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Technology readiness and mobile self-service technology adoption in the airline industry: An emerging market perspective

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Orientation: While mobile applications are seen as the way forward for airlines and airports alike, not much is known about consumers' readiness to adopt such self-service technologies. This is important because of lower than expected adoption rates of traditional self-service technologies (online websites and check-in kiosks) in the airline industry.

Research purpose: The purpose of this study was to determine passengers' level of technology readiness and its influence on their adoption of mobile self-service technologies in the airline industry of South Africa.

Motivation for the study: To ensure the adoption of mobile self-service technologies in the airline industry, it is necessary to uncover consumers' readiness and adoption behaviours towards such technologies.

Research design, approach and method: Primary data were collected from 315 respondents using a structured questionnaire. The sample comprised South African citizens who had travelled using an airline either domestically or internationally within the previous 12 months. Regression analysis was used to test hypotheses posited in the study.

Main findings: The findings showed that airline self-service mobile application adoption is influenced by technology readiness, perceived ease of use and perceived usefulness; both perceived ease of use and perceived usefulness are influenced by technology readiness; and perceived ease of use strongly influences perceived usefulness regarding airline mobile self-service application adoption.

Practical/managerial implications: Effective communication aimed at enhancing the perception that airline self-service mobile applications are easy to use is essential to increase the adoption of mobile applications in the airline industry.

Contribution/value-add: The article contributed by applying the TRAM construct to the use and adoption of self-service mobile applications in the airline industry. In addition, the study also integrated the recently refined TRI 2.0 into the TRAM construct (TRAM 2.0).

Introduction

In the new millennium, the airline industry has seen the widespread implementation of mobile self-service technologies. These technologies have been predominantly introduced for customer check-in and ticket purchasing, and have taken the form of check-in kiosks, online websites and, most recently, mobile applications (Ku & Chen 2013:87; SITA 2013a). In 2016, a total of 3.42 billion people globally were connected to the Internet. This represents approximately 46.1% of the global population, which is a large increase considering that connection to the Internet was only 1% in 1995. SITA (2013a) suggests that the implementation and use of mobile self-service technologies is set to increase, supported by growing expenditure by the airline industry on information technology. Global expenditure on information technology in the airline industry has been growing strongly over the years. In 2003, global IT spend by the industry was estimated at 2.1% of revenue, which translated to US$15.1 billion (IATA 2018; SITA 2014) while in 2016 the total IT spend was estimated at US$28.9 billion (SITA 2017). The growth of mobile self-service technologies in this sector and others is a result of their potential value to companies and their customers. This value manifests primarily in the elimination of the service employee from the service encounter, which allows the airline industry to reduce labour costs, shorten queues, occupy smaller spaces and minimise the total service time for consumers (Hassan, Sade & Rahman 2014:61).

Mobile applications have been marked as the key airline mobile self-service technology moving forward, with the platform providing a number of additional mobile functions such as boarding pass storage, check-in services, ticket purchase, baggage tracking and flight status updates (SITA 2013a, 2013b).

While mobile applications are seen as the way forward for airlines and airports alike, not much is known about consumers' readiness to adopt such mobile self-service technologies. This is important because of lower than expected adoption rates of traditional mobile self-service technologies, such as online websites and check-in kiosks in the airline industry, which raises the question of whether or not consumers are ready to adopt such technologies (SITA 2013c). One construct that can be used to determine people's readiness to adopt new technologies is the technology readiness (TR) construct (Larasati & Santosa 2017:114; Wong et al. 2016:764). According to Parasuraman (2000:308), TR can be seen as an 'overall state of mind' resulting from the combination of 'mental enablers and inhibitors', which can be used to determine an individual's readiness to embrace and use new technologies. Although TR has been found to be effective in determining an individual's general perceptions of technology, it has limited applicability in the adoption of specific technologies, such as mobile applications (Lin, Shih & Sher 2007:644–645; Wong et al. 2016:765). This is a result of TR's inability to explain situations where consumers with a high level of TR fail to adopt new, innovative technologies (Chen, Liu & Lin 2013:606; Lin et al. 2007:642). To improve the applicability of TR to specific technologies, Lin, Shih and Sher (2007:644) integrated the two beliefs (perceived usefulness[PU] and perceived ease of use[PEOU]) of the technology acceptance model (TAM) into TR to form the technology readiness and acceptance model (TRAM). This model integrates the personality dimensions of TR with the system-specific dimensions of TAM and has been found to improve the explanatory power of both individual constructs (Godoe & Johansen 2012:40; Lin et al. 2007:641). It follows that TAM was initially developed to explain the adoption of specific technological systems within a defined working environment (Lin et al. 2007:642). TAM's applicability towards the adoption of specific technologies within broader marketing settings has thus been questioned (Lin et al. 2007:642; Sheng & Zolfagharian 2014:460). The integrated model (TRAM) overcomes the shortcomings of TR and TAM by ensuring that it incorporates individuals' attitudes towards technology in general (TR) and their perceptions of a specific technology (TAM).

The airline industry has made a significant commitment towards the development and implementation of a mobile future for passenger services (SITA 2013b). This development will see the widespread implementation of mobile applications that seek to address growing consumer demand for a timelier flow of information and greater convenience (SITA 2013c). Underlying factors behind the significant investments in mobile technology include the rapid growth in global smartphone penetration and the potential benefits to airlines and airports (e.g. reduced business costs) and consumers (e.g. up-to-date flight information) (Digital Strategy Consulting 2013; SITA 2013c). GSMA (2016:4) positions the argument for the mobile economy in Africa stating that 'subscribers across Africa are increasingly migrating to mobile broadband services, driven by network rollouts and mobile operator device and data strategies'. In this regard, South Africa is no exception because, between 2016 and 2017, South Africa had 16 million active mobile users (inclusive of smartphone usage), which is a 30% increase from 2015 (Qwerty 2017:5). Despite these positive factors, the adoption rate of these mobile applications by consumers is predicted to be slow as consumers will need to be convinced of the value they can provide (Florido-Benítez & Martínez 2015:224; SITA 2013c). Furthermore, considering that technology is developing at a rapid rate, the evolution of mobile technology, as a self-service tool, will eventually become an indispensable part of the service delivery process of a supplier. Therefore, to ensure the adoption of these mobile applications and prevent the financial loss associated with development and implementation, it is necessary to uncover consumers' readiness and adoption behaviours towards such technologies (Ahn & Seo 2018:110; Godoe & Johansen 2012:39). In a previous study on the airline industry, Lee, Castellanos and Choi (2012:731) utilised TR to predict consumer adoption of check-in kiosks. Taylor, Voelker and Pentina (2011:60) not only looked at the adoption of mobile applications but also examined the influence of social groups on adoption behaviour. Furthermore, Martin-Domingo and Martín (2016:102) also did a study at European airports relating to the use of mobile services or applications (apps) at airports and how these devices are able to tailor the experience of airline passengers. In addition, Bulmer, Elms and Moore (2018:107) investigated consumer perception towards the adoption of self-service checkouts and the associated social obligations of shopping practices in New Zealand. However, the majority of these studies are conducted in the developed world, with no study focusing on mobile applications in the airline industry of the emerging economies of Africa. In addition, through an extant review of the literature, no previous studies were found that applied the TRAM model to the use and adoption of mobile applications in the airline industry of an emerging African economy such as South Africa. Furthermore, no study was found that integrated the recently refined TRI 2.0 into the TRAM model. Consequently, the level of TR and perceptions of passengers regarding the adoption of mobile applications in the airline industry of an emerging African economy such as South Africa remains unexplored and tends to be unclear. Therefore, the study attempts to address this research gap.

The study contributes to the theory because it provides further justification for the TRAM model as proposed by Lin et al. (2007:642). The proposed model differs from the original TRAM model as it also includes the updated TRI 2.0 as proposed by Parasuraman and Colby (2015:63). The final proposed model verifies the B2C relationships between mobile self-service technology adoption and its antecedents (TR, PU and PEOU) within a South African airline industry context. From a managerial perspective, the study contributes by providing airlines with information relating to South African consumers' readiness to use mobile self-service technologies and whether such technology is, in fact, a viable alternative to face-to-face services for air travellers in South Africa.

This article provides an overview of self-service technologies and an explanation of the key constructs of the study from which the different hypotheses for the study are presented and a theoretical model is proposed. The research methodology is followed by the results, the findings and the managerial implications of the study.

Literature review

The theory of reasoned action grounding the study

The TAM was built around the theory of reasoned action (TRA) and proposes that the behaviour of an individual is founded on his or her intentions to perform that behaviour (Bansal, Zahedi & Gefen 2016:2; Kaur & Quareshi 2015:761). TRA assumes that individuals' TR regarding the use of a system is guided by their attitude towards technology, which in turn is influenced by its PU and PEOU. These two elements eventually lead to intention, which ultimately influences behaviour (Mishra, Akman & Mishra 2014:29). TRA departs from the perspective that individuals behave in a rational manner and are not predisposed to unconscious solicitation so that they can categorically control their own behaviour. TRA proposes that the actual behaviour of an individual is guided by his or her behavioural intention, both of which are influenced by PU and PEOU (Yang et al. 2015:10). The theory is further grounded in the argument that there is a direct relationship between behavioural intentions and actual usage (Fodor & Brem 2016:346). Therefore, individual actions drive the decision-making process and are built around thoughts and ideas (Duh & Struwig 2015:95). The basic principle is that individuals' TR and decision to use such technology will be guided by aspects such as their optimistic and innovative attitude towards the system as well as their discomfort and insecurity with the system (Bowen & Bowen 2016:51). Therefore, TRA is perceived as a founding theory for the development of the TRAM model and of individual behaviour regarding technology adoption and use (Davis, Bagozzi & Warshaw 1989:983; Hall & Lin 2016:116; Wentzel, Diatha & Yadavalli 2013:660).

Mobile self-service technologies in the South African airline industry

Driven by advances in mobile and broadband technology, mobile self-service technologies have grown rapidly across the world. The scenario in South Africa has not followed the same trend because of a mismatch of certain supply and demand factors. This mismatch has caused the adoption of mobile self-service technologies to vary greatly across different industries and be limited to the higher living standards measure (LSM) groups in South Africa (Merchants 2013). In the context of the South African airline industry, a lack of both supply and demand factors has been prevalent in influencing the success of mobile self-service technologies in the industry (Merchants 2013; SITA 2013c).

On the supply side, the benefits inherent to mobile self-service technologies, such as cost savings and greater convenience, have been the main drivers of mobile self-service technology implementation, although issues surrounding the overall passenger experience have proved problematic (Elliott, Hall & Meng 2012:311; Hassan et al. 2014:61; Merchants 2013; SITA 2013c). This implies that South African consumers have traditionally favoured face-to-face service, because of the perception that they are receiving a better service experience compared to mobile self-service technologies (Bizcommunity.com 2013; Merchants 2013). In addition, Merchants (2013) stated that demand factors such as access to the Internet and mobile technology, as well as confidence in mobile self-service technologies, have also provided additional barriers to the success of such technologies in the South African airline industry.

These trends, which have proved effective barriers in the past, are starting to be overcome and mobile self-service technologies have once more become an attractive proposition for the airline industry in South Africa (Digital Strategy Consulting 2013; Fly SAA 2015; World Wide Worx 2012). A key driver of this change is the growth in Internet access as well as smartphone penetration within South Africa. Broadband access in South Africa is growing exponentially because of the significant shift towards mobile Internet, which has been brought on by improved smartphone penetration and the cheaper cost of mobile data (World Wide Worx 2012). As a result, smartphone penetration in South Africa is currently in excess of 40% (23 million active smartphones) and 92% of Internet users now use their smartphone to access the Internet (Effective Measure 2014; IT Web 2015).

The vast majority of the 92% of South Africans who use smartphones to access the Internet also have some form of mobile tablet device (Effective Measure 2014). With the growth in mobile device penetration providing the platform for mobile self-service technologies, it is imperative for the feasibility of such technologies that these users begin to develop a need for such services (Digital Strategy Consulting 2013; Merchants 2013). According to Fly SAA (2015), this demand has manifested itself in the South African airline industry and, as such, airlines in South Africa will need to meet this consumer demand with the enhancement of mobile self-service technologies and the development of mobile applications. One airline that has embraced this trend is SAA, which has active mobile applications for both SAA and Mango airlines (Fly SAA 2015). Through mobile self-service technologies, airlines can, for example, offer flight, seat and meal booking services, or a change of such booking services more conveniently, faster and at a cost-saving advantage (Gures, Inan & Arslan 2018:2).

Technology readiness

Technology readiness is defined as 'people's propensity to embrace and use new technologies for accomplishing goals in home life and at work' (Parasuraman 2000:308). The construct measures 'an overall state of mind resulting from a combination of mental enablers and inhibitors to determine a consumer's preference to use new technologies' (Parasuraman 2000:308). According to Lai (2008:19), this implies that the perceptions of a person with regard to technology can consist of positive and/or negative aspects, which jointly influence whether or not an individual is ready to adopt a new technology. The positive views will push individuals towards new technologies, and the negative views will pull them away (Parasuraman & Colby 2001:29). Parasuraman and Colby (2001:33) state that such beliefs can be separated into different distinctive dimensions such as 'optimism', 'innovativeness', 'discomfort' and 'insecurity'. Lin and Chang (2011:425) are of the opinion that optimism and innovativeness can be perceived as the affirmative dimensions (contributors), while discomfort and insecurity are seen as undesirable dimensions (inhibitors).

Optimism can be defined as 'a positive view of technology and a belief that it offers people increased control, flexibility and efficiency in their lives' (Parasuraman & Colby 2001:34). According to Lin and Chang (2011:428) and Parasuraman and Colby (2001:34), optimism relates to feelings that reinforce technology as being a good thing. Optimism looks at the positive aspects of technology, such as not being restricted to normal trading hours, having greater control, enhancing people's lives and being more efficient at work (Lai 2008:19; Parasuraman & Colby 2001:34–35).

Innovativeness is defined by Parasuraman and Colby (2001:38) as a 'tendency to be a technology pioneer and thought leader'. In this context, innovativeness refers to the degree to which a person believes they are at the forefront of testing new technological innovations (Lai 2008; Lin & Chang 2011; Parasuraman & Colby 2001). According to Parasuraman and Colby, innovativeness relates to attributes such as not needing help to understand and operate new technology, and being the first in an acquaintance group to obtain and utilise new technologies.

Discomfort is defined as 'a perceived lack of control over technology and a feeling of being overwhelmed by it' (Parasuraman & Colby 2001:41). According to Lin and Chang (2011:428), discomfort refers to the extent to which people may have a prejudice against technology. This view is supported by Parasuraman and Colby (2001:41), who refer to discomfort in terms of general feelings that technology is not for normal people, that it is too complicated, and that people feel they require large amounts of knowledge to be competent with it.

Insecurity was first defined by Parasuraman and Colby (2001:44) as 'distrust of technology and scepticism about its ability to work properly'. Although the discomfort dimension appears related to the insecurity dimension, they differ in that discomfort focuses on a lack of comfort, while insecurity deals with the trust side of the technological interaction (Lai 2008:19; Parasuraman & Colby 2001:44). Examples of insecurity are hesitance to provide credit card information and concerns about information reaching its destination (Parasuraman & Colby 2001:44–45).

According to Parasuraman and Colby (2001:58), it is important to understand that the different dimensions of TR are independent of one another, which means that an individual can simultaneously praise and fear technology. To bring these four dimensions together, Parasuraman (2000) developed a 36-item scale called the TR index 1.0 (TRI 1.0) to measure these dimensions and assess a person's overall level of TR (Lin & Hsieh 2012:50). The 36-item scale that makes up TRI 1.0 consists of various statements based on the four dimensions of TR (10 for optimism, 7 for innovativeness, 10 for discomfort and 9 for insecurity). The scores across each of the dimensions' respective statements allow one to assess an individual's overall level of TR (Parasuraman & Colby 2001:32–44). Consumers are then placed on a scale (which indicates 'strongly negative' at one end and 'strongly positive' at the other) based on their overall scores for the four dimensions (Jaafar & Ramayah 2007:183; Parasuraman & Colby 2001:31). An individual's relative position on the continuum can be used to determine the likelihood that they will adopt new or existing technologies (Jaafar & Ramayah 2007:183). Findings by Al-Ajam and Nor (2015) show that TR exerts positive influence on usage intentions. According to Yousafzai and Yani-de-Soriano (2012:62), individuals with an overall high TR score (i.e. consumers who score highly on optimism and innovativeness, and low on discomfort and insecurity) tend to believe in the benefits of technology and are more likely to adopt a new technology. Accordingly, it is hypothesised in this study that:

H1: *Technology readiness positively* influences passengers' intentions to adopt mobile applications in the airline industry.

Although TR has proved to be an effective determinant of a consumer's beliefs about technology, it fails to explain instances where individuals with a high level of TR fail to adopt a new, innovative technology (Lin et al. 2007:642). Lin et al. (2007:645) argue that this is because TR determines general beliefs about technology and its applicability to specific technologies is limited. According to Godoe and Johansen (2012:38), TAM has traditionally been used to explain consumers' adoption behaviour with regard to specific technologies.

Technology acceptance model

The TAM was first devised by Davis (1986:24) to help determine an individual's 'attitude' towards using a given technological system. The model represents an adaptation and extension of the TRA, which was first formulated by Fishbein and Ajzen (1975). Rooted in social psychology, the TRA involves looking at set 'determinants of consciously intended behaviours' (Wentzel, et al. 2013:660). In TRA, individuals' behaviour is directly linked to their behavioural intention to perform that behaviour, with their intention being the culmination of both their attitudes and subjective norms (Mai, Yoshi & Tuan 2013:233; Wentzel et al. 2013:660). According to Davis et al. (1989:983), the relative strength of individuals' attitudes and subjective norms directly influences the strength of their behavioural intentions to perform certain behaviours. A key foundation of TRA is the notion that individuals' beliefs pertaining to the consequences of a specific behaviour play a prominent role in their attitudes and perceptions and subsequently their intention to perform that behaviour (Li 2013:19; Mai et al. 2013:233; Mekić & Özlen 2014:138).

Davis (1986) adapted the TRA model to be able to explain consumers' behaviour towards technology and in particular towards computer usage (Davis et al. 1989:983; Nath, Bhal & Kapoor 2014:84). While TRA forms the basis of the TAM model, TAM is a substantially less general model and was originally developed to apply only to computer usage behaviour before being applied more extensively across all information systems (Davis et al. 1989:983; Mai et al. 2013:233; Martin 2012:35; Nath et al. 2014:84). Like TRA, TAM is based on the notion that an individual's behavioural intention to adopt is the result of a combination of both external variables and internal beliefs, which subsequently influences technology adoption behaviours (Davis et al. 1989:985; Mai et al. 2013:234; Mekić & Özlen 2014:138). According to Wentzel et al. (2013:660), TAM can be used to explain and predict adoption and usage behaviour in respect to information technology. TAM is widely considered to be one of the most influential models for predicting technology acceptance behaviours (Li 2013). Davis et al. (1989:983) proposed two fundamental beliefs that are reflected in TAM as (1) PU and (2) PEOU. These two perceptual beliefs are presented as the key determinants in the adoption of new technologies (Awa, Ojiabo & Emecheta 2015:77; Lin et al. 2007:643; Mekić & Özlen 2014:138; Nath et al. 2014:84–85). According to Davis et al. (1989:985), PU as an individual's perception that a specific technology will 'increase his or her job performance within *an organizational context*', while PEOU is the degree to which a potential user finds the adoption of a particular technology to be 'free of effort' and therefore simpler and more enjoyable to use. This implies that an individual's enjoyment of a system is also influenced by its user-friendliness (Matikiti, Roberts-Lombard & Mpinganjira 2016:31; Mekić & Özlen 2014:138).

According to Mekić and Özlen (2014:138), Nath et al. (2014:85), Demoulin and Djelassi (2016) as well as Roy and Moorthi (2017) both PEOU and PU have a direct influence on the behavioural intention of a person and the subsequent attitude towards the adoption of new technologies. In addition, PEOU is postulated to be a determinant of PU as it can affect the adoption of a technology through PU (Li 2013:99; Mekić & Özlen 2014:138). It follows that a consumer's PU towards a specific technology may be reduced if the user is unable to operate that technology effectively (Li 2013:99; Mekić & Özlen 2014:138). TAM and its two beliefs (in the form of PU and PEOU) have been proven over a wide range of systems to be both valid and reliable (Godoe & Johansen 2012:39). Consequently, specific hypotheses put forward are:

H^2: Perceived usefulness positively influences passengers' intentions to adopt mobile applications in the airline industry.

H^3: Perceived ease of use positively influences passengers' intentions to adopt mobile applications in the airline industry.

H^4: Perceived ease of use has a positive influence on PU.

Although TAM is considered to be effective at predicting technology adoption behaviour, questions can be raised about its applicability to broader marketing settings, because it was originally developed to explain technology adoption, mandated by organisational objectives, in the limited environment of the workplace (Lin et al. 2007:642). Owing to the high level of involvement needed by consumers to co-produce a service with mobile self-service technologies, TAM applied within a marketing setting may not adequately clarify why consumers adopt that technology (Lin et al. 2007:642). This is a result of TAM not accounting for consumers' general views about technology and how these subsequently influence their PU and PEOU towards a specific technology when adoption is not enforced through organisational objectives (Lin et al. 2007:642). According to Lin et al. (2007) and Godoe and Johansen (2012:38), a model that incorporates individual differences (TR) is, therefore, a necessary addition to TAM to improve its applicability in marketing settings.

Technology readiness and acceptance model

The TRAM was theorised by Lin et al. (2007:642) to improve both the applicability and explanatory power of TR and TAM. The proposed model supplements the two system specific dimensions of TAM (PEOU and PU) with the personality dimensions of TR (Godoe & Johansen 2012:38; Lin et al. 2007:641). According to Jin (2013:163) and Lin et al. (2007:644), the two models (TAM and TR) are interrelated, with personal beliefs about technology (TR) being closely related to PU and PEOU. Although TAM is effective at predicting the adoption of specific technologies, its applicability to marketing settings where consumers are not forced to adopt a specific technology has been questioned (Jin 2013:163; Lin et al. 2007:641; Wentzel et al. 2013:661). Likewise, TR is an effective model for determining individuals' general beliefs about technology yet ignores system-specific factors such as PEOU and PU, which prevents TR from explaining why consumers with a high TR do not always adopt a new technology (Lin et al. 2007:642; Parasuraman 2000:308). As a result, Lin et al. (2007:645) propose that TR is a determinant of PU and PEOU, with an individual's TR being positively related to both beliefs. This view is reinforced by Jin (2013:163), who states that an individual's readiness (TR) to use a new technology subsequently influences their perceptions of its usefulness and ease of use (PU and PEOU). It follows that the personality traits of TR (optimism, innovativeness, insecurity and discomfort) are closely related to the cognitive dimensions of TAM (PEOU and PU) (Jin 2013:163). As such, when looking at technology adoption, the positive dimensions of TR (optimism and innovativeness) lead to increased levels of PU and PEOU, and the negative dimensions of TR (insecurity and discomfort) lead to decreased levels of PU and PEOU (Godoe & Johansen 2012:40; Jin 2013:163).

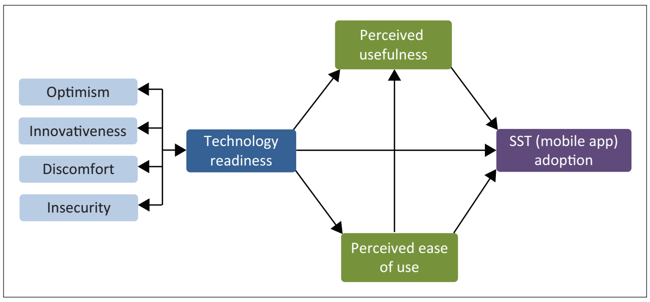
In addition, Lin et al. (2007:645) state that PU and PEOU effectively mediate the link between individuals' beliefs about technology (TR) and their predisposition to adopt and use that technology. These relationships have been confirmed by Lin et al. (2007:642), showing that the psychological process presented by TRAM is represented by TR à PEOU à PU à usage intention and adoption. Roy and Moorthi (2017) also found that TR exerts positive influence on both perceived levels of technology usefulness and on PEOU. However, according to Godoe and Johansen (2012:46), while PU has a direct effect on technology adoption, PEOU does not. It follows that because of the positive relationship between PU and PEOU, the latter has an indirect effect on technology adoption (Godoe & Johansen 2012:46). In conclusion, TRAM has been found to be superior to either of the individual constructs (TR and TAM) at explaining and predicting individuals' predisposition to adopt new technologies, where adoption is not enforced within an organisational context (Jin 2013:163; Lin et al. 2007:652). Consequently, the specific hypotheses put forward are:

H^5: Technology readiness positively influences PU.

H^6: Technology readiness positively influences PEOU.

Owing to the comprehensiveness of the TRAM model and the recent update of the TRI to TRI 2.0, this study made use of the TRAM 2.0 model in its investigation of consumers' readiness to adopt mobile applications in the airline industry. Note that TRAM 2.0 makes use of the updated TRI 2.0, which replaces the original TRI 1.0 in the model proposed by Lin et al. (2007:641).

Figure 1 depicts the proposed theoretical model for this study, illustrating the four constructs of the study. The model has been adapted from Lin et al. (2007:646) and presents a schematic representation of the links between the four



Source: Adapted from Lin, C., Shih, H. & Sher, P.J., 2007, 'Integrating technology readiness into technology acceptance: The TRAM model', *Psychology & Marketing* 24(7), 641–657. https://doi.org/10.1002/mar.20177

SST, self-service technology.

FIGURE 1: The influence of technology readiness and perceptions regarding mobile application adoption.

dimensions of TR and overall TR, the link between TR and the two beliefs of TAM (PEOU and PU) and the link between the combination of TR and TAM (PEOU and PU) on the adoption of mobile applications in the airline industry.

Research method and design

Research approach, target population, sampling and measurement instrument

This study applied a quantitative research approach using a predetermined structured questionnaire, which according to Burns and Bush (2010:235) is effective for gathering information from a large number of respondents. A descriptive research design was used. This type of research design allows the researcher to understand the 'who, why, what, when and how' (Berndt & Petzer 2011:32) and is suitable when one wishes to 'project a study's findings to a larger population' (Burns & Bush 2010:149). The target population for this study comprised South African citizens who had travelled either domestically or overseas with an airline in the preceding 12 months, and who have made use of a mobile self-service technology device during their airline travels over the same period. A two-stage non-probability quota and convenience sampling method was used to select relevant respondents from the target population and to ensure that data could be collected in a quick and relatively inexpensive manner. A combination of self-administered and computer-administered survey methods was used to collect primary data from the respondents. The self-administered surveys were carried out with employees of Reckitt Benckiser South Africa (Pty) Ltd at their place of work, after being granted permission by the human resources division. For the computer-administered stage, the questionnaire was uploaded onto the SurveyMonkey platform, and a link to the questionnaire was generated and captured. This link was then distributed to prospective respondents via direct mail and a social media platform (Facebook). The researcher made the decision to close the survey link once 270 responses had been gathered. Forty-five questionnaire were collected from the self-administered survey, which was carried out at the researcher's place of work after being granted permission by the human resources division. A total of 315 completed questionnaires were thus collated, cleaned and analysed.

The study made use of scales adapted from literature to enhance scale validity. TR was measured using items adapted from the 16-item TRI 2.0 scale developed by Parasuraman and Colby (2015). The TAM constructs of PU, PEOU and behavioural intentions were adapted from Davis (1986:286). The different constructs were measured using a labelled 7-point Likert scale, with 'strongly disagree' at one end and 'strongly agree' at the other. Respondents were asked to indicate their degree of agreement or disagreement with each presented statement. The demographic profile of the respondents was established by collecting information on their age, gender, ethnicity, economic status, current personal gross income per annum and highest level of education.

Data analysis

The statistical software program SPSS 21 (Statistical Package for Social Sciences) was used for analysis. Statistical procedures used to analyse the collected data included descriptive analysis, factor analysis and regression analysis (hierarchical regression analysis). The reliability and validity of the measurement instrument were tested using Cronbach's alpha and exploratory factory analysis respectively. The Cronbach's alpha scores for the various dimensions of TR were 0.875 for optimism, 0.916 for innovativeness, 0.820 for discomfort and 0.769 for insecurity, while the overall TR score was 0.854. Additional scores were 0.967 for PU, 0.955 for PEOU, 0.962 overall for the TAM and 0.972 for behavioural intentions towards airline mobile application adoption. For validity, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used, and the findings revealed all the constructs to be valid; they were therefore retained in their original forms for the main analysis.

Ethical considerations

The ethical clearance to conduct this study was obtained from the University of Johannesburg (clearance number: CSI001/16).

Results

Profile demographics

The sample group was well represented by an almost equal split between male (50.7%, *n* = 296) and female (49.3%, *n* = 296) respondents. There was a relatively even age group split between the various age groups ranging from 23 to 70 years, the majority of the respondents being white people (76.7%, *n* = 296). Concerning gross personal income per annum before deductions, the majority (60.8%, *n* = 296) of respondents earned more than R250 000 per annum before deductions, whereas 64.5% (*n* = 296) of the sample group perceived their economic status to be above average or higher. Lastly, the vast majority (83.4%, *n* = 296) of the respondents had a post-matric certificate or diploma, a degree or a postgraduate degree.

Descriptive statistics

Descriptive statistics for the dimensions of technology readiness

The TR statistics are presented in Table 1. The overall mean for these dimensions was 4.34, indicating that the majority of respondents demonstrated a medium overall level of TR (> 4.1) and were therefore likely to adopt airline mobile applications in the airline industry. The dimension for which respondents indicated their highest level of agreement with the presented statements was the optimism dimension (overall mean = 5.93), which indicates that the sample group generally displayed high levels of optimism towards technology in general. The statement which respondents agreed with the most was (Questionnaire, Section [QB] statement 1.2: 'Technology gives me more freedom of

TABLE 1: Descriptive statistics for the dimensions of technology readiness.

Variable	Mean	Standard deviation
Optimism		
QB1.1	5.93	1.074
QB1.2	6.23	0.970
QB1.3	5.89	1.152
QB1.4	5.67	1.365
Overall score	5.93	1.140
Innovativeness		
QB2.1	4.03	1.748
QB2.2	3.77	1.701
QB2.3	4.45	1.744
QB2.4	4.43	1.702
Overall score	4.17	1.724
Discomfort		
QB3.1	2.91	1.451
QB3.2	3.41	1.511
QB3.3	3.03	1.540
QB3.4	3.51	1.628
Overall score	3.22	1.533
Insecurity		
QB4.1	4.16	1.685
QB4.2	4.33	1.719
QB4.3	4.94	1.701
QB4.4	3.88	1.898
Overall score	4.33	1.751

Note: Overall technology readiness: Mean = 4.34; standard deviation = 1.537.

mobility (ability to perform tasks on the go)' (mean = 6.23 and standard deviation = 0.970). The dimension for which respondents indicated their lowest level of agreement with the presented statements was the discomfort dimension (overall mean = 5.93), which indicates that the sample group was generally comfortable with technology. The statement with which respondents agreed least was QB3.1: 'When I get technical support from a provider of a high-tech product or service, I feel as if I am being taken advantage of by someone who knows more than I do (mean = 2.91 and standard deviation = 1.451)'.

Descriptive statistics for the beliefs of the technology acceptance model

The statistics for TAM beliefs are presented in Table 2. The overall mean for the PU belief of the TAM was 5.23, indicating that the majority of respondents agreed with the presented statements and perceived the usefulness of airline mobile applications in their airline travels. The statement which respondents agreed with most was Questionnaire, Section C (QC) statement 1.1: 'Airline mobile apps enable/will enable me to accomplish tasks more quickly' (mean = 5.39 and standard deviation = 1.323). The statement which respondents agreed with least was QC1.4: 'Airline mobile apps enhance/will enhance my effectiveness in completing tasks' (mean = 5.08 and standard deviation = 1.480). The overall mean for the PEOU belief of the TAM was 5.21, indicating that the majority of respondents agreed with the presented statements and perceived airline mobile applications as easy to use. The statement which respondents agreed with most was QC2.1: 'Learning to operate airline mobile apps is/will be easy for me' (mean = 2.91 and standard deviation = 1.451). The statement which respondents

TABLE 2: Descriptive statistics for the beliefs of the technology acceptance model.

Variable	Mean	Standard deviation
Perceived usefulness		
QC1.1	5.39	1.323
QC1.2	5.24	1.359
QC1.3	5.09	1.469
QC1.4	5.08	1.480
QC1.5	5.18	1.400
QC1.6	5.37	1.427
Overall score	5.23	1.408
Perceived ease of use		
QC2.1	5.23	1.379
QC2.2	5.12	1.349
QC2.3	5.11	1.305
QC2.4	4.97	1.403
QC2.5	5.33	1.375
QC2.6	5.33	1.365
Overall score	5.21	1.363

agreed with least was QC2.4: 'I find/will find it not cumbersome to use airline mobile apps' (mean = 4.97 and standard deviation = 1.403).

Descriptive statistics for behavioural intentions towards airline mobile applications

The statistics for these behavioural intentions are presented in Table 3. The overall mean for behavioural intentions towards airline mobile applications was 5.30, indicating that the majority of respondents agreed with the presented statements and would be likely to continue using or adopt mobile applications in the future. The statement which respondents agreed with most were Questionnaire, Section D (QD) statement 1.2: 'I plan to (continue/start) using airline mobile app services when I travel via airlines in the future' (mean = 5.37 and standard deviation = 1.570). The statement which respondents agreed with least was QD1.3: 'I plan to (continue/start) using airline mobile app services over traditional self-service technologies (online websites, self-check-in kiosks, etc.)' (mean = 5.14 and standard deviation = 1.635).

Regression analysis and hypothesis testing

The results of the regression analysis are presented in Table 4.

TABLE 3: Descriptive statistics for behavioural intentions towards airline mobile applications.

Behavioural intentions towards airline mobile applications	Mean	Standard deviation
QD1.1	5.37	1.585
QD1.2	5.37	1.570
QD1.3	5.14	1.635
QD1.4	5.33	1.549
Overall score	5.30	1.585

For hypothesis H^1 a positive relationship was predicted between TR and airline mobile application adoption. The results from the regression analysis support the hypothesis ($\beta = 0.540$, $p < 0.05$) and so the null hypothesis was rejected. The R^2 value of 0.292 indicates that TR explains 29.2% of the total variance of airline mobile application adoption.

For hypothesis H^2 a positive relationship was predicted between PU and airline mobile application adoption. The results from the regression analysis support the hypothesis ($\beta = 0.649$, $p < 0.05$) and so the null hypothesis was rejected. The R^2 value of 0.652 indicates that PU explains 65.2% of the total variance of airline mobile application adoption.

Similarly, for hypothesis H^3 a positive relationship was predicted between PEOU and airline mobile application adoption. The results from the regression analysis support the hypothesis ($\beta = 0.207$, $p < 0.05$) and so the null hypothesis was rejected. The R^2 value of 0.652 indicates that PEOU explains 65.2% of the total variance of airline mobile application adoption.

For hypothesis H^4 a positive relationship was predicted between PU and PEOU. The results from the regression analysis support the hypothesis ($\beta = 0.703$, $p < 0.05$) and so the null hypothesis was rejected. The R^2 value of 0.494 indicates that PEOU explains 49.4% of the total variance of PU.

For hypothesis H^5 a positive relationship was predicted between PU and TR. The results from the regression analysis support the hypothesis ($\beta = 0.570$, $p < 0.05$) and so the null hypothesis was rejected. The R^2 value of 0.325 indicates that TR explains 32.5% of the total variance of PU.

Lastly, for hypothesis H^6 a positive relationship was predicted between PEOU and TR. The results from the regression analysis support the hypothesis ($\beta = 0.619$, $p < 0.05$) and so the null hypothesis was rejected. The R^2 value of 0.383 indicates that TR explains 38.3% of the total variance of PEOU.

Based on the regression analysis results, the TR → PEOU → PU → airline mobile application adoption path is shown to be the strongest predictor of airline mobile application adoption. Figure 2 presents a summary of the regression analysis results.

The alternative hypotheses for all the hypotheses for the study were accepted, including hypothesis H^1 (TR and airline mobile application adoption), hypothesis H^2 (PU and airline mobile application adoption), hypothesis H^3 (PEOU and

TABLE 4: Regression analysis summary for the hypotheses set out for the study.

Hypotheses	Dependent variable	Independent variable	p	Beta value	R^2 value	Adjusted R^2 value
H^1	Airline mobile application adoption	Technology readiness	0.000	0.540	0.540	0.292
H^2	Airline mobile application adoption	Perceived usefulness	0.000	0.649	0.652	0.650
H^3	Airline mobile application adoption	Perceived ease of use	0.000	0.207	0.652	0.650
H^4	Perceived usefulness	Perceived ease of use	0.000	0.703	0.494	0.492
H^5	Perceived usefulness	Technology readiness	0.000	0.570	0.325	0.323
H^6	Perceived ease of use	Technology readiness	0.000	0.619	0.383	0.381

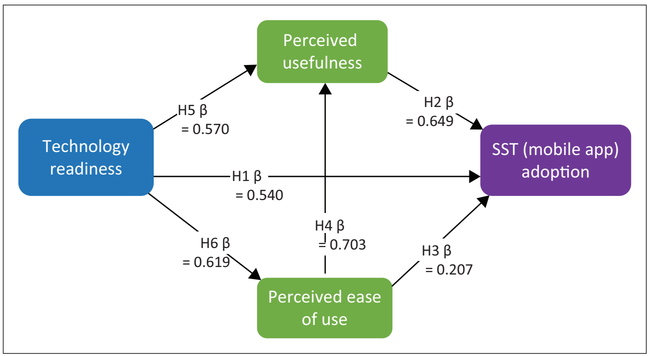


FIGURE 2: Regression analysis results for the influence of technology readiness and perceptions regarding mobile application adoption.

airline mobile application adoption), hypothesis H4 (PU and PEOU), hypothesis H5 (TR and PU) and hypothesis H6 (TR and PEOU).

Discussion

The study makes both a theoretical and a practical contribution. The results confirm that the measurement scales used to measure the adoption of mobile self-service technology (mobile applications) and its precursors are valid and reliable. The proposed model has been validated, endorsing the B2C relationships between mobile self-service technology adoption, TR, PU and PEOU. The findings on the relationship between TR and adoption are consistent with those reported by Al-Ajam and Nor (2015) showing that TR exerts positive influence on consumers' decision to use technology. Consistent with findings in Roy and Moorthi (2017), this study shows that TR has positive influence on both PEOU and on PU. While looking at TR at the dimensional level, findings in Chen and Lin (2017) show that each of the TR dimensions of optimism, innovativeness, discomfort and insecurity has a significant influence on levels of PEOU. Furthermore, consistent with the findings in this study are results reported by Demoulin and Djelassi (2016) as well as Roy and Moorthi (2017) showing the significant influence of PEOU and PU of technology respectively on consumer adoption of technology.

From a managerial perspective, the study contributes in potentially assisting airline companies in understanding how PU and PEOU can stimulate mobile self-service technology (mobile applications) adoption. This will depend, however, on whether consumers are technology ready and view PU and PEOU as positive. It is therefore important for airline and airport companies to conduct consumer research prior to the decision to invest in the launch of airline mobile applications to ascertain the level of TR of their core target market. In addition, user-friendly functionality is a crucial consideration during the design phase of airline mobile applications, so as to maintain and potentially enhance the PU and PEOU of the platform. Airline mobile applications that are easy to use and useful not only lead to enhanced adoption rates but also allow communication strategies to focus on the benefits of these applications to create demand for them.

From a theoretical perspective, the study makes three main contributions. First, the results confirm that the measurement scales used to measure the adoption of mobile self-service technology (mobile applications) and its precursors are valid and reliable. As mentioned, the proposed model has been validated, endorsing the B2C relationships between mobile self-service technology adoption, TR, PU and PEOU. Secondly, it establishes that both PU and PEOU in the airline industry of an emerging market do lead to the positive adoption of mobile self-service technology (mobile application). It can, therefore, be contended that the different constructs claimed in theory to drive mobile technology adoption are influenced by factors such as TR, PU and PEOU in an emerging market context, as hypothesised in this study. It should be highlighted that mobile self-service technology (mobile applications) adoption is a new research focus area in emerging economies in Africa, and few studies have focused on the factors that influence the adoption of this technology in the emerging economy of South Africa. This finding is important as it illustrates what constitutes mobile self-service technology (mobile application) adoption in the airline industry of an emerging market. Therefore, the study contributes to technology adoption literature by recommending valuable measurement dimensions.

Finally, the research study proposes a model that provides clarity on how TR, PU and PEOU have a positive influence on mobile self-service technology (mobile application) adoption. Therefore, the positive influence of TR, PU and PEOU on mobile self-service technology adoption can provide a supplier with a competitive advantage (SITA 2013c).

Managerial implications

The adoption of airline mobile applications is influenced by TR through PEOU and PU. The empirical results obtained in the hierarchical regression analysis proved that there is a significant positive relationship between the technological frameworks and airline mobile application adoption. Through the regression analysis the TR → PEOU → PU → MSST adoption path emerged as the strongest predictor of airline mobile application adoption, where PU was uncovered as the strongest single predictor of such adoption. In addition, there is a significant positive relationship between PEOU and PU, while TR is shown to be a strong predictor of PEOU and PU, respectively. With these findings in mind, the following recommendations are put forward.

Introduction of technology-based products

When planning for the launch of new technology-based products or services, companies need to follow a structured launch process that is centred on three key pillars: TR, PEOU and PU. The key starting point when determining the feasibility of launching a new technology-based product or service is to accurately define the desired consumer target market. Once the target market has been accurately identified, companies must conduct a two-stage marketing research process as follows.

The first stage should involve a quantitative survey that focuses on determining the average level of TR of the defined target market and its perceptions of ease of use and usefulness regarding the specific technological product or service in question. Conducting this research allows companies to accurately determine the readiness of their defined target market to trial and ultimately adopt the new product or service. This is achieved through an analysis of the findings across the three pillars. Findings on TR provide insights into whether or not the defined target market comprises technological optimists or innovators, which relates to how positive they are about the introduction of the new product or service. At the same time, the findings allow for the identification of key adoption inhibitors relating to the product or service. In addition, findings on PEOU and PU regarding the product or service allow airline and airport companies to identify the key drivers and inhibitors of final adoption, irrespective of whether or not their average target market is ready to use the product or service.

The second stage of the marketing research involves conducting focus groups that aim to narrow down the findings from the quantitative stage. Here specific drivers and inhibitors are identified and explored, such as a need for a specific feature or a very simple design requirement. This process needs to be conducted for each defined target market to ensure that the needs of each defined consumer group are addressed in the subsequent product development stage and resultant communication strategies.

Once information has been gathered and refined on the three pillars, companies need to decide whether the drivers and inhibitors of adoption can be addressed or heightened in the product development stage or through the resultant communication strategies. Inhibitors relating to the usability of the product or service should be easily identified from the findings on PEOU and could be easily addressed in the product development stage rather than through communication strategies. Similarly, for the PU of the product or service, perceptions could be easily heightened through effective communication strategies that highlight the numerous or core features of use. Such an approach ensures that companies are able to easily identify the key barriers and drivers of adoption of a specific technology-based product or service, which could then be incorporated into their product development and communication strategy. This allows for the maximisation of successful technological product or service introduction for companies in the future.

Airline mobile application introduction

Based on the findings of this study, airline and airport companies need to implement various adoption enhancement strategies to ensure the successful adoption of airline mobile applications. The usability of airline mobile applications is a key driver of adoption, which must be addressed in the design stage to ensure that the navigation and use of the core functions of airline mobile applications are easy to operate. In addressing these concerns, airline and airport companies can utilise the PEOU → PU link and enhance the PU of airline mobile applications, which allows for communication strategies that focus primarily on the benefits of use rather than actual use. However, care must be taken to ensure that communication is not solely focused on the benefits provided by airline mobile applications but rather that consumers are exposed to a basic level of usage communication. This can be achieved when highlighting specific features such as live flight status updates, while the communication of benefits can include a demonstration of basic usage such as navigation. For the roll-out of communication strategies, airline and airport companies should restrict communication to available communication platforms within the industry such as airport banners, airport TVs and online websites. Such an approach ensures a reduction of the spill-over that prevails when traditional above-the-line media target such a niche target, and the defined target market is reached in an effective manner. To enhance the potential adoption of airline mobile applications further, the use of dedicated mobile application assistant stations is recommended. At these stations, airport or airline employees would be present to answer passenger questions and assist with feature usage. Such an approach will ensure that negative experiences related to initial trial are reduced and that passengers' PEOU and ultimately PU regarding airline mobile applications are enhanced. These assistant stations should remain in place until the use of airline mobile applications has become commonplace.

Limitations

Although this study provided additional insight into the influence of the TRAM model (including the updated TRI 2.0) on airline mobile application adoption, a number of limitations are present. The main limitation of this study is that it was conducted on South African respondents who had travelled via airline in the previous 12 months. The sample group was also characterised by high income and education levels and may not be representative of the general South African population or other geographic populations. The generalisability of the findings when extending this model into other industries and target markets is therefore limited. A second limitation of the study is that the research focused only on the consumers' technology adoption behaviours. The role that employee technology adoption readiness could potentially play in successful passenger adoption and employee adoption of airline mobile applications was not investigated.

Future research could be extended to include new technologies in different industries, cultures and geographic regions of South Africa. Secondly, the introduction of various demographic variables (age, gender, education, income, etc.) could be included in the presented model. Thirdly, future research could look to include situational variables such as access to free Wi-Fi, Internet connection speed or availability of customer assistance if needed and assess the impact of these variables on consumers' predisposition to adopt new technologies through the TRAM 2.0 model. Future research could focus on airline industry employees and their readiness to adopt airline mobile applications from an internal service point of view. Lastly, future research could examine the individual dimensions of TR (optimism, innovativeness, insecurity and discomfort) and their direct relationship to new technology adoption.

Conclusion

The purpose of the study was to investigate passengers' level of TR and perceptions regarding mobile applications in the airline industry and their adoption in an emerging economy. The study concluded that it is crucial for airline and airport companies to determine their respective target markets' readiness to adopt these new technologies. The TRAM 2.0 model has been shown to be an effective predictor of consumers' technology adoption behaviour and should, therefore, form an important part of the introduction of any new technology-based product or service. Through market research using the TRAM 2.0 model, airline and airport companies can effectively identify the level of TR of their respective target markets. With this information on hand, strategies can be developed to overcome the barriers (discomfort and insecurity) and enhance the drivers (optimism and innovativeness) of airline mobile application adoption. Similarly, airline and airport companies will be able to determine the right mix of benefit (PU) and PEOU communication to enhance airline mobile application adoption.

With all this information on hand, airline and airport companies can determine the suitability of airline mobile applications in the South African airline industry and design strategies to enhance the adoption of airline mobile applications to ensure that their potential benefits are realised and financial loss is prevented. The study established that airline mobile application adoption is influenced by passengers' level of TR and their perceptions of usefulness and ease of use regarding airline mobile applications.

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Competing interests

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

Authors' contributions

C.S. was the project leader and responsible for the problem formulation, literature review, methodology formulation and statistical analyses. M.R-L. and M.M. made conceptual contributions.

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