Creating Value from Business Intelligence and Analytics in SMEs: Insights from Experts

Completed Research

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Abstract

This paper reports from an exploratory study that examines utilization of Business Intelligence and Analytics (BI&A) in Small-and-Medium-sized Enterprises (SMEs). In total, 24 semi-structured interviews of BI&A experts were conducted. The experts highlighted several critical issues that SMEs should consider: (1) to "start Small, think Big" was emphasized as an appropriate BI&A investment strategy for SMEs to obtain value in terms of both "quick wins" and long-term assets and impacts, (2) to consider BI&A investment without implementing a traditional data warehouse, and (3) to consider the automated data warehouse approach. In addition, the experts underscored to pay more attention to data governance. A recognized value framework from the literature was applied as an analytical lens to interpret the findings. We suggest modification of this framework to make it less "waterfall" oriented and more iterative and agile to create value from BI&A in SMEs. Future research should assess SMEs' readiness and capabilities for BI&A. In addition, we need to understand the exclusive needs for decision-making in SMEs across industries.

Keywords

Business intelligence and analytics, SMEs, BI&A value framework, data governance.

Introduction

For several decades, scholars and practitioners alike have been paying attention to how business intelligence and analytics (BI&A) approaches in enterprises can improve decision-making processes and create business value. BI&A systems are important for visualizing and understanding enterprises' data to support their management teams in extracting and utilizing core information resources in more intelligent ways (Guarda et al. 2013). BI&A systems are considered vital tools for improving internal business processes and for gaining effective reporting, and externally, they are important as market predictors for strengthening a sustainable, competitive position in the marketplace (Gilad and Gilad 1988).

While tools for efficient decision-making have been highly attractive to larger companies for some time, small and medium-sized enterprises (SMEs) have recently started to notice and take advantage of BI&A approaches that are suitable for their needs (Scholz et al. 2010). However, the research on BI&A in SMEs is limited because most of these systems are implemented in larger enterprises, and previous empirical research has mostly been conducted in that context (Llave 2017).

SMEs differ from larger enterprises in several ways; normally, SMEs have limited internal information technology (IT) resources and competencies available, and they are dependent upon external expertise when starting new IT projects, such as acquiring and implementing new business intelligence (BI) applications. The primary goal of BI is to enable the use of information, and an important aspect of BI projects is turning data into usable information (Larson and Chang 2016). SMEs may have different needs regarding the types of decisions that need to be supported compared to larger companies, and it is

important to understand how SMEs can utilize BI&A to take advantage of their information in more intelligent ways. They may also have limited financial resources for investing in BI&A, so it is likely that they consider different investment strategies. Therefore, more empirical research is needed to understand how SMEs can utilize BI&A to become more efficient in turning their data into usable information and to foster analyses that can improve their decision processes to generate value at operational, managerial, and strategic levels. This has been an important issue for larger enterprises in the decision support system literature (Arnott et al. 2017).

SMEs play a significant role in the economy of most countries and constitute important sources for economic development (Olszak and Ziemba 2008). Moreover, SMEs are the focal point in shaping enterprise policy in the European Union (EU). The EU considers SMEs to be the key to ensuring economic growth, innovation, job creation, and social integration (Airaksinen et al. 2015). Therefore, more research on SMEs is essential.

To bridge this research gap, we performed an exploratory study comprising 24 interviews of BI&A experts from user organizations and vendors of BI&A solutions. We were then able to build a rich picture of how SMEs tackle the implementation and utilization of BI&A solutions across different industries. The study focused on how BI&A is applied to improve SMEs' business processes and how SMEs can ensure that their investments in BI&A will deliver business value. By doing so, we hoped to gain valuable insight into the factors that can influence BI&A adoption in SMEs, fill the gaps in the literature, and facilitate the progression of BI&A research on SMEs.

Our inquiry offers two important contributions. First, this research empirically identified the significant issues that SMEs need to consider when investing in BI&A. Second, we applied well-known value frameworks from the literature that utilize process theory to understand how SMEs may create business value when implementing BI&A systems (Soh and Markus 1995; Trieu 2017). By utilizing this framework as an analytical lens to understand BI&A processes in an SME context, we recommend introducing a more agile and incremental approach into this framework to better meet the needs of SMEs. The paper is organized as follows. First, we present the background for this research and the foundation for the development of the research questions. Second, we provide a description of our research method. Then we present our results, followed by discussion, implications, and our conclusion.

Background and Development of Research Question

BI is defined as a "broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help its users make better decisions" (Wixom and Watson 2012). As the terminology of BI has evolved, the term *business analytics* has also been used to describe applications that provide decision support (Davenport 2006). Thus, business intelligence and analytics (BI&A) was proposed as a unified concept and term for describing information-intensive concepts and methods for improving business decision-making (Chen et al. 2012). BI&A systems are complemented by specialized IT infrastructures, which include data warehouses and data marts, as well as extract, transform, and load (ETL) tools (Ong et al. 2011).

We have adapted Trieu's framework as an analytical lens to explore how BI&A creates business value in SMEs (Trieu 2017). Trieu's work incorporates several acknowledged frameworks from the IS literature that utilize a process theory approach (Melville et al. 2004; Schryen 2013; Soh and Markus 1995). Figure 1 illustrates the value framework that links BI&A investments to organizational performance through certain steps. This is demonstrated as a chain of necessary conditions. For example, to increase organizational performance, the enterprise needs to obtain a certain degree of BI&A impacts, which in turn requires BI&A assets to be generated from BI&A investments. A process approach is beneficial to understanding how SMEs manage BI&A investments that yield BI&A assets, which again impact organizational performance over time. In addition, a process approach seeks to understand the underlying and interrelated probabilistic processes that are most appropriate for explaining uncertain outcomes in the research on IT investment and business value compared to variance models.

First, the link between BI&A investments and BI&A assets involves the conversion process. According to the literature, BI&A investments induce better business performance and are necessary but are not a sufficient condition for BI&A assets. The four areas that are strongly associated with BI&A conversion activities include formulating BI&A strategies, selecting appropriate organizational structures for BI&A

strategies, selecting the right BI&A projects, and managing BI&A projects effectively. The non-BI&A investment strategies include risk management (Benaroch et al. 2007) and investments in the practice of sales and operation planning (Trkman et al. 2010).

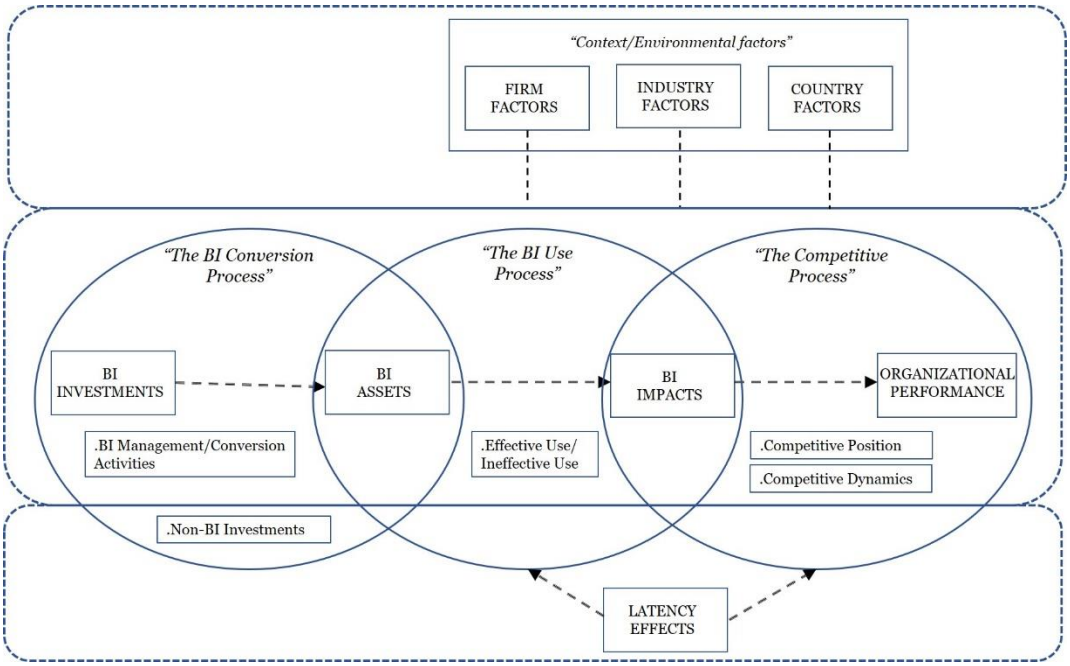

Figure 1. A Framework of How BI Creates Value (Trieu 2017)

BI&A investments consist of BI&A-related hardware, software, technical infrastructure, human resources, and management capabilities (Schryen 2013). At this stage, SMEs need to make appropriate investment selections based on their actual needs for support in decision-making processes. This also depends upon the financial situation of the SME in question and the solution it prefers. For many SMEs, cloud solutions can be good investments at low costs. The conversion process from investments to assets highly depends upon the IT maturity of the SME, the human resources available, and the application portfolios they have installed. Since BI&A constitutes a quite distinct IT investment, the companies need to have knowledge about which data they want to use, which decisions they should get support for, and how to turn data into valuable information. Moreover, good data collection strategies are essential for making BI&A assets. This involves focusing on data governance in terms of improving data quality and removing data inconsistencies (Ramakrishnan et al. 2012). We would expect that a focus on data governance will be important for SMEs in the process of creating BI&A assets.

Second, the link from BI&A assets to BI&A impacts depends on the effective use of BI&A. High-quality BI&A assets are a necessary—but not sufficient—condition for achieving BI&A impacts. Moreover, processes such as system development cycle time, business operations productivity, and BI&A planning can reduce effectiveness and result in negative impacts. *BI&A impacts* refers to a state in which enterprises have achieved one or more of the following outcomes: improved operational efficiency of processes, new/improved products or services, and/or strengthened organizational intelligence and dynamic organizational structure (Melville et al. 2004; Soh and Markus 1995). Moreover, a positive decision-making culture in the organization can play an important role in generating BI&A impacts when it builds upon deeply analytical evidence-based decision-making (Elbashir et al. 2008).

In addition, firm, industry, and country factors (as well latency effects) are important because they affect the success of the conversion of quality BI&A assets into BI&A impacts (Trieu 2017). Previous research has documented that BI&A systems provide different values depending on the types of industry in which an enterprise operates (Elbashir et al. 2008; Rouibah and Ould-ali 2002). BI&A has permeated various industries, such as retail, insurance, banking, finance, telecommunications, and manufacturing (Olszak and Ziemba 2006). For SMEs, it is likely that various industries will have different needs for decision support.

We would expect that the need for BI&A varies across industries, so a diversity of BI&A investments is likely to be utilized.

Finally, the link from BI&A impacts to organizational performance depends on the competitive process. Organizational performance includes measures of successful goal accomplishment, satisfaction of constituents, and the ability to obtain valued inputs from scarce resources. BI&A impacts are important and necessary but are not sufficient to result in improved organizational performance. The necessary conditions and probabilistic factors crucial to improving organizational performance include the competitive position of an organization, competitive dynamics, industry and country factors, and latency effects. Furthermore, obtaining BI&A impacts is the first necessary condition for improving a company's organizational performance (Elbashir et al. 2008).

Building on Trieu's framework, we are interested in exploring the different activities that SMEs undertake when they start the BI&A conversion process and move through the BI&A use process and finally into the competitive process (Figure 1). Thus, our overarching research question is as follows: *How are SMEs creating value from BI&A systems?*

Research Method

In this exploratory study, the expert interview technique was used (Meuser and Nagel 2009). The data collection comprised 24 semi-structured interviews with BI&A experts from various industries in Norway. The BI&A experts were identified using LinkedIn to find appropriate informants that had various BI&A roles. In addition, we used a snowballing technique in which we asked each informant to suggest other people we could talk to. An overview of the informants' roles is presented in Table 1.

At the beginning of each interview, the BI&A experts were asked to give brief information about how they currently work with BI&A. Also, we gave them a brief description of the status of BI&A adoption in SMEs according to the literature. The focus of the interviews varied depending on the interviewees' professions. In addition, each BI&A expert was informed about the main goal of the study, which was to explore BI&A adoption in Norwegian SMEs.

Role	Industry	Role	Industry	Role	Industry
Consultant	IT Consultancy	BI User	Chemicals	Data Scientist	BI Software Provider
Consultant	Oil & Gas	Head of BI	IT Consultancy	Data Scientist	Insurance
Consultant	IT Consultancy	Head of BI	Chemicals	Data Scientist	IT Consultancy
Consultant	IT Consultancy	Head of BI	IT Consultancy	Data Scientist	IT Consultancy
Consultant	IT Consultancy	Head of BI	Insurance	Data Scientist	Banking
Advisor	IT Consultancy	Head of BI	IT Consultancy	Vendor	BI Software Provider
Advisor	Investment Consulting	Head of BI	Banking	Vendor	Consulting & Advisory Services
BI User	Food & Beverages	Head of BI	BI Consulting	Data Governance Leader	Insurance

Table 1. The Informants' Roles and Industry Domains

The data analysis was performed using thematic analysis (Braun and Clarke 2006). First, all the interviews were transcribed and analyzed using NVivo. Then we performed the first phase, which was to become familiarized with the data. In this phase, we read and reread the transcripts and noted some initial ideas. Second, we coded the interesting features of the data in a systematic fashion and collated the data that were relevant to each code. Third, we searched for potential themes and reviewed each of them. Fourth, we generated clear definitions and names for each theme. Finally, we produced a report on the analysis, which is presented in the results section.

Results

We present the results from the expert interviews in this section. First, we address the BI&A conversion process in the SMEs. We then look at the BI&A use processes in various industries and present the competitive process.

BI&A Conversion Process

The informants emphasized three BI&A investment issues in particular: the need for an iterative and gradual investment strategy, whether the BI&A should be built without a data warehouse, and whether the BI&A system should be implemented with an automated data warehouse. In addition, they highlighted the importance of data governance.

First, a majority of the informants emphasized the importance of an iterative and gradual approach to the investment and building of the BI&A asset. Several informants used the expression "start small, think big" to denote this investment strategy. For example, one informant explained that "When enterprises embark on a BI&A project, it is important to think big, but to start very small." The informants expressed that it is crucial to focus on the things that are easy to deliver, based on what is known about the data quality and the resources available for the project. Therefore, it is better to do small deliveries, scoping and narrowing down to small areas that will give quick wins to the business. This contributes to building the legitimacy of further BI&A investments and making the BI&A effort business driven. The following quote is illustrative of this logic: "when you deliver something that is giving value to the organization, it will be much easier to move on, to continue the investment and take initiative to build the whole picture [...] It is important to have the big picture as a guideline, but you still deliver solutions that are manageable in a small amount of time." The informants believed that it is necessary to start small but to have a complete vision of the future BI&A asset and its functionality and contribution to value creation. One of the informants noted that "From the end of the 1990s until the beginning of the millennium in Norway, when a company launched a BI&A initiative, they always covered everything." Back then, it was normal to start building a data warehouse without knowing the needs of the users.

Several of the informants also pointed out that a BI&A system should be dynamic and evolve over time. Most businesses change quite frequently; new products and services are created, and new data sources become available, meaning that new systems may need to be interfaced, such as applications in the Cloud. According to these experts, BI&A systems need to be agile to deal with these changes. There will be iterative adjustments during the lifecycle of the system.

Second, several of the informants from BI&A vendors noted that SMEs should consider adopting BI&A without a data warehouse. They had SME clients from a wide range of industries. These enterprises have adopted BI&A technologies such as PowerBI, Tableau, and QlikView. These BI&A assets are pre-built solutions, so the clients do not have to worry about the technology aspect. One of the informants noted that "when enterprises are content with the tool and see what [the tools] can deliver, then [the enterprises] come back to us and we expand the use of the tools." In addition, several informants stated that getting the data from the source systems and modeling it in a star schema can be done in spreadsheets like Excel as well. The informants also noted that Excel is very easy to use out of the box and that it can be appropriate for small enterprises that only have few data sources and only need a few reports. They further asserted that it is sometimes possible to connect Excel to the data source systems and use Excel as the "local data warehouse," or the data source for the reporting tool. One informant stated that "depending on how much data you have, it is not necessary to have a huge server." In addition, several of the informants acknowledged that building a data warehouse can be a very expensive investment for an SME. In addition, the return of investment, delivery point, and delivery time can be very tough to quantify. Several of informants argued, therefore, that it may not be necessary to have all the data in one place and that the thing that matters most is that the users can have immediate access to the data and do their analyses. This indicates that a small portion of data with the right BI&A assets may be sufficient. Further, most of the informants acknowledged that "BI&A investment is beneficial for any type of business."

Third, the informants also emphasized that employing an automated data warehouse could be a feasible option for SMEs. Several of the informants illustrated how innovative BI&A technologies can automate some of the processes in building a data warehouse. These technologies are designed to automate and

improve all aspects of data warehousing. They noted that this approach is faster and cheaper compared to the traditional data warehouses, which are complex, costly, and time consuming. Two of the informants pointed out that automated data warehousing automates the ETL processes, which normally account for more than 80% of a BI&A project, while 20% of the effort is spend on reports and analytics. One of the informants from a BI&A vendor stated that "automated data warehousing is [optimizing] the process of getting the data prepared and ready for reporting [...] but not at the cost of quality, governance and documentation [...] And in automated data warehousing, we try to switch to twenty percent for preparation of data and eighty percent for decision-making processes." He also noted that "most of our customers come to us because they have multiple versions of business rules, and everything is kind of messed up, and they have no documentation [...] And yes, data warehousing is really expensive and takes a lot of time, but if you have a way to do this faster and cheaper, you kind of have to do it."

In addition, several of the informants pointed out that data governance is a neglected issue in BI&A implementation. This is illustrated by the following quote from one informant: "In the 1990s and at the beginning of the millennium, the people who built data warehouses were also the ones who were responsible for data governance [...] It was wrong, and this was one of the main reasons why the success rate of BI initiatives was very low." He underscored that "Data Governance is a business matter, not an IT matter. Data warehouse developers are usually IT-resources and has a technical mindset. That also means they treat data issues as technical issues instead of challenging the business processes - both the business processes that creates the data and the ones that use the data and defines their requirements. When the business side looks upon data management as an IT matter, they don't realize a part of the data quality problem and do not do their part in improving data quality". In addition, one of the informants noted that "I would say that in ninety percent of all cases, when you start a data warehouse project, that you kind of come to the point where, okay we need to start over again [...] And the reason for that is data governance; you need someone to tell you how to use the data, you need a strong governance in your data." The informants explained that data governance means having control over the data's availability, usability, integrity, and security. One of the informants from the banking sector emphasized that it is important to have data governance as an independent enterprise function that guides decision-making regarding the creation, use, and disposition of business information. She stated that "a data governance leader is responsible for implementing the decision rights and support mechanisms to ensure that the trust, accuracy, consistency, accessibility, and security of information across the enterprise are maintained"—hence the business need to have an enterprise-wide definition of *data*. Further, these informants noted that implementing a data governance framework is not easy.

BI&A Use Process

The interviews revealed that the use of BI&A was perceived to be important in gaining control over data. All of the informants emphasized the use of BI&A for making better and more informed decisions, because BI&A provides facts to support decision processes through the collection, processing, and presentation of data. These are decisions that are based on facts rather than gut feelings. Most of the informants believed that when an enterprise has trouble making informed decisions due to the amount and complexity of its data, then BI&A would make sense. The informants explained how SMEs use BI&A assets to achieve BI&A impacts. The interviews indicated that one of the major reasons for adopting BI&A assets in SMEs is automation. BI&A tools are used to automate their existing reporting and to avoid other tedious tasks, such as copying, pasting, uploading, and downloading the data. Therefore, automation became one of the selling points for enterprises that are unfamiliar with the full capabilities of BI&A. In addition, some of the most mature SMEs are using BI&A to automate decision-making.

The informants pointed out the contextual differences of BI&A usage in various sectors and emphasized the financial sector. All of the informants pointed out that banks have always been data-driven. They use BI&A for reporting and to make informed decisions, since banks licensed in Norway have a strict reporting obligation to the Norwegian authorities. The authorities impose a violation penalty when banks fail to meet the reporting deadlines. Therefore, BI&A is an important tool in handling this reporting issue. Banks are also using BI&A for automated decision-making, for instance in granting loan processes. This process collects information about the customer who applies for a loan. BI&A is used to automate all of the processes of collecting the information and all the way through to making the decision. Insurance companies are also using BI&A to have full control over their data, for instance, when dealing with insurance claims and

reservation processes for future damage. Moreover, most informants firmly believed that banks and insurances companies were the early adopters of BI&A.

Several of the informants talked about how production SMEs use BI&A. BI&A are used to automate their reporting and to track orders throughout production, as well as to enable informed decision-making in staffing, ensuring correct pricing, and planning production. Similarly, the interviews revealed the use of BI&A for automated reporting in architectural and private equity companies. Many informants noted that sales companies are also using BI&A to track sales for every product group and for handling bonus systems for the sales clerks. Restaurants are using BI&A to generate reports that show when their staff is working and when sales are made. As a result, they have full control over how the general sales are evolving. They also use BI&A to make informed staffing decisions and enable management to react with greater speed.

The informants perceived four BI&A impacts to be particularly significant: business insight, customer insight, cost reduction, and competitive advantage. Gaining business insight was considered the most important BI&A impact. Most of the informants agreed that to have business insight is to know how the business is doing, its strengths and weaknesses, its place in the market, and its competitors. Most of the informants firmly believed that BI&A assets can lead to competitive advantage when they have become the core of the businesses' knowledge. Many of the informants believed that any enterprises that are implementing and using BI&A assets in the right way will achieve BI&A impacts.

The informants considered customer insight to be an important BI&A impact. Many of the informants noted that customer insight can increase sales and improve customer retention. One of the informants noted that "with BI&A, enterprises can know which customers are highly valuable, which are valuable, which are less valuable, and which are not valuable." Customer retention means reducing the churn rate and improving customer loyalty. Several informants also mentioned customer segmentation and that having consumer insight can help enterprises to focus on the right customers, identify customers with high churn probability, and initiate specific retention activities. With BI&A, enterprises can create intelligent campaign management using their customer data to select target groups for upselling and cross-selling.

The informants also pointed to cost reduction. Several of the informants talked about how automated reporting can lead to cost reduction by saving time. They stated that "BI&A reduces the time spent by CFOs in making financial reports for the board of directors [...] Then CFOs will have more time to analyze the data." Similarly, many informants mentioned that automated decision-making provides further cost reduction. For instance, loan-granting processes in banks can be performed without any human involvement. Some informants also noted that BI&A can help production companies better optimize their use of resources, like raw materials.

Competitive Process

As mentioned earlier, BI&A impacts are important and necessary but not sufficient to result in improved organizational performance. According to the literature, competitive position and competitive dynamics are some of the factors that can help enterprises to convert favorable BI&A impacts into organizational performance improvement (Trieu 2017). The interviews revealed that the informants had little focus on this process. Their main focus was on the conversion and use processes and, in particular, realizing short-term BI&A impacts and benefits, but they implicitly acknowledged the importance of eventually achieving improved organizational performance.

Discussion and Future Research

In this section, we discuss the most important findings. We saw that the informants emphasized three issues in particular: an iterative and gradual investment strategy, whether the BI&A should be built without a data warehouse, and whether the BI&A system should be implemented with an automated data warehouse.

First, the informants believed that an iterative and gradual investment strategy was preferable for SMEs. This implies that they should address simple-use cases first and realize benefits from them before iteratively adding more extensive functionality. For each iteration, they should realize the benefits before defining the next iteration. This perspective goes beyond an incremental delivery approach, as described by Yeoh and Popovič (2016) and García and Pinzón (2017). It is also about creating the initial success stories and organizational learning that will be important for future BI&A investment decisions. We contend that such

early success stories are crucial for creating legitimacy for the BI&A project and for overcoming organizational skepticism towards it. Therefore, it is vital in order to secure resources for the further BI&A investments. We also contend that it will help secure a strong business grounding for the BI&A project and, thus, ensure that it is business driven. In addition, we saw that several of the informants emphasized that BI&A systems need to be agile and evolve with the business. In this regard, the systems should never be perceived as complete, and the BI&A effort should last for the entire system lifecycle.

The BI&A value framework in Figure 1 illustrates the BI&A value creation process as a set of sequential stages, where each is more or less completed before progressing to the next stage. BI&A investments are converted into BI&A assets, which, through the use process, lead to BI&A impacts, which, through the competitive process, lead to organizational performance. There are no iterations in this framework, so we argue that it fails to illustrate that BI&A assets need to be dynamic and constantly evolving. This is unfortunate, as it influences how we perceive BI&A efforts, as linear "water-fall" projects. We propose that we need to modify this framework to represent the iterative and dynamic nature of BI&A. Figure 2 depicts how the framework can be revised with feedback loops.

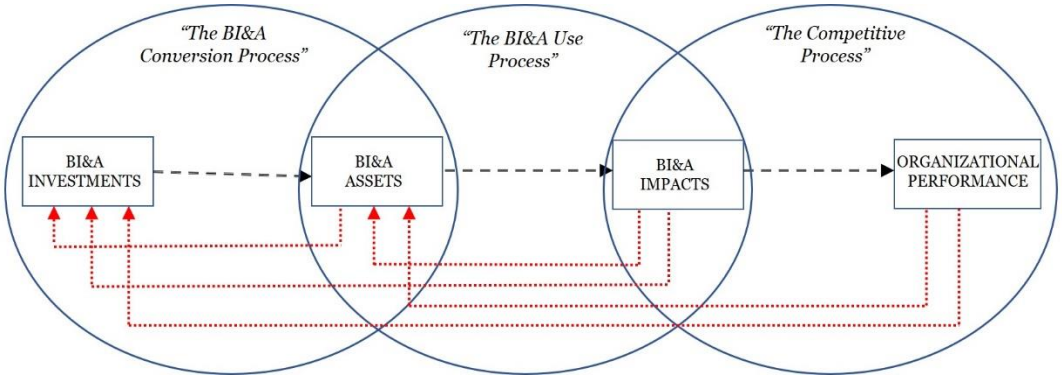

Figure 2. Revised Framework of how BI&A Creates Value (adapted from Trieu, 2017)

The informants also stressed the importance of creating and maintaining a complete vision of the BI&A effort. We contend that this is important in guiding and motivating the iterative development of the system. In addition, we propose that the BI&A project needs to plan for future flexibility, so that the entire solution will continue to deliver value to the business over time. We propose that using this strategy can lessen the factors derailing the success of BI&A initiatives. Therefore, future studies should focus on this issue.

Second, we found that there are several new options for implementing BI&A without a data warehouse. The informants considered this to be an appropriate solution for small businesses. Data warehouses can be large, complex, and costly for SMEs. BI&A without a data warehouse can help bypass the traditional complex data warehouse process. According to the interviewees, SMEs have adopted BI&A tools such as PowerBI, Tableau, and QlikView to run their business without building data warehouses. With a wide range of affordable BI&A tools now available, small enterprises that have no real need and no budget for BI&A projects can start with these tools. In addition, the data from our interviews illustrated how SMEs are realizing benefits from adopting these tools to improve their reporting and applying simple analytics on top of their BI&A environments. Hence, it is feasible for SMEs to skip the data warehouse part of a BI&A project. We found no studies on the benefits or problems of BI&A without data warehouses in the literature. Therefore, studies that assess the validity of this approach, as well as what such BI&A tools can offer to SMEs, can contribute to making BI&A more mainstream in SMEs.

Third, the automated data warehouse approach is another means of avoiding the traditional data warehouse project. We found that automated data warehouses can be an appropriate option for SMEs. Algorithms for automating data warehouses are already presented in the literature (Phipps and Davis 2002); however, we posit that there is a need for empirical studies on how automated data warehousing would be a viable alternative to traditional data warehousing.

In addition, we also found that data governance is a neglected issue in BI&A investments. This is consistent with the findings in Kamioka et al. (2016). However, we found no studies on the importance of data governance in BI&A initiatives. We also found that data governance is important for the success of a BI&A project. Therefore, we infer that data governance is also critical for BI&A benefits realization. We propose

that data governance should be part of everyone's organizational responsibility to support data governance priorities, standards, and requirements. In addition, basic guidelines for structuring data governance in SMEs needs further investigation.

The results of the interviews show that SMEs are adopting BI&A for various purposes, including automation, having full control over their data, and enhancing their decision-making processes. Various sectors, such as the banking, insurance, finance, production, sales, architecture, private equity, and hospitality industries in Norway have adopted BI&A to run their business more effectively. The literature has demonstrated how BI&A has permeated various industries; however, it has not clearly identified the type of enterprises (Olszak and Ziemba 2006). Moreover, SMEs in Norway are still at a low level of BI&A maturity. We found that they only use the simple analytics functionality of BI&A. One reason could be that business managers may not be aware of the advanced BI&A capabilities. Therefore, we argue that we need further studies assessing SMEs' readiness and capabilities for BI&A. In addition, studies should also address how BI&A is applied in SMEs in various industries.

We found that the experts' main perceived BI&A impacts for SMEs are business insight, customer insight, cost reduction, and competitive advantage. The literature points to a wider set of potential BI&A impacts (Ranjan 2009; Watson and Wixom 2007) and has proposed methods for measuring and assessing these impacts (Gibson et al. 2004; Hočevar and Jaklič 2010). However, to attain the full benefits of BI&A, the systems need to be used effectively (Burton-Jones and Grange 2012). The literature has demonstrated few studies on the effective use of BI&A (Trieu 2017). Hence, empirical studies on the effective use of BI&A in SMEs would be a valuable avenue for future research.

Conclusion

This has been an exploratory investigation of how BI&A creates value for SMEs. We interviewed 24 experts from both the vendor and the client sides. We identified many issues, three of which were perceived as particularly important. First, an iterative and gradual investment strategy is preferable for SMEs. Second, there are several new options for implementing BI&A without a data warehouse, and the informants considered this to be an appropriate solution for small businesses. Third, the experts pointed out that an automated data warehouse approach would often be the most suitable option for SMEs. In addition, we contribute to the BI&A literature by proposing a modified BI&A value creation framework for SMEs.

Our research was exploratory and performed in one country. Therefore, it has limited generalizability, providing possibilities for future research. This research can serve as input for subsequent studies on BI&A use in SMEs. It would be interesting to see if our findings are generalizable to other countries. Even if we cannot generalize the findings, the study and its findings should serve to enlighten SMEs about the pertinent issues related to BI&A adoption.

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