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## **DETERMINING BUSINESS INTELLIGENCE ADOPTION STAGES FOR APPAREL SMMEs IN DURBAN, SOUTH AFRICA.**

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### **Abstract**

*This study aims to construct and validate the T-O-E framework by examining factors influencing the adoption of business intelligence (BI). The study utilised data from a sample of 161 small, medium, and micro enterprises (SMMEs) to examine the impact of technological, organisational, and environmental factors on the adoption stages of business information systems (BIS). The analysis was conducted using the partial least squares structural equation modelling (PLS-SEM) approach. This study presents empirical findings on the influence of technological, organisational, and environmental factors on the various stages of individual business intelligence (BI) adoption. This study presents implications for managers and BI providers to enhance their understanding of the impact of several determinants to reach conclusions more efficiently on the adoption process. The findings from this study were that none of the three adoption stages namely evaluation, adoption and usage are significant for the apparel SMME sector in Durban. The recommendations for future research would be to investigate if SMMEs really need BI for the sustainability of their businesses. A recommended objective for this study would be to identify the success measures of SMMEs utilising BI in comparison to SMMEs who have not implemented BI.*

## **Keywords**

Business Intelligence, Diffusion of Innovation, SMMEs

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## **1. Introduction**

The primary aim of Business Intelligence (BI) is to equip business managers and analysts with the essential tools and resources required to proficiently carry out comprehensive business analysis. (Passlick et. al. 2023). Moreover, smaller enterprises frequently encounter difficulties in effectively employing business intelligence (BI) as a result of their restricted technical proficiency in converting data into actionable insights to facilitate informed decision-making in business activities. Choi et. al. (2022) argue that the adoption of Business Intelligence (BI) is imperative for businesses of various scales, as it facilitates improved decision-making by enabling the acquisition of comprehensive information.

Business Intelligence (BI) plays a crucial role in improving business performance, increasing profitability, and achieving a sustainable competitive advantage, while also prioritising customer satisfaction.

SMMEs commonly encounter difficulties in attaining a sustainable competitive advantage, alongside a range of constraining elements, as highlighted by Mkhize (2022). One plausible resolution for smaller enterprises involves the emergence of pioneering technologies specifically designed to facilitate and augment business operations, thereby bolstering their competitiveness. The correlation between the level of effectiveness demonstrated by an innovation, such as Business Intelligence (BI), and the likelihood of effectively addressing challenges within businesses is positively correlated. As a result, this enhances the probability of the implementation of these innovations. The objectives of this study are to:

- Determine the factors influencing the evaluation of BI by apparel SMME's in Durban, South Africa.
- Determine the factors influencing the adoption of BI by apparel SMME's in Durban, South Africa.
- Determine the factors influencing the usage of BI by apparel SMME's in Durban, South Africa.

For this reason, the investigation into the adoption of innovative technologies, specifically Business Intelligence (BI) systems, was initiated in response to inquiries regarding the generalizability of the findings obtained from the study conducted by Msomi et. al. (2020). The

researchers exhibited a specific interest in the potential of these innovations to exert a positive influence on the sustainability of small, medium, and micro enterprises (SMMEs).

Furthermore, Llave et. al. (2018) put forth a research study aimed at investigating the readiness and competencies of small and medium enterprises (SMEs) within the discipline of business intelligence (BI). Becerra-Godínez et. al. (2020) highlighted the lack of a conclusive approach for the integration of business intelligence (BI) in small and medium-sized enterprises (SMEs), as a considerable proportion of enterprises within this sector have yet to leverage these advanced technologies.

Kikawa et. al. (2019) argue that the South African government's emphasis on small and medium-sized enterprises (SMEs) stems from their capacity to create employment opportunities, a crucial consideration given the nation's high levels of unemployment. The utilisation of Business Intelligence (BI) tools is crucial for Small and Medium Enterprises (SMEs) to function at their maximum efficiency. The classification of business intelligence (BI) tools is determined by their methodology of delivering information, their capability to generate reports, and their capacity for statistical, ad-hoc, or predictive analysis. In addition, the process of selecting a suitable Business Intelligence (BI) tool capable of integrating various disparate business and financial systems is a viable endeavour, as it enables the provision of a cohesive view of the organization's overall performance.

Small, Medium and Micro Enterprises (SMMEs) are crucial catalysts for the economy, assuming a critical function in stimulating innovation and advancing the creation of novel items and socio-economic progress (Kikawa et.al.2019). According to Bordeleau et. al. (2020), it is argued that there is a notable need to enhance the expansion, dissemination of knowledge, and competitiveness of small, medium, and micro enterprises (SMMEs). According to Ain et. al. (2019), there has been a historical focus on business intelligence solutions and technologies that were primarily intended for large organisations. As a result, these solutions were not accessible or suitable for small, medium, and micro-sized enterprises (SMMEs).

This article is structured as follows: after the introduction, there will be a concise overview of the literature pertaining to the technology organisation-environment (TOE) framework in relation to the various stages of Business intelligence adoption. The subsequent section will encompass the research methodology, which will encompass a comprehensive analysis of the results and conclusions. Additionally, this section will also address the limits of the study and provide recommendations for future research endeavours.

## **2. Literature Review**

The SMME sector necessitates a continual enhancement in management efficiency due to the increasing cost pressures. To fulfil these requirements, it is imperative to employ a diverse range of tactics, methodologies, and apparatus. The implementation of business analysis tools, such as Business Intelligence (BI), is a viable approach in the field (Rikhardsson & Yigitbasioglu, 2018).

Therefore, comprehension of the elements that influence the adoption and user acceptance of Business Intelligence (BI) has been a subject of interest for both researchers and practitioners in many organisations, regardless of their size. In this regard, two prominent theoretical foundations have been identified and utilised by scholars and professionals alike (Puklavec et. al. 2018). The diffusion of innovation (DOI) theory and the technology-organisation-environment (TOE) paradigm are recognised concepts in the field. The DOI theory and TOE framework are commonly employed as foundational theoretical frameworks in a range of organisational inquiries and theories (Nguyen & Vu, 2022).

Previous research has examined the adoption of e-commerce from the standpoint of organisations. The study conducted by Putra et. al. (2020) revealed that various factors related to technology, organisation, and the environment significantly contribute to the adoption of e-business among enterprises in Indonesia. These factors include perceived benefits, compatibility, trialability, complexity, and observability in relation to technology; financial resource, innovativeness, and management support in relation to organisation; and competitive pressure, government support, and vendor support in relation to the environment. According to Dahbi et. al. (2019), the adoption of e-commerce is driven by various factors, including technological, financial, cultural, and organisational settings. Among these factors, the technological context is identified as the most significant influencer. The existing body of literature has devoted considerable emphasis to the technological, organisational, and environmental factors as the primary drivers of e-commerce adoption within the business sector.

Cho et. al. (2022) assert that various well-known models are employed to elucidate the process of innovation adoption within the business context. These models include the technology acceptance model (TAM), diffusion of innovation (DOI) (Hiran, 2020), and the unified theory of acceptance and use of technology (UTAUT) (Saliman et. al. 2021). Moreover, the Technology-Organization-Environment (TOE) framework, as suggested by Tornatzky et.

al. (1990), has garnered substantial empirical support across several studies in elucidating the factors influencing the adoption of diverse technologies inside organisations (Maroufkhani et. al. 2022). The validity of this concept is rooted in a comprehensive framework for adopting innovation in a flexible manner, considering significant factors such as technology, organisation, and the environment.

## **2.1. Theoretical Background**

### **2.1.1. The DOI Framework**

The theory of Diffusion of Innovations (DOI) characterises the process through which an innovation is gradually disseminated throughout a social system. The adoption of an innovation is regarded as an integral element within the broader process of dissemination. The DOI hypothesis considers various factors, such as the psychological and personal traits of potential adopters, as well as their perceptions of technology, to analyse the process of diffusion or adoption (Tabim, et. al. (2021). According to Schiffman and Wisenblit (2019), the diffusion of innovations is a macro-level phenomenon characterised by the gradual acceptance of an innovation within a social system. This innovation can take the form of a new product, service, idea, or practise.

The DOI theory conventionally has five distinct steps, including knowledge, evaluation (sometimes referred to as the persuasion stage), adoption (often known as the decision stage), usage (also referred to as the implementation stage), and confirmation. Nevertheless, studies on innovation diffusion often focus on three key stages: evaluation (persuasion stage), adoption (decision stage), and use (implementation step) (Tabim et. al. 2021).

Tabin et. al. (2021) argue that the innovation-decision process model exhibits limitations due to its exclusive focus on the technological components, neglecting other relevant factors. Hence, it is recommended to employ a combination of the D-O-I model and the Technology-Organization-Environment (TOE) framework to obtain a comprehensive understanding of the implementation of vertical integration.

### **2.1.2. TOE Framework**

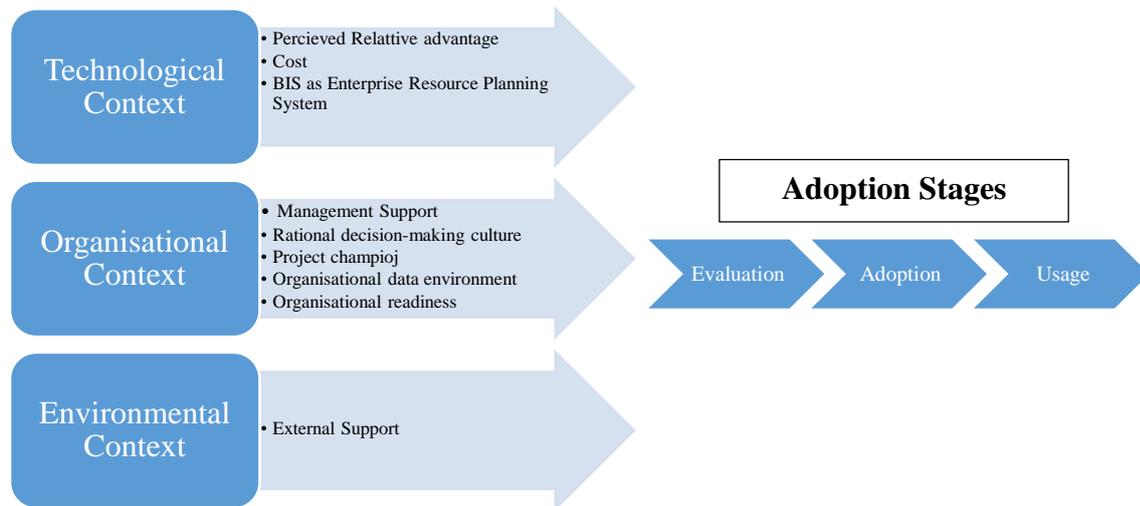
The TOE framework was originally introduced by Tornatzky et. al. (1990) as a comprehensive model for understanding the behavioural goals and implementation of innovation within organisations. The primary advantage of this behaviour model lies in its ability to consider the influence of various factors, both internal and external, on the decision-making process of adopting new practises. Specifically, this model considers three distinct

contextual groups: technology, organisation, and environment. The technical context encompasses both established technologies currently employed by firms and emerging technologies that hold relevance for these firms. The organisational context pertains to the attributes of a firm, such as its scope, size, and resources. On the other hand, the environmental context encompasses the domain in which enterprises operate, encompassing factors such as industry, competitors, and government (Tornatzky et. al. 1990). Tajudeen et. al. (2018) employed the Technology-Organization-Environment (TOE) framework to examine the influence of various factors on social media usage. Specifically, they investigated how technology-related factors (such as relative advantage and compatibility), organisational factors (including top management support and entrepreneurial orientation), and environmental factors (such as institutional pressure) affect the utilisation of social media for the purpose of understanding customer needs and enhancing organisational communication and public relations

## **2.2. Conceptual Framework and Empirical Review**

According to Puklavec et. al. (2018), there is a lack of comprehensive research on the aspects and processes related to the adoption of business intelligence (BI) in small, medium, and micro enterprises (SMMEs). The existing body of research on business intelligence (BI) adoption has primarily focused on large-sized companies. This research aims to identify organisational variables specific to small, medium, and micro enterprises (SMMEs) that may impact the development and implementation of a framework for BI adoption in this context. The existing body of literature appears to provide substantial evidence in favour of adopting the Theory of Everything (TOE) framework, which builds upon and extends the assertions put out by the Diffusion of Innovation Theory (DOI). Therefore, it is advisable to conduct additional research on the topic of innovation adoption using the TOE theory as a theoretical framework. Figure 1 depicts the comprehensive set of elements that necessitate consideration within each of the three settings outlined in the TOE framework. These criteria have been generated from a study conducted by Puklavec et. al. (2018).

**Figure 1:** *The T-O-E Framework*



*(Source: Mavutha et. al. 2023)*

### **2.2.1. Technological Factors**

The Technology-Organization-Environment (TOE) hypothesis posits that the adoption of technology is influenced by several factors. These factors include compatibility, relative advantage, observability, trialability, and. In addition, the adoption of technology is facilitated by the possession of information technology skills and financial resources. Puklavec et. al. (2014) utilised the constructs of cost, relative advantage, and business intelligence system (BIS) within the context of enterprise resource planning (ERP) to investigate the adoption of business intelligence (BI) by small, medium, and micro enterprises (SMMEs) and its subsequent influence on company performance. The primary benefit of a technology such as Business Intelligence (BI) is in its ability to enhance operational efficiency. According to previous studies on information systems (IS) adoption, the relative benefit of business intelligence (BI) has been identified as a significant predictor (Thomas and Espadanal 2014; Tsai, Lee and Wu 2010; Premkumar and Roberts, 1999; Oliveira, and Thong, 1999 as quoted in Puklavec et. al .2018). The favourable perceptions on the advantages of business intelligence (BI) have a direct impact on the level of software adoption inside small, medium, and micro enterprises (SMMEs). Considering the requirement for business owners/managers to ascertain the benefits of business intelligence (BI) prior to contemplating its implementation, it is imperative that any favourable impact on BI adoption in this context be duly acknowledged during the evaluation phase. Nevertheless, the theory posited by Puklavec et. al. (2018) was refuted in their study, which examined the relationship between relative advantage and BIS adoption during the adoption phases.

The adoption of Business Intelligence Systems (BIS) continues to face significant obstacles, with cost being a prominent barrier (Hameed et. al. 2012). To make informed decisions, organisations must carefully consider the costs and benefits associated with implementing BIS (Puklavec et. al. 2014). This entails evaluating the long-term advantages of their BI investment in relation to the immediate expenses incurred (Chong and Chan, 2012). Puklavec et. al. (2018) conducted an observation and found that their understanding of the factors influencing the stages of Business Intelligence (BI) system adoption for Small and Medium Enterprises (SMEs) contradicts the notion that cost serves as a predictor for BIS adoption. Although the researchers initially hypothesised a positive correlation between cost and all stages of adoption, their findings indicate that cost does not have a statistically significant impact on explaining BI assessments and usage. However, it does have a substantial negative relationship with adoption.

### **2.2.2. Organisational Factors**

Puklavec, et. al. (2014), management support positively affects BIS appraisal, implementation, and use. Puklavec et. al. (2014) found that management assistance positively impacts appraisal and utilisation in SMEs. No significant association was discovered with adoption.

A rational decision-making culture values monitoring, evaluating, and assessing quantitative data across the firm. This culture encourages data and information utilisation for work processes and analysis (Kulkarni et. al. 2017). Previous research found that company culture accelerates BIS adoption (Gu et. al. 2012). Popovic et. al. (2012) found that fact-based decision-making culture affects BIS use, while Frambach and Schillewaert (2002) found that SMMES become aware of technological innovations and develop an evaluation strategy during the adoption process. Puklavec et. al. (2018) predicted that a culture of logical decision-making in businesses benefits the evaluation stage. But rational decision-making culture has a negative and significant link with evaluation, but not with adoption and use. The company's data environment is also important. Puklavec et. al. (2018) define an organization's data environment as its access to information about data quality, availability, and loading for BIS input. Organisational data environments require data resource management to reduce costs, expand access to previously inaccessible data, analyse and distribute information through IT applications. Poorly managed data environments affect accessibility, quality, integrity, security, and information standards. A poorly managed data environment could cause problems when implementing BIS (Popovic et. al. 2012). BIS relies significantly on data integration.

Puklavec et. al. (2018) state that using the organisational data environment is beneficial, but evaluation and adoption are not. Organisational readiness may be a key factor in determining the BI adoption behaviour of SMMEs, not just during the adoption stage but also during the assessment stage (Ifinedo 2011; Grandon and Pearson 2004; Quaddus and Hofmeyer 2007). This is due to better prepared SMMEs being less threatened by the BIS. Furthermore, within the implementation stage, businesses that can afford more advanced BIS are more likely to experience greater benefits from use of BI (Puklavec et. al. 2014).

### **2.2.3. Environmental Factors**

External support supports BI acceptance, implementation, and use. Puklavec et. al. (2018) found that none of the three phases of adoption related to external help are relevant for the environment.

External factors—environmental contexts—influence company BI adoption. These include customers, competition, market structure, industry traits, and government rules (Hatta et al. 2015). Strong rivalry can force a company to pursue novel business tactics, yet copying other companies' strategies may cause it to eventually adapt and resemble others. Each organisation must have a unique competitive edge (Ifinedo 2011). Customers in the environmental setting indicate the firm's desire to improve customer services with BI and clients' desire to adopt BI (Boonsiritomachai et. al. 2016). Environmental factors including market and industry characteristics affect technology adoption. These causes include market complexity needs and industry organisation activities to declare innovative standards and promote acceptance. Competitive pressure and market trend expectations may force organisations to implement innovations (Chong et. al. 2009).

Business partners may influence innovation adoption because new technology improves their interactions and transactions (Ifinedo 2011). BI adoption also faces rational trust, the notion that one organization will not exploit another's flaws. Legal constraints may also impact adoption due to environmental factors (Puklavec et. al. 2014). Without restrictions, organisations are subject to fraud and hacks, which can delay technology adoption. Government support, defined as "help offered by the authority to foster the development of BI technologies in firms," also affects this industry (Ifinedo 2011). If SMMEs have vendor or outside support for the innovation, they are more likely to try it. Vendor and government support predict BI adoption most (Basole et. al. 2013).

### **3. Research Methodology**

The methodology was established to achieve several goals and subgoals. The study sought to explore how micro-small apparel businesses in the wider eThekweni region implement BI.

#### **3.1. Research Design**

This research used a quantitative cross-sectional design to analyse population data at a certain time. Simkus (2021) notes that analytical cross-sectional studies examine two parameters' associations. Dos Santos et. al. (2021) note that quantitative business research is most common. Quantitative approaches offer numerical data for statistical analysis of trends. Descriptive cross-sectional studies characterise and analyse the prevalence and distribution of one or more outcomes in a population. This quantitative cross-sectional study examined a population at a specific moment. This study used descriptive and analytical cross-sectional designs. Analytical cross-sectional studies examine the relationship between two variables to characterise and evaluate the frequency and distribution of one or more outcomes in a specific population. Descriptive cross-sectional studies measure a trait's prevalence, extent, or severity across a demographic (Simkus 2021). A cross-sectional study is chosen because it is cheaper and faster than other types of research. Surveys can reveal population features and suggest relationships (Thomas, 2021).

#### **3.2. Population and Sampling**

The eThekweni Micro Enterprise Support established the Informal Economy Support Programme (IESP), a first for South Africa, hence the researcher chose the region as the population sample. This is a specific business support project that helps micro and informal enterprises (MIEs) grow and create jobs in innovative and cost-effective ways. Although the informal sector is crucial to joblessness and economic growth, MIEs have received little support until recently, making the IESP strategically significant.

This study used non-probability sampling. Dos Santos et. al. (2021) list six non-probability sampling types: quota, purposive, convenience, theoretical, opportunistic, and snowball. This study used purposeful sampling from these numerous methods. McCombes (2019) defines purposeful sampling as judgmental sampling in which the researcher uses their experience to identify a sample that will best serve their study goals.

Purposive sampling aims to strategically sample cases/participants to answer research questions, according to Aardt et. al. (2021). The researcher can make sure the sample has enough variation in essential traits (Aardt et. al. 2021). For this study, the researcher visited

firms in several market segments to gather data on attributes. The companies visited varied from high-end La Lucia to low-income Umlazi. The starting sample for this study was 200 apparel businesses registered at the KZNFC in 2019. Overall, 132 apparel companies were interviewed.

### **3.3. Data Collection and Data Analysis**

A Likert scale questionnaire survey was used to obtain data from participants in a cross-sectional study.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Slightly Agree
- Agree
- Strongly Agree.

The researcher visited several micro-small garment business owners in eThekweni to collect data. We conducted a pilot study to ensure content and face validity. Many colleagues and associates were invited to read the questionnaire. Research specialists and academicians were among these. After making a few changes, the researcher submitted the questionnaire to several possible responders to assess for understanding, ambiguities, and completion time.

This quantitative study used descriptive and inferential statistics. Data was analysed and presented using frequency and cross tabulations. This section describes how the data was prepared and the numerous tests used to assess it. Data analysis was done with SPSS 13.0. The study used numerous tests to reach its goals. Results were shown in tables and charts.

### **3.4. Ethical Considerations**

Durban University of Technology (DUT) ethics committee approved this investigation. Participants received a letter requesting permission to perform the study in their workplace, a letter of information, and a consent letter at the start of the survey. Every participant was given a defined research purpose. The topic may not be controversial, but participants were given anonymity and confidentiality.

## **4. Data Analysis and Findings**

### **4.1. Existence of Factors in the Businesses**

A final analysis was carried out to determine any significant agreement or disagreement as to the existence of the independent and dependent factors in the businesses. The results are presented in Table 1 indicating any significant agreement or disagreement as to the existence of the independent variables and dependent variables.

**Table 1:** *Significance of Independent Variables and Dependent Variables*

Variables	Statements	Significance	t	Mean	Std Dev	df	p
<b>Independent</b>	Perceived Relative Advantage	Agreement	24.450	4.9563	.75340	1.45625	p<.005
	Costs	Agreement	6.714	4.1406	1.20686	.64063	p<.005
	Organisational Readiness	Agreement	7.467	4.1708	1.13639	.67083	p<.005
	Rational Decision-making Environment	Agreement	17.438	4.8667	.99137	1.36667	p<.005
	Management Support	Agreement	4.524	4.0281	1.47649	.52813	p<.005
	Organisational Data Environment	Disagreement	-4.712	3.0813	1.12419	-.41875	p<.005
	Environmental Support	Disagreement	-5.256	3.0036	1.18824	-.49375	p<.005
<b>Dependent</b>	Evaluation	Agreement	1.715	3.6850	1.36452	.18500	.088
	Adoption	Agreement	1.673	3.6575	1.19103	.15750	.096
	Usage	Disagreement	-.647	3.4281	1.40450	-.07187	.518

*(Source: Self/Authors' Own Illustration)*

According to Table 5, the first five constructs for the independent variables show significant agreement, which indicates that respondents agree that perceived relative advantage, costs, organisational readiness, rational decision-making environment, and management support have a positive influence on the adoption of BI. However, the study found that that organisational data environment and environmental support have a negative influencing on BI adoption. This study also found that none of the three dependent variables namely evaluation, adoption and usage are significant, indicating that there is no conclusive evidence that BI is being evaluated, adopted or used by respondents.

## 5. Discussion

With regards to the evaluation of BI, the findings from this study match those of previous studies worldwide. In the eThekweni region, most individuals had not tested BI. Since most of these businesses are sole proprietorships with 1-5 employees, limiting resources may be the hinderance. A trial run may take them a long time. It is interesting that perceived relative

advantage does not affect appraisal since most respondents had examined BI benefits and practicality. Contrary to the results, SMMEs do not see the relative benefit of BI evaluation. Afolayan and de la Harpe (2019) observed that SMMEs cannot evaluate BI to help their business due to a lack of knowledge and comprehension. Due to their fast-paced production and customer demands, micro-small apparel owner/managers may not have time to train one or two staff members on new technological systems. The results showed that cost had a negative link with adoption, but most respondents said they could make financial plans to implement BI and that it might be cost-effective for their organisations. Despite these findings, several firms still lack finance. Several studies found that positive owner/manager perceptions of BI and how it fits into the organisational work environment reinforced their willingness to adopt BI. Jaklica et. al. (2018) also found that peer support, management incentives, organisational support, and BI visibility, improves employee perceptions of BI adoption. . This study found that organisational data environment, organisational readiness, perceived relative advantage, and management support positively influenced adoption.

Usage results support previous findings that a data-driven BI culture influences managerial data insights and analytical decisions. BI use is heavily influenced by organisational culture and data settings. Organisational data environment involves transparency, open reporting, and error and failure disclosure. Developing a data-driven culture and management support significantly impact BI utilisation, as supported by prior studies (Grublješič and Jaklič, 2015; Puklavec et. al. 2018). It's intriguing that perceived relative advantage negatively affects usage and appraisal but positively affects adoption. The notion is that adoption differs from usage because innovation advantages drive adoption. But when BI is deployed. The abundant information that comes with BI implementation and ease of use could contribute to this detrimental association. Previous study has highlighted confusion and misconceptions about perceived relative advantages, which can lead to lack of direction and organization-wide decision-making.

## **6. Conclusion**

Given the integration of empirical research findings described within this research it is pertinent to explore the necessity of business intelligence (BI) for small, medium, and micro enterprises (SMMEs), despite its well-documented advantages for larger businesses. Small, Medium, and Micro Enterprises (SMMEs) have demonstrated a propensity for assessing and opting to adopt Business Intelligence (BI) solutions. Nevertheless, a notable proportion of

SMMEs have encountered difficulties in effectively executing BI within their operations. Hence, it is strongly recommended to conduct a study to examine the necessity of Business Intelligence (BI) for the sustainability of Small, Medium, and Micro Enterprises (SMMEs). One suggested research objective for this study would be to ascertain the success metrics of small, medium, and micro enterprises (SMMEs) who employ business intelligence (BI) systems, in contrast to SMMEs that have not adopted BI.

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