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E-Public Transportation, Quantitative Analysis in Fiji

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Synonyms

Customer behavior; Developing; E-transport; Fiji

Brief Definitions

Unified theory of acceptance and use of technology (UTAUT) – a combination of eight models that helps to understand user intentions as well as acceptance and the actual use of given technology.

Performance expectance – the user's belief that the use of the given technology can provide every day benefits.

Effort expectance – the given technology is easy and convenient for the user.

Social influence – the extent to which a user percieves that significant others believe that the user should use the given technology.

Facilitating conditions – the extent to which a user believes that organizational as well as technical infrastructure is available to support the use of the given technology.

Sacrifice – can be monetary and nonmonetary and includes time, search, and psychological cost the user bears to obtain a good or service.

Introduction

Undoubtedly, information and communication technology (ICT) has changed the way industries and services operate. Public services, such as the public transport system, are no exception. The smart-card technology is no new phenomenon – "invented more than 30 years ago" (Blythe 2004, p. 47). Evidently, "electronic ticketing in public transportation based on smart cards is gaining momentum worldwide" (Welde 2012, p. 134) since 1990.

The perusal of international literature reveals a dearth of objective evaluations of such systems in developing country contexts. While various scholars have discussed several benefits for users of e-transportation systems for bus services, only a few researched on smart card but in a relatively developing context. Scholars have suggested extensive research on other countries aside the ones already studied to better understand e-transportation.

Above all, there are few empirical studies in transportation industries except for in airline

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industry with only a few published ones focusing on factors influencing e-ticket usage behavior which explains why still little is known about user motivations for using or not using e-ticketing schemes (Puhe 2014), the more the reason for more empirical research on social dynamics and contexts linked to e-ticketing usage (Puhe 2014).

This entry contributes to these gaps. It will examine the implementation of e-transportation in Fiji, a South Pacific developing economy, exemplified by an empirical research of regular commuters of tertiary students of a regional university – The University of the South Pacific (USP). To the best of the researchers' knowledge, there has not been any study on developing countries in the context of Pacific Island countries (PICs). Furthermore, Fiji's case is unique since it is the only PIC that has implemented e-transportation. In particular, this entry focuses on factors influencing the use of e-transportation card of tertiary students as bus commuters. In addition, unlike earlier research that have used 8 or 20 questions questionnaire, this entry has used a total of 37 questions to make this research more comprehensive. In addition, the SPSS v25 software program was used for descriptive statistical methods while SPSS AMOS v26 was used for structural equation model and further analysis. However, researching into the views of other stakeholders is beyond the scope of this study. Nonetheless, the study can prove valuable and be applied to other PICs' planning such transportation systems.

Literature Review

The concept of sustainable mobility (Puhe 2014) and growing cashless services have driven countries like Australia, New Zealand, Nigeria, Canada, USA, China, Japan, Hong Kong, Malaysia, Europe, and Fiji to invest in e-transportation systems for bus services. It is the smart card tool that enables e-transportation to function. Smart cards are used for a number of different transportation applications, among which ticketing is the most widespread (Puhe 2014). Smart cards have unique names such as Melbourne's Myki (Transport Ticketing Authority 2009), Adelaide's Metrocard (Pratibha 2017), Canberra's MyWay Transport card (Pratibha 2017), South Korea's T-money (Korea4expats 2015), Hong Kong's Octopus card London's Oyster card (Transport for London 2019), and Fiji's e-transport card (Pratibha 2017). The last 15 years has seen a growing number of smart card schemes being launched, many of which are a result of the success of large-scale e-ticketing schemes in Asia (Blythe 2004). This has led to increased interest in investigations into the benefits and costs of smart card ticketing for public transportation. Various scholars like Booz and Hamilton (2001), Diab et al. (2015), Iseki et al. (2008), and Welde (2012) have discussed several benefits for users of e-transportation systems for bus services such as ease of use (time and cost savings), reliability, increased travel convenience, flexible ticketing, lesser need to carry cash, and card balance protection (durability). Still, as per Diab et al. (2015, p. 6), "it is rare to find empirical studies in the literature investigating the value of time savings that come as a result of service improvements." Blythe (2004) claims that smart cards provide market data and research on when and where consumers use cards. Thus services could be reengineered to more readily meet a traveller's needs. E-transportation results in reduced need for cash (Welde 2012) which not only promotes a cashless economy but also fosters safety for passengers. Yet, Welde (2012, p. 134) argues that, while "it is widely recognized that smart cards can deliver benefits . . .," the benefits of e-transport systems have been overly optimistic (Welde 2012). Iseki et al. (2008) adds that benefits of such systems are also often vague and unclear on whether benefits outweigh costs. Habits, attitudes, and preferences play a decisive role in transport behavior which depend heavily on individual contexts such as the end user trip purposes (commuting, leisure, business travel), frequencies (daily, regular, occasional), travel distance, and destinations (rural or urban). While a lot of research has been carried out to understand e-transport systems, there are still gaps in literature that need attention which this research

attempts to address. Apparently, the benefits of a cashless transportation system are manifold, especially in developing countries (Mondato 2019). While there are studies on developing country e-transport systems like Kenya, Philippines, and Rwanda, some scholars describe "public transport in developing countries as unreliable, expensive, and unsafe in a macroscopic way." Such studies are thus incomplete since they fail to investigate "the deficiencies of public transport payment preference from the perspective of the passengers". A few scholars did "research on smart card" but "with a relatively developing context such as Metro Manila". Furthermore, in addition to "the imitations of previous studies and the lack of general methodologies. . ." (Welde 2012, p. 137), empirical studies in transportation industries have been scant except for in airline industry (Sumaedi et al. 2012; Wen et al. 2005). Given that e-ticketing is complex, involving many actors who need to readjust (Welde 2012, p. 144), better understanding of user intention and adoption is still required and important (Sumaedi et al. 2012) especially when only a few published studies focus on factors influencing e-ticket usage behavior. In the recent 5 years, the mobile-payment mode has attracted much more interest than smart-card ticketing adoption. Hence, only little is known about user motivations for using or not using e-ticketing schemes (Puhe 2014). Empirical research is also needed on the social dynamics and contexts linked to e-ticketing usage of potential users (Puhe 2014). Scholars like Iseki et al. (2008) and Welde (2012) mention that benefits also appear overly optimistic and vague. Also, while some research cast little doubt on smart card benefits, the benefits accrued to each stakeholder may vary (Iseki et al. 2008). The present study thus contributes to the abovementioned gaps by investigating the behavioral intentions of using e-transportation card in bus transport in a developing PIC. The users are of particular importance since it is their decision of using the e-ticketing system that makes the scheme successful (Puhe 2014). Also, extensive research on other countries aside the ones studied, "seems essential to improve the understanding of the state of different field" (Sumaedi et al. 2012, p. 84) since a one-size-fit-all product may not fully address user needs. Therefore, solutions should not be globally dictated but rather locally informed (Blythe 2004; Mondato 2019). In filling the gaps in literature, the study also highlights how Fiji adopted the characteristics of the global e-transport system and custom-made it to suit its developing economy and its end user needs. The key objectives of this study are: (1) to examine what influences behavioral intention in using e-transportation card in buses; (2) to modify the UTAUT model by incorporating an additional element and removing a moderator to make it suitable to the context being studied; and (3) to assess the effectiveness of the modified model empirically. The remainder of this entry is organized as follows. The next section reviews the theoretical underpinnings, stating hypotheses using the modified UTAUT model. The following section describes the quantitative research methodology. The subsequent section presents and discusses the empirical results. The final section highlights limitations and implications, and makes suggestions for future research.

Theoretical Underpinnings: UTAUT

Among the various competing and complementary models on IT acceptance and adoption, one of the most popular models namely, the technology acceptance model (TAM) has evolved over the years into the unified theory of acceptance and use of technology (UTAUT). This is now one of the latest developments in general technology acceptance models. UTAUT has been used to understand the users' intentions and acceptance of technology. It is a combination of eight models (Venkatesh et al. 2003; Venkatesh et al. 2013) which are: Theory of Reasoned Action (TRA) (Davis 1989), Technology Acceptance Model (TAM) (Davis 1989), Theory of Planned Behavior (TPB) (Taylor and Todd 1995), combined TAM and TPB (Taylor and Todd 1995), Motivation Model (MM) (Vallerand 1997), the Model of PC Utilization (MPCU) (Thompson et al. 1991), the Social Cognitive Theory (SCT) (Compeau and Higgins 1995), and the Diffusion of Innovation Theory (DOI) (Rogers 2003). This combination makes UTAUT more complete, enhancing its

explanatory power in user intentions furthering the usage behavior as well as acceptance and the actual use of technologies, leading to its extensive use in applied research. The resulting UTAUT model comprises of four main elements and four moderators. The four main elements are: (1) performance expectance, (2) effort expectance, (3) social influence, and (4) facilitation conditions. The four moderators are: (1) gender, (2) age, (3) experience, and (4) voluntariness (Venkatesh et al. 2003). The UTAUT model has been used to explicate behavioral intention of users' in various fields of study such as e-government services, mobile banking (Zhou et al. 2010), technology adoption – initial use and post-adoptive use and transportation systems (Madigan et al. 2016; Wu et al. 2012). For example, in Taiwan's Kaohsiung MRT system, the UTAUT model was used to investigate the adoption technology of the transit fare payment system of iPass transit smartcard. The results showed that most of the elements of the UTAUT model had a positive influence on the behavioral intention of the commuters. However, because UTAUT's explanatory capability on individuals' technology acceptance appears doubtful, the original UTAUT model has been modified with additional variables (Chao 2019). Similarly, this present study has modified the subject model, adding sacrifice as the fifth element and removed the forth moderator to make the model more suitable to the context being studied.

The Four Elements of UTAUT Model

Performance Expectance (PE)

Venkatesh et al. (2003) explains that a user's intention to adopt technology is based on how they perceive usefulness of technology. Thus, performance expectance is considered a vital element affecting a person's behavioral intention of usage. Studies by Madigan et al. (2016), and support this argument. In the present study, PE is described as the commuter's belief that using the e-transport card can provide every day benefits and has an added advantage over the traditional ticketing system (Venkatesh et al. 2003). Naturally, if e-transportation is more advantageous than the traditional cash system, passengers will find it useful in their daily life and value it. Some researchers have incorporated perceived value as a determinant of UTAUT construct. This present study likens performance expectance to perceived value since high transportation service quality will not eventuate without improvement in passengers' perceptions of value (Sumaedi et al. 2012). Prior studies have investigated the role of perceived value to gauge public transit passenger intention behavior.

Hence, ***Hypothesis 1***: Performance expectance has a positive and significant effect on the intention of commuters to use e-transport card.

Effort Expectance (EE)

According to Venkatesh et al. (2003), effort expectance is the level of ease and comfort users feel when using technological systems. Introducing a new fare medium may be a burden as well as have associated learning costs for end users (Puhe 2014). Various research undertaken by Madigan et al. (2016), Venkatesh et al. (2003), and Wu et al. (2012) highlight that effort expectancy has a direct and significant effect on user behavioral intentions. In this study, EE is described as e-transport card being easy and convenient for the commuter, causing no apparent struggle when using the card. Convenience can be associated with a time-saving product or service – one that is easy to use, not complicated, and where users face no hurdles. E-transport card does reduce the need for carrying cash (Welde 2012) as well reduces the time spent on boarding and paying when compared to the cash system (Mondato 2019; Welde 2012) since users do not have to take the card out of their wallet to pay their bus fare and "do not have to worry about having enough money or exact change" (Iseki et al. 2008, p. 12). According to PFIP (2017), a Fijian commuter was not only excited with the e-card tapping experience but also relieved of carrying coins and change haggling hassle. Overall, research is indicative of time savings being the major benefit of e-transportation (see Welde 2012). Although this may be a small time saving for the individual, it is important to note that the individual passenger will save time at every stop and for every

foregoing passenger who previously would have paid by cash.

Therefore, ***Hypothesis 2***: Effort expectance has a positive and significant effect on the intention of commuters to use e-transport card.

Social Influence (SI)

Venkatesh et al. (2003, p. 451) explains that "social influence is the degree to which an individual perceives that important others believe that he or she should use the new system." The work of various researchers like Gupta et al. (2018) proved that SI is a paramount element in understanding user behavior intentions in adopting a new technology interface. Likewise, Wu et al. (2012) reported positive and significant impact of SI on user behavioral intentions for iPass smartcard adoption. Current research defines SI as the stress caused by family and known associates who influence the intent to use. The present study includes political agents as those exerting SI in Fiji. Notably, the e-ticketing system was a compulsory implementation by the Fijian government (Fiji Commerce Commission 2014). Thus, the Fijian public had no choice but to transit from cash to digital given the government's directive to digitize the bus public transit (PFIP 2017).

Hence, ***Hypothesis 3***: Social influence has a positive and significant effect on the intention of commuters to use e-transport card.

Facilitating Conditions (FC)

According to Venkatesh et al. (2003, p. 430), FC are "the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system." FC may include training programs on how to use new technology interface and helpdesk assistance to positively influence the user intention and rate of adoption. The present study describes FC as easy card registration, replacement of lost or stolen cards, various top-up locations, and the sale of disposable cards to support commuters' adoption of e-transport cards. Wu et al.'s (2012) study proved that FC affect commuter intention to use new technology.

Thus, ***Hypothesis 4***: Facilitating conditions have a positive and significant effect on the intention of commuters to use e-transport card.

Sacrifice (S)

Researchers such as Maillet et al. (2015) suggested additional external variables to the UTAUT model to help better understand user ability in accepting IT changes. According to various authors such as Wen et al. (2005), sacrifice is perceived as the monetary and nonmonetary aspects including time, search, and psychological cost one bears to obtain a good or service. Wen et al.'s (2005) study reported perceived sacrifice as statistically significant with a direct negative effect on perceived value. The willingness to use any technology is inversely related to risk – the higher the risk, the lower the willingness to use. The present study describes sacrifice as one's time and effort to top-up e-transport card, the need to find a kiosk or vendor close to the commuter, the psychological cost of not having enough credit on the card, and the feel of embarrassment when told that the card balance is low, leading to the commuter disembarking the bus.

Hence, ***Hypothesis 5***: Sacrifice has a positive and significant effect on the intention of commuters to use e-transport card.

Moderating Factors

The UTAUT model includes gender, age, experience, and voluntariness of use as moderators. A number of studies that utilized the UTAUT model did not suggest the use of moderating factors (Williams et al. 2015) and those that did, focused on moderating factors of gender only, or gender and age (Yu 2012), or gender, age, and experience. Past studies have also used sociodemographic factors of age, income, education, and so forth to help with better explanation in analysis. Such sociodemographic factors help identify personal characteristics of bus commuters. In this study, the three moderating factors of gender, age, and experience will be used. The forth factor, voluntariness will not be used as the e-transport card is deemed mandatory if intending to travel by bus. These three moderating factors will help test the strength of association between

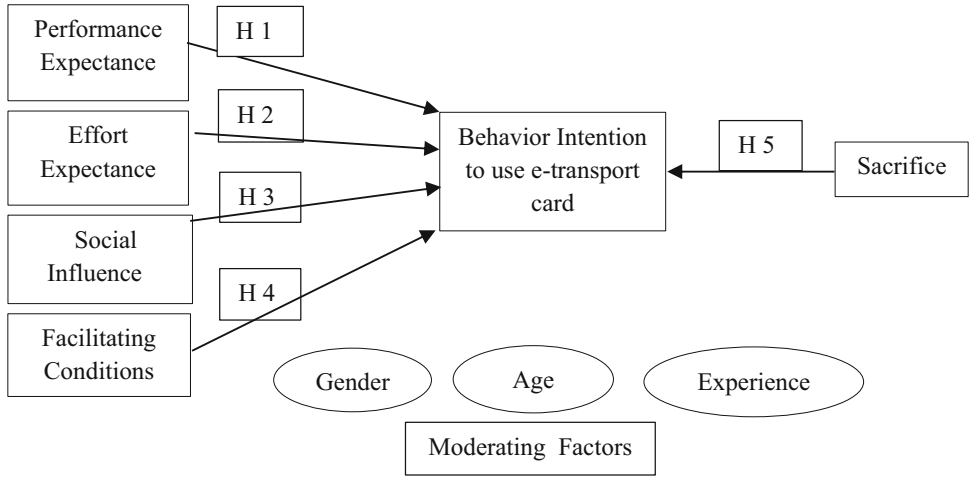
the five independent variables and the commuters' behavioral intentions to use e-transport card. There is sufficient evidence to suggest that the moderating factor of *gender* has a significant effect on the behavioral intention to use new technology (Magsamen et al. 2015; Wang and Shih 2009). In a study conducted by Chiemeke and Evwiekpaefe (2011), women appeared more motivated to use technology because of the ease of use, while men are motivated to use technology because of its usefulness. In another study conducted by Wang and Shih (2009) on the use of information kiosk, women were more inclined to be influenced by their significant others than man. *Age* is also a significant predictor of behavior intention (Lu et al. 2009; Venkatesh et al. 2003), and according to Magsamen et al. (2015), age is seen as an integral element of behavior intentions. The study found that the older a person is, the more likely he or she will not intent to adopt a new technology. The older generation are more likely to use the new system if it is user-friendly (Wang and Shih 2009). Another study by Yu (2012) showed that the facilitating conditions were higher among the mobile banking users below the age of 30 and over 50, in terms of the use of mobile banking. *Experience* is also a significant predictor according to Chiemeke and Evwiekpaefe (2011).

Proposed Research Model

The objective of this study is to identify factors influencing the bus commuter intentions to use e-transport cards in Fiji. The research model of the study is presented in Fig. 1. Various researchers have cited behavioral intentions as having positive and direct influence on usage behavior (Venkatesh et al. 2003). The behavioral intentions of student's use of e-transport card will be analyzed using Venkatesh et al.'s (2003) model of UTAUT with some modification of the added element of sacrifice drawn from the work of Prayoonphan and Xu. In social influence, the present study has added political influencers – no other study has looked at this contributing item in the *social influence* factor of the UTAUT model which makes the model unique and suitable to the context being studied. The elements of *PE* questions were sourced and modified from Venkatesh et al. (2003). The elements of *EE* questions were sourced and modified from: Iseki et al. (2008), Madigan et al. (2016), Welde (2012), Wu et al. (2012), and Venkatesh et al. (2003). The elements of *SI* questions were sourced and modified from Prayoonphan and Xu, Venkatesh et al. (2003), and Wu et al. (2012). The elements of *FC* questions were sourced and modified from and Venkatesh et al. (2003). The elements of *S* questions were sourced and modified from Wen et al. (2005). All five element questions were also integrated with the authors own perspective of questions relevant to the research. This entry has used a total of 37 questions to identity areas that are related to the South Pacific perspective and has used more questions compared to various articles that have used the UTAUT model in relation to transportation systems, which makes this research more comprehensive. Authors such as Madigan et al. (2016) have used 8 questions in total, while Prayoonphan and Xu used 20 questions in total with other added elements. Figure 1 below presents the research model.

Fiji's E-Transportation System

This study attempts to investigate into the factors affecting commuters' intention to use the e-transportation card for bus transportation, exemplified by an empirical research of tertiary students', in Fiji. Fiji, a parliamentary democracy in the South Pacific ocean is located about 2000 km northeast of New Zealand with an approximate population of 900,000 with two main islands of Viti Levu and Vanua Levu (COP23 2017–2018). Its road transport is serviced by private cars, taxis, rental and hire cars, heavy goods vehicles, buses, tractors, and motor cycles. Approximately 210,000 school and university students as well as more than 50,000 senior citizens depend on public transport (PFIP 2017). "Due to this heavy reliance on bus services, the bus industry is of national interest" (Consumer Council of Fiji 2017a: 1). Fiji has joined 71 other countries in cashless travel (Pratibha 2017). The primary purpose of introducing the e-transport card in Fiji was to eliminate cash handling and pilferage – an



Source: *Venkatesh et al. (2003) and Prayoonphan & Xu (2019)*

E-Public Transportation, Quantitative Analysis in Fiji, Fig. 1 Research model: modified UTAUT model. Source: Venkatesh et al. (2003)

ongoing issue for years (Consumer Council of Fiji 2017b). Given the issue of pilferage, government announced compulsory implementation of an e-ticketing system on first October 2017 (Fiji Commerce Commission 2014; Consumer Council of Fiji 2017a). Such a system was first implemented in February 2013, however, marred with issues like charging of incorrect fares, poor availability of disposable cards in buses, lack of card top-up centers, and lack of proper training of bus drivers (Consumer Council of Fiji 2017a). Nonetheless, even developed countries like Singapore and Hong Kong faced teething problems. Therefore, Fiji being a developing country and the first PIC in the South Pacific to implement an e-transport system given resource constraints is a milestone in itself. In late December 2008, the Land Transport Authority (LTA) and Ministry of Works and Transport in conjunction with the FBOA engaged the UK-based Orion Consulting Associates to carry out a comprehensive review of the bus industry. The 2009 Orion report strongly recommended prepaid tickets by installing ticket machines or e-ticketing. Every month, around $9.5 million is spent by the bus travelling public with bus companys' annual revenue of approximately $114 million (Pratibha 2018). Before the introduction of e-ticketing, a third of this amount was pilfered and not accounted for, resulting in unpaid taxes. In Fiji, the public had no choice but to transit from cash to digital given the government's decision to digitize the bus public transit (PFIP 2017). E-transportation is still a new service, initially test launched in 2013. When the system failed to function well back then due to poor self-regulation, government stepped into regulate e-ticketing by amending the Land Transport Regulations and invited various telecommunications agents to assist in the process. Commuters can either pay bus fares by using their e-transport cards or buy a disposable card for as little as $2 FJD from the driver. In Fiji, e-transportation benefits are twofold, direct and indirect. The direct benefit is fair assessment of bus fares based on reliable data. Indirect benefit for the consumers is – their taxes will no longer subside the bus industry because of poor financial performance of bus companies due to fraud. The Pacific Financial Inclusion Programme (PFIP) stated that advantages for end users include: greater transparency and control over targeting, coverage and distribution of the transport assistance/subsidy to the students, the pensioners, the senior citizens and the disabled citizens/residents; no cash or change requirement for passengers or drivers, resulting in speedy transactions; and the

reduction in handling of cash and associated efforts and risks (PFIP 2017). In addition, the e-ticketing system provides the government and its stakeholders with the essential consumer data to help re-align or add resources to better meet the needs of the travelling public (Pratibha 2017). These user benefits are consistent with global studies (Blythe 2004; Welde 2012).

Methodology

This study began with a thorough review of e-transportation literature the world across as well as reviewed relevant documents on the subject matter in Fiji. Upon sufficient secondary sources, questionnaires were distributed for bus commuters' responses for primary research. While a cross-sectional and self-reported data through a convenient sample has its limitations, this study used convenience sampling technique as like Sumaedi et al. (2012). The study was conducted in line with all ethical considerations. Tertiary students participated in the study voluntarily and were told that they could refuse to participate if felt uncomfortable. They were also informed that their participation will not affect their grades in the respective courses.

Participants of the Survey

The researchers conducted the questionnaire survey, face-to-face targeting second and third year university student passengers during tutorials through convenience sampling. These are the students of the School of Management and Public Administration in Faculty of Business and Economics, the largest school in the University of the South Pacific (USP). USP was established in 1968 and "... is one of the [only] two regional universities in the world..." (p. 87). It is a regional university that is co-owned by 12 Pacific Island Countries – Fiji, Cook Islands, Nauru, Kiribati, Marshall Islands, Samoa, Niue, Tuvalu, Solomon Islands, Tonga, Tokelau, and Vanuatu. The reason behind selecting these commuters is their regular use of e-transportation cards. This selection makes sense since e-transport systems mostly benefit those who use public transport regularly (Puhe 2014). E-ticketing interests those who use public transport regularly, since it means time (and sometimes cost) savings (Puhe 2014). The authors of this entry are involved in teaching 200 and 300 level courses in the same school and have an easy reach of participants. Participants spent about 10 min to complete the questionnaire. The questionnaires were filled out between 8 and 18 October 2019. The questionnaire, based on previous studies then modified to conform to the context of this study and to better understand tertiary student commuters' in Fiji, was designed with a five-point Likert scale ranging from strongly disagree (1) and strongly agree (5). The variables were developed after a thorough review of research related to the UTAUT model and e-transportation research. The Cohen's rule suggests a sample size of at least 10 times the number of the hypotheses for robustness. Hence, our modified model's hypotheses required a sample size of at least 90 participants – this was achieved for the study. Total sample collected were 202 of which 198 were considered valid for use in the study.

Analysis of Data

Data was analyzed using SPSS v25 software program. To evaluate the data, descriptive statistical methods (number, percentage, mean, standard deviation) were used. SPSS AMOS v26 was used to carry out Structural Equation Modeling (SEM), path analysis, confirmatory factor analysis, exploratory factor analysis, covariance analysis, correlations, and multiple regression to perform hypotheses testing in order to support the research and theory. SEM is widely used by researchers in marketing and consumer research (Hershberger 2003). The use of SEM also helps researchers to be more precise in the specification of hypotheses and operationalization of constructs (Bagozzi and Yi 2012). It also takes into account reliability of measures in tests of hypotheses in ways going beyond the averaging of multi-measures of constructs. To the best of the researchers' knowledge, there has not been any e-transportation study that has used AMOS.

Results and Discussion

Descriptive Analysis

Of the 198 respondents, 33.30% were male (n = 66) and 66.70% were female (n = 132). Of the total respondents, 83.80% (n = 166) were full-time and 16.20% (n = 32) were part-time students. 5.10% of the respondents were less than 20 years old, 86.90% were between 21 and 30 years old, 6.10% were between 31 and 40 years old, 1.50% were between 41 and 50 years old, and the remaining 0.50% represented age groups older than 50. Frequencies obtained for a 198 sample size are consistent with USP's overall student-related statistics. In terms of gender, there are more females (11,085.5) than males (8,537.5) enrolled at the university (USP 2018). There are more full-time students (12,679.6) than part-time students (6,943.5) (USP 2018). Students were asked about the number of times they use the e-transport card. Forty-nine participants used e-transport card once (25.40%), 34 used it twice (17.60%), 21 used it thrice (10.90%), and 89 used it more than four times (46.10%). Majority students who responded to the questionnaire were between 20 and 30 years of age. This is because majority of students enrolled at USP are high-school leavers and youths. The survey indicates that of the five factors, performance expectancy matters most to passengers since the introduction of e-ticketing system for bus services in Fiji has brought about benefits for passengers. Performance expectancy variables in line with the perceived benefits include: usefulness of e-transport card compared to the traditional ticketing system, requires carrying of less cash, is reliable for passengers, makes it easy to track the use of cash spent on bus travel and budget, offers flexibility in terms of top-ups, is an efficient way to pay for travel, and allows for reduced boarding time.

From all the age groups, it is the 20–30 year olds that is more readier in adopting e-transformation scenarios. This maybe because they are the e-generation and are thus more tech-savvy and more technologically comfortable when compared to the other age groups. The other noticeable age group is the above 51 years' age group. Comparatively, their adoption rate of e-transport card is much lower and they largely prefer cash payments for public transportation. This maybe because of the old mindset of how public transportation has been used, comfort and convenience in using cash than card, and small bus fare budgets compared to pre-top ups of amounts greater than $2 FJD. This concurs with the study by Magsamen et al. (2015) who argued that the older a person, the more likely he or she will not intent to adopt a new technology.

SEM and Hypotheses Testing

Exploratory Factor Analysis (EFA)

The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and the Bartlett's test of sphericity are the key assumptions of EFA. According to Pallant (2013), the KMO statistic ought to be greater than 0.50 and Bartlett's test of sphericity should be statistically significant ($p < 0.05$).

KMO and Bartlett's test in Table 1 showed that KMO statistic was $0.873 > 0.50$ and Bartlett's test of sphericity was significant ($p = 0.000 < 0.05$), and thus, the assumption for the confirmatory factor analysis (CFA) has been met. CFA was conducted, using the most used method of principal component analysis (PCA). Rotation was carried out using Varimax rotation method. Table 2 below shows communalities that measure the level of correlation between an item with all the items combined, the results of which should be a high common variance (>0.40).

Since the results in Table 2 show that none of the communalities were less than 0.40 thus, all the communalities were important for an efficient factor extraction. According to Pallant (2013), Kaiser criterion should be used to determine the number of components that would be extracted in EFA. This criterion only considers components with eigen value of 1.00 or above (Pallant 2013). The scree plot below is also used to show the number of components that would be extracted in EFA. Figure 2 below illustrates the scree plot showing the number of components that would be extracted in EFA.

E-Public Transportation, Quantitative Analysis in Fiji, Table 1 Exploratory factor analysis: KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sampling adequacy		0.873
Bartlett's test of sphericity	Approx. Chi-square	3355.458
	Df	496
	Sig.	0.000

E-Public Transportation, Quantitative Analysis in Fiji, Table 2 Communalities

	Initial	Extraction
PE_useful	1.000	0.701
PE_lesscash	1.000	0.474
PE_reliable	1.000	0.669
PE_track	1.000	0.554
PE_flexible	1.000	0.729
PE_efficient	1.000	0.694
PE_fast	1.000	0.588
EE_easy	1.000	0.653
EE_convenient	1.000	0.701
EE_operate	1.000	0.720
EE_understand	1.000	0.834
EE_assistance	1.000	0.788
EE_comfortable	1.000	0.700
SI_family	1.000	0.790
SI_friends	1.000	0.751
SI_govt.	1.000	0.651
SI_family/friend	1.000	0.578
SI_mandatory law	1.000	0.730
SI_not a law	1.000	0.571
FC_register	1.000	0.607
FC_queries	1.000	0.799
FC_resolved	1.000	0.741
FC_replacement	1.000	0.604
FC_top-up	1.000	0.633
FC_kiosk	1.000	0.570
FC_top-up location	1.000	0.642
FC_disposable card	1.000	0.492
S_effort	1.000	0.576
S_time	1.000	0.575
S_time	1.000	0.672
S_embarrassment	1.000	0.699
S_wrong fare	1.000	0.597

Extraction method: principal component analysis.

The scree plot shows five screes above the eigen values. This evidences that there are five factors in this study.

Reliability and Validity Testing

The components extracted from PCA need to be validated before it is applied in SEM. Cronbach's alpha coefficient was used to determine the reliability and internal validity of components extracted from PCA. Reliability analysis was used to

determine the internal validity and reliability of components. Tabachnick and Fidell (2007) argues that the generally acceptable threshold for the acceptance of alpha is 0.60. Table 3 below presents the results.

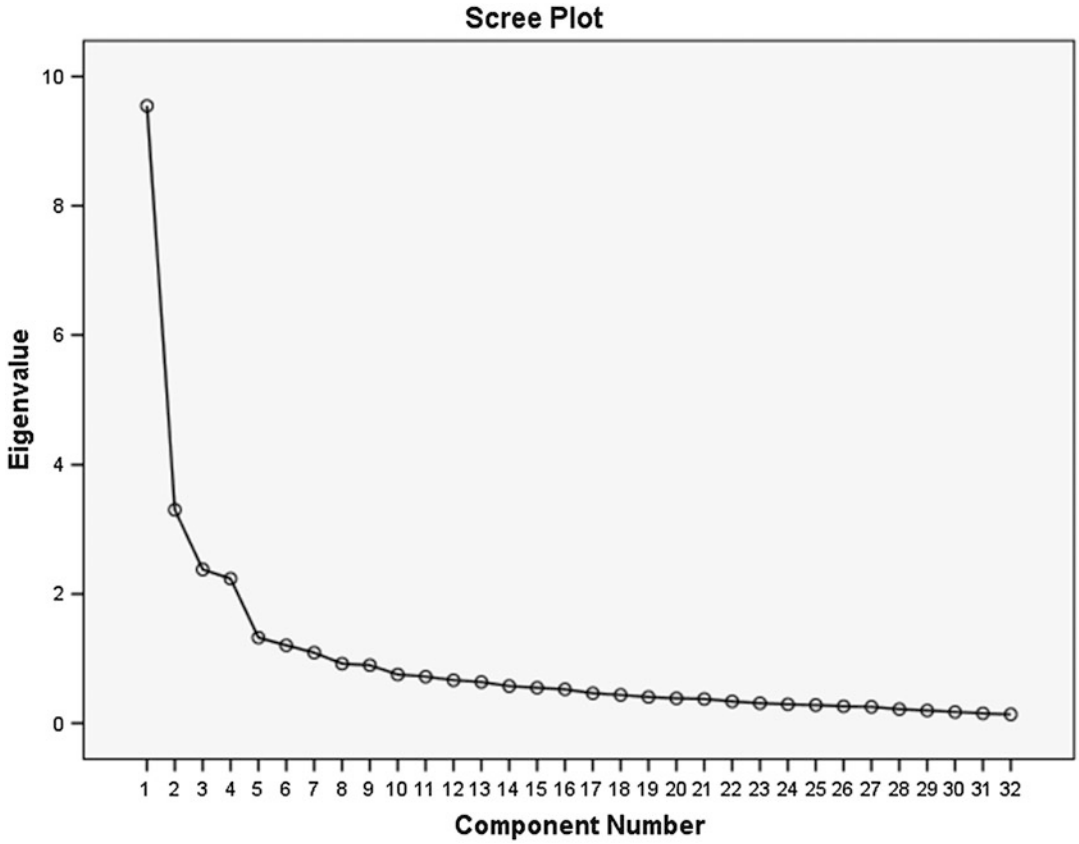
Results show that scale Performance expectance has good internal validity and reliability (alpha = 0.873). The average value of Performance expectance is 3.72 (M = 3.72; SD = 0.93). The results showed that scale Effort expectance has a good internal validity and reliability (alpha = 0.874). The average value of Effort expectance is 3.80 (M = 3.80; SD = 0.1.01). Results showed that scale Social influence has a good internal validity and reliability (alpha = 0.639). The average value of Social influence is 3.63 (M = 3.63; SD = 1.03). Results showed that scale Facilitating conditions has a good internal validity and reliability (alpha = 0.879). The average value of Facilitating conditions is 3.49 (M = 3.49; SD = 1.03). The results showed that scale Sacrifices has a good internal validity and reliability (alpha = 0.745). The average value of Sacrifices is 3.73 (M = 3.73; SD = 1.23).

Confirmatory Factor Analysis (CFA) (Fig. 3 and Table 4)

Table 5 shows the results of moderation analysis. The moderating effect of gender, experience, and age were examined using AMOS.

The results of moderation analysis showed that gender has moderation effect between behavior intention and performance experience, and between behavior intention and social influence. The results showed that experience has moderation effect between behavior intention and performance experience, between behavior intention and social influence, and between behavior intention and facilitating conditions. The results also showed that age has moderation effect between behavior intention and social influence. In past studies by Magsamen et al. (2015) and Wang and Shih (2009), gender was reported to have a significant effect on the behavioral intention to use new technology. Studies by Lu et al. (2009), Magsamen et al. (2015), and Venkatesh et al. (2003) proved that age is a significant predictor of behavior intention and serves as an integral element of behavior intentions and the study by Chiemeke and Evwiekpaefe (2011) showed the importance of experience. The results also showed significant positive impact of performance expectance on behavior intention.

Therefore, Hypothesis 1: Performance expectance has a positive and significant effect on the intention of commuters to use e-transport card, is confirmed. This is in agreement with studies by Madigan et al. (2016), who argued that performance expectance is a vital element affecting a person's behavioral intention of usage. The results showed that there is positive but not a significant effect of effort expectation on behavior intention. Therefore, Hypothesis 2: Effort expectance has a positive and significant effect on the intention of commuters to use e-transport card, can be partially confirmed. Effort expectancy included variables such as passenger ease of use, convenient traveling, operability of e-transport card with/without assistance, and comfort in using card instead of cash for bus fare. This thus, only partially concurs with the findings of Madigan et al. (2016), Venkatesh et al. (2003), and Wu et al. (2012). This may be because tertiary students are still getting used to the e-transportation system which is still relatively new after the not so successful launch in 2013 when compared to better developed nations where locals have more experience with smart cards. At this point, it can be assumed that after some years and given more experience with e-transportation, this result may differ. The results showed significant but negative impact of social influence on behavior intention. Therefore, Hypothesis 3: Social influence has a positive and significant on the intention of commuters to use e-transport card, is partially confirmed. Here again, the result only partially agrees with the findings of Gupta et al. (2018) who claim that social influence is paramount in understanding user behavior intentions in adopting a new technology. Likewise, the result also only partially concurs with Wu et al. (2012) who reported positive and significant impact of social influence on user behavioral intentions for iPass smartcard adoption. In Fiji's case, it is worth noting that the public had no choice but to go digital given

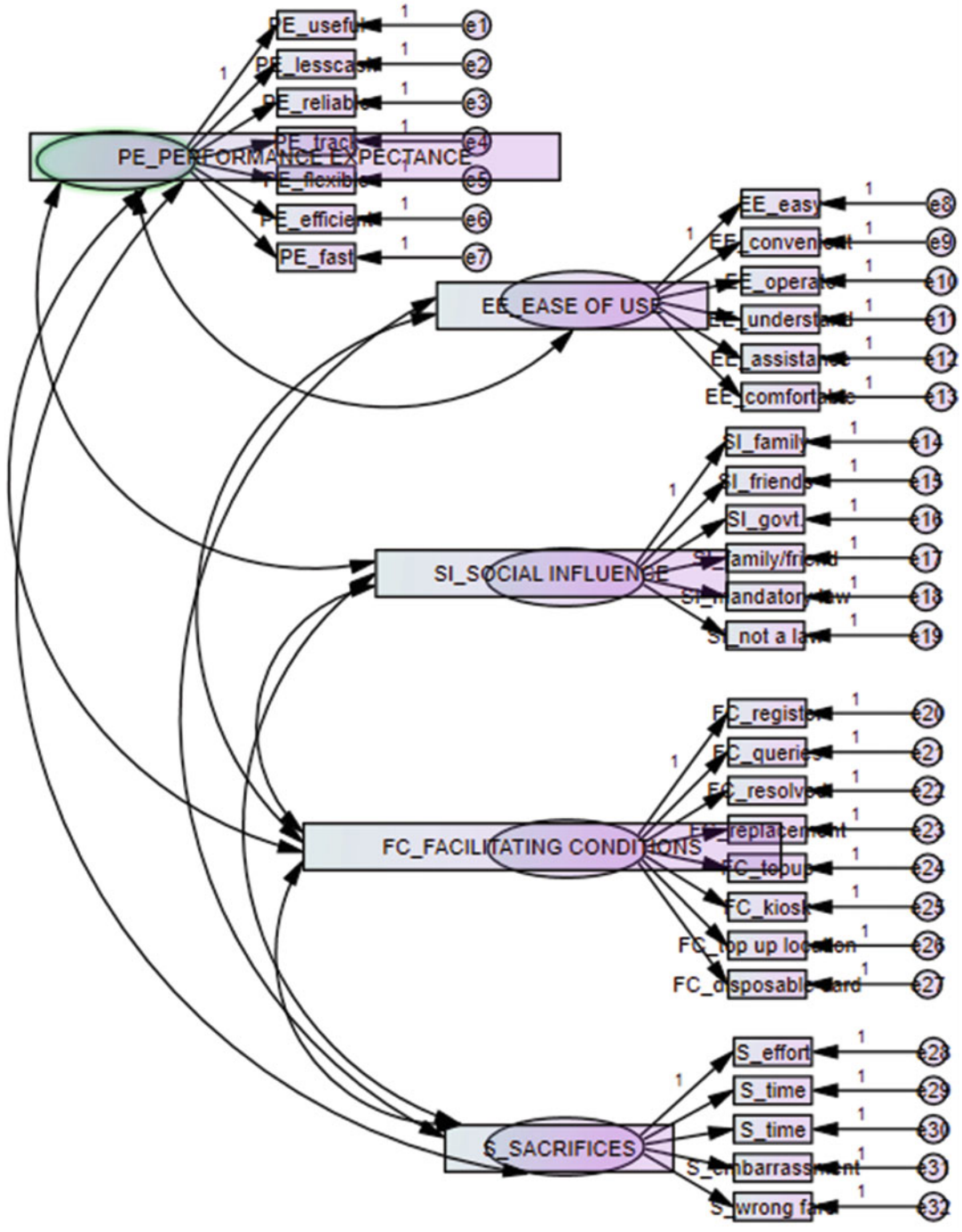


E-Public Transportation, Quantitative Analysis in Fiji, Fig. 2 Scree plot: number of components extracted in EFA

E-Public Transportation, Quantitative Analysis in Fiji, Table 3 Reliability analysis: Cronbach's alpha coefficient, mean, and standard deviation

Variable	Cronbach's alpha	Number of items	M; SD
Performance expectance	0.873	7	3.72; 0.93
Effort expectance	0.874	6	3.80; 1.01
Social influence	0.639	6	3.63; 1.03
Facilitating conditions	0.879	8	3.49; 1.03
Sacrifices	0.745	5	3.73; 1.23

the government's directive, leaving little room for any other's (family/friends) significant influence (PFIP 2017). It was more of a coercive effort from the government. This is an unusual interesting finding specific to Fiji's situation. The results showed significant negative effect of facilitating conditions on behavior intention. Therefore, Hypothesis 4: Facilitating conditions has a positive and significant effect on the intention of commuters to use e-transport card, is partially confirmed, since the results showed significant, but negative effect of facilitating conditions on behavior intention. Once again, the result only partially agrees with Wu et al. (2012) whose studies proved that facilitating conditions affect commuter intention to use new technology. Fiji is still relatively new and not that well equipped with the needed facilitating conditions/infrastructure



E-Public Transportation, Quantitative Analysis in Fiji, Fig. 3 SEM: confirmatory factor analysis

which can make e-transportation convenient. The results showed that there is no statistically significant effect of sacrifice on behavior intention. Therefore, Hypothesis 5: Sacrifice has a positive and significant effect on the intention of commuters to use e-transport card, must be rejected.

E-Public Transportation, Quantitative Analysis in Fiji, Table 4 Confirmatory factor analysis

Variables			Estimates
PE_01_useful	←	PE_08_BENEFITS	0.535
PE_02_lesscash	←	PE_08_BENEFITS	0.397
PE_03_reliable	←	PE_08_BENEFITS	0.502
PE_04_track	←	PE_08_BENEFITS	0.439
PE_05_flexible	←	PE_08_BENEFITS	0.451
PE_06_efficient	←	PE_08_BENEFITS	0.512
PE_07_fast	←	PE_08_BENEFITS	0.477
EE_09_easy	←	EE_15_EASEOFUSE	0.563
EE_10_convenient	←	EE_15_EASEOFUSE	0.677
EE_11_operate	←	EE_15_EASEOFUSE	0.506
EE_12_understand	←	EE_15_EASEOFUSE	0.465
EE_13_assistance	←	EE_15_EASEOFUSE	0.439
EE_14_comfortable	←	EE_15_EASEOFUSE	0.751
SI_16_family	←	SI_22_SOCIALINFLUENCE	0.347
SI_17_friends	←	SI_22_SOCIALINFLUENCE	0.316
SI_18_govt	←	SI_22_SOCIALINFLUENCE	0.233
SI_19_ff	←	SI_22_SOCIALINFLUENCE	0.453
SI_20_law	←	SI_22_SOCIALINFLUENCE	0.264
SI_21_notlaw	←	SI_22_SOCIALINFLUENCE	0.232
FC_23_register	←	FC_31_FACILITATINGCONDITIONS	0.422
FC_24_queries	←	FC_31_FACILITATINGCONDITIONS	0.474
FC_25_resolved	←	FC_31_FACILITATINGCONDITIONS	0.494
FC_26_replacement	←	FC_31_FACILITATINGCONDITIONS	0.436
FC_27_top-up	←	FC_31_FACILITATINGCONDITIONS	0.526
FC_28_kiosk	←	FC_31_FACILITATINGCONDITIONS	0.400
FC_29_top-uplocation	←	FC_31_FACILITATINGCONDITIONS	0.543
S_32_effort	←	S_37_SACRIFICES	0.153
S_33_time	←	S_37_SACRIFICES	0.022
S_34_forget	←	S_37_SACRIFICES	0.178
S_35_embarrassed	←	S_37_SACRIFICES	0.175
S_36_wrongfare	←	S_37_SACRIFICES	0.284

This is in contrast to past studies like Wen et al. (2005) who reported perceived sacrifice as statistically significant with a direct negative effect on perceived value. This maybe because in Fiji, the sample commuters may not feel that: they are making significant sacrifices in terms of one's time and effort in topping-up e-transport card, in finding a kiosk or vendor close to them, the psychological cost of not having enough credit on the card, and the feel of embarrassment when told that the card balance is low. The respondents have to top-up anyway to recharge mobile phones, the vendors are located close to USP and the study sample is tertiary students so it is assumed that this sample is not that psychologically affected than the sensitive senior citizens. For this group, not having enough credit or lower card balance may not be a big deal or common among them.

Model Test for Fitness

CMIN/DF was used for the absolute fit indices. Table 6 depicts CMIN/DF results.

The results show that CMIN/DF = 0.476 < 3.00, confirming absolute fit. Table 7 below shows RMSEA results.

Root Mean Square Error of Approximation (RMSEA) was used for the non-centrality-based fit indices. The maximum threshold is 0.05. The

E-Public Transportation, Quantitative Analysis in Fiji, Table 5 Results of moderation analysis

			Estimate
BehaviorIntention	←	PE_08_BENEFITS	0.022*
BehaviorIntention	←	EE_15_EASEOFUSE	0.002
BehaviorIntention	←	SI_22_SOCIALINFLUENCE	−0.009*
BehaviorIntention	←	FC_31_FACILITATINGCONDITIONS	−0.020*
BehaviorIntention	←	S_37_SACRIFICES	0.000
BehaviorIntention	←	GenderxPE	0.018*
BehaviorIntention	←	GenderxEE	0.002
BehaviorIntention	←	GenderxSI	−0.023*
BehaviorIntention	←	ExperiencexPE	−0.998*
BehaviorIntention	←	ExperiencexSI	0.039*
BehaviorIntention	←	ExperiencexFC	0.033*
BehaviorIntention	←	AGExPE	−0.001
BehaviorIntention	←	AGExEE	−0.003
BehaviorIntention	←	AGExSI	0.005*
BehaviorIntention	←	AGExFC	0.001

*the relations are strong amongst variables, and hypothesis are likely to be true

values of 0.05 or lower indicate good model fit, while 0.06–0.08 indicate acceptable model fit. Since the RMSEA value is 0.000 < 0.05, results indicate a good model fit. The results (Tables 6 and 7) show that goodness of fit was not violated, thus confirming that model findings are valid. Also, there is enough evidence, except for H5 to support the claims that there is an association between the use of e-transport card and the respective variables of interest used in the questionnaire.

Conclusion and Recommendations

This research attempted to contribute towards better understanding of user intention and adoption, a topic that is still deemed important as per scholars like Sumaedi et al. (2012) especially when only a few published studies focus on factors influencing e-ticket usage behavior. All in all, our research only confirmed H1 (Performance expectance has a positive and significant effect on the intention of commuters to use e-transport card). It only partially confirmed H2, H3, and H4 (Effort expectance, Social influence and Facilitating conditions have positive and significant effect on the intention of commuters to use e-transport card). It rejects H5 which was – Sacrifice has a positive and significant effect on the intention of commuters to use e-transport card. These results may be generalizable to other smaller PICs but may not be generalizable to other larger and better developed countries since the study is just premised in one small developing PIC and just based on the segment of tertiary students of one university. Also, studies using the same research model and questionnaire in other countries may bring about different findings. The self-reported questionnaire as the research tool is also a common limitation since interviewees may rush through, not express true opinions, select responses that may please the interviewer, all of which could lead to errors in the results. The research was also conducted within a short period. As Chao (2019) mentions, customer perception can change over time with new knowledge and accumulated experiences.

Nonetheless, findings from the present study can help better understand user issues of regular commuters, which can better inform the policy makers, bus service providers/operators, and the assisting mobile phone companies for improvement in the current system. For transportation scholars, the study suggests research on other segments and larger samples and, like Chao (2019), suggests longitudinal studies for updated findings. Furthermore, "...other key factors beyond the scope of this study could be

E-Public Transportation, Quantitative Analysis in Fiji, Table 6 Absolute fit indice: CMIN/DF results

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	11	1.429	3	0.699	0.476
Saturated model	14	0.000	0		
Independence model	4	5.196	10	0.878	0.520

E-Public Transportation, Quantitative Analysis in Fiji, Table 7 Non-centrality-based fit indice: RMSEA results

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	0.000	0.000	0.089	0.828
Independence model	0.000	0.000	0.038	0.974

incorporated to improve the explanatory power of the endogenous variables". For the industry and the economy, after sometime as the public becomes comfortable and readier towards card systems, recommendations are to use e-cards for other purposes aside bus transport like in some Asian cities. Integrated e-tickets could even be extended to tourism and leisure activities (Puhe 2014). E-transportation card can be applied to other modes of public transportation too like mini buses and taxis. Fiji may also look into integrated use of the card so that it can be linked to other services like parking meter payments as well as other retail purchases (Iseki et al. 2008).

Overall, the study advanced the research work in the area of e-transportation and in developing nations. It also modified the model to better understand user behavior intention in the bus industry. This paves the way for development of even more effective models. Our study, however, should not be taken to exemplify the entire e-transportation adoption scenario. Nevertheless, it is envisaged that this study will inspire scholars to further scrutinize the subject matter with larger scale studies, more comprehensive questionnaires, longitudinal studies, comparative studies, and use of other variables. Also, a one-size-fit-all product may not fully address user needs. Overall, this entry agrees with Blythe (2004) and Mondato (2019) who argue that solutions should not be globally dictated but rather locally informed.

Cross-References

- Citizen Participation in Public Management
- Citizen Satisfaction with Government Services in Japan
- Digital Social Innovators
- Digital Transformation, Brazil

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