User Related Challenges of Self-Service Business Intelligence

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Abstract

Self-service Business Intelligence (SSBI) is an upcoming trend allowing non-technical casual users to use Business Intelligence (BI) in a self-reliant manner without the support of technical power users. Many organizations struggle to utilize the potential of SSBI and experience data-related and user-related SSBI implementations challenges. This study aimed at exploring user-related SSBI challenges by conducting and analyzing a total of 30 qualitative interviews with 5 BI consultants and 10 customer representatives involved in 2 SSBI implementation project teams. Analysis of the interviews revealed ten challenges related to "self-reliant users", seven challenges related to "creating SSBI reports" and five challenges related to "SSBI education", which differ considerably from SSBI challenges commonly discussed in literature. Awareness of these 22 challenges can help practitioners to avoid unnecessary obstacles when implementing and using SSBI, and guide SSBI researchers in simplifying the implementation process of SSBI.

1. Introduction

Traditional BI has been implemented by organisations for decades and is often defined as an umbrella term that includes a set of technologies and software, which is used for accessing and using data for analysis helping users make better decisions [1]. To access and use multiple data sources to make better decisions is not an easy process since it requires technical skills which not all users possesses [2, 3]. Therefore, different user groups are involved to interact in a request and response scenario with BI and decision-making. Technical BI specialists who have the technical skills needed to operate BI efficiently often serve more casual non-technical decision makers [2]. Today, more users are in need of BI since there is an increasingly dynamic world where accessible data is growing, which creates a bottleneck between BI specialists and casual users [2, 4, 5]. More flexible and usable BI systems are needed to cope with this change [4].

One upcoming trend suggested to address this problem is self-service BI (SSBI), since its focus is to empower casual users to become more self-reliant and less dependent on BI specialists [5]. SSBI allows casual users to access and use data as desired when analysing and making decisions without support from a technical BI specialists [2, 5].

Even though SSBI offers benefits compared to traditional BI, there are many challenges to address in order to make SSBI work [6, 7], while there are few studies discussing SSBI challenges in depth. There is a lot of research on challenges for traditional BI implementation [8, 9], but it is presumable that challenges for SSBI at least partly differ from traditional BI challenges.

As one of the major differences between SSBI and traditional BI is the shifting role of the user (from a technical power user to a non-technical casual user) it is especially interesting to investigate whether user related challenges for SSBI differ from traditional BI related user challenges [10, 11].

In response, this research presents a case study aiming at identifying user related challenges of SSBI.

2. Background

BI is widely offered to different user groups within organisations [2, 3]. Different users like information consumers, analysts and specialists are using BI to create foundations when making decisions. These types of users are grouped into two types: power users and casual users [2, 3]. Users who have technical skills to build and run BI efficiently are the power users. Casual users are the opposite to power users since they do not have technical BI skills. Instead, they are using different foundations such as pre-defined reports or dashboards to make decisions [2, 3]. One of many benefits of SSBI is to offer the ability for all users, especially the casual users, to use BI without support from power users. They should be more self-reliant when accessing and using data as to create reports as desired when

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making decisions. In this paper, SSBI is defined as: "*The facilities within the BI environment which 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."* [5]. However, implementing SSBI is not as easy as expected even though it offers many benefits [2, 6].

Previous research on SSBI is relatively limited. State of the art SSBI reports which mention associated challenges when implementing and using SSBI are briefly mentioned [12, 13]. Lennerholt, et al. [6] have done an extensive literature review to identify known challenges associated to the implementation of SSBI. The results include six challenges related to "Access and use of Data" and four challenges to "A self-reliant user". The user related challenges were: 1) Make SSBI tools easy to use; 2) Make SSBI results easy to consume and enhance; 3) Give the right tools to the user; and 4) Educate user in how to select, interpret and analyse data for decision-making. Several studies [6, 12, 13] indicate on a general level how realising SSBI is not as easy as suggested, but more in depth research is needed to in detail understand what those challenges implicate.

Therefore, the study reported on in this paper focused on identifying more user related SSBI challenges and describing them in more detail compared to existing SSBI literature.

3. Research Method and Analysis

Case study research is an appropriate research method to achieve in-depth understanding [14, 15] and involves in this study a BI consulting firm and two of their customers. The customer organisations have strong ongoing relationships with the consulting firm as the consulting firm supports their implementation and usage of SSBI. The consulting firm has had BI and decision-making as their core business area for over 10 years and has supported over 200 customers. The two customer organisations are included in the study since they both have a strong interest but also rather different experience with regard to implementing SSBI. One of them has implemented and used SSBI for many years and is considered an experienced SSBI adopter since they have achieved many benefits compared to other organisations. The second chosen customer organisation is newcomer to SSBI and started their journey towards SSBI recently. Triangulating experiences from all three involved organisations gives in-depth understanding of what kind of user-related SSBI challenges can exist.

3.1. Research Process

There are many valuable contributions on how to conduct case study research [14, 16]. The chosen research process is inspired by and Braa and Vidgen [15] and Pan and Tan [17] and has followed their proposed steps and detailed instructions. The following steps have all been conducted by the first author:

1) Existing theory: The case study started by conducting a review on the associated challenges existing in current literature.
2) Collecting and organising data: The data collection process was considered done once saturation of user experiences was reached, i.e. no more user experiences were identified, and when enough data could fulfil the aim of the research. All collected data was transcribed.
3) Confirming and validating data: Respondents were contacted for an additional interview to confirm previous transcripts, solve potential misinterpretations and to confirm or add missing data.
4) Coding process: Open, axial and selective coding was used iteratively to analyse the collected data [18], which is described in section 3.3. During this process, the categories and challenges were identified.
5) Validate the results: a follow-up interview was used to discuss the identified categories and its challenges. No respondents rejected the results. Instead, they found the challenges trustworthy even though not all respondents were aware of them from the beginning.

3.2. Data collection

The chosen data collection for the conducted case study was semi-structured interviews [14, 17]. The data was collected during spring and autumn in 2017 and consisted of 30 semi-structured interviews with all responsible employees and consultants who have participated in the implementation of SSBI. The SSBI project consisted of 5 employees from respective customer and 5 involved BI consultants, resulting in 15 respondents. The representatives ranged from vice-presidents, consultants, analysts, architects, SSBI evangelists, BI developers, business

improvements managers, strategists, business controllers, IT specialists, managers and end-users. The respondents did belong to more than one role since they have many responsibilities within their organisations. Based on their roles and responsibilities, they were able to speak for other employees with similar roles and backgrounds. On average, all respondents had between 5-10 years of experiences working with implementing and using BI and SSBI. Therefore, all respondents are considered experts with strong focus towards implementing and using BI and SSBI within their organisation.

Each respondent participated in an initial contact, a main interview and a follow-up interview. The initial interview was held some weeks before the main interview to inform and prepare the respondent. The focus of the main interview was to collect data which fulfils the aim of the research. The interviews from the main event were transcribed and validated by the respondent before entering the qualitative analysis process, which is described in section 3.3. The follow-up interview was conducted to include details that were missed or changed during the main interview. On average, each interview lasted 1 hour. The data collection was considered complete when saturation was reached, i.e. when no more challenges were identified.

3.3. Qualitative analysis

The qualitative process applied open, axial and selective coding [18]. First, the coding process focuses on identifying a set of main categories and sub-categories which visualise how the collected data portrays the identified challenges. The focus was to have an open mind when identifying categories representing the collected data and not let previous research guide or affect the process. An iterative process has grouped different segment of text into categories, which represent the identified challenges within each category. The output from the open coding process was the three main categories. The aim of the open coding was to iteratively identify a set of main categories which can represent all identified challenges within the collected data.

The coding process and the qualitative analysis were considered complete once all transcripts had been analysed and no new challenges, sub-categories or main-categories were identified [18]. The qualitative coding process was conducted manually using different colors for each sub and main category in a word processor. All categories and challenges were shown to the respondents for validation. No categories or challenges were changed during validation.

4. Results

The result of the conducted research is summarized in figure 1. It presents the sub-categories of challenges of being a self-reliant user, difficulties creating SSBI reports and challenges of SSBI education.

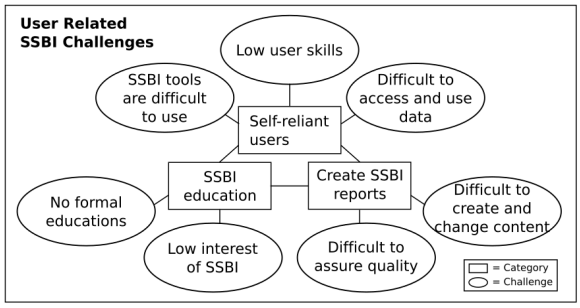

Figure 1. User related SSBI challenges

The rest of this chapter presents the identified categories of challenges. Challenges of being a self-reliant user is described in section 4.1. Section 4.2 presents the difficulties of creating SSBI reports and section 4.3 focuses on challenges of SSBI education.

4.1. Self-reliant user

One of the key factors to use SSBI efficiently is to let all users, including non-technical casual users to be self-reliant when using BI. Casual users are supposed to perform their daily tasks, including accessing and using data for their analysis when making decisions, without support from power users. The result of this research shows how users have difficulties to use SSBI. The category related to a self-reliant user consists of three sub-categories and ten challenges, which are described in section 4.1.1-4.1.3:

- Access and use data:
  1. Available data sources
  2. How to access data
  3. How to use data
  4. Different data sources
  5. Support for missing data
- Low user skills:
  6. Competence level
  7. SSBI reports content
  8. General IT skills
- Difficult SSBI tools:
  9. Difficult to use
  10. Isolated solutions

4.1.1. Difficult to access and use data. This section describes the challenges related to the sub-category: A*ccess and use data*, which belongs to the main category: *Self-reliant user*.

Challenge #1: Available data sources: The access of data when desired and needed is important to let SSBI run efficiently. According to our findings it is not easy to fulfil this requirement.

The first challenge faced by casual users is the difficulty to understand which data sources are existing. Imagine that important data is needed to make good decisions. If users do not understand if important data is available it causes major problems when analysing content for decision making. Users have low awareness of which data sources are available.

Challenge #2: How to access data: Many respondents are in line with the following quote: "*I do not really know what data sources are available. I know that most of the data I need usually is located in our database*". If users understand that data is missing they often discuss whom to contact to gain access, which is a time-consuming and troublesome process. One respondent mentions: "*Whom shall I contact? Who is in charge for this data? I want to calculate customers and do not know what database to access. When I manage to access, what fields are needed to determine if it is a customer at a given time? Does it have to be a product connected or what is the definition?*". This shows how users lack knowledge of how to access data even though users understand that it is available. If users of SSBI are having problems to access and use data affect the benefits of SSBI negatively. One quote mentioned by a respondent which goes in line with other respondents is: "*It is difficult to access the available data which is out there. It is possible to access and use it fully, but very few knows how to*". Even more experienced SSBI users are having problems, which is shown by the following quote: "*I have used the system for many years, with access to more basic data, and starts to learn what data exists*". This challenge is considered one of the largest affecting SSBI negatively, which was mentioned by many respondents.

Challenge #3: How to use data: Even though users manage to access desired and important data when making decisions, the next challenge to address is to understand how data can be used. Our findings show that there is a lack of knowledge on how to use data. Even though data is of high quality, users must understand the content of the data and to understand when to join and when to not join data. Sometimes you can filter data on specific details and sometimes you cannot. If users are not aware of how to use data, it will lead to wrong conclusions which affect decision making negatively. A respondent mentions: "*Even if people have access to data, I observe many who actually do not know how to use important data*". Another quote says: "*There are two aspects which go wrong when organisations start to implement SSBI. First, it is to make data accessible in an efficient way. Before SSBI, there were experts who understood data. It could be column names of codes. If you do not understand them, you cannot use SSBI. You need to have good names and make data more understandable. You cannot expose all data because it is difficult to understand. Instead, it requires different data for different SSBI users.*".

Challenge #4: Different data sources: Our findings show it is difficult to use many different data sources at the same time. In a traditional BI system, power users have the technical skills to join data correctly. If done wrong, foundations of analysis and decision-making consist of incorrect data. A respondent says: "*It is not easy to access different data sources. It does not exist a single main data source to use. Instead, we have around 5-10 data warehouses which have been created over a time period of 15 years*". Therefore, to implement and use SSBI requires a lot of planning on how to access and use data efficiently. We argue that the implementation of SSBI is not as easy as expected, which goes in line with one of the respondents with lots of experiences of SSBI: "*I believe SSBI is so simplified. It sounds really nice to have and easy to implement. All users are able to do their own work without support. It is not so simple to achieve."*.

Challenge #5: Support for missing data: Most users find the process to access and use data too difficult. They often need to contact IT support to use missing data**.** Even though SSBI implies letting all users be self-reliant without support from a power user, our findings show how SSBI users still need IT support to use missing data when making decision. Therefore, the request-response scenario between casual and power users still exists, even though the main driver for SSBI is to eliminate this bottleneck. A respondent from the IT department mentions this challenge: "*If users miss data, or the possibility to divide on, for example, car colour when looking at sales. Then it is often a request back to us*". This quote goes in line with two other users who have a lot of experience implementing and using SSBI. It is a challenge which affects even experienced SSBI organisations and not only newcomers to SSBI.

4.1.2. Low user skills. The second sub-category of challenges related to being a self-reliant user shows how SSBI requires skills which many users do not

possess. Three challenges have been identified within this sub-category.

Challenge #6: Competence level: One of many mentioned and advertised benefits of SSBI is to let non-technical casual users use BI more efficiently without support from more experienced and technical power users. Bottlenecks in traditional BI systems where power users serve causal users should be removed with SSBI. Our findings indicate there are still challenges to address in order to achieve this requirement. Still, users lack the right level of competence to use SSBI. One respondent who supports organisations to implement and use SSBI mentions: "*When I meet people and talk about SSBI, they want to enable all users to do more themselves. But when we sit down and try to show them how SSBI could work, I realize within 5 minutes when they push buttons and navigate systems that they will not be able to make it work. This person will never be able to use SSBI*". It is not only the choice of software which affects how users can use SSBI. Another respondent within another organisation who uses different software are agreeing: "*It is pretty common that users themselves do not know what they are doing. They have no clue what they are up to*.". We believe that it is important to understand which users are supposed to use SSBI and what competence is needed to support their working task. Perhaps not all users are supposed to use SSBI, even though it is advertised as the main benefit of SSBI, which some respondents illustrate with the following quote: "*I work with people who have limited technical competence. They are perhaps able to use standard reports which already exist. As long as they do that it is probably okay. But if they change anything, everything crashes. So, they are able to use it as long as nothing changes. It should work for a short while. But when anything changes, it will crash and I have to fix it*". Then we are back to a request-response scenario where power users support casual users when using data to make decisions. We argue that it is important to manage this challenge to understand what competence is needed to use SSBI on a daily basis and for a specific work task.

Challenge #7: SSBI reports content: Users find it difficult to interpret content in SSBI reports. In traditional BI systems power users have the skills to create reports which consist of relevant data which is presented in a way so users understand it when analysing its content for decision making. When SSBI enables all users to access and use data as desired brings difficulties to understand what the data actually means. According to a respondent: "*The biggest challenge to SSBI is to understand the data. There are so many different definitions which are named differently in different systems. Some data is basic stored data while others are created definitions based on calculations. But what does this mean? How have they calculated things which are stored and what is not included in the calculation?*". It makes a huge different if data is needed to see trends compared to specific and accurate data. If users do not have control and understand the data when creating SSBI reports can cause serious problems when making decisions. A respondent mentioned a scenario which caused problems due to difficulties to understand the data when using an existing SSBI report while creating a more custom SSBI report for their department: "*We used a SSBI report and its data without knowing where the data came from. Based on what they done we created a new SSBI report and later found out this data was inaccurate and wrong. We thought the existing report was of good quality but it was not thought through well.*". Such a challenge needs to be addressed in order to solve serious problems if many causal users are using existing reports with errors when making decisions on a daily basis.

Challenge #8: General IT skills: Some basic IT skills are needed even though SSBI are supposed to simplify the process to use BI. Our findings show how users lack general IT skills, which affect the usage of SSBI. Even though SSBI are supposed to simplify the process to use BI, some IT skills are needed to use SSBI systems. Not all users have this skill according to this quote: "*We work with different software to make our analyses. They are pretty easy tools to use, but far from obvious to use. Many of our users lack general IT skills. Users need an SSBI intro, some kind of minor education, to learn for a few days and hours.*". We believe this problem rises because SSBI is given to many casual users who were not using traditional BI earlier. Even though SSBI is advertised to simplify the process of using BI, it does not mean that anyone can use SSBI efficiently, especially not without general IT skills or any education on how to use SSBI.

4.1.3. SSBI tools are difficult to use. The third and last sub-category of challenges related to being a self-reliant user shows how users find SSBI tools too difficult to use.

Challenge #9: Difficult to use: Power users who possess technical skills to create and use traditional BI systems are not causing any major problems. Things start to be challenging when non-technical causal users are given a SSBI tool to run their daily task with BI. If they are supposed to be self-reliant it requires that SSBI tools are easy to use. Otherwise,

we go back to a request-response scenario which was common for a traditional BI system. Our findings show how users are having difficulties to understand and use SSBI tools. All respondents agree to one of their quotes: "*If you use a specific software, it is not piece of cake. It took a long while before I created another SSBI report once the first was done. It was not the feeling you have when riding a bicycle.*". Another quote which goes in-line: "*It is pretty easy to get started creating really basics. But very difficult when you want to create good looking reports. We were in need of huge support from the software experts*". We do not believe this is a common threshold for new software since all of the respondents have high IT skills and worked with SSBI for many years. Two respondents mention that SSBI tools are difficult to use and how they had to run for their colleagues to ask for support. Another respondent agrees: "*I have to ask colleagues all the time. We cannot work like that. It is really difficult to understand how to use SSBI".* If users are supposed to be self-reliant it requires that SSBI tools are easy to use. Many employees have to ask their colleagues for support in order to run SSBI, which is not in a self-reliant way of working.

Challenge #10: Isolated solutions: Users need to run their daily tasks even though SSBI tools are difficult to use. Another challenge which was identified was how users are building their own isolated solutions. Excel is commonly used as traditional BI tool which users feel comfortable using. Two respondents say they have more skills with Excel and are therefore creating their own solutions when other SSBI tools are difficult to use. This quote represents two other respondents: "*There are many users who believe it is no idea to contact IT for support when facing difficulties with SSBI tools. They will not prioritize it. Instead, we collect data from the SSBI tools, copy paste into our own solution, and we make sure it fulfils our requirements. I also see leaders who do not want to spend a lot of time searching for data in different reports. Instead, they create their own solutions in Excel"*. If SSBI tools are not used as they are supposed to, it will cause negative effects to the SSBI implementation. Users who are not able to be self-reliant due to difficult SSBI tools are facing the option to ask for support or the option to create their own isolated solutions. We believe this is a first step to reverse back to the negative situation of request-response bottlenecks in a traditional BI system.

4.2. Creating SSBI reports

Reports in many different formats are often used as a foundation for data and analysis when making decisions in traditional BI. It is also common for SSBI but the only difference is that all users are now able to create reports by themselves without support from a power user. The results in this research show how the process to create reports is difficult and hinders the effectiveness of SSBI. Two categories and seven challenges are related to creating SSBI reports, which are described in section 4.2.1-4.2.2:

- Create and change content:
  11. Difficult to create SSBI reports
  12. Requires lots of time and manual work
  13. Difficult to change content
- Assure quality:
  14. Difficult to assure quality of reports
  15. Redundant reports
  16. SSBI report governance
  17. Unsupported tools

4.2.1. Difficult to create and change content. The first identified sub-category shows how users find it difficult to create and change content in SSBI reports. Three challenges belong to this sub-category.

Challenge #11: Difficult to create SSBI reports: Different users have different background and skills, which affect the process to create SSBI reports. The first identified challenge is that many users find it difficult to create SSBI reports. They are not able to create reports which are based on raw data from different data sources. Instead, they manage barely to create their own reports by collecting data within already created reports designed by power users. A respondent who works as a power user mentions: "*Users collect data from reports which I have made. It works at this level. They will never be able to create new reports by themselves*". The more experienced users with a more technical background manage to create SSBI reports more easily while others require support. A respondent working within the IT department as a power user says: "*We have data scientists who are very self-reliant. They are able to work independent from us. We have a broad spectrum of users. Some users are able to create SSBI reports by themselves while others require lots of support*". Even power users are experiencing challenges when creating reports. Accessible data is available but it is a complex process to fulfil all follow up questions when creating reports, which is mentioned by the following quote: "*Well, I am able to access data. We have data warehouses and good information is build up in different cubes. The problem is, even though I am able to access data, is*

that I am not able to ask too many follow up questions. Then it is very complicated and requires an order to the IT department". Even the technical skilled users believe that creating SSBI reports is complex.

Challenge #12: Requires lots of time and manual work: Users of SSBI find that creating SSBI reports takes a lot of time and requires lots of manual work. The software tools are not able to automate the creation of SSBI reports. It requires manual work which is a troublesome process, especially when many users are involved in the creation. A respondent mentions: "*Reports which are used nationally is created by many users and cannot be automated. It requires lots of manual work even though SSBI aims to simplify the process*". Another respondent explains how creating SSBI reports sometimes is a technical and time-consuming process: "*There is no list of requirements when creating SSBI reports. It is now part of my role and the time it takes depends. An example when I create a report for our team leaders to follow up on their advisors, they needed lots of kpi´s from different sources. It was a mega job to fulfil everything technically*". When the process starts to become troublesome users start to ask power users for support, just the way they were when working with the previous traditional BI system.

Challenge #13: Difficult to change content: The third identified challenge shows that SSBI users often require IT support to change existing reports. Even experienced organisations working with SSBI for many years are facing this challenge on a daily basis. One quote, which goes in line with many respondents working within the IT department, states: "*It is common that users come back all the time to change content. When I show them what the software can do, they get new ideas and want more. Or they ask if they have interpreted things correct. SSBI is still an iterative process*". Even the smallest change is a request to the IT department, which is shown in the following quote: "*If some data is missing or if they want to split of example car color and sales. It is often a request back to us*". The purpose of implementing SSBI may be questioned if organisations do not manage to minimise the request and response scenario which is one of the main problems SSBI tries to solve compared to a traditional BI system.

4.2.2. Difficult to assure quality. The second and last identified sub-category related to creating SSBI reports consists of four challenges which are described in this section.

Challenge #14: Difficult to assure quality of reports: The first challenge in this category shows it is difficult to assure quality of created SSBI reports. When all users are able to create reports will lead to an increase of the amount of created reports. Our findings show it is difficult to assure quality of reports. How do we know casual users have created reports which are of high quality and where data has been used properly? Ten respondents agree to this challenge where one quote says: "*The problem with SSBI is not that users are not creating reports. Instead, too much content is created. If we are supposed to make decisions based on this, we must have extremely high confidence in the user who created the report. That the calculation from this number is correct and according to the information model"*. If users have missed something or when reports are created will affect the implementation of SSBI negatively, which is mentioned by one respondent with lots of SSBI experiences: "*SSBI brings many benefits in different ways. But there is a problem to implement SSBI for many users if we cannot assure the quality within reports exists"*. Users are prone to believe that content is of high quality since someone else already has created the report and approved its quality.

Challenge #15: Redundant reports: All users with different skills and needs are allowed to create new reports. But the challenge is more obvious when old reports are reused and customized. There are different levels of quality needed for different types of decisions. If users are not aware of the different levels of quality it can cause serious problems, which is mentioned by the following respondent: "*One unit within our organisation created a report for their needs. They wanted to look at trends and were satisfied with that level of quality so they marked the report as quality secured. Then, another unit started to look at the same report. This was good so we start to create new content based on the earlier report. After a while they realised the quality was not good enough for their needs. But since the report was already created and marked as quality assured, they thought it was good enough for their needs".* We believe this can cause serious problems when making decisions, since users are more prone to believe content is good for all needs, if someone else approved its quality, even though their current needs are different. On the other side of the same coin lies another challenge according to our findings: reports are created even though they exist. Users are not aware of the available reports. Instead of analysing existing reports, the same reports are created redundantly, which affect the implementation and usage of SSBI negatively. Five respondents mention this and even the ones who have worked with SSBI for a long time agree: "*It is common users are*

creating the same report over and over again. The wheel is reinvented many times". Self-reliant users are not supposed to duplicate work.

Challenge #16: SSBI report governance: According to our findings organisations are facing the challenge to govern SSBI report, especially when users are customizing existing reports. One of the respondents mentions an example which goes in-line: "*Previously, I worked in a place where there were many technical users who created good reports. They were considered heroes when they released a solution. Then others started to add and change things, which started to cause problems. Later, there were ten different solutions which did not fit together. How can we know if we can use these reports? How do you give the freedom to create BI-solutions without good governance?*". To implement and use SSBI efficiently requires good governance, similar to data governance which organisations have implemented for years.

Challenge #17: Unsupported tools: The last challenge identified within this category shows how users are using tools which are not supported by the IT department. According to some respondents, it is common users are working with their own ad-hoc tools. If someone creates a report consisting of content which is created by these tools, it may cause problems. One respondent mentions: "*Some users create reports with tools which are not supported. For example, when the tool hit the roof in the amount of data it could handle caused problems since nothing worked any more. Then they requested help from IT. We do not support this software but tried to understand the problem. One of the reasons we do not support the software is because it cannot deal with these volumes of data. It is not a stable and secure solution*". We believe users may start to use any software as desired when moving towards SSBI. Organisations need to be aware of these challenges. A self-reliant user is perhaps not allowed to work as freely as desired. Instead, proper education is needed to achieve an efficient SSBI implementation, which leads us to the next chapter of challenges regarding SSBI and education.

4.3. SSBI education

Changes within organisations often come with education. Users need the right skills to perform their tasks and a proper understanding of how the new workflows affect their daily work. The third identified category of challenges focuses on education and SSBI, which has shown to affect the implementation and usage of SSBI negatively. Two categories and five challenges are related to creating SSBI reports, which are described in section 4.3.1-4.3.2:

- No formal education:
  18. No formal education
  19. Users forget
  20. Not using SSBI after education
- Low interest of SSBI:
  21. Users do not see the benefits of SSBI
  22. Different technical backgrounds

4.3.1. No formal education. The first identified sub-category related to SSBI education consists of three challenges which are described in this section.

Challenge #18: No formal education: The first identified challenge shows organisations do not have formal education when implementing and using SSBI. SSBI is supposed to simplify the usage of traditional BI. This can lead to the misunderstanding that users who manage to use traditional BI, do not require any major education when they change to SSBI. Our findings show how a lack of formal education becomes a challenge which hinders the implementation and usage of SSBI. All respondents agree and go in-line with the following quote: "*We do not have any formal education. But we need it since the existing education is on a very superficial level".* Instead, users meet informally to share experiences how to use SSBI. They discuss what they have done and how they worked in order find their solution.

Challenge #19: Users forget: Organisations organize education focusing on sharing experiences and ideas of how to use SSBI. However, our findings show how education brings another challenge: users forget how to use SSBI even though they participated. According to a respondent: "*We have some education where many employees participate. Most of them are satisfied and want to use SSBI on their own. But not many are able to use SSBI on their own. I know a few close colleagues who took education and are probably able to use SSBI on their own, but they forget how to and ask me instead. So, they are not using SSBI in a self-reliant manner like SSBI is supposed to*". Therefore, we believe organisations need more formal education to increase the possibility to let users be more self-reliant without support. Otherwise, there is no difference compared to traditional BI where power users created content.

Challenge #20: Not using SSBI after education: The result shows users are not using SSBI after their education. Six respondents agree and mention that users who participate in education find SSBI great, but they are not using SSBI afterwards. At first, users

like SSBI and see its benefits compared to traditional BI. But after a while, they have not created or used SSBI at all. A respondent who goes in-line with others say: "*We hade some educations in the beginning where you got licenses for SSBI tools. But then you do nothing, users start to lose knowledge and perhaps the interest. Lots of users in my department are not creating their own reports like SSBI is supposed to offer. Instead, there are a few who have the competence who do. In the beginning, SSBI seems hot and attractive, but most of the users prefer standard reports where they are able to tweak and filter data on. There are many users who participated the SSBI educations and later have not touched the SSBI tools"*.

We believe it is important to plan for formal educations, especially when introducing SSBI, to let users become self-reliant and see the benefits of SSBI compared to the previous ways of working. Even though SSBI is supposed to simplify the process to use BI, it requires formal education.

4.3.2. Low interest of SSBI. The second identified category within SSBI and education shows organisations have users who have low interest of SSBI.

Challenge #21: Users do not see the benefits of SSBI: Some respondents believe it is due to the choice of software while others believe it is because they do not have any need for SSBI. One respondent who goes in-line with three others says: "*I know many users who believe SSBI was great when first experienced during education. SSBI was so cool in the beginning but they did not see any need to use it in their daily work. This is due to the major threshold to understand how to use SSBI".* Users need education to understand the benefits which SSBI brings compared to their previous way of working. If users do not understand they are more eager to resist the change towards SSBI. This goes in line with a respondent who been to many SSBI educations: "*You can easily notice users who do not care at all about SSBI. These users do not care to assimilate SSBI"*. Proper education targeted to specific users and their daily work tasks are needed. Otherwise, users tend to reverse back to their old routines.

Challenge #22: Different technical backgrounds: Another challenge contributing to the low interest of SSBI is that users have different technical backgrounds. Users with more technical skills are able to become self-reliant more easily compared to non-technical users. Organisations need to be aware of user's different backgrounds, especially when defining formal educations. All users must be able to use SSBI in their way, even though they have different technical backgrounds. A respondent mentioned: "*Our data scientists are very self-reliant when using SSBI. Others are not. But we all use data differently so it matters what kind of background users have when using SSBI"*. Perhaps SSBI is not a one-size fits all tool for every user in the organisation. We believe it is important to understand how to use SSBI for all users within the organisation when defining formal educations. Otherwise, users are probably not seeing the benefits of SSBI and therefore go back to their previous ways of working. We believe SSBI brings more benefits compared to using traditional BI. Therefore, organisations need to be aware of the related challenges to manage in order to succeed with their implementation of SSBI.

5. Discussion and future research

This Study has revealed 22 user related SSBI challenges in three categories. Our findings show how users are having difficulties using SSBI on a daily basis. The core idea of SSBI is that users are supposed to use BI more freely without support from technical power users. The first category of challenges shows how users are not as self-reliant as SSBI promises. There are still difficulties to access and use data, which is a key component of BI. Even though SSBI is supposed to be easy to use, our challenges show that users are having problems to apply SSBI efficiently. Perhaps SSBI is not a one-size fits all system for all users within an organisation? Instead, organisations might need to plan which tools are needed for a specific user and why.

The entire SSBI implementation could be questioned if users are not able to be self-reliant when making-decisions. The usage of SSBI can be more complicated when there is no guideline for how to assure quality in created reports. In traditional BI, the power users took this responsibility since they have all skills needed to create content without errors. But when all users are able to create reports require a quality assurance strategy to avoid faulty decisions are made due to improper foundations.

Our last category of challenges shows SSBI is no exception with regard to education. Like all new changes within organisation, proper education is needed to inform all employees its benefits and how to use SSBI on a daily basis. It shows organisations are not prioritizing education when implementing and using SSBI since it promises simplification of usage compared to traditional BI. Users who do not understand why SSBI is implemented or how to use

SSBI loose interest, which affects the implementation and usage of SSBI in the long term. SSBI is not just software to buy and install. Instead, SSBI is a new way of working which requires more preparation to achieve its benefits.

Our 22 challenges in three categories do partly match and confirm the 4 user related SSBI challenges revealed in recent literature studies [6] and commonly listed in BI handbooks [12, 13], but are here described on a much more detailed level.

To achieve the benefits of SSBI it is required that organisations are aware of the potential challenges which affect the implementation and usage of SSBI. This paper lists user related challenges of SSBI and is a first step towards the process to facilitate the implementation and usage of SSBI. The next step to be tackled in further research is to focus on how to address these challenges. Suggested recommendations for how to manage these challenges will hopefully increase the adoption rate of SSBI. Another option for further research is to investigate which challenges are more important to consider for newcomers and which are more important for experienced SSBI organisations. Understanding what challenges arise first and which come up later is useful for all organisations looking for expanding their implementation of SSBI.

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