

Determinants of BIS adoption by SMME grocery retailers in Tshwane Metropolitan Municipality



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Background: Fourth Industrial Revolution (4IR) technologies drive business transformation; yet, small, medium and micro enterprises (SMMEs) in the Tshwane Metropolitan Municipality grocery retail industry lag, thus calling for further scrutiny and solutions to accelerate business intelligence systems (BIS) adoption.

Aim: This research intends to determine the impact of thoughtfully chosen variables on BIS adoption among SMMEs in the grocery retail industry within three selected regional zones in Tshwane Metropolitan Municipality, South Africa, and presents an all-embracing framework to assist SMMEs in adopting BIS.

Setting: The information utilised in this research was gathered from 275 SMME owners and managers from three selected regional zones in Tshwane Metropolitan Municipality.

Methods: A quantitative research method underpinned this study. Data collection was conducted through self-administered questionnaires utilising multistage sampling techniques. For data analysis, structural equation modelling (SEM) was employed to determine the model fit and evaluate the suggested hypotheses.

Results: The findings revealed that task technology fit, perceived ease of use, BIS characteristics, perceived usefulness, task characteristics and trialability positively influence BIS adoption. Observability did not influence BIS adoption. Out of the seven hypotheses, six were accepted.

Conclusion: The results of this research are informative and crucial for policymakers in various government entities, SMME owners and managers and other stakeholders seeking better ways to promote the growth of SMMEs and bolster service provision through integrating BIS technologies.

Contribution: The results helped to close the literature gap by illuminating the relevant methods for speeding up BIS adoption by SMMEs in the grocery retail industry.

Keywords: adoption; 4IR; business intelligence systems; SMMEs; technology-acceptance; grocery retailers; South Africa.

Introduction

Small, medium and micro enterprises (SMMEs) are not just businesses; they are the backbone of sustainable livelihoods and employment creation and contribute towards gross domestic product (GDP) in most emerging markets (Ayalu, Abbay & Azadi 2023). Their flourishing and sustainable growth is not just crucial but urgent for employment creation, empowering, revitalising and uplifting the socio-economics of local communities (Fiseha & Oyelana 2015). In other nations, SMMEs are the primary source of income, a hub for creativity and business growth and a catalyst for generating wealth (Marughu & Akintoye 2023). However, SMMEs in South Africa face various challenges, ranging from low capitalisation, high staff turnover, constrained innovation because of inadequate financing, a shortage of market access and high failure rates, which makes it very hard for most of them to compete nationally, regionally and internationally with large businesses (Zahoor et al. 2024). A significant limitation is the need for more integration of business intelligence systems (BIS) tools into their business operations.

The definition of SMMEs varies depending on the regulations of a country, and they are classified according to their revenue, size and assets. The Department of Small Business Development (DSBD) (2023) describes an SMME in the grocery retail industry in South Africa

as an organisation that employs less than 50 employees and has an annual turnover of between R2.4m and R3.5m. In addition, the DSBD (2023) estimated that only 30% of the 3.3 million SMMEs in South Africa are formal business entities, while the vast majority are informal operators like street vendors, spaza shops and businesses run from the back of the house. Formal SMMEs usually have an organisational South African Revenue tax number, pay tax returns and operate at an identifiable physical address (Bhorat et al. 2018). Being informal exacerbates the chances of most SMMEs not securing capital to grow their businesses, thus rendering them less competitive.

Adopting innovative business intelligence tools offers excellent opportunities for grocery retailers to gain a deeper insight into customer purchasing habits, boost sales numbers, boost profits and lower operational expenses (Wu, Yan & Umair 2023). Thus, BIS-like point-of-sale (POS) systems and inventory optimisation analytics become useful tools for long-term business survival and growth. Typical examples of the widely used POS BIS in South Africa are Square software, National Retail Solutions and POS Nation system. These systems offer features such as inventory management for the back-end control of stock levels, as well as front-end features like instant bar-coding sales at the till-point and competitive marketing loyalty management (Kellermayr-Scheucher, Hörandner & Brandtner 2022). While some grocery retailers know BIS technologies and their benefits, most SMMEs need more resources and affordability to adopt them (Gomwe, Potgieter & Litheko 2023). The growing demand for data-driven solutions at every level of business calls for SMMEs in the retail industry to keep pace with technological innovations for competitive advantage through adopting BIS systems (Rana et al. 2022). Stjepić, Pejić Bach and Bosilj Vukšić (2021) argue that some SMMEs find it difficult to adopt innovative BIS tools because of high licence costs and technical knowledge required to run such systems. Moreover, various scholars posit that the operations and implementation of BIS in the SMME grocery retail industry within the Tshwane Metropolitan Municipality are affected by technological, organisational and policy factors that are complex, under-researched and require further scrutiny (Mkansi & Nsakanda 2025; Sibiya, Van der Westhuizen & Sibiya 2023).

Equally, BIS continues to be a key focus for businesses to obtain practical insights, reply promptly to clients and stay significant in the growing competitive market landscape (Wang et al. 2022). In today's competitive and dynamic business terrain, most businesses leverage the power of BIS technology for success and growth (Ain et al. 2019). Thus, BIS is critical in aiding strategic planning and enhancing operations (Chaudhuri et al. 2024). Through the provision of features like big data analytics, businesses can acquire worthwhile insights that enhance decision-making, streamline operations and generate additional revenue (Wang et al. 2022). Earlier research indicates that SMMEs play a role in boosting the economy of South Africa

(Enaifoghe & Vezi-Magigaba 2023; Matekenya & Moyo 2022). According to the Small Enterprise Development Agency (SEDA) (2023), SMMEs serve as South Africa's key contributors to comprehensive economic advancement and progress.

Small, medium and micro businesses contribute considerably to the South African economy, and adopting BIS technologies may aid their productivity and efficiencies, resulting in economic growth (Kahn, Sithole & Buchana 2022). In the current customer-focused, digital-first environment, numerous business leaders and administrators feel inundated with information and look for creative methods to gain enhanced control, insight and competitive advantage from institutional data (Gauri et al. 2021). A potential solution to this escalating issue is through BIS implementation and seeking funding or incubation programmes (SEDA 2023). Nonetheless, numerous businesses have been hesitant to embrace BIS because of insufficient understanding of its components, how to initiate it and the timeframe required to observe any advantages (Stjepić et al. 2021). Business intelligence systems plays a crucial role in aiding policymaking to enhance managerial efficiency (Alzghoul et al. 2024; Wang et al. 2022). Trustworthy data and information underpin every strategic management choice (Matheus, Janssen & Maheshwari 2022). Business intelligence systems enable organisations to extract significant insights from vast amounts of data instantly. As the power of BI technologies yield dividends, businesses are increasingly depending on these systems to assist in lowering operational expenses and increasing revenues (Hossain, Yoshino & Taghizadeh-Hesary 2021). Gaining sufficient information is essential for any organisation to maintain a competitive edge; thus, an organisation must implement BIS to achieve an advantage over its competitors (Stjepić et al. 2021).

Various scholars have suggested that SMMEs are confronted with many challenges that they often cannot resolve themselves, as alluded to in this section (Mkansi & Nsakanda 2025; Sibiya et al. 2023; Zahoor et al. 2024). In response, the South African government, over the years, developed various initiatives and schemes to assist SMME business growth (SEDA 2023). These include 2 years to 3 years of business incubation, soft grants, market access, inclusivity and diversity, skills development through mentorship and training, subsidies, loans and technology for sustainable livelihoods (Bolosha, Sinyolo & Ramoroka 2023).

While there is much research done on SMMEs that highlight the importance of business management, training and the unique characteristics of SMMEs (Bolosha et al. 2023; Matekenya & Moyo 2022), there is not much attention given to the extent of BIS adoption and utilisation and the possible benefits of BIS in enhancing innovation, efficiencies and competitiveness in the highly competitive SMME grocery retail industry in South Africa (Gomwe et al. 2023; Khoase et al. 2020).

Therefore, given the substantial contributions of SMMEs to the South African economy, employment creation and socio-economic well-being of communities and their reported struggles to adopt BIS systems, this study highlights the importance of establishing the drivers of BIS adoption by SMMEs. This research determines the impact of thoughtfully chosen variables on BIS adoption among SMMEs in the grocery retail industry within three selected regional zones in Tshwane Metropolitan Municipality, South Africa, and presents an all-embracing framework to assist SMMEs in adopting BIS. Consequently, the subsequent research enquiries direct this research:

- Which elements affect BIS implementation by SMMEs in Tshwane Metropolitan Municipality?
- How can the government assist SMME grocery retailers in ensuring their survival and expansion in Tshwane Metropolitan Municipality?

The article is structured as follows: firstly, the literature review and theoretical foundation are outlined; secondly, a conceptual framework and suppositions are provided. The study methodology is implemented, resulting in the findings, discussions and conclusions.

Theoretical underpinnings and hypotheses

This study is guided by three models: the diffusion of innovation (DOI), task–technology fit (TTF) and technology acceptance. These models were selected based on their widespread usage in similar studies (Raj et al. 2024; Yang et al. 2023). Selected and pertinent constructs were drawn across from these three models to come up with this study's conceptual framework as discussed next.

Diffusion of innovation

The DOI model explores four elements: social system, communication channels, innovation and time, which affect digital transformation in organisations (Kaminski 2011). Mamun (2018) indicates that the spread of innovation emphasises an information-based perspective on the adoption of technology grounded in five characteristics: complexity, observability (OB), compatibility, relative advantage and trialability (TB).

Observability refers to citizens' perceptions of the benefits that a system presents (Mamun 2018). In the meantime, relative advantage refers to how much an innovation is viewed as superior to the concept it replaces. Trialability is the degree to which organisational employees test a system to establish its benefits. Compatibility is the extent to which a system can be readily incorporated with current systems and satisfy the requirements of prospective users. Finally, complexity refers to the comparative level of difficulty in comprehending and utilising a technological innovation. Thus, this study draws OB and TB from the DOI model as postulated:

H1: Observability positively influences BIS adoption in SMME grocery retail.

H2: Trialability positively influences BIS adoption in SMME grocery retail.

Technology acceptance model

Technology acceptance model (TAM) predicts users' acceptance of technological innovations (Davis 1993). The TAM model identifies two contract variables that impact people's decisions to adopt any technological innovation. These are perceived ease of use (PEOU) and perceived usefulness (PU). Perceived ease of use refers to how much a person thinks that utilising a specific system would require little to no physical and mental effort (Davis 1993). In comparison, PU refers to the extent to which a person believes that utilising a specific system would improve his or her work performance. Technology acceptance model suggests that the perceived simplicity of using a BIS directly affects its PU, which together influence a person's intention to utilise the system (Kaur & Arora 2020). Therefore, this study hypothesised that:

H3: Perceived ease of use of BIS has a positive effect on BIS adoption.

H4: Perceived usefulness of BIS has a positive effect on BIS adoption.

Task–Technology Fit model

The TTF model holds that there should be an alignment between an individual performance and IT capabilities to yield a positive impact (Howard & Rose 2019). Thus, any technological innovation should align well with the tasks it facilitates to positively affect user performance (Abrokwah-Larbi & Awuku-Larbi 2024). The TTF model consists of five elements: task features, technology features, task–technology alignment, performance and usage. Mamun (2018) proposes that to enhance BIS uptake within organisations, the capabilities of BIS must align with the requirements of the users' tasks. Therefore, in line with TTF, three hypotheses were proposed:

H5: BIS characteristics (BISC) positively impact TTF.

H6: Task characteristics (TC) positively impact TTF.

H7: Task–technology fit positively impacts BIS adoption.

Research model

Based on the analysed literature, the DOI, TAM and TTF models, this study proposed a conceptual framework for adopting BIS systems in the SMME grocery retail industry (see Figure 1). Only those constructs pertinent to BIS adoption in the South African grocery retail industry were selected to form the conceptual framework in Figure 1. Tselentis, Vlahogianni and Karlaftis (2015) assert that this mixing of carefully selected constructs offers an excellent understanding of BIS adoption by users compared to a single viewpoint. Consequently, the proposed model seeks to elucidate the elements that affect BIS adoption within the South African SMMEs grocery retail industry.

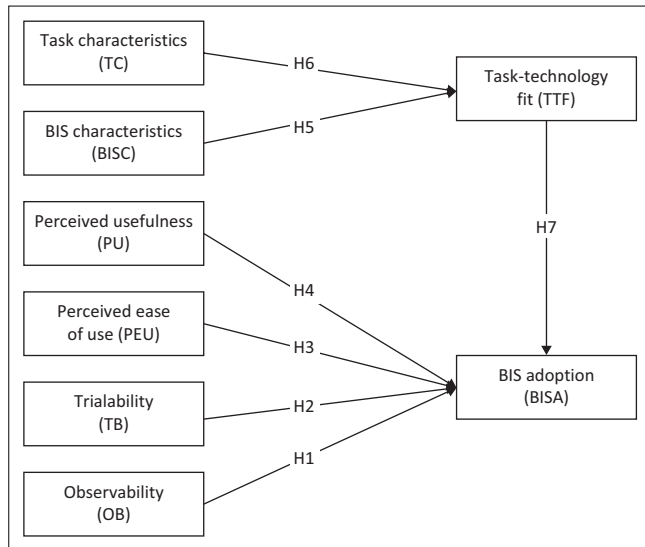


FIGURE 1: Research model.

Research methods and design

This study uses a quantitative and deductive inquiry (Johnson & Christensen 2024). The choice of using a quantitative and deductive inquiry in this research is consistent with prior research on intelligent technology adoption in SMMEs (AlZayani, Mohammed & Shoaib 2024; Mishrif & Khan 2023). The precise number of SMMEs in Tshwane Metropolitan Municipality is not readily available because of the complex nature of identifying the informal players (sometimes unregistered) that dominate the grocery retail industry (Shibiti, Masabo & Ladzani 2023).

However, according to SEDA (2023), there were 1 005 288 SMMEs across all industries in the Gauteng province in 2022. Of these, only 376 959 were classified under the retail and accommodation industry, which includes the grocery retail industry. Self-administered, structured questionnaires were used to gather quantitative data from 300 formal SMME grocery owners and managers from three selected regional zones in the Tshwane Metropolitan Municipality, South Africa. The participants completed the questionnaires without the assistance of the researcher as recommended by Bell, Harley and Bryman (2022) and Fink (2024). This work emanates from the main researcher's master's dissertation, and as such, no field workers were used in this study. The questionnaires were distributed in-person at various locations and shops, and the participants were given between 1 day and 2 days to complete the questionnaire. The researcher recorded the physical address for each participant for later collection of the completed questionnaire. The researchers then made a follow-up to collect all the distributed questionnaires.

Multiphase sampling techniques were utilised to choose the 300 respondents. Firstly, purposive sampling was utilised to choose three significant regions out of the six in the Tshwane Metropolitan Municipality of the Gauteng province. These were Region 1 (focusing on the Soshanguve township),

Region 3 (focusing on the Pretoria central business district [CBD]) and Region 6 (focusing on the Pretoria East). These areas were chosen because of their differing economic growth, urban township versus affluent suburb environments, visibility and use of technologies in business at different levels (Masenya 2023). Secondly, purposive and random selection methods were employed to select the ultimate participants from the three regions, considering their lived experience with BIS systems. To mitigate any possible bias when self-administering the questionnaires, a neutral set of questions was set and completed by participants requiring no guidance from the researchers. The study included SMME owners and managers above 18 years old. Before completing the questionnaire, each of the 300 participants was asked to complete an informed consent letter laying out their ethical rights for participating in the study.

The questionnaire for this study had two major segments: The first section collected demographic data, while the second section B comprised five five-point Likert scale questions assessing the eight aspects proposed in Figure 1. The set of questionnaire items was tailored to this inquiry based on previous enquiries on BIS adoption by SMMEs (Fauzi & Sheng 2022; Ng, Kee & Ramayah 2020; Puklavec, Oliveira and Popovič 2018). The survey instrument was piloted with 15 individuals who had prior knowledge of utilising BIS. The final survey questionnaire incorporated suggestions from the trial run.

Data gathering took place for 12 weeks across the three Tshwane Metropolitan Municipality regions. The IBM SPSS AMOS version 29 was used for data analysis and to validate the proposed research model. The structural equation modelling (SEM) approach enabled the refining of the conceptual model using confirmatory factor analysis (CFA) and various model fit indices as explained in the following section.

Ethical considerations

Ethical clearance to conduct this study was obtained from the University of Venda Research Ethics Social Sciences Committee (No.: SMS/20/BIS/05/0807).

Results

Data analysis

Data cleaning, common methods bias and univariate normality procedures

Following Mardia, Kent and Taylor's (2024) suggestion, all 300 collected questionnaires were scrutinised for either non-response sections or erroneous completion. Of the 300 questionnaires gathered, 275 were utilised in the data analysis. Twenty-five were not completed in full and were excluded from data analysis, thus giving a 91.7% overall response rate, sufficient for quantitative data analysis and following Wu, Zhao and Fils-Aime's (2022) suggestion of an 80% response rate.

Harman's single-factor (HSF) test was used to establish any method discrepancies leading to performing CFA to determine common method variance. The rule of thumb for the HSF test is that the eigenvalue of the primary component must be under 50% to suggest that common method bias is not present (Kock, Berbekova & Assaf 2021). The first main factor was separated, accounting for just 13.56% of the variance. Therefore, many factors contributed to the unexplained variance, leading to the absence of common method bias.

Pearson's first parameter test for skewness and kurtosis assessed this study's normality of the single-variable distribution because the sample size was 300 and ideal (González-Estrada, Villaseñor & Acosta-Pech 2022). The study's skewness assessments vary from 0.0145 to 1.068, with the kurtosis results varying between -0.015 and 1.078. Therefore, both kurtosis and skewness results were within the ± 3 recommended bounds (Seijas-Macias, Oliveira & Oliveira 2023).

Descriptive analysis

The respondents consisted of 57.09% males and 42.91% females. Age-wise, 31.64% were aged between 30 years and 39 years, while 40 years to 49 years constituted 28%, and 22.18% were between 20 years and 29 years. The 50 years and above age category scored the lowest response (18.18%). Business managers constituted 32.4% of the participants, whereas 29.5% were business owners. Small, medium and micro businesses operated and managed by their owners in the Tshwane Metropolitan Municipality constituted 17.5%. Most SMMEs (34.5%) were run by managers, 29.5% by the owner and the remaining 20.7% responded to the 'Other' option, which were ordinary staff in the business. Regarding BIS experience, 32.36% had 2–5 years of using BIS, 24.73% had 5 and above years, while the 2 and below years constituted 26.91%. Only 16% lacked experience in using BIS. The survey found that 39.6% of SMMEs employed between 10 and 30 employees, and 36.9% employed below nine workers. Only 13% of SMMEs hired more than 50 workers. With regard to academic qualifications, 48% hold diplomas, 28.7% had matric certificates, while those with a postgraduate certificate or diploma constituted 10%. Those with a university degree constituted 9%. The respondents who had no educational qualification constituted 3.6%.

Measurement model analysis

Confirmatory factor analysis was used in this study to evaluate the internal consistency of the measurement model. Standardised factor loadings, average variance extracted (AVE) and construct reliability were utilised to assess convergent validity (Mardia et al. 2024). Table 1 displays the construct reliability test results. Factor loading values for all construct items for this study range from 0.70 to 0.95, thus falling above the greater-than -0.50 recommended score (Mardia et al. 2024). To establish the internal consistency of variables, this research used

TABLE 1: Reliability test results for the study.

Constructs	Factor loadings	Construct reliability	AVE
Acceptable level	≥ 0.50	≥ 0.700	≥ 0.500
OB			
OB1	0.78	0.881	0.690
OB3	0.93		
OB4	0.84		
TB			
TB1	0.80	0.970	0.702
TB2	0.79		
TB4	0.89		
PEOU			
PEOU2	0.81	0.863	0.666
PEOU3	0.90		
PEOU4	0.85		
PU			
PU1	0.90	0.794	0.605
PU3	0.70		
PU4	0.82		
PU5	0.79		
BISC			
BISC2	0.77	0.801	0.708
BISC3	0.93		
BISC4	0.78		
TC			
TC1	0.90	0.712	0.599
TC2	0.81		
TC3	0.84		
TTF			
TTF1	0.95	0.963	0.732
TTF3	0.81		
TTF4	0.97		
BISA			
BISA2	0.84	0.852	0.698
BISA3	0.78		
BISA5	0.76		

AVE, average variance extracted; OB, observability; TB, trialability; PEOU, perceived ease of use; PU, perceived usefulness; BISC, BIS characteristics; TC, task characteristics; TTF, task-technology fit; BISA, BIS adoption; BIS, business intelligence systems.

construct reliability analysis. All the values for the construct items were above the recommended 0.70 value, thus demonstrating good construct reliability.

This study used AVE to validate the convergent validity of all variables. All AVE results should be above 0.50 to confirm that each construct exhibits a more significant variance in its measurements than the other underlying constructs (Cheung et al. 2024). Table 1 illustrates that the results for all AVE values were above the rule of thumb, thus demonstrating no convergent validity issues.

Discriminant validity was performed to verify the uniqueness of first-order factors (constructs), ensure that each differed from the rest of the constructs and measure specific phenomena under investigation (Cheung et al. 2024). Fornell-Larcker's criterion of cross-loadings was used in this study to establish discriminant validity (Fornell & Larcker 1981). To establish discriminant validity, the outer loadings of each first-order construct on its related construct must exceed those of the other related constructs (Rönkkö & Cho 2022), that is all values in brackets on top of each column are greater than any values

in the same column. Table 2 shows that the square root values (outer loadings) are above the correlations of the rest of the constructs, therefore, showing acceptable convergent and discriminant validity for the measurement of constructs.

Structural model analysis

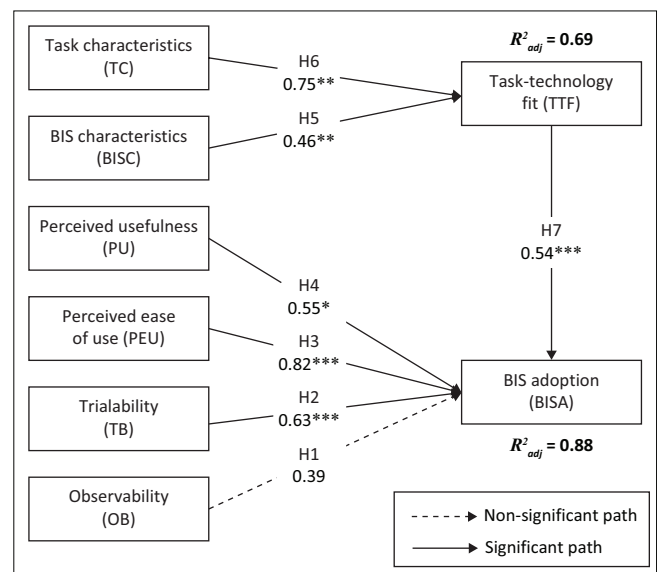
Various fit indices were used in this study to establish the overall model fit. The Chi-square (χ^2) statistic was 498.27, having 335 degrees of freedom, and a p -value significant at < 0.05 . The proposed research model obtained a 1.78 chi-square over degree of freedom value, which is within the acceptable range of 1–3 (Cheung et al. 2024). This research used different measures to evaluate the overall model adequacy. The normed-fit index value (NFI) of 0.988, a comparative fit index (CFI) of 0.955 and a goodness-of-fit index (GFI) value of 0.975 were obtained. The scores for NFI, CFI and GFI surpassed the recommended 0.90 value (Kline 2023). The index of fit (IFI) score was 0.988, while the Tucker–Lewis index (TLI) was 0.992, and both were above the 0.95 golden rule (Cheung et al. 2024). A root-mean-square-error of approximation (RMSEA) score of 0.03 was obtained, thus demonstrating excellent model fit (i.e. lower than 0.08) (Goretzko, Siemund & Sterner 2024). The Adjusted Goodness-of-Fit Index (AGFI) value of 0.890 obtained in this study was higher than the recommended 0.80 threshold for goodness-of-fit (Cheung et al. 2024).

Model path and hypotheses testing

This part assesses the significance of each proposed hypothesis by examining the path coefficients of the construct variables. A combination of criteria was used for

this analysis. For a path coefficient to be significant, its p -value should be less than 0.05, and its t -value should exceed 1.96 (Hair, Howard & Nitzl 2020). All hypotheses, except H1, had t -values significant above the 1.96 rule of thumb. H1 had a non-significant t -value of 1.64. Thus, hypotheses H2–H7 were accepted; however, H1 was rejected (see Table 3).

According to the results shown in Table 3, the proposed research model illustrated in Figure 1 was improved. Figure 2 shows that 88% of the variations among the seven endogenous constructs can be attributed to SMMEs' adoption patterns of BIS systems. This finding shows that the proposed model



*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$.

FIGURE 2: Refined structural model.

TABLE 2: Descriptive analysis.

First-order factors	Mean	SD	OB	TB	PEU	PU	BISC	TC	TTF	BISA
OB	3.4965	1.8479	(0.9532)	-	-	-	-	-	-	-
TB	2.6991	1.7310	0.369*	(0.8971)	-	-	-	-	-	-
PEU	3.5563	2.0357	0.218**	-0.170**	(1.0000)	-	-	-	-	-
PU	4.8250	0.6803	-0.309*	-0.252**	-0.242*	(0.9578)	-	-	-	-
BISC	1.3052	0.3662	0.221**	-0.068	0.505**	0.330**	(0.7745)	-	-	-
TC	2.6904	1.8479	0.324**	0.395**	-0.341**	-0.607*	0.388**	(0.8850)	-	-
TTF	5.2011	0.7855	0.572**	0.412**	-0.512**	-0.375*	0.420**	0.362**	(0.7901)	-
BISA	5.0276	0.9900	0.377**	0.312**	-0.141**	-0.242*	0.213**	0.225**	0.426**	(0.8348)

Note: Diagonal elements (bracket values) = first-order factor construct reliability.

SD, standard deviation; OB, observability; TB, trialability; PEU, perceived ease of use; PU, perceived usefulness; BISC, BIS characteristics; TC, Task characteristics; TTF, task–technology fit; BISA, BIS adoption; BIS, business intelligence systems.

**, Significant at 0.01 level (two tailed); *, Significant at 0.05 level (two tailed).

TABLE 3: Hypotheses testing results.

Hypothesis	Path	Regression weights	SE	t -value	β	Sig. level	Hypothesis accepted?
H1	OB → BISA	0.25	0.02	1.64	0.39	-	No
H2	TB → BISA	0.59	0.12	5.22	0.63	***	Yes
H3	PEU → BISA	0.60	0.25	3.71	0.82	***	Yes
H4	PU → BISA	0.72	0.06	4.23	0.55	0.02*	Yes
H5	BISC → TTF	0.43	0.04	5.01	0.46	0.01**	Yes
H6	TC → TTF	0.66	0.14	5.22	0.75	0.01**	Yes
H7	TTF → BISA	-0.58	0.02	-4.93	-0.54	***	Yes

SE, standard error; BISA, BIS adoption; OB, observability; TB, trialability; PU, perceived usefulness; TTF, task–technology fit.

*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$.

accurately forecasts the adoption behaviour of SMME owners and employees on BIS in the grocery retail industry in South Africa.

Discussion

This study explored how OB, TB, PEOU, PU, BISC, TC and TTF influence SMME owners' intention to adopt BIS in three selected regional zones in the Tshwane Metropolitan Municipality, South Africa. To achieve this aim, seven hypotheses were empirically tested, and the results of the hypotheses are discussed below.

This study found that SMMEs are less likely to adopt BIS if the owners of these businesses can observe the relative advantages of such technological innovations. Thus, to adopt BIS systems, it is crucial for SMMEs to comprehensively observe and monitor in real time their performance, functionality, scalability and any actionable insights before adoption. The BIS vendors or agencies could facilitate the observation (Khaddam et al. 2023). This finding contradicts Lateef and Keikhosrokiani (2023), who established a positive association between OB and technology adoption. A possible explanation for this could be that most of the SMME participants in this study had yet to have an opportunity to observe the BIS systems in advance. Thus, OB had an insignificant influence on BIS adoption in this study.

Trialability was found to have a significant effect on BIS adoption. The findings of this study establish that SMME owners should have a chance to experiment with a business intelligence system to establish its functionality, robustness and security features because there are often uncertainties and risks associated with new systems. Thus, demonstrations may aid the adoption of BIS systems by SMMEs. This finding is consistent with a study by Salisu, Bin Mohd Sappri and Bin Omar (2021) on SMEs, which confirmed that TB influences BIS adoption.

Perceived ease of use positively influenced BIS adoption in SMMEs. Thus, this study found that SMMEs are bound to adopt BIS systems to improve the effectiveness and efficiency of their business operations if they perceive that the new systems are user-friendly and require less effort. Therefore, tailor-made BIS systems for the SMMEs' grocery retail industry may entice adoption, as Mavutha, Kamwendo and Corbishley (2023) found.

In line with the findings of Alsibhawi, Yahaya and Mohamed (2023), this study confirmed that PU positively affects BIS adoption in Tshwane Metropolitan Municipality. In other words, if grocery retail SMMEs realise how BIS can transform their business operations and performances, they will likely adopt BIS. Thus, for the widespread adoption of BIS systems in SMMEs, system developers and vendors should go the extra mile to convince and demonstrate the benefits of adopting BIS systems in daily business operations.

This study confirmed BISC (tools) like performance dashboards, data analytics and reports positively influencing decisions to adopt BIS systems in SMMEs. The ergonomics of these features should be that they are user-friendly to the end-users and relatively less complex to use. Most BIS systems are complex and require training (Maroufkhani, Wan Ismail & Ghobakhloo 2020). However, considering that people with varying tech-savvy levels operate most SMMEs, greater attention should be paid to tailoring BIS systems to suit the needs and operational requirements of SMMEs in the grocery retail industry. While this finding concurs with a study by Alkhwalidi et al. (2023), it is essential to note that BIS adoption in SMMEs also presents challenges, such as initial costs, resistance to change and the need for ongoing support and training.

Similarly, TTF positively influences BIS adoption. The findings of this study confirmed that BIS systems can positively assist SMME business owners in performing their tasks much better if the BIS and TC are given adequate attention. This finding implies that system orientation and walk-throughs are crucial for SMME owners to master and use the system effectively and efficiently to attain business goals. This finding concurs with Alkhwalidi et al. (2023) but contradicts the findings of Popovič, Puklavec and Oliveira (2019).

Theoretical and practical significance

This research holds significance in three areas. Firstly, the research adds to the comprehension of the elements affecting BIS implementation in the grocery retail industry of SMMEs in a developing nation. A comprehensive research framework was developed by integrating three adoption models: TAM, DOI and TTF. Thus, the relationship between the seven determinant factors and BIS adoption is demonstrated. The study adds value to the broader body of knowledge on BIS adoption in small grocery businesses. Secondly, the study contributes to the policy formulation. The proposed framework could act as a guideline lens for policymakers and implementers to recognise some key factors that may aid the adoption of BIS systems by SMME grocery retail stores. The results indicated that most respondents had a positive attitude towards adopting BIS systems. Thus, it draws attention to government officials in the Tshwane Metropolitan Municipality to assist SMMEs in acquiring BIS tools to achieve economies of scale, potentially leading to improved business performance and economic growth. Thirdly, the study contributes to managerial practices so that the findings can guide management and business owners who seek innovative ways to improve their efficiency and effectiveness and expand their business operations by adopting BIS systems. The success of a business depends on the accuracy, timeliness and velocity of decisions made by management. Thus, this study highlights the importance of using BIS in making fact-based decisions in the SMME grocery retail industry.

Conclusion

This research investigated the impact of OB, TB, PEOU, PU, BISC, TC and TTF on SMME owners' decisions to adopt BIS

in the grocery retail industry in Tshwane Metropolitan Municipality, South Africa. A conceptual model integrating pertinent constructs from the DOI, TAM and TTF models was developed to underpin this study. Survey data were collected from 275 SMME owners and managers in three districts in the Tshwane Metropolitan Municipality to test the seven hypotheses and refine the proposed model. This study found that SMME owners and managers are likely to adopt BIS if they can first test them and establish their usefulness in daily business operations. Moreover, the findings established that the system's features should be eased to master and use, as this will likely entice the SMME owners to adopt it. Most SMMEs are financially constrained, and as such, the reviewed literature amplified the need for financial rescue packages to afford the adoption of BIS systems. In line with TC, the findings attested to the need for constructive alignment between the daily tasks of SMMEs and the features of the BIS systems. In other words, BIS systems should be tailored to the needs and operations of SMMEs in the grocery retail industry. Thus, BIS technology should meet the needs of the SMMEs for the innovation to achieve the intended impact. However, OB did not influence BIS adoption in the SMME grocery retail industry.

Furthermore, the study also found that BIS is vital to business success by improving customer service, reducing operational costs, increasing revenue, increasing employee productivity, improving decision-making and increasing information sharing. BIS provides tools enabling information sharing in organisations, significantly impacting business decisions. Effective communication, which enables enhanced employee engagement, is achieved through increased information sharing. Furthermore, BIS enables management to make fact-based decisions quickly and improves the outcomes of their decisions. Employees can use BIS for their daily tasks to improve efficiency and productivity.

Additionally, BIS systems provide advanced tools like data analytics and performance dashboards that can assist the management in reaching timely decisions, increasing efficiencies and streamlining costs, leading to reduced expenses and profitability. The results of this research can assist policymakers and practitioners in developing viable SMME incubation programmes tailored to the needs of SMMEs in various industries. The research is restricted, as it did not solicit any further information on the BIS system users' experiences on other factors outside the scope of this study, like funding mechanisms available to non-South African SMME grocery retail business operators because they are integral players in paying tax returns and employment creation. Thus, future research should explore this narrative.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

A.E.S.M. conceptualised and wrote the original article. W.M. extended the article, wrote the methodology, performed data analysis, supervised, reviewed and edited the manuscript, and A.K. assisted in writing the draft and supervised and edited before submission.

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Data availability

The data that support the findings of this study are available from the corresponding author, W.M, upon reasonable request.

Disclaimer

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