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Strategies for success: A theoretical model for implementing business intelligence systems to enhance organizational performance

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ABSTRACT

The use of Business Intelligence Systems (BIS) has seen a significant rise worldwide in recent years, aiming to support organizations in navigating the competitive business environment. Despite this, many organizations struggle to fully benefit from BIS due to challenges in its implementation. A key reason identified for these challenges is the lack of effective measurement strategies. This paper seeks to provide a clear overview of business intelligence and the key factors that influence its successful implementation in organizations. Through a review of existing literature, the study identifies the most critical components necessary for the effective use of a business intelligence system. It proposes a theoretical model for evaluating BIS performance at the organizational level inspired by the Information System Performance Model. This model suggests that system quality, information quality, service quality, relationship quality, and process quality all play a vital role in enhancing perceived usefulness and user satisfaction, thereby leading to organizational benefits. By integrating insights from relevant literature, this paper offers a detailed understanding of how to assess the success of BIS within an organization. The findings highlight the positive impact of business intelligence systems on organizational performance and decision-making processes, aiding organizations in making informed decisions. This research is unique in that it presents a theoretical model for evaluating the success of BIS in organizations based on an extensive review of the literature. Additionally, it extends the application of the Information System Success Model to the domain of BIS for analyzing performance at the management level.

1. Introduction

Organizations faced significant difficulties at the start of the twenty-first century, including fierce rivalry, ongoing technological advancements, and a massive amount of data. Organizations today need specialized Information Systems (IS) like business intelligence to do different causal analyses of large statistics and make the data reachable to decision-makers and specialists at numerous stages within a society in direction to prosper in the face of these difficulties (Al-Ajlouni et al., 2024).

According to a survey conducted by the IBM Institute for Business Value, which included 3,000 participants from 100 countries, advanced analytics have significantly enhanced competitiveness (Alyan, 2022). In the current era of digital technology, it's clear that Business Intelligence Systems (BIS) are a top priority for Chief Information Officers (CIOs) when considering new technologies (Alzghoul et al., 2022). Business Intelligence Systems are defined as a comprehensive set of tools, software, and technologies designed to collect, integrate, analyze, and present data effectively (Arefin et al., 2021).

BIS consists of several technological components, including data warehouses, dashboards, and online analytical processing (OLAP) tools (Sorour and Atkins, 2024). OLAP enables users to perform various operations such as merging, filtering, sorting,

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and drilling down into data for deeper analysis. This facilitates immediate multi-dimensional analysis. Data warehouses support the thorough examination of data that is meticulously gathered and cleaned from multiple sources.

Dashboards in BIS allow for the monitoring of key performance metrics through the use of diagrams, charts, and various visual aids (Mudau et al., 2024). BIS encompasses a variety of strategies, tools, concepts, and methods aimed at collecting, analyzing, and presenting data to enhance business decision-making (Mudau et al., 2024). Despite the dynamic and rapidly growing global market for BIS, which is projected to reach $22.8 billion by the end of 2020 (Chen and Lin, 2021), many organizations report that BIS does not meet expected outcomes and benefits (Daradkeh, 2022). Furthermore, Gartner Inc. reports that between 70 and 80 percent of BIS initiatives fail (Costa et al., 2024), and similar rates of failure are attributed to both technical and managerial challenges (Yaghoubi et al., 2024). Another study finds failure rates between 65 and 70 percent (Huang et al., 2022).

Additionally, it has been difficult for developing nations throughout the world, particularly Jordan, to reap the benefits of BIS. For many firms, measuring the performance of BIS is difficult from a theoretical and management standpoint (Olszak et al., 2024).

Organizations nowadays are concerned with understanding the advantages and returns of BIS investments. Understanding the benefits of BIS may help with budgeting and scheduling, which can help you avoid failure and decide where to spend your time and money most efficiently (Jaradat et al., 2022). According to scholarly research, the success variables that BIS uses to help the organization achieve its goals have not been properly investigated. This is due to the lack of understanding of the research of Critical Success Factors (CSFs) for BIS implementation (Jadhav et al., 2024).

Undoubtedly, by prioritizing the essential elements most likely to lead to successful BIS implementation, organizations can optimize their efforts and limited resources. Consequently, further research is needed to understand how CSFs influence BIS implementation. This conceptual paper introduces a theoretical model focused on evaluating BIS success at the administrative level. Similar to other studies in the field, this paper utilizes DeLone and McLean's (2003) Information Systems Success Model (ISSM) as a foundational framework. The structure of the paper is organized as follows: the next section presents the theoretical foundations of the study; the third section discusses the model; the fourth section outlines the proposed hypotheses in line with previous research; the fifth section describes the methodologies used in the study, followed by the paper's conclusion.

2. Theoretical background

BIS was developed in the mid-1990s to demonstrate the advantages of combining, analyzing, collecting, and clarifying information. These processes help organizations make informed decisions and better understand market trends, which can lead to increased profits, reduced costs, enhanced productivity, and stronger competitive positioning within an organization. However, due to the high failure rates of BIS projects, organizations often question whether the investment in these systems yields substantial organizational benefits. This uncertainty makes it challenging for organizations to effectively evaluate the performance of BIS. The literature suggests that IS success is a complex and multi-dimensional phenomenon that cannot be fully captured by simple metrics (Khan et al., 2020).

Despite the recognized value of BIS, there is limited understanding of the factors contributing to their success. Masa'Deh et al. (2021) addressed this gap by developing a multi-dimensional model to assess the effectiveness of IS. This model identifies six interconnected success factors: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. According to their theory, both the quality of information and the system's efficiency influence a user's behavior (actual usage) and attitudes (satisfaction). These user attitudes and behaviors not only affect each other but also have subsequent impacts on both individual performance and broader organizational outcomes. This framework highlights how the interplay between these elements can lead to successful IS deployment and utilization.

This methodology has been broadly adopted and is often used as a foundational theory for evaluating IS performance (Kimball and Ross, 2024). However, it has also faced criticism for being incomplete. For example, Nithya and Kiruthika (2021) have pointed out that the model does not consider service quality, which is crucial for the success of IS. In a subsequent study, Nuseir et al. (2021) argued for the replacement of 'use' with 'usefulness,' emphasizing that usefulness is a critical factor for success in both mandatory and voluntary contexts, suggesting that merely using a system does not equate to its success.

Due to the challenges in measuring the impact of IS usage based solely on behavior, the criteria for assessing IS performance have evolved. Rahardja and Harahap (2019) proposed that perceived usefulness should be considered a critical factor of success, shifting the focus from mere usage to the relevance and utility of the system. This perspective acknowledges that IS's influence extends beyond individual and organizational boundaries to affect customers, workplace groups, businesses, and broader societal interactions.

In response to these critiques and the need for a more comprehensive understanding of IS success, a revised version of the model was introduced in 2003 to incorporate these broader dimensions. This updated model included service quality as a significant component, recognizing its essential role in IS effectiveness (Rahman, 2021). The revised model also introduced a new construct, 'net

benefits,' which captures the cumulative effects on both individuals and organizations, highlighting the interconnectedness of various IS dimensions.

This enhancement included feedback loops between the causes and effects within the IS framework, suggesting a dynamic interaction where quality factors not only influence usage dimensions but also impact overall benefits. This approach allows for a more nuanced understanding of how IS usage and quality affect outcomes, potentially both positively and negatively. The modifications are visually represented in the updated ISSM model shown in Fig. 1, emphasizing the complex interplay between system quality, use, and the resultant benefits.

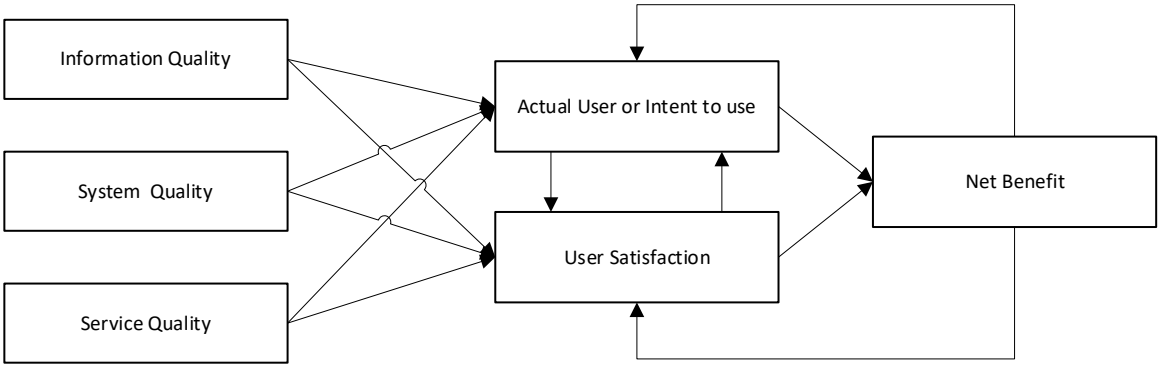

Fig. 1: Information system success model (DeLone and McLean, 2003)

Without a doubt, this prototype has made substantial and important aids to the works in the field. It provides a sound foundation for more theoretical and experiential study. It also presents a theoretical framework for categorizing the recognized IS success domain variables that have been put out in earlier research (Richards et al., 2021). Their model hypothesizes fleeting and sporadic interactions between the listed elements (Saleem and Ilkhanizadeh, 2021). Fourth, depending on the goal of the study, their achievement prototypical may be applied at various stages of examination (Alshurideh et al., 2024). It is extensively employed in the sphere of IS success (Tripathi et al., 2020). For these details, it has been broadly embraced as a hypothetical electron lens in the works on measuring IS performance. However, this model was not frequently employed in earlier research to assess the advantages of BIS. For instance, Vugec et al. (2020) tested the impact of excellence features on structure usage, fulfillment, and personal influence among Peruvian businesses using the success model. Their research, however, found no connection between system utilization and other model dimensions. Yiu et al. (2021) used the success model in different research to examine BIS success in 12 Danish community clinics. Commonly speaking, their model has a strong analytical rate, but they also highlighted that the influence of the system usage on other features should be minimal. This research provided an explanation for why use did not significantly affect other aspects because users in mandated contexts lack access to an alternate information processing system. It's interesting to note that no research has used the achievement model to assess BIS from an administrative position. Calls for theoretically supported research on the advantages of BIS have identified this as a deficit. Our present study has created a hypothetical model constructed on ISSM toward analyses of BIS from an administrative viewpoint in order to close this research gap. The theoretical framework outlined in the present study is accessible in the next section.

While the updated ISSM has been significantly revised, some scholars believe that it still requires further validation before it can serve as a robust theoretical framework for assessing IS success (Sorour and Atkins, 2024). Additionally, to better suit the specific needs of BIS within organizational contexts, further expansions of the model are suggested. These expansions include additional success criteria specific to the BIS domain (Maaitah, 2023a).

The current research proposes a theoretical model based on the ISSM tailored to evaluate BIS success in an organizational setting. To align the model more closely with the unique demands of BIS, specific adjustments were made. These include integrating two critical success factors identified from relevant literature: process excellence and teamwork excellence. These additions aim to provide a more comprehensive and relevant assessment framework for BIS effectiveness in administrative environments.

While some researchers believe that cooperation and process characteristics are sufficiently covered under the existing system quality factor of the ISSM, others argue that these aspects are unique and require distinct consideration. This divergence in views led to a modification in the model, replacing system utilization with the perceived usefulness construct. This change reflects the understanding that system usage becomes a significant success factor, primarily when it is optional. This perspective is supported by Yassine et al. (2023), who contend that system usage should not be seen as an accurate indicator of success when usage is mandatory.

Additionally, Maaitah (2023b) suggested considering system use more as a precursor to success rather than a success element itself. To simplify the model, the most recent modification removed the feedback loops, thus reducing its complexity. These developments in the model are detailed in Fig. 2.

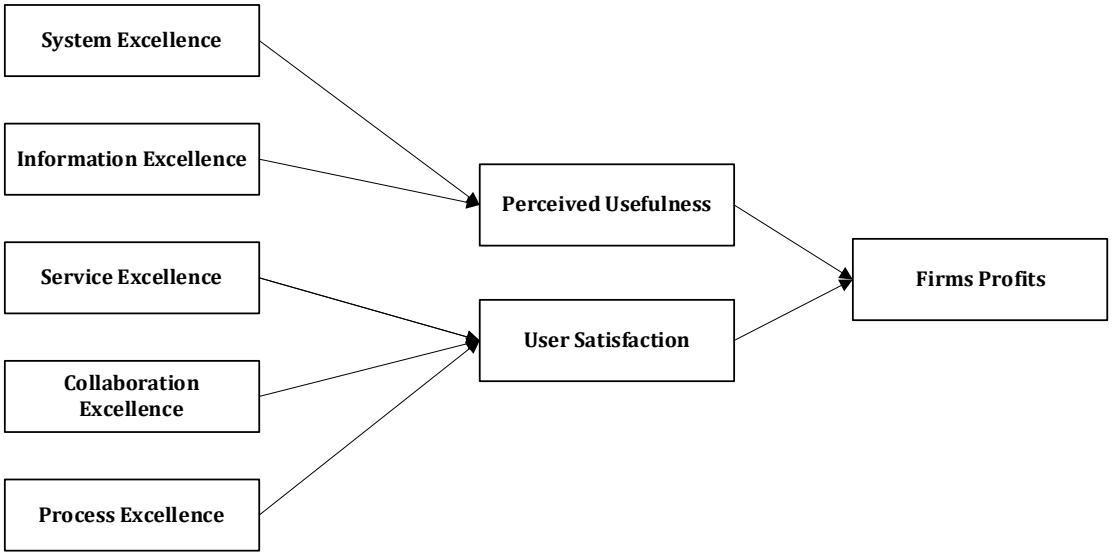

Fig. 2: Theoretical model

3. Study hypotheses

As previously mentioned, our model hypothesizes that system, data, service, collaboration, and process quality each uniquely influences perceived usefulness and user satisfaction, which in turn are considered precursors to organizational benefits. Specifically, system quality is evaluated based on its integration, utility, usefulness, reliability, responsiveness, and adaptability. It is generally accepted that the integrity of an organization's systems is crucial for system performance (Al-Maaitah et al., 2021). The findings suggest that system integrity is a significant factor affecting perceived usefulness and indirectly influencing customer satisfaction. However, recent studies indicate that the actual utility perceived by users and their satisfaction levels may not necessarily be impacted by the technical reliability of the system. This has led to the development of the following hypotheses to address the inconsistencies observed in this area.

H1: The observed utility of the system will rise with system quality.
H2: Customers will be happy thanks to the system's effectiveness.

In contrast to system quality, information quality pertains to the characteristics of data produced by systems, which include relevance, accuracy, completeness, reliability, conciseness, timeliness, and clarity. Previous research indicates that perceived utility and user satisfaction are positively and significantly influenced by the quality of information. However, some studies have found minimal correlation between the level of information quality and its utility, particularly when compared to its impact on satisfaction. This discrepancy in findings has led to the formulation of new hypotheses to further explore and understand these relationships.

H3: The information's substance will have a favorable effect on perceived utility.
H4: The accuracy of the physical will have a promising outcome on client satisfaction.

Outstanding facility: The significant increase in client demand has provided IT service providers with the opportunity to function as both a source of information and a service provider. Service quality is characterized by how responsive, reliable, and empathetic the IS department is to its customers. Numerous studies have shown that high service quality can lead to better perceived utility and increased customer satisfaction. However, Alkhwaldi (2024) found that there isn't a strong correlation between high-quality service and the utility perceived by users, nor between high-quality service and user satisfaction. In light of these mixed findings, we propose the following hypotheses for further investigation:

H5: Superior customer care will have a favorable effect on perceived utility.
H6: User happiness will be positively impacted by service excellence.

Cooperation effectiveness: Technological advancements have significantly improved the efficiency and effectiveness of collaborative efforts. It is widely recognized that effective collaboration boosts knowledge sharing, resource allocation, and decision-making processes. Some studies suggest that a high degree of teamwork positively influences perceived utility and customer satisfaction. However, other research indicates that the quality of

collaboration does not significantly affect perceived utility or client satisfaction. These conflicting findings lead us to propose the following hypotheses for further study:

H7: Perceived utility will be positively impacted by collaboration quality.
H8: User happiness will be positively impacted by collaboration quality.

Process quality in BIS refers to how these systems support the business operations of an organization, enhancing their overall effectiveness and efficiency. This involves evaluating organizational processes in terms of their adaptability, reliability, accuracy, and other relevant factors. Empirical research, such as the study by Paradza and Daramola (2021), has shown that high process quality significantly and positively impacts perceived usefulness. Additionally, some studies have found a correlation between process quality and customer satisfaction, suggesting that effective processes contribute to overall client contentment. Based on these insights, we propose the following hypotheses to further explore the role of process quality in BIS:

H9: Procedure excellence will increase perceived usefulness.
H10: User happiness will increase as a result of better process efficiency

Perceived usefulness is a crucial metric in evaluating information systems. It refers to the extent to which an individual believes that using a specific system will enhance their job performance. Research has shown that perceived usefulness positively influences client satisfaction and organizational outcomes. For instance, studies by Ahmad et al. (2024) and Whig et al. (2024) support the positive impact of perceived usefulness on both client satisfaction and broader organizational effectiveness. However, Maaitah (2023a) found that the influence of perceived usefulness on personal satisfaction is minimal, suggesting variability in its effects across different contexts. This discrepancy indicates the need for further investigation into how perceived usefulness translates into actual benefits in various organizational settings.

H11: User happiness will be positively impacted by perceived utility.
H12: Perceived utility will contribute to organizational advantages.

User satisfaction has emerged as a critical factor in the success or failure of BIS. The concept of satisfaction relates to how well users feel that the BIS meets their needs. It is seen as a precursor to immediate organizational impacts (Alzahrani, 2024). Research has indicated that user satisfaction significantly influences organizational efficiency across various technological settings (Ismail Al-Alawi et al., 2024). However, contrasting studies by Al-Hamad et al. (2024) suggested that employee satisfaction does not necessarily lead to positive organizational outcomes. Moreover, further research shows that the connection between user satisfaction and decision-making capabilities is only marginal. Based on these insights, the following hypotheses can be developed. These hypotheses aim to further explore the nuanced roles of user satisfaction in impacting organizational dynamics and performance.

H13: The advantages to the organization will be positively impacted by user happiness.

4. Methodology

The discussions in our manuscript implicitly acknowledge that the relationships identified in our theoretical model may vary across different types of users, systems, and administrative contexts. Such variability could be attributed to differences in system contexts, regulatory environments, and economic conditions between developed and emerging countries, which might explain the inconsistent findings observed. There is a clear need for additional research within organizational settings to better understand these dynamics. Consequently, our study aims to extend previous research by examining the effectiveness of BIS at the organizational level.

To construct our theoretical model, we integrated insights from a broad array of interdisciplinary sources related to BIS. This approach helps in understanding the essential elements that influence BIS performance in organizational contexts. Our research methodology is grounded in an extensive review of the literature, which includes books, scholarly articles, and full-text papers accessible through reliable internet databases. Key terms and advanced search queries were employed to ensure a comprehensive collection of sources that address BIS advancements globally without limiting the scope to any particular geographic or developmental context. This inclusive approach is vital as it addresses the existing gaps in knowledge about BIS performance, a relatively recent area of inquiry.

By expanding the range of sources and considering variations across different settings, our methodology not only enriches the understanding of BIS in diverse environments but also enhances the robustness of the theoretical model developed. This comprehensive review allows for a more nuanced analysis of how BIS can be effectively implemented and utilized in organizations worldwide, contributing to the broader field of information systems research.

5. Conclusion

Technology has rapidly advanced, generating vast amounts of data within organizations and presenting new research opportunities in the BIS field. Despite

the complexity, cost, and significant resource requirements—including employee training, infrastructure development, and software licensing—organizations worldwide continue to implement BIS. However, many organizations and individuals find that BIS implementations often fail, leading to significant losses in time, resources, and potential investment.

To address these challenges, this conceptual paper introduces a novel theoretical model based on the ISSM. This model is designed to assess the effectiveness of BIS within organizational contexts. The evaluation of BIS success serves two primary purposes: firstly, to validate the benefits and value of BIS implementations, and secondly, to ensure that BIS meets customer needs effectively.

The proposed theoretical model integrates eight success factors: perceived utility, user satisfaction, organizational benefits, system quality, information quality, service quality, collaboration quality, and process quality. Our literature review confirms the critical importance of each factor in the model. This conceptual work lays a robust theoretical foundation for future empirical research in the BIS field. By applying this model across various companies and industries, researchers can help organizations enhance profitability, productivity, market share, and customer satisfaction. Additionally, the insights gained from such studies could aid decision-makers and managers in improving their decision-making processes.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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