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Factors influencing taxi entrepreneurs to adopt intelligent transport management systems

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Background: Transporting the urban population in South African cities is chaotic because of traffic congestion, and one possible solution is the adoption of transport management systems to manage the timely picking and dropping of passengers by metered taxi operators.

Objectives: This study examined factors that influence the South African metered taxi entrepreneurs' willingness to adopt transport management systems (TWTMS).

Method: This is a quantitative study that collected data from 253 metered taxi entrepreneurs from Sandton in the Johannesburg metropolitan area, South Africa. This study tested 14 hypotheses using regression analysis.

Results: Attitude towards use had an insignificant relation with behavioural intention (BI); however, BI had a significant relationship with TWTMS. There were four factors that directly determined BI, which are perceived usefulness, perceived safety, perceived convenience and perceived trust.

Conclusion: The results of this study suggest that taxi entrepreneurs will adopt transport management systems if they find the system useful, safe to use, convenient and trustworthy.

Contribution: This study uncovered factors that influence the adoption of transport management systems by metered taxi entrepreneurs. Therefore, software developers should incorporate these factors when designing transport management systems so that acceptance can be improved.

Keywords: technology acceptance model; transport management systems; taxi entrepreneurs; e-hailing; adoption; transport; South Africa.

Introduction

Economic growth for a country depends on sustainable and efficient movement of people and goods in cities (United Nations 2023). However, because transporting the booming urban population in cities brings chaos to transport networks, modern transport information systems are needed to efficiently manage public transport. Reckless rush hour driving by public transporters was observed in most major African cities and is a cause of concern because of the high probability of road carnage (Makhoba 2011). However, attempts to introduce transport information systems into developing countries have received varied results (Mawela, Ochara & Twinomurinzi 2016; Motsi, Chipangura & Musanhi 2023; Murugi 2022). Government departments and transport logistics companies were observed as early adopters, while motorist and commuter taxi operators were observed to selectively adopt transport information systems (Mawela et al. 2016; Murugi 2022). As evidence, the Kenya Revenue Authority implemented an information system to improve the flow of cargo at borders, which was successfully adopted by transport logistic operators (Murugi 2022). Furthermore, the South African National Road Agency Limited (SANRAL) implemented the e-tolling transport information system on the N1 Ben Schoeman Highway in Gauteng, which was positively adopted by most transport logistics operators and rejected by most private car owners (Mawela et al. 2016). Another rejection of transport information systems is that of e-hailing by metered taxi associations in South Africa (Henama & Sifolo 2017). Although metered taxi associations rejected the use of e-hailing systems, entrepreneurs and customers in urban areas accepted the opportunity. Customer acceptance of e-hailing was overwhelming because e-hailing is delivering cost-effective and timely services, which have escalated market share competition with the existing metered taxi operators (Ngubane, Mkhize & Olofinbiyi 2020). Of academic significance is the understanding of why some transport management systems are accepted and others are rejected. Therefore, the study must understand the factors that influence the adoption of transport management systems in South Africa.

To investigate the disparity in the adoption of transport management systems, this study investigated the factors that influence the willingness to adopt transport management systems by metered taxi entrepreneurs in South Africa. Metered taxi entrepreneurs are important stakeholders in the adoption of transport management systems because they chose not to adopt e-hailing applications while they are among the South African population who adopted technologies such as mobile phones, automated teller machines (ATMs), Google Maps and many other recent technologies. Therefore, this presents a scenario of discriminatory selection of technology; hence this study investigated factors that influence the South African metered taxi entrepreneurs' willingness to adopt transport management systems (TWTMS).

Review of the literature: Technology adoption factors

From the analysis of the literature carried out for this study, the factors that can influence the adoption of transport information systems by metered taxi entrepreneurs were found to be perceived ease of use (PEOU), perceived usefulness (PU), perceived pricing (PP), perceived safety (PS), perceived trust (PT), perceived convenience (PC), attitude towards use (ATU) and behavioural intention (BI). The factors are now discussed.

Perceived ease of use

Perceived ease of use is a factor of technology acceptance model (TAM) theory. Davis (1989:320) defined PEOU as 'the degree to which a person believes that using a particular system would be free of effort'. The results of empirical studies have supported that PEOU plays an important role in technology adoption (Arora, Singh & Gupta 2022; Arumugam, Ismail & Joeharee 2020). This tells that metered taxi operators in South Africa are more likely to use technologies that they find easy to use.

Perceived usefulness

Davis (1989:320) defined PU as 'the degree to which a person believes that using a particular system would enhance his or her job performance'. From the perspective of Rogers (2010), the usefulness of a technology is affected by the shared view of potential users in a network or association. As metered taxi operators in South Africa are aligned to networks or associations (Ngubane et al. 2020), the usefulness of a transport management system is determined by the network or association to which the operators belong. This situation was explained by Venkatesh et al. (2003), who said that social influence affects how individuals perceive the usefulness of a technology.

Perceived price value

The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) postulated that the price value of a technology determines the BI to use the technology by consumers (Venkatesh et al. 2003). Consumers will adopt a technology if they can afford the hardware, services and operational costs. Utami et al. (2021) found that transport entrepreneurs require capital to buy smartphones and broadband to operate e-hailing services. In the same vein, Boateng, Appau and Baako (2022) highlighted that it costs money for transport entrepreneurs to join an e-hailing application such as Uber. In South Africa, to operate an Uber car, the car model should be in good condition and fully insured (Ngubane et al. 2020). As most metered taxi operators fund their businesses, the costs of adopting e-hailing applications have a direct impact on BI to use the application.

Perceived safety

The second level of Maslow's hierarchy of needs is safety, which refers to security, stability and protection (Maslow & Lewis 1987). In business, safety is equated to minimising the probability of risk and uncertainty (Holton 2004). Risks associated with operating a transport business include damage to vehicles, inability to receive clients, and injuries to drivers and customers. Concerning customer and driver safety, studies carried out in Ghana revealed that customers of e-hailing perceived e-hailing taxis as safe (Boateng et al. 2022). This is because e-hailing cars are tracked in real time, the identification details of drivers and the customers are shared, cars are insured, and drivers undergo criminality screening (Arumugam et al. 2020). However, in the South African transport environment, e-hailing operators are prone to targeted violence by transport networks or associations fighting over the domination of profitable routes (Henama & Sifiso 2017). Because of such violence, e-hailing operators risk their vehicles being destroyed.

Perceived trust

Trust is the perceived risk of willingness to accept that one part will do good for another part (eds. Marková & Gillespie 2007). A part can be a person, an institution or a system. Trust is an important factor in the adoption of online services (Arora et al. 2022). Trusting online services is a challenge because many people operate from the point of distrust. After all, when online, people are afraid of cybercrime, for example, credit card fraud, and account hacking (eds. Marková & Gillespie 2007). Mechanisms to improve online customer trust are known to include product advertisement, product quality, product testimonials (Li 2019), information accuracy, security and product usability (Fong et al. 2023). As an example, e-hailing customers trust that the service provider will provide them with a car, and transport operators trust that the quality of e-hailing apps is of good quality for customers to book a car (Fong et al. 2023).

Perceived convenience

> Convenience of a service is a judgment made by consumers according to their sense of control over the management, utilisation, and conversion of their time and effort in achieving their goals associated with access to and use of a service. (Farquhar & Rowley 2009:434)

The convenience of a service is also perceived as the experience that the consumer benefits from using a service, which can be positive or negative (Kumar, Sachan & Dutta 2020). Empirical studies on e-hailing revealed that convenience is a benefit of e-hailing (Arumugam et al. 2020; Boateng et al. 2022; Utami et al. 2021). Utami et al. (2021) found that e-hailing services are convenient for secure movement of money because all transactions are carried online.

Attitude towards use

Attitude is an evaluative response, which is an affect for or against an object (Ajzen 2005). Arul and Misra (2002) argued that attitudes are tendencies with the ability to promote or impede an action at individual or group level. There are factors that affect attitude towards an object, for example, PEOU and PU in the TAM (Davis 1989), and social pressure expectations and self-efficacy (Ajzen 2005). Furthermore, the past literature has reported on many other factors that determine attitude in technology adoption, for example, trust and convenience (Liu & Tai 2016). In the context of the adoption of e-hailing, there are empirical studies that found significant relationships between attitude and PEOU, and attitude and PU, for example, as by Shah et al. (2020).

Behavioural intention

Davis, Bagozzi and Warshaw (1989:984) referenced Fishbein and Ajzen (1975) to define BI as 'a measure of the strength of one's intention to perform a specified behaviour'. Behavioural intention has been measured through various determinants depending on the theoretical model; for example, in TAM, the determinants are PU and ATU (Davis et al. 1989), and in UTAUT, the determinants are performance expectancy, effort expectancy, social influence and facilitating condition (Venkatesh et al. 2003). There are empirical studies that adopted and extended adoption theories to test BI, for example, a study by Kumar et al. (2020).

Research model and hypotheses

The literature analysis identified factors that influence TWTMS such as PEOU, PU, ATU, BI, PS, PT, PC and PP. These factors appear primarily in technology adoption theories, of which five of the factors came from the TAM theory (PEOU, PU, ATU, BI and AU [actual use]) and the other four factors (PS, PT, PC and PP) came from different studies that adopted theories such as UTAUT2, Maslow's hierarchy of needs and trust theories.

According to Davis (1989), TAM is a model for testing user acceptance of a system before being used in an organisation. The model postulates that the adoption and AU of a technology is informed by the BI of the user, which is influenced by the user's ATU. The ATU is influenced by how the user perceives the usefulness and ease of use of the technology.

Malatji, Eck and Zuva (2020) discussed the weaknesses of TAM model and argued that the weaknesses were because of that TAM was originally designed for adoption of computers and not information systems that are voluntarily adopted. They claimed that voluntary adoption of technology is affected by economic and social factors. Aligned to their argument, literature analysis in this study found four factors that are not included in TAM that influence the willingness of metered taxi entrepreneurs to adopt transport management systems. The factors were PS, PT, PC and PP and were adopted in this study to extend the TAM model.

Figure 1 presents the research model and the study hypotheses, which are structured into three groups. The first group of hypotheses focusses on constructs that determine the ATU, the second group focusses on constructs that determine BI, and the last group focusses on determinants of the willingness of taxi entrepreneurs to adopt transport management systems.

Firstly, this study hypothesised that the primary constructs of TAM (PEOU and PU) together with the four constructs

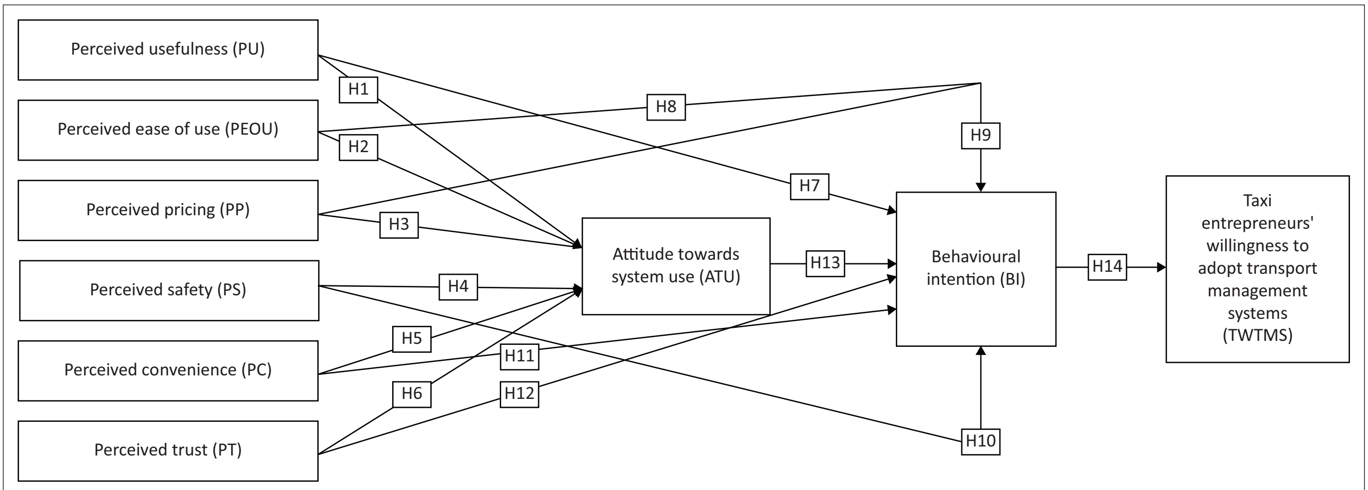

FIGURE 1: Research model and hypotheses.

from other studies (PS, PT, PC and PP) positively influence the ATU of transport management systems.

H_1: Perceived usefulness (PU) positively influences the attitude towards use (ATU) of the transport management systems.

H_2: Perceived ease of ease (PEOU) positively influences the attitude towards use (ATU) of transport management systems.

H_3: Perceived pricing (PP) positively influences the attitude towards use (ATU) of transport management systems.

H_4: Perceived safety (PS) positively influences the attitude towards use (ATU) of transport management systems.

H_5: Perceived convenience (PC) positively influences the attitude towards use (ATU) of transport management systems.

H_6: Perceived trust (PT) positively influences the attitude towards use (ATU) of the transport management systems.

Secondly, this study hypothesised that the six constructs (PU, PEOU, PP, PS, PC and PT) positively influence BI to use transport management systems. Furthermore, ATU was hypothesised to positively influence BI. This study differs from the original TAM model in that it uses primary constructs of TAM (PU and PEOU) and four constructs (PP, PS, PC and PT) identified from other studies to determine BI. The following hypotheses were proposed.

H_7: Perceived usefulness (PU) positively influences behavioural intention (BI) in transport management systems.

H_8: Perceived ease of use (PEOU) positively influences behavioural intention (BI) in transport management systems.

H_9: Perceived pricing (PP) positively influences behavioural intention (BI) in transport management systems.

H_{10}: Perceived safety (PS) positively influences behavioural intention (BI) in transport management systems.

H_{11}: Perceived convenience (PC) positively influences behavioural intention (BI) in transport management systems.

H_{12}: Perceived trust (PT) positively influences behavioural intention (BI) in transport management systems.

H_{13}: The attitude towards use (ATU) positively influences behavioural intention (BI) in transport management systems.

Thirdly, the study hypothesised that BI determines the willingness of taxi entrepreneurs to adopt transport management systems.

H_{14}: Behavioural intention (BI) positively influences taxi entrepreneurs' willingness to adopt transport management systems (TWTMS).

Methodology

This section presents the study sample, the measurement instrument and the data analysis. Quantitative data were collected through a survey, and Statistical Package for the Social Sciences (SPSS) (version 24) was used for data analysis.

Sampling

The study participants were metered taxi entrepreneurs who were randomly sampled from Sandton, in the Johannesburg metropolitan area. Participant selection was based on availability and desire to participate in the study, and no compensation was paid. The questionnaire was self-administered from April to September 2020. In total, 250 questionnaires were completed; however, 227 had usable data and were analysed, which met the recommended threshold sample size of between 200 and 500 for quantitative analysis (Hair et al. 2019).

Measurement instrument

The construction of the questionnaire was based on the constructs of the research model (Figure 1). The questionnaire covered both the dependent and independent constructs of the model. Attitude towards use was measured by six independent variables, while BI was measured by seven independent variables. The construct TWTMS was measured with five items. The questionnaire measured the responses on an unlabelled five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree).

Data analysis

The data were cleaned; a statistical analysis was performed to measure central tendency and normality, and multilinear regression analysis was used for hypotheses testing. The SPSS statistical package (version 24) was used to analyse the data.

Ethical considerations

Ethical clearance to conduct this study was obtained from the University of South Africa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee (No. 062/NM/2018/CSET_SOC).

Results

Descriptive statistics for the model constructs are provided in Table 1. The table shows the weighted mean scores per construct measured on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The weighted means ranged from 3.2414 to 3.8316, indicating moderate to slightly positive perceptions of the respondents. The standard deviations, ranging from 0.82391 to 1.05891, suggest varying degrees of

TABLE 1: Descriptive statistics of the constructs (*N* = 253).

Construct	Minimum	Maximum	Mean	s.d.
PU	1.00	5.00	3.48	1.01331
PEOU	1.00	5.00	3.59	1.05891
PP	1.00	5.00	3.84	1.02954
PS	1.00	5.00	3.60	0.90773
PC	1.00	5.00	3.25	0.98333
PT	1.00	5.00	3.36	0.82391
ATU	1.00	5.00	3.70	0.93353
BI	1.00	5.00	3.35	0.84391
TWTMS	1.00	5.00	3.70	0.94353

PEOU, perceived ease of use; PU, perceived usefulness; BI, behavioural intention; PP, perceived pricing; PS, perceived safety; PC, perceived convenience; PT, perceived trust; ATU, attitude towards use; TWTMS, taxi entrepreneurs' willingness to adopt transport management system; s.d., standard deviation.

dispersion around the means. These statistics offer a quantitative overview of participants' responses, aiding in the interpretation of construct scores and their potential impact on the study's outcomes.

Reliability

The internal consistency of the model was measured using the Cronbach's alpha, with alpha coefficients ranging between 0.907 and 0.989 (see Table 2). Aligned with Pallant (2016), the Cronbach's alpha values were above 0.70, which suggest that the measurement scales were internally consistent, and the collected data were reliable.

Regression results

The provided analyses examine regression models across various dependent variables and predictor combinations (see Table 3–Table 11). For ATU, PC, PP and PT, they collectively contribute to explaining variance, with Model 3 being the most effective. Conversely, in predicting BI, models incorporating PC, PS, PT and PU demonstrate superior explanatory power, particularly Model 4. Meanwhile, the impact of TWTMS on BI is highlighted, with Model 1 showcasing the strongest association.

Attitude as dependent variable

Table 3 presents the results of three regression models that assess the relationship between PC, PP, PT and the dependent variable. Model 1, with PC as the sole predictor, yields a moderate *R*-square of 0.303. Adding the construct PP in Model 2 increases the *R*-square to 0.328, and including PT in Model 3 further improves the *R*-square to 0.341. These findings suggest that, while PC alone accounts for some variance in the dependent variable, incorporating PP and PT enhances the model's explanatory power. Even though the *R*-square values of the models are close to 0.3, Quinino, Reis and Bessegato (2013) stated that *R*-square value of at least 0.10 is acceptable in social science research if predictors are significant. Additionally, the decrease in the standard error of the estimate indicates a better precision in predicting the dependent variable as more predictors are included.

Table 4 outlines the analysis of variance (ANOVA) results for regression models that predict ATU, each with varying predictor combinations. Significant *F*-values ($p < 0.05$) signify the effectiveness of the model. The regression component explains the variance of ATU, while residuals represent unexplained variability. In particular, Model 3, which incorporates PC, PP and PT, yields the lowest F-value, indicating its superior predictive power. This underscores the importance of these factors in measuring ATU. Overall, the ANOVA table emphasises the significance and contribution of predictors, particularly in the context of the best-performing Model 3, towards comprehending ATU.

Among the three regression models analysed in Table 5, Model 3 emerges as the most comprehensive and effective in predicting ATU. This model includes PC, PP and PT as predictors. The coefficients for each predictor are statistically significant ($p < 0.05$), indicating their importance in

TABLE 2: Cronbach's alpha coefficient.

Constructs	Cronbach's alpha
PU	0.963
PEOU	0.912
PP	0.934
PS	0.945
PC	0.954
PT	0.989
ATU	0.917
BI	0.907
TWTMS	0.943

PEOU, perceived ease of use; PU, perceived usefulness; BI, behavioural intention; PP, perceived pricing; PS, perceived safety; PC, perceived convenience; PT, perceived trust; ATU, attitude towards use; TWTMS, taxi entrepreneurs' willingness to adopt transport management system.

TABLE 3: Summary of the model.

Model	*R*	*R*-square	Adjusted *R*-square	Std. error of the estimate
1	0.550[a]	0.303	0.300	0.49442
2	0.573[b]	0.328	0.323	0.48635
3	0.584[c]	0.341	0.333	0.48253

PP, Perceived pricing; PC, perceived convenience; PT, perceived trust; Std., standard.

[a], Predictors: (constant), PC.

[b], Predictors: (constant), PC, PP.

[c], Predictors: (constant), PC, PP, PT.

TABLE 4: Analysis of variance for the regression model: Attitude towards use.

Model	Variable	Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	26.640	1	26.640	108.978	0.000[a]
	Residual	61.358	251	0.244	-	-
	Total	87.997	252	-	-	-
2	Regression	28.863	2	14.432	61.012	0.000[b]
	Residual	59.134	250	0.237	-	-
	Total	87.997	252	-	-	-
3	Regression	30.021	3	10.007	42.979	0.000[c]
	Residual	57.976	249	0.233	-	-
	Total	87.997	252	-	-	-

Note: Significant at $p < 0.05$. Dependent variable: ATU.

PP, perceived pricing; PC, perceived convenience; PT, perceived trust; *df*, degrees of freedom; Sig., significance; ATU, attitude towards use.

[a], Predictors: (constant), PC.

[b], Predictors: (constant), PC, PP.

[c], Predictors: (constant), PC, PP, PT.

TABLE 5: Coefficients of the regression model: Attitude towards use.

Model	Variable	Unstandardised coefficients		Standardised coefficients: β	*t*	Sig.
		β	Std. error			
1	(Constant)	1.823	0.192	-	9.509	0.000
	PC	0.505	0.048	0.550	10.439	0.000
2	(Constant)	1.531	0.211	-	7.250	0.000
	PC	0.444	0.052	0.483	8.583	0.000
	PP	0.140	0.046	0.173	3.066	0.002
3	(Constant)	1.401	0.217	-	6.443	0.000
	PC	0.376	0.060	0.409	6.309	0.000
	PP	0.129	0.046	0.159	2.821	0.005
	PT	0.119	0.053	0.140	2.230	0.027

Note: Significant at $p < 0.05$. Dependent variable: ATU. Independent variables: PP; PC and PT.

ATU, attitude towards use; PP, perceived pricing; PC, perceived convenience; PT, perceived trust; β, beta; Sig, significant; Std., standard.

explaining variations in ATU. With a standardised coefficient for PC (β = 0.409), PP (β = 0.159) and PT (β = 0.140), Model 3 demonstrates the strongest influence of PC on ATU, followed by PP and PT. This suggests that while PC plays a predominant role, PP and PT also contribute significantly in measuring the impact of ATU. Therefore, Model 3 stands out as the best model for predicting ATU, providing valuable insights into user behaviour and perceptions.

Behavioural intention as dependent variable

Table 6 summarises the relationship between PU, PEOU, PP, PS, PC, PT and BI. Each model (from Model 1 to Model 4) includes different combinations of predictors. Key metrics such as *R*, *R*-square, adjusted R-square and standard error of the estimate are provided. The best model, Model 4, with predictors PC, PS and PT, exhibits the highest *R*-square (0.592) and adjusted *R*-square (0.585), indicating its superior explanatory power for BI. This suggests that considering PC, PS and PT together provides the most comprehensive understanding of the impact of BI.

Table 7 presents the ANOVA results for regression models that predict BI. Each model incorporates varying combinations of predictors. All models exhibit significant *F*-values ($p < 0.05$), indicating the effectiveness of the regression models. However, the best model to predict BI appears to be Model 4, which includes PC, PS, PT and PU as predictors. This model demonstrates the highest F-value and explains a substantial amount of variance in BI. The inclusion of multiple predictors allows for a more comprehensive understanding of BI, encompassing factors such as PC, PS, PT and PU. Therefore, Model 4 stands out as the most robust and suitable model for predicting BI, providing valuable insights into user behaviour and decision-making processes.

In Table 8, the coefficients of regression models predicting BI are presented. Among the models tested, Model 4 emerges as the most comprehensive for predicting BI. This model incorporates PC, PS, PT and PU as predictors. The standardised coefficients reveal that PC has the highest influence on BI, followed by PS, PT and PU. All predictors show significant effects on BI ($p < 0.05$), as indicated by their respective *t*-values. Model 4 demonstrates the highest explanatory power, explaining variance in BI through multiple critical factors. Therefore, Model 4 stands out as the most robust and suitable model for predicting BI.

Taxi entrepreneurs' willingness to adopt transport management systems as dependent variable

Table 9 presents the model summary for regression models that predict TWTMS variable with BI as predictor. Among the models analysed, Model 1 exhibits the highest *R*-square value, albeit modest, at 0.098. This indicates that approximately 9.8% of the variance in TWTMS is explained by BI. Adjusted *R*-square, which accounts for the number of predictors, is slightly lower at 0.094. The standard error of the estimate is 0.58479, reflecting the average deviation of the observed values from the regression line. Although the model shows some explanatory power, the *R*-square values suggest that BI alone may not sufficiently capture the complexity of the relationship with TWTMS. Quinino et al. (2013) stated that *R*-square value of at least 0.10 is acceptable in social science research if predictors are significant. Further

TABLE 6: Summary of the model of the relationship between perceived usefulness, perceived ease of use, perceived pricing, perceived safety, perceived convenience, perceived trust with behavioural intention.

Model	*R*	*R*-square	Adjusted R-square	Std. error of the estimate
1	0.676[a]	0.456	0.454	0.45392
2	0.724[b]	0.525	0.521	0.42524
3	0.748[c]	0.559	0.554	0.41041
4	0.769[d]	0.592	0.585	0.39580

PU, perceived usefulness; PC, perceived convenience; PS, perceived safety; PT, perceived trust; Std., standard.

[a], Predictors: (constant), PC.

[b], Predictors: (constant), PC, PS.

[c], Predictors: (constant), PC, PS, PT.

[d], Predictors: (constant), PC, PS, PT, PU.

TABLE 7: Analysis of variance for the regression model: Behavioural intention.

Model	Variable	Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	43.422	1	43.422	210.744	0.000[a]
	Residual	51.716	251	0.206	-	-
	Total	95.138	252	-	-	-
2	Regression	49.930	2	24.965	138.059	0.000[b]
	Residual	45.207	250	0.181	-	-
	Total	95.138	252	-	-	-
3	Regression	53.198	3	17.733	105.281	0.000[c]
	Residual	41.940	249	0.168	-	-
	Total	95.138	252	-	-	-
4	Regression	56.288	4	14.072	89.828	0.000[d]
	Residual	38.850	248	0.157	-	-
	Total	95.138	252	-	-	-

Note: Dependent variable: BI. Significant at $p < 0.05$.

PU, perceived usefulness; BI, behavioural intention; PS, perceived safety; PC, perceived convenience; PT, perceived trust; Sig., significance; *df*, degrees of freedom.

[a], Predictors: (constant), PC.

[b], Predictors: (constant), PC, PS.

[c], Predictors: (constant), PC, PS, PT.

[d], Predictors: (constant), PC, PS, PT, PU.

TABLE 8: Coefficients of the regression model – behavioural intention.

Model	Variable	Unstandardised coefficients		Standardised coefficients: β	*t*	Sig.
		β	Std. error			
1	(Constant)	1.303	0.176	-	7.406	0.000
	PC	0.645	0.044	0.676	14.517	0.000
2	(Constant)	0.925	0.177	-	5.238	0.000
	PC	0.479	0.050	0.502	9.597	0.000
	PS	0.272	0.045	0.314	5.999	0.000
3	(Constant)	0.716	0.177	-	4.048	0.000
	PC	0.379	0.053	0.397	7.099	0.000
	PS	0.234	0.045	0.270	5.254	0.000
	PT	0.202	0.046	0.229	4.405	0.000
4	(Constant)	0.272	0.198	-	4.977	0.000
	PC	0.288	0.055	0.302	5.206	0.000
	PS	0.212	0.043	0.244	4.882	0.000
	PT	0.210	0.044	0.238	4.741	0.000
	PU	0.214	0.048	0.209	4.441	0.000

Note: Dependent variable: BI. Significant at $p < 0.05$.

PU, perceived usefulness; BI, behavioural intention; PS, perceived safety; PC, perceived convenience; PT, perceived trust; Sig., significance; Std., standard.

TABLE 9: Model summary.

Model	*R*	*R*-square	Adjusted *R*-square	Std. error of the estimate
1	0.313[a]	0.098	0.094	0.58479

BI, behavioural intention; Std., standard.
[a], Predictors: (constant), BI.

TABLE 10: Analysis of variance.

Model	Variable	Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	9.302	1	9.302	27.201	0.000[a]
	Residual	85.836	251	0.342	-	-
	Total	95.138	252	-	-	-

Note: Dependent variable: TWTMS. Significant at $p < 0.05$.
TWTMS, taxi entrepreneurs' willingness to adopt transport management system; BI, behavioural intention; *df*, degrees of freedom; Sig., significance.
[a], Predictors: (constant), BI.

TABLE 11: Coefficients.

Model	Variable	Unstandardised coefficients		Standardised coefficients: *β*	*t*	Sig.
		β	Std. error			
1	(Constant)	3.024	0.158		19.174	0.000
	BI	0.254	0.049	0.313	5.215	0.000

Note: Dependent variable: TWTMS. Significant at $p < 0.05$.
BI, behavioural intention; TWTMS, taxi entrepreneurs' willingness to adopt transport management system; Std., standard; Sig., significance.

exploration or inclusion of additional predictors may be warranted for a more comprehensive model.

The ANOVA table presents the results of regression models predicting TWTMS (see Table 10). Key metrics such as the sum of squares, degrees of freedom (*df*), mean square, *F*-statistic and significance (Sig.) are presented. Notably, significant *F*-values ($p < 0.05$) indicate the effectiveness of the model.

In Table 11, the coefficients of regression models predicting TWTMS are presented. Model 1, with BI as the predictor, emerges as significant. The coefficient of BI is 0.254, indicating that for every one-unit increase in TWTMS, BI increases by 0.254 units. This relationship is statistically significant with a *t*-value of 5.215 ($p < 0.05$). The standardised coefficient (beta [*β*]) of 0.313 suggests a moderate effect size. Additionally, the constant term has a coefficient of 3.024, representing the expected BI when TWTMS is zero. In general, Model 1 demonstrates a robust association between TWTMS and BI, providing valuable information on the impact of traffic management on BI.

Discussion of study results

This study extended the TAM framework to investigate factors that influence metered taxi entrepreneurs' willingness to adopt transport management systems. The study was carried out in Sandton, Johannesburg metropolitan area, South Africa. A total of 14 hypotheses were tested and 8 were significant. The results are presented in three sections. The first discussion is for the results of factors tested against ATU, the second discussion is for the results of factors tested against BI, and the third discussion is for the results of the relationship between BI and TWTMS. Table 12 presents the results of tested hypotheses.

TABLE 12: Hypotheses results.

Hypotheses	Path	Result	*β*	Sig.
H1	PU → ATU	Not supported (NS)	NS	NS
H2	PEOU → ATU	Not supported (NS)	NS	NS
H3	PP → ATU	Supported	0.159	0.000
H4	PS → ATU	Not supported (NS)	NS	NS
H5	PC → ATU	Supported	0.409	0.000
H6	PT → ATU	Supported	0.140	0.027
H7	PU → BI	Supported	0.209	0.000
H8	PEOU → BI	Not supported (NS)	NS	NS
H9	PP → BI	Not supported (NS)	NS	NS
H10	PS → BI	Supported	0.244	0.000
H11	PC → BI	Supported	0.302	0.000
H12	PT → BI	Supported	0.238	0.000
H13	ATU → BI	Not supported (NS)	NS	NS
H14	BI → TWTMS	Supported	0.313	0.000

Note: Significant at $p < 0.05$.
PEOU, perceived ease of use; PU, perceived usefulness; BI, behavioural intention; PP, perceived pricing; PS, perceived safety; PC, perceived convenience; PT, perceived trust; ATU, attitude towards use; TWTMS, taxi entrepreneurs' willingness to adopt transport management system.

Attitude towards use

Six hypotheses (H1, H2, H3, H4, H5 and H6) were tested to assess the ATU of transport management systems by metered taxi entrepreneurs. Three of the hypotheses were significant (H3, H5 and H6) and are discussed.

The first significant hypothesis was H3, which found that the PP positively influences the ATU ($\beta = 0.159$; $p < 0.05$). These results suggest that metered taxi entrepreneurs will have a positive attitude towards transport management systems if they find them to be of economic value. There is a scarcity of studies that have tested this factor on the adoption of transport management systems by metered taxi entrepreneurs. However, a study that investigated customer loyalty to e-deals (Cheah, Phau & Liang 2015) found that perceived value positively predicted attitudes towards e-deals.

The second significant hypothesis was H5, which found that PC positively influences the ATU ($\beta = 0.409$; $p < 0.05$). These results suggest that the subjective feeling that transport management systems provide the convenience of managing metered taxis will positively affect the attitude of entrepreneurs towards using them. There is a lack of studies that have tested this factor on the adoption of transport management systems by metered taxi entrepreneurs; however, there are other studies that found a significant relationship between these factors, for example, in mobile learning (Chang, Yan & Tseng 2012) and mobile payment (Sari, Habibi & Hayuningputri 2022).

The third significant hypothesis was H6, which found that PT positively influences ATU (H6) ($\beta = 0.481$, $p < 0.05$). These results suggest that the trustworthiness of transport management systems will positively influence metered taxi entrepreneurs to believe that they are useful in managing their businesses. These results corroborate the findings of other studies that investigated the adoption of e-hailing applications and found that trust influences ATU (Arora et al. 2022; Razi, Tamrin & Nor 2019).

Behavioural intention

Seven hypotheses (H7, H8, H9, H10, H11, H12 and H13) were tested to evaluate BI to adopt transport management systems by metered taxi entrepreneurs. Four of the hypotheses were significant (H7, H10, H11 and H12).

The first significant hypothesis was H7, which found that PU positively influences BI ($\beta = 0.209$; $p < 0.05$). The results suggest that taxi entrepreneurs will be inclined to use transport management systems if they perceive the system as valuable or beneficial to their businesses. The results corroborate the findings of Arora et al. (2022) and those of Arumugam et al. (2020).

The second significant hypothesis was H10, which found that PS positively influences BI ($\beta = 0.244$; $p < 0.05$). The results suggest that metered taxi entrepreneurs will use transport management systems if they are guaranteed security, integrity and confidentiality. These results align with the findings of Arumugam et al. (2020), who found that drivers and passengers felt that they were secure when using e-hailing because cars are tracked, and drivers' and passengers' identification details are captured. The issue of physical security is of concern in South Africa because the metered taxi transport environment has been reported to be volatile (Henama & Sifolo 2017).

The third significant hypothesis was H11, which found that PC positively influences BI ($\beta = 0.302$; $p < 0.05$). These results suggest that BI to adopt will increase if transport management systems are perceived to improve business convenience. These results are consistent with the findings of prior studies on e-hailing (Arumugam et al. 2020; Utami et al. 2021). E-hailing was found to be convenient because it provides geolocation to pick up and drop clients (Utami et al. 2021) and provides an estimation of travel time to pick up and drop clients (Boateng et al. 2022).

The fourth significant hypothesis was H12, which found that PT positively influences BI ($\beta = 0.238$; $p < 0.05$). The results suggest that if metered taxi entrepreneurs trust that the transport management system is reliable, secure or efficient, adoption will increase. These findings are aligned with the finding of Mohamad et al. (2016), who found that taxi operators have a high likelihood of adopting Uber if they find it trustworthy.

Taxi entrepreneurs' willingness to adopt transport management system

H14 was significant and found that BI positively influences TWTMS ($\beta = 0.313$; $p < 0.05$). These results can be interpreted to mean that metered taxi entrepreneurs are willing to adopt and use transport management systems to reap the benefits. The results of this study satisfy the TAM model as proposed by Davis (1989), who postulated that a positive BI results in the AU of the technology. Furthermore, the results of this study align with those of Haba and Dastane (2018), who found a significant relationship between BI and AU of taxi hailing mobile applications in Malaysia.

Conclusion

This study examined factors that influence the willingness of South African metered taxi entrepreneurs to adopt transport management systems. Theoretically, this study extended TAM and identified factors that influence the adoption of transport management systems by metered taxi entrepreneurs. The factors are PU, PS, PC, PT and BI. Practically, developers of transport management systems must implement these factors in the design of transport management systems. That will probably increase adoption, especially in South Africa, where metered taxi entrepreneurs have been observed to resist the adoption of transport management systems such as e-hailing applications. This is valuable for overcoming the legacy challenges of the taxi industry, particularly the violence against e-hailing operators in the major cities of South Africa.

The contribution of this study could be limited by the small sample of participants who were sampled from Sandton in Johannesburg Metropolitan area, South Africa. Future research should collect data from a larger sample that includes participants from other major South African cities to improve the generalisation of the study.

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Authors' contributions

L.M. conceptualised the paper, wrote first draft, data processing, analysis and results. B.C. carried out literature analysis, wrote second draft, implemented reviewer corrections and proof reading.

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Data availability

The data that support the findings of this study are available on request from L.M., the corresponding author.

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