparing data for visual analysis is an integral part of all BI projects. Should the consultant not prepare data for visual analysis, there would only have been a view filled with data without meaning to the users. In response to the challenge, Per data aggregates as far as possible. By maintaining and clearing old data, the consultant enables the users to use the correct data. Sam and Per's descriptions of the handling are illustrated with the following quotes:

"The normal thing is that a BI consultant does everything, so there is nothing specific about making visualizations in the BI industry." - Sam

"We need to aggregate the data as far as possible and clear so that the application does not collect unnecessarily many lines." – Per

Make BI Tools Easy to Use

Analysts stated that the consultant must prepare data to make the tools easy to use. Axel explains that drag-and-drop is an example of how the system pulls automatic couplings and facilitates the use of the tool, but for it to work, it is important that the tool's back-end is properly prepared. Sam explains that the consultant needs to produce standard reports and basic templates that facilitate the use of the tool. These reports and templates are produced together with the organization to enable them to meet the user's needs. Axel and Sam express what follows:

"The system finds a date field, where it automatically creates month, week, year and weekday etc. Where drag-and-drop makes it user-friendly so a business user completely without programming background or IT background can do more" - Axel

"If the consultant does good preliminary work, the individual user can choose whether he or she wants to continue using the reports, images, graphs and other tools that we have done for them when analyzing data "- Sam

Bert explains that it is important to have transparency in the system where everyone understands what they are looking at. Bert points out the difficulties of making data credible if there is no kind of control, for example from super users or the IT department. Bert expresses the following:

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"It depends on the system being transparent, everything should be easy for the user. Different types of transparency but that is a big part for all users "- Bert

Glenn expresses that SSBI should be self-explanatory, which is not so different from traditional BI. In both SSBI and traditional BI, users need to have access to explanations of things. In both cases, the consultant needs to work close to the client and preferably as iteratively as possible to facilitate compliance. Glenn expresses the following:

"We have to work iteratively with the customer to make sure they can benefit from an SSBI tool" - Glenn

Elof explains that they are building platforms under the tools that make it possible to produce new reports and analyzes quickly. The consultant needs to ensure that users have the data they need and the flexibility to combine data from different systems. Elof expresses the following: "Larger groups often have several systems, so if they want to be able to count on a group's income statement, they must combine data from different systems" – Elof

Make BI Results Easy to Consume and Improve

Most analysts stated that the consultants need to develop standard templates that users can refine and improve. Axel explains that consultants, together with the customers, need to develop SSBI content and centralize these as the standard for the preparation of reports. Per expresses that the consultants build standard reports, visualizations and tables to match the end user's needs. Glenn described that SSBI tools contain sharing functions that allow the dissemination of reports within the organization. Axel, Glenn and Sam's descriptions of the handling are illustrated with the following quotes:

"We want to create a" type analysis "because then we do not put a lot of support and management on a specific user in the business" - Axel

"SSBI has a number of hundreds of ready-made functions that can be used in diagrams to create visualizations" - Glenn

"If you are really smart then you have an IT department where there are people who take care of these users and what the users do." – Sam

Bert explains that the various SSBI tools allow for equal opportunities for improvement in consuming and improving BI results. The consultant needs to inform about what functionalities the tool offers and how the users can use them. Bert explains that SSBI tools are often part of an Enterprise environment where the consultant can integrate with other modules through APIs. Bert expresses the following:

"Often we need to integrate the SSBI tools into intranets and other web-based operating systems in order for the customer to utilize its full functionality" – Bert

David explains that the challenge is a tool issue where the consultant educates the user in the SSBI tool. David described that the training is ongoing throughout the implementation, where the consultant will support the users. David expresses what follows: "It is a more tool issue I would say and the consultants obviously need to explain they are going" – David

Provide the Right Tool to the Right User

Some analysts stated that it is not possible to generalize the tool to a specific role in the organization, but the consultants need to carry out analyzes of different kinds. Axel described that the consultant needs to rely on authorization models to know who should have access to what, and then the system interface can be adapted to facilitate the use of the tool. Furthermore, Axel explains that in the requirements phase, the roles need to be clarified through a stakeholder analysis to identify who is working with what, what tool needs the role has and what business needs exist. Bert described that the analysis is done through an ongoing

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dialogue with the organization, throughout the implementation, to be able to handle requirements that arise during the implementation. Axel and Bert express what follows:

"We will discuss this during the requirements phase, when we do a stakeholder analysis, which are the future users" - Axel

"It is not possible to generalize and say that controllers should have a specific tool. Without you having to have an open dialogue about which tools to use for the different user categories "- Bert

David explains that at the beginning of a project, the consultant produces a stakeholder analysis. The stakeholder analysis contains what stakeholders are available, what information needs they have and how they want to use the information. There is one category of users who are satisfied with getting fixed reports once a month, the other category is for example controllers who want to process their reports continuously. David expresses the following:

"A stakeholder analysis is performed at the beginning of the project, identifying the stakeholders and information needs available to find the right tools for the right users" – David

Per described that when they go into a project they try to sell the tool as a concept. The concept is that the specific user must match a number of character traits in order to be able to make full use of the tool. Per expresses what follows: "Based on past experience, we have been able to bring the lessons we have learned to try to give the right users the right tools" – Per

Sam described that users who are generally interested in analytics often use more features in the system. Less engaged users rarely deviate from the standard reports the person was introduced with. Furthermore, Sam explains that the tools are license-based, therefore the consultant always informs the user about the tool's follow-up activities in the form of user statistics. Sam described the follow-up activities as a way of taking advantage of benefits, regulating shortcomings and removing unused licenses. Sam expresses the following:

"We try to make things easier for those responsible by pressing the statistical possibilities in the tools. Then the responsible person can go in and look at, for example: what users are actually inside and use things, what reports people look at, how often people are inside, when, etc. "- Sam

Educate Users on How Data Is Selected, Interpreted and Analyzed for Decision Making

Some analysts expressed their involvement at an early stage. Bert explains that the best results are achieved by involving users already in the definition phase. The reason was described as being that early involvement gives users motivation because they feel they have contributed to the new system. Glenn explains that education must come early and iteratively throughout the implementation. Axel explains that the consultant needs to set up open forums where users can discuss business cases and hold workshops, in order to share knowledge. The forum facilitates continuous sharing of knowledge and allows users to learn from each other. Axel, Bert, Glenn and David's descriptions of the handling are illustrated with the following quotes:

"It is not possible to see the education of SSBI as a one-time education, but we need to set up forums to ensure continuity" - Axel

"We need to take advantage of the customer's already existing business knowledge because it is their business and what they know best." - Bert

"We educate users on the solutions so that they can quickly start visualizing and exploring information, gain insight and make better decisions." – Glenn

"By involving users early, we avoid building and building in the solution, then when it's done - thank you and hello." – David

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Both Elof, Sam and Per expressed the benefits of educating super users within the organization. Elof described that the training should focus on training the super users to act as support for the ordinary users. Sam explains the importance of organizations allocating the resources that the consultant requires in order to conduct a thorough education. Per described the training as a good opportunity to inform users of any pitfalls in using the tool. Elof, Sam and Per's descriptions of the handling are illustrated with the following quotations:

"It's about setting up an internal organization where they can support their own tools as well" - Elof

"You should try to explain this to the customer in the beginning. Above all, one should include the training as a separate cost in the project so that it is allocated time and money. "- Sam

"We usually tend to have a full-day education in place where we gather everyone involved. Where we go through everything they may need to know but also everything that can go wrong so they know what to watch out for "- Per

Discussion

This study investigated the challenges in SSBA implementation, in order to gain an understanding of how these can be handled. The main difference between SSBA and traditional BI is that SSBA simplifies the process of traditional BI use (Lennerholt et al., 2018). SSBA should enable an ordinary user to be able to develop advanced analysis and decision-making, without involving the IT department (Imhoff & White, 2011). Our study indicated that no matter how self-sufficient users are, some kind of control is needed to maintain the quality of the decision. SSBA is presented in the literature as the future and a lasting trend that will enable more benefits than traditional BI. The SSBI systems available on the market promise more benefits than traditional BI systems and interest in the SSBI systems is increasing (Lennerholt et al. 2018). Nevertheless, discussions about implementation are scarce and the literature available shows that it is problematic to succeed (Stodder, 2015). The motivation for implementing an SSBI implementation is largely based on overcoming the problems of traditional BI (Lennerholt et al., 2018). The interpretation we have made suggests that there are three groups of approaches to succeed with challenges related to SSBI implementations. The approaches identified are: involving the user and business needs in the system, standardizing work processes in the system and establishing the use of the system.

Our study indicated that users need to be involved and business needs integrated, in response to challenges related to preparing data in the SSBA tool. Without business context, it is unlikely that SSBA implementation will succeed (Imhoff & White, 2011). Through our study, we have shown that it is an overly complicated process, for users, to retrieve data directly from the data sources. In our study's literature section, the researchers write that if source data is not easily accessible to users, an SSBI cannot function (Imhoff & White, 2011). Our study indicates that the consultant instead needs to prepare as much data as possible before it is used by the users. Through our study, we have interpreted that data being prepared needs to be refined into user-friendly Data Warehouse and based on this, users can access the data they need. If analytical requirements and rules are relatively simple, it is possible to design user-friendly Data Warehouse, which isolates and produces meaningful data for users (Webber, 2013). Given our study, the SSBI tools need to combine scalability with flexibility to meet requirements that align with the organization's business needs. The most compelling motivation for implementing SSBI is the increased flexibility that the system offers users, which makes them more independent and thus improves the operational efficiency of the organization (Lennerholt et al., 2018). The use of BI tools for information management and analysis is part of the organizational culture and the opposite of decision making based on "gut feeling" (Watson, 2010). In SSBI tools, users are not served reports and analyzes but need to produce them on their own (Lennerholt et al., 2018). Users need easier access to data sources to create their own reports and analyzes (Imhoff & White, 2011). Unlike traditional BI, the process should not burden the IT department to the same extent (Weber, 2012). To succeed in this, Lennerholt et al (2018) describe that traditional Data Warehouse needs to be expanded and that data criteria are required.

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Through this study we have shown that standardizing work processes in the system makes it possible to maintain the data quality. In traditional BI, the most common cause of BI is the lack of high data quality (Watson, 2010). In an SSBI, responsibility is transferred from the IT department to the individual user (Imhoff & White, 2011). To succeed with the SSBI implementation, Data Warehouse needs to facilitate the distribution of data (Lennerholt et al., 2018). Our study indicates that the consultant needs to standardize the workflow in the systems to enable decision-making to be based on data with good data quality. Unlike a traditional BI, greater emphasis is placed on managing processing activities that match the user's needs and maintain a certain data quality. The sources of data vary in quality and format and have different meanings, depending on the origin of the data sources (Lennerholt et al. 2018). The consultant's work on pre-defining data is described in the study as a difficult challenge, but necessary to maintain data quality. In traditional BI, there is a tendency for users to make decisions that are not based on BI because of the IT department's inability to deliver reports on time (Imhoff & White, 2011). The SSBI system's answer to the problem is that users can produce the reports without interfering with the IT department (Lennerholt et al., 2018). Our study indicates that at the SSBI introduction, the consultant or other persons, with advanced IT skills, need to produce standard templates and standard reports that facilitate the user. The ability to choose parameters based on immediate needs gives users a feeling that they are really self-sufficient and at the same time ensures the quality of data (Imhoff & White, 2011). The results of our study show that simplicity must be present in the system for it to work. There is a complexity in trying to make complex processes in the back-end look simple in the front-end. No matter how simple the consultant makes it for the users, a certain understanding of the underlying logic will always be required. Users need to gain self-confidence in order to utilize SSBI and this is most easily done by taking small steps towards becoming independent (Imhoff & White, 2011).

The result of our study indicates that the consultant must establish the use of the system and provide the training required. Since SSBI requires a higher level of IT competence from the users, the structure and planning of the training becomes something the consultant must prioritize from the start of the project. Independent work requires training in order for the use of the system to be considered profitable. In traditional BI, users should be provided with tools that are appropriate to their needs, trained in how to use tools and the data that is available, and have access to support that helps them when needed (Watson, 2010). Given our study, we have interpreted that users' IT competence either needs to increase or the complexity of the tool needs to decrease, for example through the generation of metadata. It may be tempting to take shortcuts that violate best practices for BI metadata, but in the long run it will prove unsustainable (Weber, 2013). While the tool's "simplicity" is up to the suppliers, the consultant needs to give users the opportunity to understand the information obtained (Lennerholt et al., 2018; Imhoff & White, 2011). Our interpretation is that more training is required in the preparation of reports and how the analysis work should be interpreted, instead of tool-based training. This is so that the user can freely manipulate data and build reports as needed, even if it is outside the majority of users' knowledge area. The training is described in the result as a key factor in establishing the use of the tool. What distinguishes the result from the literature is that the result describes a methodology that involves encouraging users to discuss and learn from each other, rather than passing all questions to a department or individual. In an SSBI environment, the IT department is freed from designing reports and analyzes, which allows the IT department to focus on other relevant tasks in the organization (Lennerholt et al., 2018). There is a consequence of transferring the responsibility for the preparation of analyzes and reports to the user. In the worst case, the IT department's old support tasks are transferred to the users, which results in new tasks such as acting support for other users. In such a scenario, SSBI deviates from its basic concept, to facilitate the users, instead simply moves the problem and becomes a burden to the users.

Conclusion and Future Works

The main objective of this study is to create an understanding of how the challenges related to SSBA implementation is managed for enabling a successful implementation. According to the literature review, a number of challenges must be addressed in order to success with the implementation of SSBA platforms. This is confirmed in our interpretation of the results and we highlight further challenges that need to be

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DOI: https://doi.org/10.62754/joe.v3i7.4548

addressed, which are: static and mathematical models, the degree of utilization of the system, strategies for cloud-based systems, defining SSBI in advance, downgrading customers and expectations.

The results of our study demonstrate that The technical scope of a SSBI system must support scalability and meet the flexibility requirements in line with the dynamic business needs. Reasons to apply user involvement is that it can contribute to a better specification, define and understand user needs, and to support users' work and streamline work processes. Another important factor is customizing Data Warehouse for users. Furthermore, working with standardization of the system also facilitates the implementation routines and enables increased use of the tool. The Standardization of work processes in an SSBI environment allows the consultant to set rules for how reports and analyzes should look, when they have passed the various processes of the tool. Users need an understanding of the analytical work and the tool to use to generate income. Thus, establishing the use of the system should increase the utilization rate of the SSBI system.

Future research could therefore further investigate how the approaches to managing the challenges affect the use of the SSBI tools. It may also be of interest to make an in-depth study of our study's identified challenges: static and mathematical models, the degree of utilization of the system, strategies for cloud-based systems, defining SSBI in advance, downgrading customers and expectations. This is to identify the impact of the challenges on the user's autonomy when using the SSBI tools. As people put more and more trust in the data and data analytics in society, there is a risk that privacy will suffer. As people put more and more trust in data and data analytics in society, there is a risk that personal integrity will suffer. The IT systems make it possible to collect quantities of data, which today can be translated into information. It is therefore critical when users with less IT expertise to use this type of tool. Analysis tools used to combine information with information from various external players, which means that it is possible to obtain detailed information about the individual. Through analysis tools, the information may lead the user to draw generalizations about clusters, individuals, and groups of individuals. This can have both positive and negative impact on the individual, but requires an ethical discussion. For example, if banks would take a decision on credit loan based on where the individual lives, combined with the latest web increases, there is a risk of unwarranted denials.

References

Daradkeh, M., & Moh'd Al-Dwairi, R. Self-Service Business Intelligence Adoption in Business Enterprises: The Effects of Information Quality, System Quality, and Analysis Quality. In Operations and Service Management: Concepts, Methodologies, Tools, and Applications, 2017.

T. V. Johannessen and A. M. Fuglseth, "Challenges of Self-Service Business Intelligence", Bibsys Open Journal Systems, 2016.

M. M. Zaghloul, A. Ali-Eldin and M. Salem, "Towards a Self-service Data Analytics Framework", International Journal of Computer Applications, 2013.

Christian Lennerholt , Joeri van Laere , Eva Söderström ,"Implementation Challenges of Self Service Business Intelligence: A Literature Review", Proceedings of the 51st Hawaii International Conference on System Sciences ,2018

D. Stodder, "Visual analytics for making smarter decisions faster–applying self-service business intelligence technologies to data-driven objectives", TDWI Best Practices Report, 2015.

C. Imhoff and C. White, "Self-service Business Intelligence", Empowering Users to Generate Insights, TDWI Best practices report, TWDI, Renton, WA, 2011.

S. Williams and N. Williams, "The profit impact of business intelligence", Morgan Kaufmann, 2010.

B. J. Oates, Research Information Systems and Computing, Sage Publications, London, 2006.

Spahn, M., Kleb, J., Grimm, S., & Scheidl, S. Supporting business intelligence by providing ontology-based end-user information self-service. Proceedings of the First international Workshop on ontology Supported Business intelligence. Karlsruhe, Germany,2008

P. A. Schlesinger and N. Rahman, "Self-Service Business Intelligence Resulting in Disruptive Technology", Journal of Computer Information Systems, 2016

Howson, C. (2016). Embrace Self-Service Data Preparation Tools for Agility, but Govern to Avoid Data Chaos. Gartner. Howson, C., Sallam, R., Richardson, J., Tapadinhas, J., Idoine, C., & Woodward, A. 2018

Wanda J. Orlikowski, Jack J. Baroudi, "Studying Information Technology in Organizations: Research Approaches and Assumptions",1991.