International Journal of Management and Human Science (IJMHS), Volume 3, Issue 1, Pages 1-9, 2019
eISSN: 2590-3748
URL: http://www.ijmhs.org

Impact of Ease of Use and Usefulness on the Driver Intention to Continue Using Car Navigation Systems in the United Arab Emirates

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Abstract
This research uses modelling of structural equations via PLS to assess the 167 suitable questionnaires so as to evaluate the recommended model to identify factors that affect driver intention to continue using car navigation systems among UAE's drivers with private licenses. The research will describe relationships among ease of use, perceived usefulness, and intention to continue using car navigation systems. Our efforts have improved our understanding of the use of satellite navigation technology. Results suggested that both independent variables significantly predicted intention to continue usage. The recommended model also clarified 20% of the variance in the intention to continue using car navigation systems.

Keywords: Navigation systems; ease of use; perceived usefulness; TAM; UAE

1. Introduction

A traffic accident is one the cause of death with a greater number of premature deaths in men after lung cancer and cardiac ischemia (Ibarrola-Jurado et al., 2013). Lu et al. (2016) identified that the traffic accidents (TA) are currently a major public health problem at a global, national and regional level as they cause a great number of death and disabilities. Therefore, it is important to carry out further studies to identify the root cause traffic accidents and analyze the driver's behavior that develops the accidents. This would help and evolve mitigation plans to lower the number of fatalities and injuries due to TA (Melchor et al., 2015).

The latest spread of in-car navigation systems (Satnav) is the result of the development of Global Navigation Satellite Systems (GNSS), the advances in hardware such as resolution, processing power, and screen size, in addition to the improvements in the gathering and visualization of geographic information such as navigable map databases and in-vehicle sensors. The outcome gadgets fulfill drivers' need to improve the comfort, safety, and their travel efficiency.

The United Arab Emirates (UAE) is a rapidly developing high-income country and the number of motor vehicles has increased rapidly (Al-Shamsi et al., 2018; Alkhateri et al., 2018; Mohamed et al., 2019; Nusari et al., 2018; Shamsi et al., 2018). With the construction of many high-speed modern motorways, police data show a rise in crashes and injuries per vehicle and per unit of population. This was associated with increased severity of crashes and a higher rate of severe injuries and fatalities (El-Sadig et al., 2004). Key issues contributing to traffic injury morbidity and mortality in the UAE have included the extremely low use of safety restraints for adults and children, especially among UAE nationals. Variables of interest included road user type as well as personal factors such as age, sex, and nationality; vehicle factors; and locations of incidents (Grivna et al., 2013).

2. Literature Review

2.1 Ease-of-Use (EOU) and Perceived Usefulness (PU)

Technology Acceptance Model (TAM) is broadly utilized to understand technology adoption and usage (Abd-Elaziz et al., 2015; Abou-Shouk and Khalifa, 2017; Khalifa and Abou-Shouk, 2014; Khalifa and Fawzy, 2017; Khalifa and Hewedi, 2016; Khalifa and Mewad, 2017; Mohamed et al., 2018). Among its positive features is robustness (Venkatesh And Davis, 2000) and this has been the reason for its vast reputation in the information system field and among IT practitioners (A. H. Aldholay, Isaac, Abdullah, & Ramayah, 2018; A. Aldholay, Isaac, Abdullah, Abdulsalam, & Al-Shibami, 2018). There are two fundamental elements of TAM (ease of use and perceived usefulness) which influence user intention to adopt technology (Davis, 1989; Alrajawy, Daud, Isaac, & Mutahar, 2017). Ease of use is defined as the extent to which an individual considers that using a specific system would effortless, while perceived usefulness is defined as the extent to which an individual considers using a particular system would improve his performance (Davis, 1989). These two main important variables of TAM are empirically established to be substantial as determinants of user intention to adopt diverse technological applications and cultural contexts (Mutahar, Daud, Ramayah, Isaac, & Abdulsalam, 2018; Mutahar, Daud, Ramayah, Isaac, & Alrajawy, 2017b; Chang, 2013; Khalifa and Fawzy, 2017; Lian, 2015; Nusari et al., 2018; Oliveira et al., 2014; Sahadev and Purani, 2008; Suh and Han, 2002; Tarhini et al., 2014). Consequently, the following hypotheses are proposed:

H1: Ease-of-use has a positive effect on perceived usefulness.

H2: Ease-of-use has a positive effect on the intention to continue using car navigation systems.

H3: Perceived usefulness has a positive effect on the intention to continue using car navigation systems.

2.3 Intention to Continue Using Car Navigation Systems (INT)

Intention refers to the intentional and purposeful aim to take on a certain novel undertaking, consequently is connected to the concept of using, whereby the intentions directly influence the rate of usage. Hence, usage or actual adoption is intimately dependent on intention. Noticeably, users' intentions are also dependent on their understanding of the system or technological application, potential benefits, and perceived risk Riffai et al. (2012). For the purpose of this research, intention to continue using the technology specifically targets the innovation of car navigations systems. Intention to accept and use different applications of technology has been studied through years and in different contexts (Mutahar, Daud, Ramayah, Isaac, & Alrajawy, 2017a; A. H. Aldholay, Abdullah, Ramayah, Isaac, & Mutahar, 2018; A. H. Aldholay, Isaac, Abdullah, Alrajawy, & Nusari, 2018; Mutahar, Daud, Ramayah, Isaac, & Aldholay, 2018). The intention to adopt is affected by a variety of factors that are related to customer behavior. Through the systematic literature review, many scholars have studied the intention as the dependent variable of their studies (Cudjoe et al., 2015; Gbenga et al., 2013; Khalifa & Shen, 2008; Luarn & Lin, 2005; Kocaleva, 2014; Wang et al., 2006)(Ameen and Ahmad, 2012).

3. Research Method

3.1 Overview of the Proposed **Conceptual Framework**

The correlations between the parameters conjectured in the conceptual model have been obtained from the Technology Acceptance Model. Fig 2 displays the recommended model that includes perceived usefulness, ease of use, and intention to continue using car navigation systems. These correlations are adapted from (Davis, 1989). The given model evaluates the relationship among the aforementioned aspects for the UAE's drivers with private licenses. The proposed conceptual framework has three hypotheses to be tested.

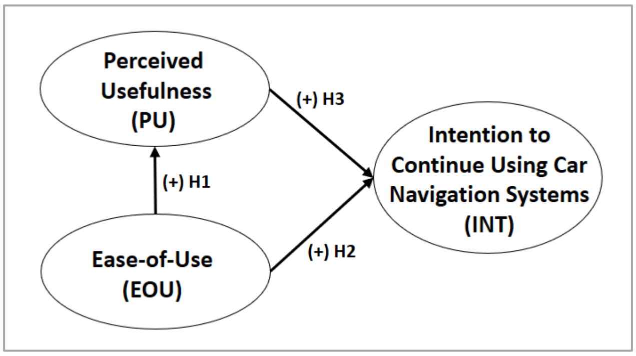


Figure 1: The proposed conceptual framework

3.2. Instrument Development and Data Collection

The creation of a tool for this research involved a questionnaire of 8 questions, and on the basis of the literature on IS, this research employed a multi-item Likert scale (Lee et al., 2009). The parameters were evaluated using a Likert scale recommended in the earlier studies (Isaac, Abdullah, Ramayah, & Mutahar, 2017; Isaac, Abdullah, Ramayah, Mutahar, & Alrajawy, 2017; Isaac, Abdullah, Ramayah, & Mutahar Ahmed, 2017; Ameen, Almari, & Isaac, 2019). The information was gathered by delivering a self-managed questionnaire 'in-person' from March to May 2018 to UAE's drivers with private licenses. The number of the distributed questionnaires was 220, and the number of the returned sets is 180 of which 167 responses were considered suitable for the analysis. According to Tabachnick & Fidell (2012) and Krejcie & Morgan (1970), the sample size was seen as sufficient.

4. Data Analysis and Results

PLS (Partial Least Squares) SEM-VB (Structural Equation Modelling-Variance Based) was employed to assess the research model by utilizing the software SmartPLS 3.0 (Ringle et al., 2015). A two-phase analytical technique (Anderson & Gerbing, 1988; Hair, Hult, Ringle, & Sarstedt, 2017) consisting of (i) measurement model analysis (reliability and validity) and (ii) structural model analysis (examining the conceptualized relationships) was employed after performing the descriptive assessment. This two-phase analytical technique consisting of a structural and a measurement model assessment is better than a single phase assessment (Schumacker & Lomax, 2004; Hair et al., 2010). While the model of measurement explains each parameter's measurement, the structural model describes the correlation between the parameters in this model (Hair et al., 2017).

The PLS technique is employed for both the structural and the measurement model in this study because of its capability to conduct the simultaneous assessment, giving more accurate assessments (Barclay et al., 1995). The main bases for selecting SEM as a statistical technique for this research is that it offers a simultaneous assessment which results in more precise estimates (Isaac, Abdullah, Ramayah, & Mutahar, 2017a; Isaac, Abdullah, Ramayah, & Mutahar, 2017b; Isaac, Masoud, Samad, & Abdullah, 2016).

4.1 Descriptive analysis

Table 1 presents the mean and standard deviation of each variable in the current study. The respondents were asked to indicate their opinion in relation to transformational leadership and human capital based on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Intention to continue using car navigation systems score the highest with mean 3.507 out of 5.0, with a standard deviation of 1.077.

4.2 Measurement Model Assessment

Construct reliability as well as validity (comprising discriminant and convergent validity) were used to examine the measurement model. The particular alpha coefficients of Cronbach were tested to determine the reliability of every core parameter in the measurement model (construct reliability). The quantities of all the unique alpha coefficients of Cronbach in this research ranged from 0.925 to 0.946, which went beyond the proposed value of 0.7 (Kannana & Tan, 2005; Nunnally & Bernstein, 1994; Al-Shamsi, Ameen, Isaac, Al-Shibami, & Sayed Khalifa, 2018). Moreover, for inspecting construct reliability, all the CR (composite reality) values ranged from 0.952 to 0.974, which went beyond 0.7 (Werts, Linn, & Jöreskog, 1974; Kline, 2010; Gefen, Straub, & Boudreau, 2000). Thus, as Table 1 shows, construct reliability has been fulfilled as Cronbach's CR and alpha were rather error-free for all the parameters.

Analysis of *indicator reliability* was conducted by utilizing factor loadings. When the related indicators are very similar, this is reflected in the construct and signified by the construct's high loadings (Hair et al., 2017). As per Hair et al. (2010), the exceeding of values beyond 0.70 suggests substantial factor loadings. Table 1 displays that all articles in this research had factor loadings greater than the suggested value of 0.7.

AVE (average variance extracted) was employed in this study to analyze *convergent validity*, which represents the degree to which a measure is correlated positively with the same construct's other measures. All the AVE values ranged from 0.869 and 0.890, which went beyond the proposed value of 0.50 (Hair et al., 2010). Thus, all constructs have complied with the convergent validity acceptably, as shown in Table 1.

Table 1: *Mean, standard deviation, loading, cronbach's Alpha, CR and AVE*

Constructs	Item	Loading (> 0.5)	M	SD	α (> 0.7)	CR (> 0.7)	AVE (> 0.5)
Ease-of-Use (EOU)	EOU1 EOU2	0.973 0.975	3.468	1.113	0.946	0.974	0.949
Perceived Usefulness (PU)	PU1 PU2 PU3	0.954 0.931 0.912	3.259	1.125	0.925	0.952	0.869
Intention to Continue Using Car Navigation Systems (INT)	INT1 INT2 INT3	0.951 0.947 0.932	3.507	1.077	0.938	0.960	0.890

Note: M=Mean; SD=Standard Deviation, α= Cronbach's alpha; CR = Composite Reliability, AVE = Average Variance Extracted.
Key: EOU: ease-of-use, PU: perceived usefulness, INT: intention to continue using car navigation systems

The degree to which the articles distinguish among concepts or measure different constructs is demonstrated by discriminant validity. Cross-loadings, as well as Fornell-Larcker, were employed to analyze the measurement model's discriminant validity. Generally, cross-loadings are employed as the initial step in examining the discriminant validity of the markers (Hair et al., 2017). In this research, the markers' outer loadings on a parameter went beyond all the cross-loadings with other parameters, and thus the cross-loading condition had met the requirements (refer to Table 2).

Table 2: *Results of discriminant validity by the cross loading*

	EOU	PU	INT
EOU1	**0.973**	0.576	0.409
EOU2	**0.975**	0.587	0.426
PU1	0.550	**0.954**	0.317
PU2	0.508	**0.931**	0.317
PU3	0.602	**0.912**	0.382
INT1	0.413	0.330	**0.951**
INT2	0.412	0.379	**0.947**
INT3	0.387	0.324	**0.932**

Key: EOU: ease-of-use, PU: perceived usefulness, INT: intention to continue using car navigation systems

Table 3 shows the outcomes for discriminant validity by employing the Fornell-Larcker condition. It was discovered that the AVEs' square root on the diagonals (displayed in bold) is bigger than the correlations among constructs (corresponding row as well as column values), suggesting a strong association between the concepts and their respective markers in comparison to the other concepts in the model (Fornell & Larcker, 1981; Chin, 1998). According to Hair et al. (2017), this indicates good discriminant validity. Furthermore, the exogenous constructs have a correlation of less than 0.85 (Awang, 2014). Therefore, all constructs had their discriminant validity fulfilled satisfactorily.

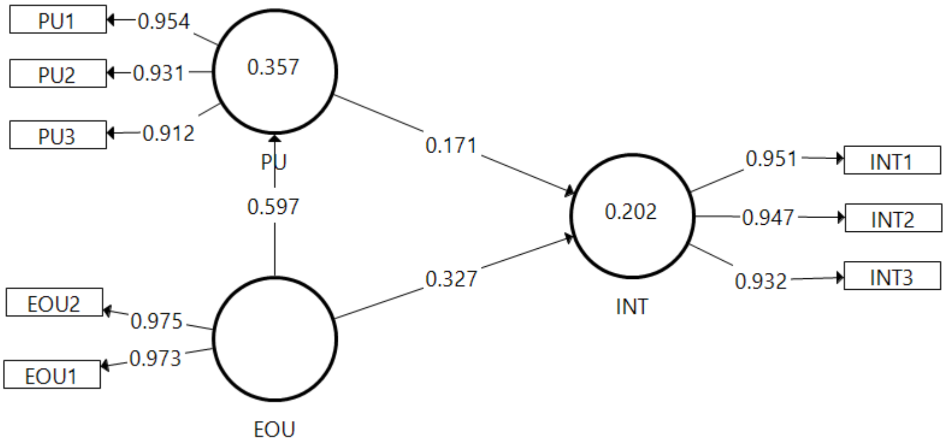
Table 3: *Results of discriminant validity by Fornell-Larcker criterion*

	Factors	*1*	*2*	*3*
		EOU	INT	PU
1	EOU	**0.974**		
2	INT	0.428	**0.943**	
3	PU	0.597	0.366	**0.932**

Note: Diagonals represent the square root of the average variance extracted while the other entries represent the correlations.
Key: EOU: ease-of-use, PU: perceived usefulness, INT: intention to continue using car navigation systems

4.3 Structural Model Assessment

The structural model can be tested by computing beta (β), R^2, and the corresponding *t*-values via a bootstrapping procedure with a resample of 5,000 (Hair, Hult, Ringle, & Sarstedt, 2017).



Key: EOU: ease-of-use, PU: perceived usefulness, INT: intention to continue using car navigation systems
Figure 2: PLS algorithm results

Figure 2 and Table 4 depict the structural model assessment, showing the results of the hypothesis tests, with 3 out of the 3 hypotheses are supported. Ease-of-Use has a positive influence on perceived usefulness. Hence, H1 is accepted with (β = 0.597, t= 14.255, p <0.001). Ease-of-Use has and perceived usefulness have a positive influence on the intention to continue using car navigation systems. Hence, H2 and H3 are accepted with (β = 0.327, t= 4.862, p <0.001) and (β = 0.171, t= 2.330, p <0.01) respectively.

The strength of the relationship between exogenous and endogenous constructs are measured by the standardized path coefficients, which in this case show that the direct effects of Ease-of-Use on intention to continue using car navigation systems is stronger than the influence of perceived usefulness on intention to continue using car navigation systems. The values of R^2 have an acceptable level of explanatory power, indicating a substantial model (Cohen, 1988; Chin, 1998).

Table 4: *Structural path analysis result*

Hypothesis	Relationship	Std Beta	Std Error	t-value	p-value	Decision	R^2
H1	EOU→PU	0.597	0.042	14.255	0.000	Supported	0.36
H2	EOU→INT	0.327	0.067	4.862	0.000	Supported	0.20
H3	PU→ INT	0.171	0.073	2.330	0.010	Supported	

Key: EOU: ease-of-use, PU: perceived usefulness, INT: intention to continue using car navigation systems

5. Discussion and conclusion

The study found that ease of use positively affects perceived usefulness of car navigation systems among drivers with private licenses in the United Arab Emirates, this is supported by previous studies (Haupt et al., 2015; Lu et al., 2016). It is explained by the fact that the more the car navigation systems are easy to use, including learning its operation easily, the more using car navigation systems save time, improves driving effectiveness and hence become generally useful.

Likewise, it was found that ease of use positively affects intention to continue using car navigation systems, this is supported by previous studies (Girardin & Blat, 2010; Liu & Zhou, 2016; Melchor et al., 2015; Ameen & Ahmad, 2011) (Abou-Shouk and Khalifa, 2017; Khalifa and Abou-Shouk, 2014; Mohamud et al., 2017). It is explained by the fact that the more the car navigation systems are easy to use, including learning its operation easily, the more drivers have the motivation to use car navigation systems continuously in the future, promote others use car navigation systems, and decide to actually use it in the future.

Moreover, the study also found that perceived usefulness significantly influence intention to continue using car navigation systems, which is in line with previous studies (El-Sadig et al., 2004; Girardin & Blat, 2010; Grivna et al., 2013; Ameen & Ahmad, 2013). It can be explained by the notion that the more using car navigation systems save time, improves driving effectiveness and hence become generally useful, the more drivers have the motivation to use car navigation systems continuously in the future, promote others use car navigation systems, and decide to actually use it in the future.

The United Arab Emirates government is determined to enhance its road safety by utilizing new technology (Global Innovation Index, 2016), the findings of this study could be considered as one of the initiatives to serve on that direction. The aim of this study was to examine factors that affect drivers' intention to continue using car navigation systems among drivers with private licenses in the United Arab Emirates (Al-Obthani and Ameen, 2018). It has provided a case to validate parts technology acceptance model and despite various constraints to the study, the results have been encouraging. The results revealed that all hypotheses are significant. The independent variables significantly explain 20% of intention to continue using car navigation systems.

Appendix A

Instrument for varibles

Varible	*Measure*	*Source*
Ease-of-Use (EOU)	EOU1: Car navigation systems are easy to use. EOU1: Learning to operate car navigation systems is easy.	(Gu et al., 2009)
Perceived Usefulness (PU)	PU1: Using car navigation systems would save me much time. PU2: Car navigation systems would enhance my effectiveness in driving. PU3: Overall, car navigation systems would be useful.	(Huang et al., 2007)
Intention to Continue Using Car Navigation Systems (INT)	INT1: I intend to use car navigation systems continuously in the future. INT2: I will recommend others to use car navigation systems. INT3: I will frequently use car navigation systems in the future.	(Gu et al., 2009)

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