Research Article

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Critical Success Factors for Implementation of Self-Service Business Intelligence in Management Accounting

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Abstract

The practice of data analytics in management accounting has grown with the increasing business complexity, necessitating new strategies for data processing and analysis that support better decision-making. Although studies on this subject are scarce, Self-Service Business Intelligence (SSBI) system is an intriguing topic of discussion. Therefore, this study aimed to explore success factors of implementation of the SSBI systems in management accounting. To accomplish this, a Systematic Literature Review (SLR) was conducted, examining the latest related publications. Furthermore, it adopted a search procedure as well as inclusion and exclusion criteria to select 28 sample articles. The results showed that success factors were classified into users, organizational, and technology perspectives. From the perspective of users, most citations emphasized the importance of capabilities in implementation of the SSBI, in order to make them self-reliant towards the IT division. Most citations from organizational perspective focused on the significance of collaboration across divisions, emphasizing the involvement of various parties in the SSBI implementation. Additionally, most citations from a technology perspective were data management and governance, which supported data growth and organizational paradigm changes.

Keywords: *Critical Success Factors, Self-Service Business Intelligence, Management Accounting*

1. Introduction

The Industrial Revolution 4.0 has caused many changes in the digital transformation of the economy and industry (Moll & Yigitbasioglu, 2019). This transformation has led to data becoming one of the most valuable resources in the world (Picciotto, 2020). It is projected that by 2025, approximately 463 exabytes of data will be generated daily (Desjardins, 2019). According to a McKinsey survey, 87% of CFOs and financial professionals agreed that big data have the potential to change business world in the next decade (McKinsey, 2011). Furthermore, McKinsey explained that the 2011 survey was only in its early stages and the opportunity to use big data would continue to increase (McKinsey, 2016). This data trend is closely correlated with accounting principles of data collection, information processing, measurement, analysis, and reporting (Liu & Vasarhelyi, 2014). To facilitate better data analysis

capabilities, business intelligence system technology became very important (Rikhardsson & Yigitbasioglu, 2018). Previous studies have attempted to link business intelligence with management accounting because the primary responsibility of management accounting is to provide information to decision-makers (Appelbaum et al., 2017; Moll & Yigitbasioglu, 2019; Rikhardsson & Yigitbasioglu, 2018). However, only a few studies examined management accounting in this context (Moll & Yigitbasioglu, 2019; Rikhardsson & Yigitbasioglu, 2018).

Business intelligence development is influenced by several factors, including the volume, variety, and velocity of big data, as well as the emergence of new technologies for its analysis (Appelbaum et al., 2017; Bhimani & Willcocks, 2014; Deloitte, 2018; Richins et al., 2017). However, despite these influences, the fundamental purpose of business intelligence remains the same, which is to collect, process, and analyze data to enhance decision-making quality (Appelbaum et al., 2017). Studies conducted on business intelligence and big data often overlap (Liang & Liu, 2018). In fact, the term "big data", which has been in existence since 2011, forms the core of business intelligence since it was first explored by Chen et al. (2012) (Liang & Liu, 2018).

The development of modern business intelligence (BI) has been previously conceptualized (Deloitte, 2018; Rikhardsson & Yigitbasioglu, 2018; Appelbaum et al., 2017; Richins et al., 2017; Unsworth, 2017), leading to a more interactive and user-friendly approach (Tableau, 2020). This has raised a new paradigm for successful utilization of business intelligence (Mcknight, 2014), where the analysis is no longer static on historical data but has become more dynamic, descriptive, predictive, and prescriptive (Appelbaum et al., 2017) and can even be accessed in real-time (Unsworth, 2017).

Moreover, this modern concept recognizes that business intelligence should not be confined to one function, such as IT, due to the complexities of business operations. This understanding has led to the emergence of Self-Service Business Intelligence (SSBI) in the 2010s (Riggins & Klamm, 2017). In line with this, Logi Analytics (2015) reported that 91% of business and IT professionals acknowledge the importance of flexible access to data and information without the assistance of the IT division. Furthermore, 95% of IT organizations agree to invest in the SSBI within one to two years (Logi Analytics, 2015) with 62% citing it as one of the six most important technologies in business intelligence development (Columbus, 2020). Despite the perceived benefits of the SSBI, its implementation presents several technical and organizational challenges (Rikhardsson & Yigitbasioglu, 2018; Logi Analytics, 2015; Richards, 2015). This is the reason the adoption of the SSBI is still relatively low and only accessible to about 21% of professional business (Logi Analytics, 2017).

The objective of this study was to examine the key success factors of the SSBI system that could assist management accountants in their data analytics role (Brands & Holtzblatt, 2015; Richins et al., 2017). It aligned with the opinion of CIMA (2016) and Richins et al. (2017) that data analysis skills complemented the role of an accountant. Contrary to Frey & Osborne (2013) assertion of 94% automation in accounting and auditor jobs, it was suggested that the ability of accountants to process big data could provide added value and competitive advantage (Wilkin et al., 2020). The importance of developing business intelligence was further highlighted, as recognized by accounting academics and practitioners (AACSB, 2018; AICPA, 2020; CIMA, 2016; KPMG, 2019; PwC, 2015), but there was limited literature on the SSBI in management accounting area (Moll & Yigitbasioglu, 2019; Rikhardsson & Yigitbasioglu, 2018). Therefore, this study aimed to fill the gaps in the existing literature and address the current business challenges.

2. Literature Review

2.1 The SSBI

Business intelligence encompasses a range of tools, technologies, and programs that are used to collect, integrate, analyze, and provide data (Reinschmidt & Francoise, 2000). This capability is crucial for an effective decision-making process (Appelbaum et al., 2017; Wixom & Watson, 2010). As business become more complex, it is essential that users other than IT have access to business intelligence system of organization (Riggins & Klamm, 2017), also known as the SSBI (Lennerholt et

al., 2020; Olszak, 2016). The term "self-service" was first introduced by Eckerson (2009) to describe the ability of business intelligence users without IT dependency.

Imhoff & White (2011) defined the SSBI as a business intelligence facility that enables users to be more independent and less reliant on the IT department. The SSBI allows users to access data "democratically" (Arnaboldi et al., 2020), which empowers them to transform from information consumers to producers (Bani-Hani, Tona, et al., 2018). According to Imhoff & White (2011), the four primary objectives of the SSBI are to 1) facilitate quick access to data, 2) provide easy-to-use business intelligence tools, 3) offer accessible and manageable data warehouses, and 4) present comprehensive results that are easy to consume.

The SSBI implementation requires technology that prioritizes the needs of users and covers the entire organization. One of the main differences between business intelligence architecture and the SSBI technology model is access to organization data. Another difference is the access to capable tools for performing collaborative analysis and distributing results to users in order to obtain feedback (Bani-Hani, Tona, et al., 2018). Preparing the technology infrastructure to support the SSBI technology model is a challenging task that requires careful planning and design. It involves data integration and quality equalization, the creation of new data models in the warehouse, and management of large databases. Therefore, successful implementation of the SSBI requires the support of management and the IT division to provide the necessary infrastructure, establish standardization, governance, and develop a matrix for its success (Imhoff & White, 2011).

2.2 Management Accounting

Management accounting is a process that involves providing managers and employees with relevant financial and non-financial information. This information is then used to make decisions, allocate resources, as well as monitor, evaluate, and reward performance (Atkinson et al., 2012). According to Cokins (2013), the role of management accounting can be separated into two, namely cost accounting and measurement functions. Cost accounting involves providing information to create financial reports, such as the cost of goods sold and inventory valuation. On the other hand, cost measurement is further divided into reporting and analysis, as well as decision support with cost planning. Cost reporting and analysis evaluate the cost performance of organization, such as variance and process analysis techniques. Meanwhile, decision support with cost planning focuses on future planning, including what-if-analysis and budgeting techniques. Appelbaum et al. (2017) categorized management accounting role into three, namely cost accounting, performance measurement, as well as planning and decision-making.

Management accounting has evolved to adapt to the increasing complexity of business and technology, as well as industry competition (Atkinson et al., 2012). Cokins (2013) categorized the development of this phenomenon into six phases, including ancient (20,000 BC), medieval (1494), industrial age (1911), regulatory compliance (1930s), consumer (1980), and predictive analytics (2015). Currently, management accounting is entering the predictive analysis era, marking a paradigm shift from focusing on historical data to preparing strategies (Cokins, 2013). Appelbaum et al. (2017) referred to this shift as modern management accounting, which is influenced by the increase in the technological capabilities of organization to perform complex data analysis (Appelbaum et al., 2017; Chaudhuri et al., 2011; Cokins, 2013).

Appelbaum et al. (2017) formulated data analytics that can be performed by management accountants, as summarized in Table 1:

Table 1: Types of Analysis in Management Accounting Practices

Management Accounting Function	Analysis Type
Cost Accounting	*a. Descriptive*
Performance Measurement	*1. Descriptive* *2. Predictive*

Management Accounting Function	Analysis Type
Planning and Decision Making	*1. Descriptive* *2. Predictive* *3. Prescriptive*

Spraakman et al. (2020) described the real practice of data analytics on management accountants, as shown in Table 2:

Table 2: Data Analytics Practices in Management Accounting

Analysis Type		Example	
Comparative/variance analysis	Comparative year-over-year sales, variance on budget	Sales by SKU, time	Cash flow
Cost/benefit analysis	Costs by banner, store	Margins percentage, why sales went down	Project cost analysis
Forecasting/trend analysis	Budget projection, planning	Patterns, what have changed	Trends by expenditure
Non-financial analysis	Maximum number of patients in one day? Minimum?	Analysis by postal Code; Colorectal cancer analysis	Recovery rate and unexpected side effects; Impact of new products entering the market
Modeling	Modeled the life cycle of a mine	Budgeting model	Modeling scenarios
KPI analysis	Reports on KPIs	KPIs, scorecards	
Other analysis	Looking at ageing, A/P, A/R	"What if" analysis	Fraud detection

The close relationship between data analytics and decision-making processes in management accounting highlights the strong connection between business intelligence systems and management accounting (Rikhardsson & Yigitbasioglu, 2018). This notion is supported by Appelbaum et al. (2017), Nielsen (2018), Oesterreich & Teuteberg (2019), Peters et al. (2016), Rikhardsson & Yigitbasioglu (2018), Spraakman et al. (2020), and Wilkin et al. (2020).

2.3 Critical Success Factors (CSF)

The organizational benefits of implementation of the SSBI in management accounting were examined in this study using CSF approach (Bullen & Rockart, 1981). Success factors are essential in achieving the organizational goals (Bullen & Rockart, 1981), and this method, particularly in IT is used to align new systems with business goals and increase organizational value (Olszak, 2016). These factors can provide a good basis for formulating the criteria to be followed during the SSBI implementation.

Generally, CSF has been developed for business intelligence implementation. For example, Yeoh & Koronios (2010) and Yeoh & Popovic (2015) divided CSF into organization, process, and technology dimensions. Appelbaum et al. (2017) elaborated on CSF for implementation of business intelligence in management accounting, as summarized in Table 3.

Table 3: CSF Implementation of Business Intelligence in Management Accounting

No.	Dimension	CSF
1	Organization	Management and sponsorship support, availability of infrastructure, and clear goals in using business intelligence and its suitability for the type of organization
2	Process	Support team in business orientation, continuous development, and a new paradigm of management accountants function

3	Technology	Business-driven, scalable, and flexible to process big data; quality and data integrity supported by a master data approach.

Implementation of business intelligence in small and medium-sized organizations using CSF has also been explained by Olszak & Ziemba (2012), as summarized in Table 4:

Table 4: CSF Implementation of Business Intelligence in Small and Medium Enterprises

Organization	Process	Technology
Support from senior managers	Effective change management	Data quality
Adequate ability	Knowledge of business problems to be solved	ERP and business intelligence integration
Competent project manager	Knowledge of users expectations	Adequate tools and technology
A supplier with experience in business intelligence	Adjustment of business intelligence systems to users expectations	User-friendly business intelligence system
Clear business plan and vision		Flexible and responsive business intelligence system according to users needs.
Sufficient budget		

3. Methodology

This study employed the structured literature review method based on the guidelines provided by Kitchenham (2004). A comprehensive literature search was conducted to identify success factors associated with implementation of the SSBI system in management accounting. To ensure an unbiased process, review protocols proposed by Kitchenham (2004) were utilized. Both manual and automated literature searches were performed (Ain et al., 2019; Kitchenham et al., 2009), and the following electronic databases were used, including Emerald Insight, ScienceDirect, Taylor & Francis Online, Willey Online Library, and Springer. The keywords considered in the search process were 1) "self-service" and "business intelligence", 2) "self-service" and "business analytics", or 3) "self-service", "big data", and "management accounting". This study employed the following inclusion and exclusion criteria:

Table 5: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Articles published in 2010 – 2020	Proceedings, books, discussions, reports, informal studies, study with technical issues.
Articles written in English	Study duplication
Articles published in journals with business intelligence and accounting domains	

The quality assessment and data extraction were conducted on sample articles that met the inclusion and exclusion criteria. The extracted data included title, publication journal, year of publication, electronic database, method, approach, and success factors. The analysis was presented descriptively through tables, narrative statements, and visual graphics. Moreover, the study emphasized success factors for implementation of the SSBI system in management accounting.

4. Results

4.1 Descriptive Analysis

An in-depth analysis was conducted using the abstracts and content of the sample articles that fulfilled the specified requirements. The initial search obtained 391 articles from five electronic databases. Table 6 showed that the sample was dominated by the Taylor and Francis electronic database with 11 articles, followed by Emerald with seven. The following was a resume table of article search results based on the compiled protocol:

Table 6: Resume on Article Search Results

Electronic Database	Articles Collected	Relevant to Abstract	Incomplete Article Component	Relevant to Article Content
ScienceDirect	150	25	10	5
Emerald	118	13	-	7
Taylor and Francis	68	18	-	11
Willey Online Library	50	8	-	2
Springer	5	4	-	3
Total	391	68	10	28

Most articles were published in 2020, with eight studies, followed by six and five studies in 2018 and 2016, respectively. This indicated that studies on the SSBI fluctuated but tended to increase. Figure 1 showed a graph of articles by publication year:

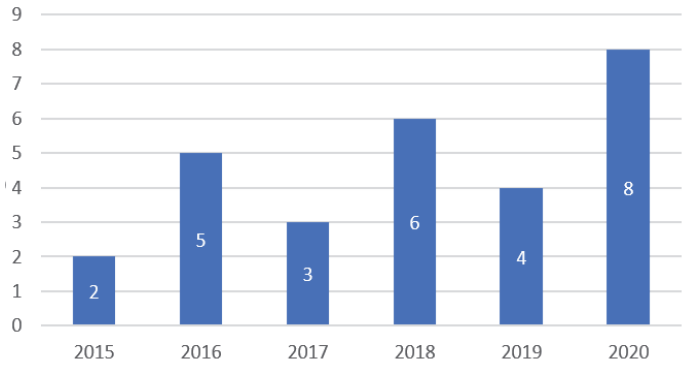

Figure 1: Articles by Year of Publication

The journals that published the most articles about the SSBI included Information Systems Management, Journal of Decision Systems, and Journal of Management Control, with three articles each, while others, on average published 1 article. The table below shows the articles based on publication journal:

Table 7: Articles Based on Publication Journal

Journal	Number of Articles
Facilities	1
Information & Management	1

Journal	Number of Articles
Information Systems Journal	1
Information Systems Management	3
Information Technology & People	1
Institutional Research Technology & People	1
International Journal of Accounting Information Systems	2
International Journal of Information Management	2
Journal of Accounting & Organizational Change	1
Journal of Accounting & Organizational Change	1
Journal of Applied Accounting	1
Journal of Business Analytics	1
Journal of Computer Information Systems	1
Journal of Decision Systems	3
Journal of Management Control	3
Journal of Organizational Computing and Electronic Commerce	1
Journal of Systems and Information Technology	1
Production Planning & Control	2
Qualitative Research in Accounting & Management	1

The most widely utilized methods were qualitative and quantitative, with 19 and eight articles, respectively. The majority of studies used a case study approach with 11 articles, while survey and conceptual papers were rated next, with eight and six articles, respectively. Figure 2 shows a graph of articles based on the method and approach used.

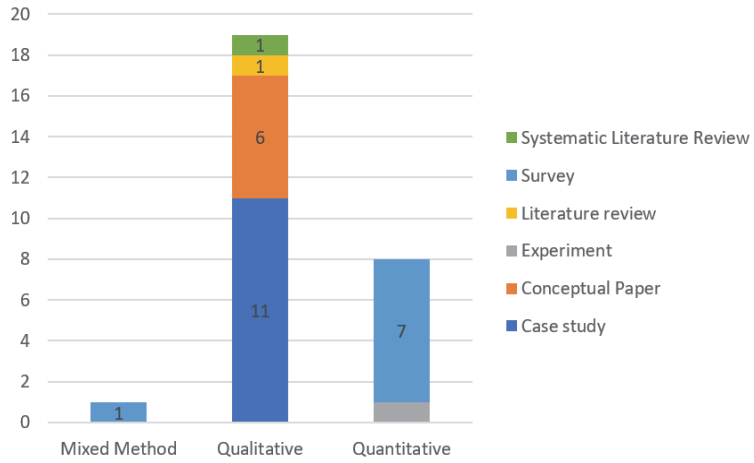

Figure 2: Articles by Year of Publication

A total of 15 studies were related to business intelligence users, and seven were associated with management accountants. However, 12 studies indicated that they used more than one organization, while seven did not mention anyone. The graph of articles categorized by subject and organization type is shown in Figure 3.

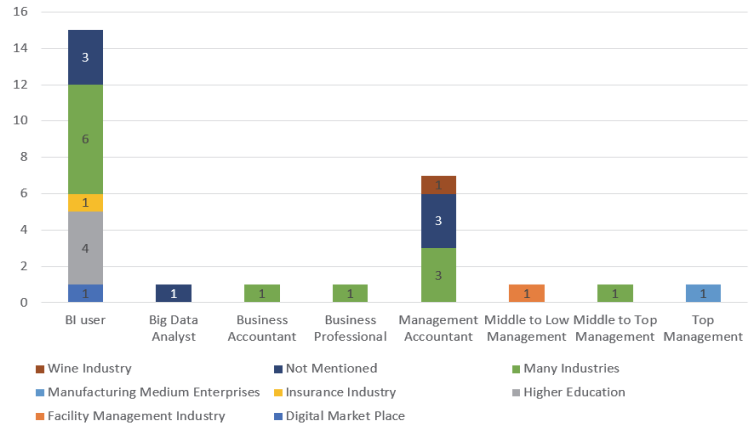

Figure 3: Articles by Subject and Type of Industry

The articles were also categorized based on the place of study. Figure 4 showed the most common places, including those not mentioned (or cross-country), with 13 studies. This is followed by the US with three, while the remaining locations had an average of one.

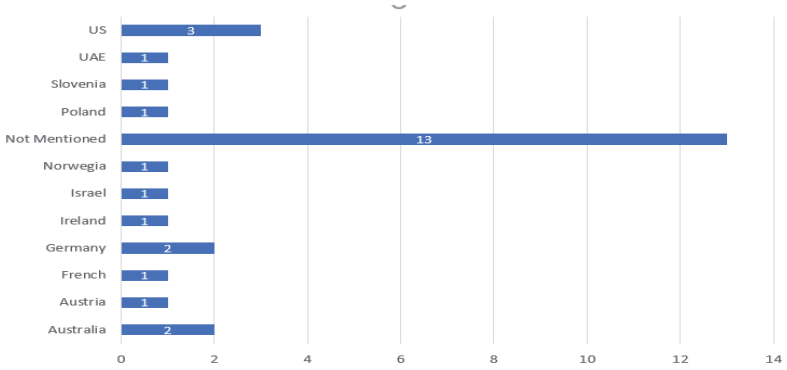

Figure 4: Article Graph by Study Place

4.2 CSF of the SSBI in Management Accounting

The study divided CSF into several groups based on the analysis conducted by Olszak & Ziemba (2012), Yeoh & Koronios (2010), and Yeoh & Popovic (2015). These groups were categorized based on success factors with users, organizational, and technology perspectives. Success factors were further specified from each perspective into groups of dimensions and indicators.

Table 8: Perspective of Users

No	Success Factors	Number of Citations Discussed
1	Ability	19
2	Knowledge and understanding of data	7
3	Perception of users	3
4	Learning motivation	1

Table 9: Organizational Perspective

No	Success Factors	Number of Citations Discussed
1	Collaboration between divisions	10
2	Decision-making culture	5
3	Organizational strategy	5
4	Educational facilities	4
5	Readiness in system development	4
6	Management support	3
7	Continuous system development	2

Table 10: Technology Perspective

No	Success Factors	Number of Citations Discussed
1	Data management and governance	17
2	Supporting technology	14

The grouping presented in Table 8 aimed to identify important factors for management accountants interested in implementation of the SSBI. These factors are interrelated and cannot be sorted individually. The most significant factors in terms of users, organizational, and technology perspectives included capability, collaboration between divisions, as well as data management and governance, respectively. The following is a detailed explanation of each perspective.

4.2.1 Perspective of Users

This perspective described success factors related to the users side of the SSBI system. The system allowed management accountants to perform analysis without involving the IT division (Lennerholt et al., 2020). Moreover, the SSBI users had to be self-reliant (Lennerholt et al., 2020) as they were the main stakeholders in implementation of the system, making the perspective in using the system the main viewpoint.

From the perspective of users, the first factors considered was capability, which included their proficiency in business, analytics, visualization, and technical skills. In order to possess business skills, users are expected to understand business questions. Furthermore, they needed to know the three main functions of management accounting, which included cost accounting, performance measurement, as well as planning and decision-making (Appelbaum et al., 2017). Atkinson et al. (2012) stated that the role of management accountants was closely linked to decision-making and strategy implementation, emphasizing the need for them to comprehend the overall business processes of organization. The second ability that was considered was analytics skills, needed after compiling the appropriate business questions. Management accountants had to retrieve and process data from accounting information systems using the tools available in the SSBI system (Chaudhuri et al., 2011).

The third essential skill for users was visualization, and it involved creating reports that were attractive, easy to understand, and effective in conveying information. According to Nielsen (2018), management accountants needed to have strong presentation skills when using data analytics. They were also expected to select appropriate visualization methods that met the needs of decision-makers. The importance of selecting the right visualization method was further confirmed by L. Perkhofer et al. (2020) and L. M. Perkhofer et al. (2019). These studies showed that the effectiveness of information delivery could be influenced by the choice of visualization. To increase the effectiveness of presentations, management accountants could take advantage of the attractive dashboard features in the SSBI system.

The fourth capability for users was technical skill, which involved installing the SSBI system and

accessing information in the data warehouse of organization. Spraakman et al. (2020) stated that the responsibilities of management accountants had increased due to data preparation. Before analysis, the data from the warehouse was processed at the Extract, Transform, Load (ETL) stage. Additionally, data cleansing capabilities were required because the extracted data had varying qualities.

Another essential ability that required consideration was management skills. Implementation of the SSBI required collaboration between parties (Imhoff & White, 2011). Therefore, the managerial ability was important in coordinating and making joint decisions. Appelbaum et al. (2017) and Bordeleau et al. (2020) confirmed that a supportive business intelligence team could affect business intelligence implementation.

From the perspective of users, knowledge and understanding related to data comprised the second factors. Bhimani & Willcocks (2014) revealed that a paradigm shift in data had an impact on digitization in management accounting. To perform a thorough analysis, management accountants were required to possess a solid grasp of several elements, such as file format, size, data type, storage area, and analysis speed (Lennerholt et al., 2020). Similarly, they needed to have an understanding of the data necessary to support business questions, the data available, how to expect the analysis results, and how to process the required data.

The third factors pertained to the perception of the ease of using the SSBI and its usefulness. Bani-Hani, Tona, et al. (2018) demonstrated that a positive perception of the ease and usefulness of technology could increase self-efficacy and the intensity of using the SSBI system. With frequent utilization, users were more likely to gain experience, as highlighted by L. M. Perkhofer et al. (2019). The experience was a crucial element in successful implementation of business intelligence system.

The final factors was learning motivation, which Seddon et al. (2017) identified as a success factors in conducting business analytics. Overcoming Organizational Inertia (OOI) was crucial in this regard, as it pertained to how members of an organization were motivated to learn, use, and accept new technologies. Table 11 summarized success factors for implementation of the SSBI system from the perspective of users.

Table 11: CSF of the SSBI System Implementation with Perspective of Users

No	Factors	Dimension	Indicator
1	Users Skills (Cahyadi & Prananto, 2015) (Mawed & Al-Hajj, 2017) (M. K. Daradkeh, 2019) (Lennerholt et al., 2020) (Bani-Hani, Tona, et al., 2018) (Torres & Sidorova, 2019) (Möller et al., 2020)(L. Perkhofer et al., 2020) (Seddon et al., 2017) (Bordeleau et al., 2020) (Bani-Hani, Pareigis, et al., 2018) (Clarke et al., 2016) (Passlick et al., 2020) (O'Neill & Brabazon, 2019)(Spraakman et al., 2020) (Oesterreich & Teuteberg, 2019) (Appelbaum et al., 2017) (L. M. Perkhofer et al., 2019) (Nielsen, 2018)	*Analytic Skills*	Combining financial and non-financial data
			Perform complex technical analysis such as modeling analysis and forecasting.
			Perform analysis promptly
			Have analytical thinking skills
		Business Skills	Ability to make the right business inquiries
		Visualization Skills	Make reports that are attractive, easy to understand, and effective.
			Use the visualization consistent with the needs.
		Technical Skill	Perform system installation and configuration
			Doing data preparation
		Management Skill	Collaborate with other divisions

No	Factors	Dimension	Indicator
2	Data knowledge and understanding (Schlesinger & Rahman, 2016) (Cahyadi & Prananto, 2015) (M. K. Daradkeh, 2019) (Lennerholt et al., 2020) (Peters et al., 2016) (Jaklič et al., 2018) (Passlick et al., 2020)	Data knowledge and understanding	Knowledge of data characteristics
			Knowledge of the data needed
			Knowledge of the available data
			Knowledge of expected data analysis results
			Knowledge of data acquisition from the required data
3	Perception of convenience and usability (M. K. Daradkeh, 2019) (Bani-Hani, Tona, et al., 2018) (L. M. Perkhofer et al., 2019)	Perception of convenience and usability	Perception of Ease of Use
			Useful Perception
4	Learning Motivation (Seddon et al., 2017)	Learning Motivation	Have the motivation to learn, use, and accept new systems

The perception factors of users aligned with the Theory of Acceptance Model (TAM) by Davis (1989), which is a development of the Theories of Reasoned Action and Planned Behavior. According to the TAM, the perception of ease of use has an impact on the perception of usability and usage intensity. Bach et al. (2017) & Sonmez (2018) concluded that this theory has been generally applied in business intelligence.

In the context of the SSBI, Bani-Hani, Pareigis, et al. (2018) and M. K. Daradkeh (2019) demonstrated that the perceived ease of use and usefulness played a significant role in determining the adoption of Self-Service Analytics (SSA). Bani-Hani, Tona, et al. (2018) also identified the trust factors of users perceptions in using Self-Service Technology (SST).

4.2.2 Organizational Perspective

From an organizational perspective, CSF needs to be considered in implementation of the SSBI system. Imhoff & White (2011) suggested that this system is not easy to implementation and requires the organization to act as a protector. Since the SSBI implementation is applicable to all management functions (Imhoff & White, 2011), a well-defined strategy and coordination among different management levels are required in order to produce a common agreement.

One of the most crucial factors in the organizational perspective is a collaboration between divisions, which is needed in complementing the expertise of scientists, IT, and business users and performing data analysis effectively and efficiently. Collaboration enables users to share data and expertise, leading to a better analysis outcome. Furthermore, it aims to establish a team responsible for compiling a standard reference for data management. This reference facilitates the creation of a framework that governs the analysis format and a matrix for a successful implementation of the SSBI (Foster et al., 2015). By adhering to this standard, organization can test and implementation the reliability of the SSBI system.

While the standard was expected to promote self-reliance for all management functions (Imhoff & White, 2011), the role of the team, IT, or business intelligence division remained necessary in implementation to maintain and control data flow within the organization. This role was essential because implementation could lead to significant behavior changes, requiring management to interact with data and adjust, which took the considerable time (Imhoff & White, 2011).

In terms of optimizing the SSBI system role, the second factors that organization had to consider was the decision-making culture. To achieve a fact-based decision mindset, leaders had to support and closely relate to the overall culture (Cahyadi & Prananto, 2015; Nielsen, 2018).

The third factors focused on the strategy of an organization when implementation of the SSBI

system. Since numerous challenges could arise during implementation process, a special strategy was necessary to maximize the benefits of business intelligence (Rikhardsson & Yigitbasioglu, 2018). Strategies included stating the purpose of the system, aligning IT goals with business, adjusting IT resources to business needs, creating appropriate policies, and establishing a supportive team structure.

The fourth factors pertained to providing formal and non-formal educational facilities to the SSBI system users. Meeting the criteria for analytic, business, technical, and management skills required adequate educational resources. The fifth factors entailed the support from middle-level to top management in order to ensure that every organizational level used the SSBI system. This factors was closely related to other factors discussed.

The sixth factors involved the readiness of organization to develop the SSBI system regarding funds, time, and change in management. To achieve this, organization had to prepare for long-term system development and be willing to accept the consequences of changing their usual practices (Appelbaum et al., 2017; M. K. Daradkeh, 2019; O'Neill & Brabazon, 2019). Funding could come from various sources, such as the organization, sponsors, or debt. The last factors emphasized the need for continuous the SSBI system development to address the ever-increasing business complexity and adapt to new challenges and expectations (Lennerholt et al., 2020; Olszak, 2016). Table 12 summarized success factors of the SSBI system implementation from organizational perspective.

Table 12: CSF Implementation of the SSBI System with Organizational Perspective

No	Factors	Dimension	Indicator
1	Collaboration between divisions (Cahyadi & Prananto, 2015) (Mawed & Al-Hajj, 2017) (Belkahla & Triki, 2011) (Foster et al., 2015) (Olszak, 2016) (Barlette & Baillette, 2020) (Trigo et al., 2014) (Lennerholt et al., 2020) (Fink et al., 2017) (Bordeleau et al., 2020)	Collaboration between the IT division, data scientist, and business users	Fellow divisions share data and expertise
		Form a team/division tasked with compiling the SSBI implementation standards	Data management standards
			Standard analysis format
			Success matrix standard
2	Decision-making culture (M. K. Daradkeh, 2019) (Appelbaum et al., 2017) (O'Neill & Brabazon, 2019) (Cahyadi & Prananto, 2015) (Seddon et al., 2017)	Decision-making culture	Management has a fact-based decision mindset
3	Organizational strategy (M. K. Daradkeh, 2019) (Lennerholt et al., 2020) (Seddon et al., 2017) (O'Neill & Brabazon, 2019) (Appelbaum et al., 2017)	Organizational strategy	State the purpose of using the system clearly
			Align IT goals with business organization
			Align IT resources with business needs
			Create supportive policies
			Creating a supportive organizational/team structure
4	Educational facilities (M. K. Daradkeh, 2019) (Lennerholt et al., 2020)(Nielsen, 2018) (Clarke et al., 2016) (M. K. Daradkeh, 2019)	Educational facilities	Formal and informal education
5	System development readiness (M. K. Daradkeh, 2019) (Seddon et al., 2017) (Appelbaum et al., 2017) (O'Neill & Brabazon, 2019)	Fund readiness	The SSBI project is funded internally, sponsored, or in debt.
		Time readiness	Management provides dedicated time for system development.
		Management change readiness	Carry out a change management program
6	Management support (M. K. Daradkeh, 2019) (Seddon et al., 2017)(Appelbaum et al., 2017)	Management support	The SSBI implementation at all management levels
7	Continuous system development (Olszak, 2016) (Lennerholt et al., 2020)	Continuous system development	System development always adapts to needs

4.2.3 Technology Perspective

Success of SSBI implementation relied significantly on the technology perspective, which concerned the technology-related factors contributing to the achievement of the project objectives. Given the ever-evolving nature of business needs, it was essential to consider these success factors seriously (Imhoff & White, 2011). One of the key factors from the technology perspective was data management and governance, which was supported by numerous studies. This factors is critical because of their high urgency in modern business operations. To achieve this, a master data structure and data governance framework were established. The master data structure provided definitions for data and metadata across the organization, while data governance ensured data security, quality, access, and integration.

Data inconsistency often arose from variations in data source names, even within a single data warehouse (Schlesinger & Rahman, 2016). When an organization relied on multiple data warehouse sources, the possibility of data errors increased. Therefore, it was crucial to manage data with well-defined structure and metadata to ensure that users had the same perception of data nomenclature.

As reported by Schlesinger & Rahman (2016), ensuring a mutual agreement between the IT sector and business users on the same perception was crucial. In this regard, Daradkeh (2019) ranked governance and metadata management as the 8th out of 32 factors that affected visual analytic adoption. The study highlighted the importance of organizational capability in creating semantic and metadata models that were useful to users.

Various users, including the finance and personnel departments, required sales data. However, the ambiguous definition of data and metadata could cause a misunderstanding of sales data, such as net sales, sales before tax, or gross sales data. The conclusions from this information were subjective, which could lead to miscommunication among divisions within the organization, causing decision-making errors (Schlesinger & Rahman, 2016).

The second critical factors in the SSBI implementation was technology infrastructure, which included SSA, flexibility, and ease of use. The essence of the SSBI was how all system users could perform data processing and reporting independently without relying on the IT division. This implies that adequate infrastructure was required in order to provide SSA. Furthermore, the SSBI-supporting technology had to be flexible in developing, such as leading to cloud computing. It also had to be easy to use and learn by users to optimize all the expected capabilities and benefits. The summary of success factors for implementation of the SSBI system from a technology perspective is presented in Table 13.

Table 13: CSF of the SSBI System Implementation with a Technology Perspective

No	Factors	Dimension	Indicator
1	Data management and governance (Schlesinger & Rahman, 2016) (Cahyadi & Prananto, 2015) (M. K. Daradkeh, 2019) (Foster et al., 2015) (Torres & Sidorova, 2019)(Bergmann et al., 2020) (Drake & Walz, 2018) (Seddon et al., 2017)(Fink et al., 2017)(Bordeleau et al., 2020) (Peters et al., 2016) (Clarke et al., 2016) (Passlick et al., 2020) (O'Neill & Brabazon, 2019) (Spraakman et al., 2020) (Appelbaum et al., 2017)(Lennerholt et al., 2020)	Master data structure	Data definition
			Metadata
		Data governance	Data security
			Data quality
			Data access
			Data integration
2	Supporting Technology (Cahyadi & Prananto, 2015) (M. K. Daradkeh, 2019) (Torres & Sidorova, 2019) (Seddon et al., 2017) (Peters et al., 2016) (Clarke et al., 2016) (Passlick et al., 2020) (O'Neill & Brabazon, 2019) (Appelbaum et al., 2017) (Fink et al., 2017) (Bani-Hani, Pareigis, et al., 2018) (Bani-Hani, Tona, et al., 2018)	Technology infrastructure	SSA
			Interactive visualization features
			Can be developed flexibly
		Ease of use of technology	Easy to use

Information Systems (IS) Success Model theory by DeLone & McLean (2003), supported several crucial factors, particularly regarding information and system quality variables. By enhancing usage and users satisfaction, these variables had a positive impact on both individuals and organization. One key variable was information quality, which focused on the characteristics of the information produced. However, success of system implementation was sometimes evaluated using interchangeable terminology for information and data (Torres & Sidorova, 2019). This means that data management and governance were crucial in constructing information quality. In the second construction, system quality stood out as the most prominent factors of business intelligence. It primarily focused on aspects such as ease of use, usability, reliability, system flexibility, mobility, integration, and importance. This aligned with the second factors of supporting technology.

Several studies have supported the relationship between the Information Systems Success Model theory and business intelligence (Torres & Sidorova, 2019; Mudzana & Maharaj, 2015). Others attempted to combine different theories in the SSBI context. For example, M. Daradkeh & Al-Dwairi (2017) linked the Information Systems Success Model theory and the TAM, thereby proving that the theories could be concurrent factors affecting the adoption of the SSBI system in an organization.

5. Conclusion

This study explored success factors required for implementation of the SSBI system in management accounting. The sampled articles complied with all established study protocols. Furthermore, it identified three groups of success factors, namely those from the users, organization, and technology perspectives. It is important to note that these three perspectives were interrelated and needed to be considered when implementation of the SSBI system. From the perspective of users, most citations focused on capabilities, implying that they needed to be self-reliant when implementation of the SSBI without depending on the IT division. From organizational perspective, most citations are related to collaborations between divisions. This highlighted the importance of involvement between parties in the SSBI implementation. Finally, from a technology perspective, most citations centered on data management and governance. This emphasized the need to manage the yearly increase in the amount of data and changes in the data paradigm in organizations. In order to optimize all benefits, management accountants are expected to consider these factors when implementation of the SSBI system. It is crucial to acknowledge that the results were obtained from a literature review and required verification through in-depth testing. Future studies could examine success factors identified in order to confirm the results and expand the discussion to cover accounting and assurance.

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