

Conceptualizing the Antecedents and Individual Impact of Business Intelligence in the Public Sector: The Technology-Organization-Authoritative Framework

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Abstract: Business intelligence (BI) refers to a technological tool and process that transforms large and fragmented data into well-informed graphical insights to aid managerial decision-making. Recognizing the significant benefits of BI in leveraging extensive amounts of data, governments have been progressively investing in BI tools to improve efficiency in public offices. Nevertheless, despite a significant body of knowledge related to BI adoptions and their advantages, there is a dearth of theoretical understanding of how the effective use of the system affects employees' work performance, particularly among civil servants who have distinctive work natures compared to businesses. Most studies have also ignored external and institutional factors that influence individual usage, whilst studies on the effective use of BI tools remain limited. The paper thus proposed a new conceptual framework for examining the factors that influence the effective use of BI and its impact on individual job performance. The suggested propositions could provide a theoretical contribution by integrating technological, organizational and authoritative dimensions that are novel and unique to the public sector. It would also contribute to practical understandings for public managers and policymakers in ensuring the investment made on BI is worthwhile. Ultimately, the paper seeks to bridge the gap in BI studies related to public organizations.

Keywords: *Business Intelligence, Public Sector, Effective Use, Individual Impact*

1. Introduction and Background

With the advent of big data in business processes nowadays, translating the data into valuable insights that can support managerial decisions is paramount. Business Intelligence (BI), a technological tool and process that analyses and transforms enormous and fragmented data into coherent and practical information, has become an essential tool in modern business operations (Phillips-Wren et al., 2021). Through graphical reporting, BI enables managers and executives to swiftly discern trends and patterns and make well-informed decisions (Jha & Jha, 2022).

Acknowledging the notable advantages, governments worldwide have also been progressively investing in BI technology to improve efficiency and effectiveness in public offices (Merhi & Bregu, 2020). Nevertheless, pouring substantial resources into organizations by integrating advanced technology does not automatically guarantee positive returns. As pointed out in the literature, many public organizations face challenges at various levels of the adoption process, including a lack of data literacy, cultural resistance, technological issues and inefficient system use (Ain et al., 2019; Alkrajji, 2020; Merhi, 2021). In Malaysia, introducing the BI tool in the electronic human resources management system (e-HRM) that manages the human resources aspect of public service in the country is a noteworthy step in modernizing the administration. Nonetheless, how the system impacts job performance remains elusive, which motivates the present study.

Through preliminary studies and a literature review, several issues are observed. In the technological context, the information's reliability and trustworthiness may be inadequate to support the decision-making process. In addition, usability and poor system performance remain the subject of concern (Al-Okaily et al., 2023; Merhi, 2021; Torres & Sidorova, 2019; Trieu et al., 2022). Further, considering BI is a workplace system, studies highlighted institutional obstacles that can impede the efficacy, such as deficient leadership and a lack of shared values to embrace data-driven decision-making (Alkrajji, 2020; Hmoud et al., 2023; Merhi, 2021; Trieu, 2023). Moreover, in the context of the present study, where the system is developed, managed, and governed by a single authority, challenges such as lack of training and unsupportive assistance are also discussed in the literature (Ain et al., 2019; Al-Okaily et al., 2023; Mudau et al., 2024).

Accordingly, the paper seeks to address these issues by proposing a new conceptual framework for measuring the factors that influence the effective use of BI and its impact on individual job performance in public organizations. The following section reviews previous studies on BI usage and its impact on individuals, followed by research gaps related to this work. The theoretical model and proposed hypotheses are discussed in the fourth section. Next, the theoretical and practical significance of the study is presented, followed by the conclusion in the last section.

2. Literature Review

Several empirical studies have investigated the impact of BI usage on the individual level, as summarised in Table 1. Besides technological factors, the studies deliberately highlighted the significance of organizational dimensions in influencing individual usage, such as top management support (Trieu et al., 2022) and culture and resources (Trieu, 2023). Literature also shows recent studies have advanced into more objective construct to examine the system's utilization on post-adoption usages, such as effective use (Trieu et al., 2022), system dependence and infusion (Trieu, 2023) and advanced use (Mudau et al., 2024). However, determinants affecting system usage and the subsequent impact on users are still inconclusive (Jeyaraj, 2020b), with mixed results in BI research (Gonzales & Wareham, 2019; Kapo et al., 2021). Therefore, further investigation in this area is required.

Table 1: Prior Studies in BI Usage and Individual Impact

AUTHOR(S) / YEAR	RESEARCH FOCUS	KEY FINDING(S)
Mudau et al. (2024)	Impacts of routine and advanced use of BI among accountants in South Africa.	Advanced use is a crucial predictor in determining individual impact and IS success.
Trieu (2023)	Impacts of organizational factors on the actual use of BI among managers in the United States.	Complementary organizational resources (CORs) significantly influence the actual use of BI, resulting in improved decision-making.
Candra and Nainggolan (2022)	Determinants of BI success among business managers in Indonesia.	BI usage significantly affects decision-making quality and increases user satisfaction and job performance.
Trieu et al. (2022)	Contextualisation of Theory of Effective Use (TEU) in BI context among managers.	The study emphasized the value of system quality, data integration and evidence-based culture in promoting effective use of BI.
Kapo et al. (2021)	Investigating user satisfaction, BI usage and job performance among employees in Bosnia and Herzegovina.	BI usage positively impacts employees' job performance, and acquiring profound comprehension at the individual level is crucial. Future studies should integrate managerial support and training.
Montero and Lind (2020)	Examining the efficacy of BI by analyzing information use among senior managers in the United States.	Information use is strongly reliant on the information and system quality, while system maturity moderates the quality and success of the system.
Gonzales and Wareham (2019)	Evaluating the individual impact of BI by assessing system dependence in Peru.	System usage is an essential indicator of IS success in obligatory and voluntary contexts.

Despite the significant advancements in BI studies, a thorough literature examination reveals several research gaps. First, prior research on BI has predominantly focused on the initial acceptance of the system, neglecting more perspicuity on post-adoption usage. The lack of said attention hinders the comprehension of the actual impact of the system (Trieu, 2023; Trieu et al., 2022). Second, empirical studies produced inconsistent results between BI usage and individual job performance (Gonzales & Wareham, 2019; Kapo et al., 2021). Third, although BI technology has been adopted in the public sector, there is a dearth of comprehensive examination in this domain, which has distinctive characteristics and challenges compared to the private sector (Di Vaio et al., 2022; Kaasalainen, 2020; Merhi & Bregu, 2020).

Further, most BI research solely focuses on organizational impact, with little attention given at the individual level (Ain et al., 2019; Talaoui & Kohtamäki, 2021). Since BI is primarily designed to aid decision-making,

researchers indicate that the system's success largely depends on the end users (Kapo et al., 2021; Trieu et al., 2022). In addition, given that BI is a workplace system, various scholars have underlined the significance of incorporating institutional factors that may alter individuals' attitudes towards the usage, such as organizational leadership and culture (Paradza & Daramola, 2021; Trieu, 2023; Venkatesh et al., 2016). Finally, most existing studies on BI are conducted in developed nations (Ain et al., 2019; Purnomo et al., 2021). Expanding the research to other regional contexts will allow a more diverse and profound understanding of the topic. Objectively, the present study aims to address these gaps while achieving the research objectives through a new conceptual framework discussed below.

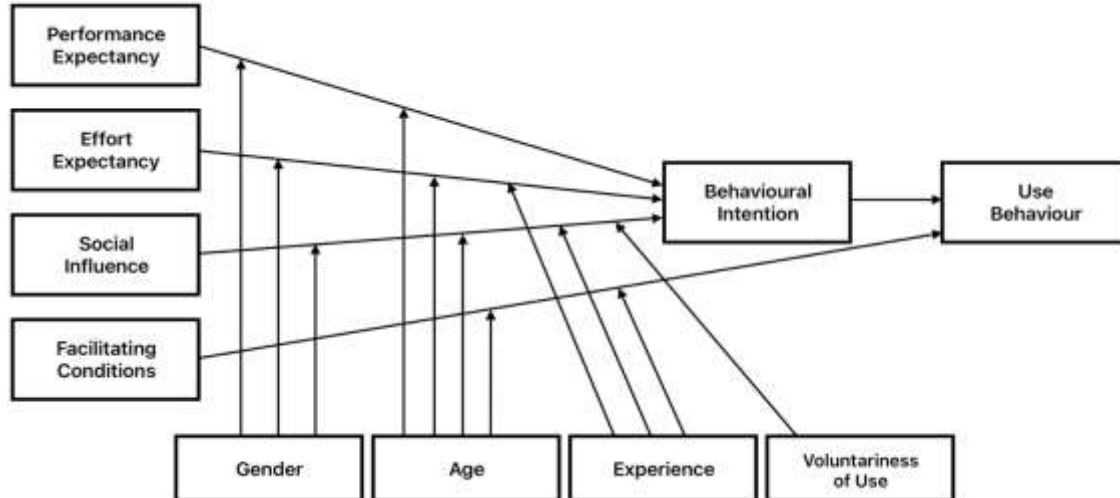
3. Theoretical Foundation

The theoretical foundation of the proposed framework is grounded on two prominent models of IS adoption, namely the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) and the Updated DeLone and McLean Information System Success Model (ISSM) (DeLone & McLean, 2003), as elaborated as follows:

Unified Theory of Acceptance and Use of Technology

UTAUT is an integrative model incorporating eight prior theories on technology acceptance, aiming to predict users' behavioral intentions and usage (Alturas, 2021). UTAUT consists of four predictors: performance expectancy, effort expectancy, social influence, and facilitating conditions, which are influenced by four moderators: gender, age, experience, and voluntariness of use, as illustrated in Figure 1. Recent studies in BI indicated that the UTAUT application is gaining prominence among researchers for assessing users' behavior, such as among banking employees (Zitha & Ajigini, 2023) and remote workers (Kašparová, 2023). It is a notable, mature technology adoption model that has been extensively tested and validated in various contexts, making it a suitable theoretical basis for developing the framework (Venkatesh et al., 2016).

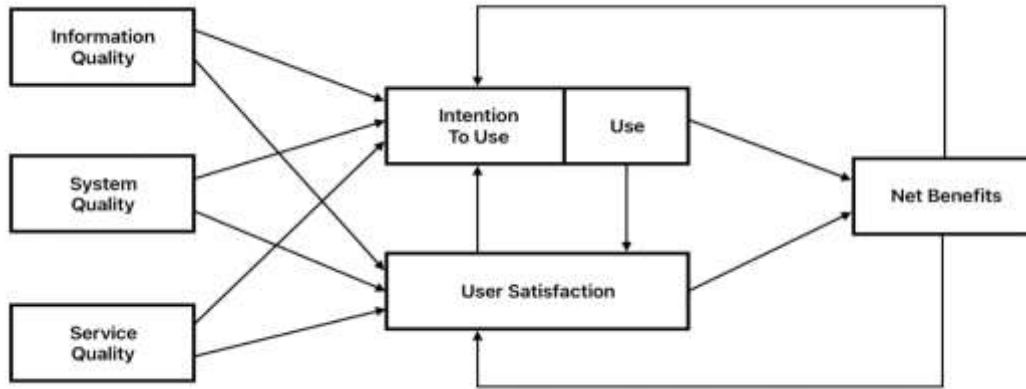
Figure 1: UTAUT (Venkatesh et al., 2003)



Updated DeLone and McLean Information System Success Model

The Updated ISSM (DeLone & McLean, 2003) proposes that information system (IS) success is determined by six dimensions: system quality, information quality, service quality, intention to use or use, user satisfaction, and net benefits. The determinant of system quality refers to the technical features of the IS, such as its performance, dependability and usability. Information quality is measured by the semantic quality the user gains from using the IS, while service quality is the caliber of support and services offered by the service providers (DeLone & McLean, 2016). The model offers several strengths, such as providing a holistic view of IS success, particularly at the individual level, a multidimensional approach and adaptability to various contexts of IS (Sabeh et al., 2021), including the public sector (Elazzaoui & Lamari, 2022). In addition, it is the most widely used model in BI studies (Ain et al., 2019), making it an appropriate model for this study.

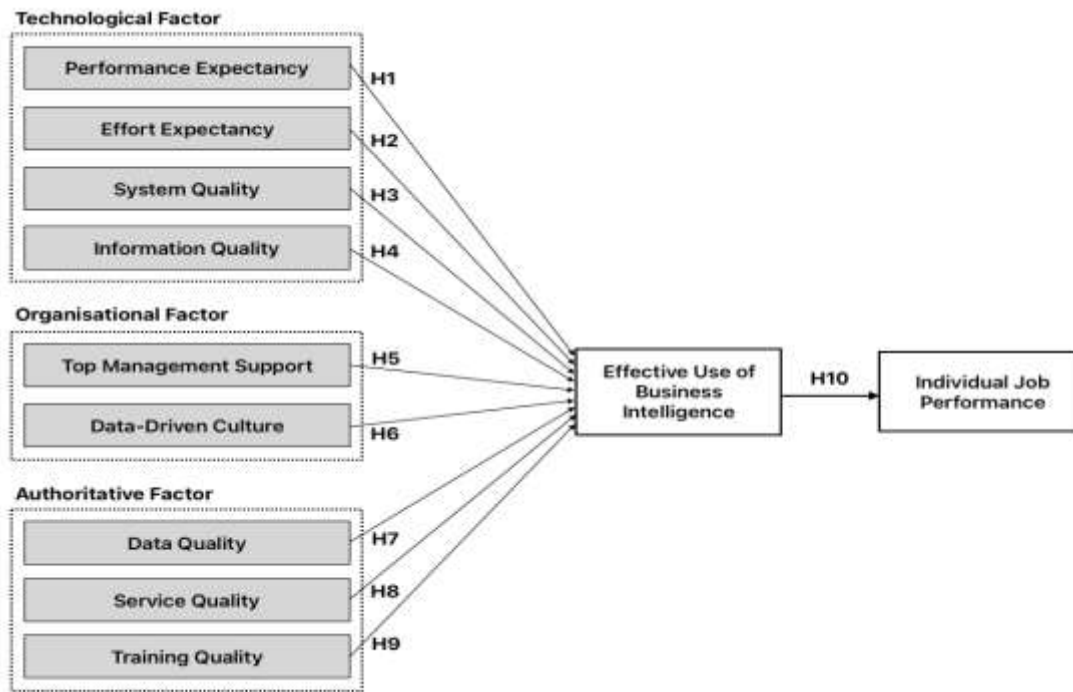
Figure 2: Updated ISSM (DeLone & McLean, 2003)



4. Conceptual Framework and Proposed Hypotheses

Both models abovementioned have been extensively validated in various IS contexts (Blut et al., 2022; Jeyaraj, 2020a). Based on the issue, gaps and recommendations from prior research, new variables are integrated into the concept: top management support, data-driven culture, data quality and training quality. In addition, the study proposes effective use as the mediating variable in recognizing the necessity to go beyond broad and oversimplified methods in measuring system usage (Burton-Jones & Grange, 2013; DeLone & McLean, 2016; Petter et al., 2008; Trieu, 2023). For systematic comprehension, the variables are grouped into three attributes: technological, organizational, and authoritative factors. The authoritative dimension is a unique characteristic of the public sector since it refers to the central governing body that implements, directs, monitors and manages the BI system and associated data for use by multiple public agencies, as is the case in Malaysia. All the independent variables are conceptualized as determinants of the effective use of BI and consequently impact individual job performance, as illustrated in Figure 3. The following subsections discuss each construct and outline the proposed hypotheses.

Figure 3: The Proposed Technology-Organisation-Authoritative (T-O-A) Framework



Technological Factor

Performance Expectancy: Performance expectancy (PE) refers to the degree to which a user perceives that using a particular technology will provide advantages or positive consequences when executing specific tasks (Venkatesh et al., 2003). Several BI studies highlighted PE's significance in influencing users' behavioral intention to use the system (Alkaabi & Kassim, 2023; Kašparová, 2023; Zitha & Ajigini, 2023). However, when it comes to obligatory use, such as mandated in many public organizations, the dynamics of PE are expected to be reduced (Brown et al., 2002). Nevertheless, this study asserts that if users believe using the BI will improve their work performance, their motivation to use the system effectively will increase. Thus, the following hypothesis is formulated:

H1: Performance expectancy will have a positive influence on the effective use of BI.

Effort Expectancy: Effort expectancy (EE) is the extent to which a user believes using a particular technology will be easy and effortless. It is a pivotal factor that affects initial acceptance (Venkatesh et al., 2003) and subsequent system usage and satisfaction (Wixom & Todd, 2005). However, prior BI studies have shown contrary results on the relationship between EE and behavioral intention (Kašparová, 2023; Zitha & Ajigini, 2023). Similarly, empirical studies on other information systems discovered that EE does not positively affect system usage (Ayaz & Yanartaş, 2020; Zha et al., 2022). Nonetheless, several studies highlighted the importance of a well-designed interface and user-friendliness as key factors toward continuance usage of IS (Chhabra et al., 2020; Choudhury et al., 2022; Daud et al., 2022). Accordingly, the following hypothesis is proposed:

H2: Effort expectancy will have a positive influence on the effective use of BI.

System Quality: System quality (SQ) refers to the desirable technical characteristics of the IS, such as the system's availability, reliability, accessibility and performance (DeLone & McLean, 2016). SQ is crucial as it directly impacts how effectively users can extract, analyze, and utilize data for decision-making, as empirically revealed in several BI studies (Baig et al., 2021; Hmoud et al., 2023; Torres & Sidorova, 2019). The shred of evidence thus leads to the following hypothesis:

H3: System quality will have a positive influence on the effective use of BI.

Information Quality: Information quality (IQ) represents the quality of the output or content produced by the system to users (DeLone & McLean, 2016). In the context of BI, IQ is paramount as it directly impacts decision-making processes by providing accurate, pertinent, and timely insights (Wixom & Todd, 2005). Much empirical evidence has shown that IQ significantly influences BI usage (Alkaabi & Kassim, 2023; Hmoud et al., 2023). On the contrary, a study found that although IQ influences user satisfaction, it does not affect the intention to use BI (Candra & Nainggolan, 2022). While the evidence is mixed, the study implies that IQ is the primary goal for utilizing BI. Thus, the following hypothesis is formulated:

H4: Information quality will have a positive influence on the effective use of BI.

Organisational Factor

Top Management Support: Top management support (TM) toward IS usage refers to the level of leadership commitment in fostering technological enthusiasm among the employees, which includes strategic vision, involvement and provision of necessary resources (Ragu-Nathan et al., 2004). Prior research has empirically supported the significant influence of TM on BI adoption (Baig et al., 2021; Bordeleau et al., 2020; Hmoud et al., 2023). It has also been revealed that TM plays a crucial role in determining the effectiveness of data utilization in public organizations (Merhi, 2021). These evidence thus allow the following hypothesis:

H5: Top management support will have a positive influence on the effective use of BI.

Data-Driven Culture: Data-driven culture (DC) refers to the collective beliefs, standards or practices among individuals in an organization that prioritizes using factual data in their decision-making processes (Ali & Miah, 2018; Alkrajji, 2020). Various studies have demonstrated that organizations cultivating DC have increased employees' confidence to make informed decisions using data (Kiu & Chan, 2023; Medeiros et al., 2020; Triono et al., 2023). However, studies on the relationship between DC and the effective use of BI remain limited (Trieu, 2023). Consequently, the proposed hypothesis is:

H6: Data-driven culture will have a positive influence on the effective use of BI.

Authoritative Factor

Data Quality: Data quality (DQ) refers to the fitness of available data stored in a data warehouse and leveraged for analysis and reporting (Wixom & Watson, 2001). BI studies indicate that DQ is critically important as it directly affects information accuracy, credibility and trustworthiness, eventually impacting decisions (Al-Okaily et al., 2023; Torres & Sidorova, 2019; Trieu, 2023). A recent empirical study shows that DQ positively affects BI usage and subsequently influences user performance (Mudau et al., 2024). These conclusions thus allow the following hypothesis:

H7: Data quality will have a positive influence on the effective use of BI.

Service Quality: Service quality (SVQ) pertains to the quality of support and assistance given by the authority that oversees and manages the BI system, either in technical or administrative aspects. It includes responsiveness, professionalism and corresponding skills (DeLone & McLean, 2003; DeLone & McLean, 2016). Research shows that SVQ positively affects users' intention to use BI (Alkaabi & Kassim, 2023) and system usage (Mudau et al., 2024). Therefore, the hypothesis proposed is:

H8: Service quality will have a positive influence on the effective use of BI.

Training Quality: Training quality (TQ) is defined as a process of educating users to enhance their knowledge, skills and proficiencies in using the system (Merhi, 2021). Literature reveals that insufficient, unsuitable, and poor trainers are reasons for user resistance to BI usage (Ain et al., 2019). Since BI is a dynamic system involving various user characteristics, TQ is essential in motivating and influencing system usage. Thus, the study proposed:

H9: Training quality will have a positive influence on the effective use of BI.

Effective Use and Individual Job Performance

System usage has become an essential dimension in numerous IS studies and is a significant predictor of IS success (DeLone & McLean, 2016). Recent studies have emphasized the need to transcend beyond simplistic measures and proposed a more comprehensive method for measuring system usage (Trieu, 2023; Trieu et al., 2022). Consequently, the overall success of an organization relies on each individual's job performance in achieving the goals and objectives. In the context of BI, individual job performance is described as the extent to which the system impacts decision-making quality and enhances overall work performance (Mudau et al., 2024; Trieu, 2023). Nevertheless, prior studies examining the relationship between system usage and individual impact yield inconclusive findings (Jeyaraj, 2020b). In addition, measuring the effective use of BI remains understudied (Torres & Sidorova, 2019; Trieu, 2023). Asserting that the actual rewards and benefits of IS can only be achieved through the effective use of the system, thus the proposed hypothesis is:

H10: Effective use of BI will have a positive impact on individual job performance.

5. Implications

The proposed conceptual framework, developed through extensive literature analysis, would pave the way for validation through future empirical examination. The discussion and propositions of the framework offer a fresh theoretical perspective on BI studies. It also fills the research gaps and addresses prior research suggestions, particularly on post-adoption usage and individual impact. Practically, by focusing on the public sector, this research could provide valuable insights for policymakers, administrators, and system developers to reflect and formulate more effective strategies to ensure that the investment of IS made in public organizations is fully optimized and yields beneficial impacts.

Conclusion and Recommendations

The emergence of big data has prompted many governments, including Malaysia, to invest in BI technologies in public offices to obtain the advantages. Unfortunately, the adoption often faced obstacles in reaping the actual benefits. The topic has also gained considerable concern among scholars, highlighting the issues and gaps in the research. Hence, grounded on robust theoretical models, the paper thus presents a new conceptual framework for examining the determinants and impact of effective use of BI at the individual level in the public sector. The novelty of the model would provide a fresh foundation for ongoing empirical validation to expand the knowledge in the field while also offering practical insights to stakeholders. The limitations of this article include its inability to draw definitive conclusions on the effectiveness of the proposed model, which will

require further validation through empirical research. As highlighted in the gaps, future research on BI should prioritize understudied areas, such as examining the end-user level, post-adoption usage and unexplored domains like the public sector.

References

- Aboagye-Da-Costa, D. P. (2012). Internet Quality in Southern Ghana for Businesses Vendor: Viope Solutions Oy. Bachelor Thesis. Leppävaara, Finland: Laurea University of Applied Sciences.
- Ain, N., Vaia, G., DeLone, W. H., & Waheed, M. (2019). Two decades of research on business intelligence system adoption, utilization and success – A systematic literature review. *Decision Support Systems*, p. 125, 113113. <https://doi.org/10.1016/j.dss.2019.113113>
- Ali, M. S., & Miah, S. J. (2018). Identifying Organisational Factors for Successful Business Intelligence Implementation: *International Journal of Business Intelligence Research*, 9(2), 47–63. <https://doi.org/10.4018/IJBIR.2018070103>
- Alkaabi, W., & Kassim, N. M. (2023). Examining the Psychological Factors Influencing Intention to Use Business Intelligence Dashboards in the UAE. *Journal for ReAttach Therapy and Developmental Diversities*, 6(8s), 164–179.
- Alkrajji, A. I. (2020). Weighting the challenges to the effectiveness of business intelligence systems in organizations: An empirical study of government organizations in Saudi Arabia. *Journal of Decision Systems*, 29(2), 102–127. <https://doi.org/10.1080/12460125.2020.1770436>
- Al-Okaily, A., Teoh, A. P., & Al-Okaily, M. (2023). Evaluation of data analytics-oriented business intelligence technology effectiveness: An enterprise-level analysis. *Business Process Management Journal*, 29(3), 777–800. <https://doi.org/10.1108/BPMJ-10-2022-0546>
- Alturas, B. (2021). Models of Acceptance and Use of Technology Research Trends: Literature Review and Exploratory Bibliometric Study. In M. Al-Emran & K. Shaalan (Eds.), *Recent Advances in Technology Acceptance Models and Theories* (Vol. 335, pp. 13–28). Springer International Publishing. https://doi.org/10.1007/978-3-030-64987-6_2
- Ayaz, A., & Yanartaş, M. (2020). An analysis of the unified theory of acceptance and use of technology theory (UTAUT): Acceptance of electronic document management system (EDMS). *Computers in Human Behavior Reports*, 2, 100032. <https://doi.org/10.1016/j.chbr.2020.100032>
- Baig, M. I., Shuib, L., & Yadegaridehkordi, E. (2021). A Model for Decision-Makers' Adoption of Big Data in the Education Sector. *Sustainability*, 13(24), 13995. <https://doi.org/10.3390/su132413995>
- Blut, M., Chong, A. Y. L., Tsigna, Z., & Venkatesh, V. (2022). Meta-Analysis of the Unified Theory of Acceptance and Use of Technology (UTAUT): Challenging its Validity and Charting a Research Agenda in the Red Ocean. *Journal of the Association for Information Systems*, 23(1), 13–95. <https://doi.org/10.17705/1jais.00719>
- Bordeleau, F.-E., Mosconi, E., & De Santa-Eulalia, L. A. (2020). Business intelligence and analytics value creation in Industry 4.0: A multiple case study in manufacturing medium enterprises. *Production Planning & Control*, 31(2–3), 173–185. <https://doi.org/10.1080/09537287.2019.1631458>
- Brown, S. A., Massey, A. P., Montoya-Weiss, M. M., & Burkman, J. R. (2002). Do I have to? User acceptance of mandated technology. *European Journal of Information Systems*, 11(4), 283–295. <https://doi.org/10.1057/palgrave.ejis.3000438>
- Burton-Jones, A., & Grange, C. (2013). From Use to Effective Use: A Representation Theory Perspective. *Information Systems Research*, 24(3), 632–658. <https://doi.org/10.1287/isre.1120.0444>
- Candra, S., & Nainggolan, A. (2022). Understanding Business Intelligence and Analytics System Success from Various Business Sectors in Indonesia. *CommIT (Communication and Information Technology) Journal*, 16(1), 37–52. <https://doi.org/10.21512/commit.v16i1.7849>
- Chhabra, V., Rajan, P., & Chopra, S. (2020). User acceptance of new technology in mandatory adoption scenario for food distribution in India. *International Journal on Food System Dynamics*, 11(2), 153–170. <https://doi.org/10.18461/ijfsd.v11i2.47>
- Choudhury, A., Asan, O., & Medow, J. E. (2022). Clinicians' Perceptions of an Artificial Intelligence-Based Blood Utilisation Calculator: Qualitative Exploratory Study. *JMIR Human Factors*, 9(4), e38411. <https://doi.org/10.2196/38411>
- Daud, N. M., Rokhman, F., Mohamed, I. S., Masyhar, A., Syaifudin, A., & Farida, L. A. (2022). Examining the Connection Between Mandatory Technology Usage and Technology Withdrawal in The Maritime

- Industry. *Journal of Maritime Research*.
- Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems*, 19(4), 9–30. <https://doi.org/10.1080/07421222.2003.11045748>
- DeLone, W. H., & McLean, E. R. (2016). Information Systems Success Measurement. *Foundations and Trends in Information Systems*, 2(1), 1–116. <https://doi.org/10.1561/2900000005>
- Di Vaio, A., Hassan, R., & Alavoine, C. (2022). Data intelligence and analytics: A bibliometric analysis of human–Artificial intelligence in public sector decision-making effectiveness. *Technological Forecasting and Social Change*, 174, 121201. <https://doi.org/10.1016/j.techfore.2021.121201>
- Elazzaoui, E., & Lamari, S. (2022). Delone and McLean information systems success model in the public sector: A systematic review. *Journal Of Social Science and Organization Management*, Vol. 3, 133-156 Pages. <https://doi.org/10.48434/IMIST.PRSM/JOSSOM-V311.30393>
- Gonzales, R., & Wareham, J. (2019). Analyzing the impact of a business intelligence system and new conceptualizations of system use. *Journal of Economics, Finance and Administrative Science*, 24(48), 345–368. <https://doi.org/10.1108/JEFAS-05-2018-0052>
- Hmoud, H., Al-Adwan, A. S., Horani, O., Yaseen, H., & Zoubi, J. Z. A. (2023). Factors influencing business intelligence adoption by higher education institutions. *Journal of Open Innovation: Technology, Market, and Complexity*, 9(3), 100111. <https://doi.org/10.1016/j.joitmc.2023.100111>
- Jeyaraj, A. (2020a). DeLone & McLean Models of Information System Success: Critical Meta-Review and Research Directions. *International Journal of Information Management*, p. 54, 102139. <https://doi.org/10.1016/j.ijinfomgt.2020.102139>
- Jeyaraj, A. (2020b). Variation in the effect of system usage and individual impact: A meta-regression of empirical findings. *Information & Management*, 57(6), 103242. <https://doi.org/10.1016/j.im.2019.103242>
- Jha, S. K., & Jha, B. (2022). An Introduction to Business Intelligence. In D. Singh, A. Singh, A. Omar, & S. Goyal, *Business Intelligence and Human Resource Management* (1st ed., pp. 1–30). Productivity Press. <https://doi.org/10.4324/9781003184928-1>
- Kaasalainen, V. (2020). *Business Intelligence System Implementation and Design Framework: A Public Sector Case Study* [Master Degree]. University of Jyväskylä.
- Kapo, A., Turulja, L., Zaimović, T., & Mehić, S. (2021). Examining the effect of user satisfaction and business intelligence system usage on individual job performance. *Management: Journal of Contemporary Management Issues*, 26(2), 43–62. <https://doi.org/10.30924/mjcmi.26.2.3>
- Kašparová, P. (2023). Intention to use business intelligence tools in decision-making processes: Applying a UTAUT 2 model. *Central European Journal of Operations Research*, 31(3), 991–1008. <https://doi.org/10.1007/s10100-022-00827-z>
- Kiu, C. T. T., & Chan, J. H. (2023). Firm characteristics and the adoption of data analytics in performance management: A critical analysis of EU enterprises. *Industrial Management & Data Systems*. <https://doi.org/10.1108/IMDS-07-2023-0430>
- Medeiros, M. M. D., Hoppen, N., & Maçada, A. C. G. (2020). Data science for business: Benefits, challenges and opportunities. *The Bottom Line*, 33(2), 149–163. <https://doi.org/10.1108/BL-12-2019-0132>
- Merhi, M. I. (2021). Evaluating the critical success factors of data intelligence implementation in the public sector using analytical hierarchy process. *Technological Forecasting and Social Change*, p. 173, 121180. <https://doi.org/10.1016/j.techfore.2021.121180>
- Merhi, M. I., & Bregu, K. (2020). Effective and efficient usage of big data analytics in the public sector. *Transforming Government: People, Process and Policy*, 14(4), 605–622. <https://doi.org/10.1108/TG-08-2019-0083>
- Montero, J. N., & Lind, M. (2020). Determining Business Intelligence Usage Success. *International Journal of Computer Science and Information Technology*, 12(6), 45–67. <https://doi.org/10.5121/ijcsit.2020.12604>
- Mudau, T. N., Cohen, J., & Papageorgiou, E. (2024). Determinants and consequences of routine and advanced use of business intelligence (BI) systems by management accountants. *Information & Management*, 61(1), 103888. <https://doi.org/10.1016/j.im.2023.103888>
- Paradza, D., & Daramola, O. (2021). Business Intelligence and Business Value in Organisations: A Systematic Literature Review. *Sustainability*, 13(20), 11382. <https://doi.org/10.3390/su132011382>
- Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: Models, dimensions,

- measures, and interrelationships. *European Journal of Information Systems*, 17(3), 236–263. <https://doi.org/10.1057/ejis.2008.15>
- Phillips-Wren, G., Daly, M., & Burstein, F. (2021). Reconciling business intelligence, analytics and decision support systems: More data, deeper insight. *Decision Support Systems*, 146, 113560. <https://doi.org/10.1016/j.dss.2021.113560>
- Purnomo, A., Firdaus, M., Sutiksno, D. U., Putra, R. S., & Hasanah, U. (2021). Mapping of Business Intelligence Research Themes: Four Decade Review. 2021 IEEE International Conference on Communication, Networks and Satellite (COMNETSAT), 32–37. <https://doi.org/10.1109/COMNETSAT53002.2021.9530790>
- Ragu-Nathan, B. S., Apigian, C. H., Ragu-Nathan, T. S., & Tu, Q. (2004). A path analytic study of the effect of top management support for information systems performance. *Omega*, 32(6), 459–471. <https://doi.org/10.1016/j.omega.2004.03.001>
- Sabeh, H. N., Husin, M. H., Kee, D. M. H., Baharudin, A. S., & Abdullah, R. (2021). A Systematic Review of the DeLone and McLean Model of Information Systems Success in an E-Learning Context (2010–2020). *IEEE Access*, 9, 81210–81235. <https://doi.org/10.1109/ACCESS.2021.3084815>
- Talaoui, Y., & Kohtamäki, M. (2021). 35 years of research on business intelligence process: A synthesis of a fragmented literature. *Management Research Review*, 44(5), 677–717. <https://doi.org/10.1108/MRR-07-2020-0386>
- Torres, R., & Sidorova, A. (2019). Reconceptualizing information quality as effective use in the context of business intelligence and analytics. *International Journal of Information Management*, 49, 316–329. <https://doi.org/10.1016/j.ijinfomgt.2019.05.028>
- Trieu, V.-H. (2023). Towards an understanding of actual business intelligence technology use: An individual user perspective. *Information Technology & People*, 36(1), 409–432. <https://doi.org/10.1108/ITP-11-2020-0786>
- Trieu, V.-H., Burton-Jones, A., Green, P., & Cockcroft, S. (2022). Applying and Extending the Theory of Effective Use in a Business Intelligence Context. *MIS Quarterly*, 46(1), 645–678. <https://doi.org/10.25300/MISQ/2022/14880>
- Triono, S. P. H., Alamsyah, A., & Dudija, N. (2023). Driving factors for the use of business intelligence and analytics among Indonesian startups. *International Journal of Technoentrepreneurship*, 4(4), 277–296. <https://doi.org/10.1504/IJTE.2023.134928>
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27(3), 425. <https://doi.org/10.2307/30036540>
- Venkatesh, V., Thong, J. Y. L., & Xu, X. (2016). Unified Theory of Acceptance and Use of Technology: A Synthesis and the Road Ahead. *Journal of the Association for Information Systems*, 17(5), 328–376. <https://doi.org/10.17705/1jais.00428>
- Wixom, B. H., & Todd, P. A. (2005). A Theoretical Integration of User Satisfaction and Technology Acceptance. *Information Systems Research*, 16(1), 85–102. <https://doi.org/10.1287/isre.1050.0042>
- Wixom, B. H., & Watson, H. J. (2001). An Empirical Investigation of the Factors Affecting Data Warehousing Success. *MIS Quarterly*, 25(1), 17. <https://doi.org/10.2307/3250957>
- Zha, H., Liu, K., Tang, T., Yin, Y.-H., Dou, B., Jiang, L., Yan, H., Tian, X., Wang, R., & Xie, W. (2022). Acceptance of clinical decision support system to prevent venous thromboembolism among nurses: An extension of the UTAUT model. *BMC Medical Informatics and Decision Making*, 22(1), 221. <https://doi.org/10.1186/s12911-022-01958-8>
- Zitha, A., & Ajigini, O. A. (2023). A Model for the Business Intelligence System Acceptance in the South African Banking Sector. *Journal of Theoretical and Applied Information Technology*, 101(8), 3027–3043.