Digital Payments Adoption Research: A Meta-Analysis for Generalising the Effects of Attitude, Cost, Innovativeness, Mobility and Price Value on Behavioural Intention

Pushp P. Patil, Nripendra P. Rana, Yogesh K. Dwivedi

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Pushp P. Patil[1], Nripendra P. Rana[2], Yogesh K. Dwivedi[3]

[1]Emerging Markets Research Centre (EMaRC), School of Management, Swansea University
Bay Campus, Swansea, SA1 8EN, UK
{pushpppatil@gmail.com}
[2] Emerging Markets Research Centre (EMaRC), School of Management, Swansea University
Bay Campus, Swansea, SA1 8EN, UK
{n.p.rana@swansea.ac.uk}
[3] Emerging Markets Research Centre (EMaRC), School of Management, Swansea University
Bay Campus, Swansea, SA1 8EN, UK
{y.k.dwivedi@Swansea.ac.uk}

Abstract

The rapid evolution of mobile-based technologies and applications has led to the development of several different forms of digital payment methods (DPMs) but with limited enthusiasm in consumers for adopting them. Hence, several academic studies have already been conducted to examine the role of various antecedents that determines consumers' intention to adopt DPMs. The degree of effect and significance of several antecedents found to be inconsistent across different studies. This provided us a basis for undertaking a meta-analysis of existing research for estimating the cumulative effect of such antecedents. Therefore, this study aims to perform a meta-analysis of five antecedents (i.e. attitude, cost, mobility, price value and innovativeness) for confirming their overall influence on intentions to adopt DPMs. The results of this study suggest that the cumulative effect of four out of five antecedents found to be significant while influence of price value was found insignificant on behavioural intentions. The recommendations drawn from this research would help to decide if and when to use such antecedents for predicting consumer intention to adopt DPMs.

Keywords: Adoption, Cashless Payments, Digital Payments, Meta-analysis, Mobile Payments

1. Introduction

There have been rapid advances in evolution of information and communication technologies (ICT) including wireless handheld devices such as smartphones both in terms of their technological capability and fast reduction in their purchase cost for consumers. Widespread availability of smartphones and other handheld devices with Internet connectivity is providing conducive environment for innovation development and commercialisation in various areas including digital payment methods (DPMs). In the past two decades, a wide range of new functionalities have been developed and added to mobile and portable devices supporting different forms of financial services. These include bill payments, account transfers, person-to-person transfers, electronic point of sales payment, remote payments for purchasing goods and services as well as other types of services such as mobile marketing, ticketing, discounts or coupon etc. (Oliveira et al., 2016). Majority of consumer oriented DPMs are mobile payment (m-payment) systems, which refer to making payments for goods and services using mobile devices including wireless handsets, personal digital assistants, radio frequency devices and near-field communication based devices (Chen and Nath, 2008; Slade et al. 2013; 2014).

Despite the availability of various forms of mobile based DPMs and the encouraging possibility provided by the m-payment systems, their penetration and adoption are relatively low in comparison to the other recent forms of cashless payments mode (or DPMs) including credit card and online payments. For example, only 17.1% of mobile Internet users have ever used m-payments in China whereas in the US, this figure is 12% (Gao and Waechter, 2017; Garrett et al., 2014; Zhou, 2014). A similar trend of low adoption rates for the m-payment systems have been witnessed in several European countries such as the UK and France (Kapoor et al., 2014a; Slade et al. 2013; 2014). Although m-payment offers a number of benefits including ubiquity, convenience and value to users, it also involves great deal of uncertainty and risk due to virtuality and lack of control (Lin et al., 2014; Yan and Yang, 2014), which might have impact on consumer attitude towards emerging DPMs (Hossain & Mahmud, 2016; Liebana-cabanillas, 2015ab; Schierz et al., 2010; Tian and Dong, 2013). There is a cost for owning appropriate devices, having Internet connectivity and sometime there is a fee for making mobile-based transactions, which may or may not be influencing consumers' intentions towards mobile-based DPMs (Lu et al. 2011; Phonthanukitithaworn et al., 2015; Zhou 2011). Relating to cost and fee, existing research has also examined the role of price value (Oliveira et al. 2016; Slade et al. 2015a). One of the major advantages of mobile-based DPMs over other types of DPMs (such as e-banking) is its portability/mobility from one place to other place, which makes anytime, anywhere payment feasible. Some studies (e.g. Liu 2012; Schierz et al. 2010) have already examined the role of mobility for explaining consumer intention to adopt. However, a number of other studies (e.g. Liebana-cabanillas 2015; Makki et al. 2016; Oliveira et al. 2016; Sam et al. 2014; Slade et al. 2015b; Thakur & Srivastava 2014; Yang et al. 2012) have argued consumer innovativeness as a significant antecedent of consumer intention to adopt DPMs. Considering the importance of such constructs, various existing adoption studies have integrated them with dominant technology adoption models (such as IDT, TAM,

UTAUT and UTAUT2) for explaining consumer intention to adopt DPMs. Effects of some of these constructs have been consistent (across different studies) in terms significance but their extent of influence varies across studies. However, for some constructs both significance level and degree of influence vary across different studies.

Integration and synthesis of existing results about these constructs are essential for better understanding of the overall influence of such constructs on intention to adopt DPMs. An initial literature review suggested that there is no existing work yet that has either undertaken systematic literature review or meta-analysis around these constructs in relation to DPMs. Therefore, in order to understand the overall influence (by estimating cumulative effect size) of theoretical constructs (namely, attitude, cost, mobility, price value and innovativeness) on intention to adopt DPMs, *the aim of this study is to undertake the meta-analysis of findings reported in the existing research.* This is to be noted that although there are many other external constructs that are important for explaining intention to and usage of DPMs, the focus of this submission is to review and integrate results of aforementioned five constructs only due to space limitations. This study is part of a larger project so subsequent outputs would cover other important constructs.

The remaining part of this submission is structured as follows: Section 2 describes research and analysis method, which is followed by a descriptive review around constructs of interest in Section 3. The meta-analysis results are then presented in Section 4. Finally, conclusions, limitations and future research directions are presented in Section 5.

2. Research Method

The purpose of this study is to analyse and integrate results from existing studies. Hence, the first step was to identify relevant empirical research work on digital payment methods/systems adoption, which was undertaken by employing a keyword-based search. The following keywords were searched in the Scopus database: "Digital Payment" OR "Cashless Payment" OR "Mobile Payment" AND "Adoption" OR "Acceptance" OR "Diffusion" OR "Usage" OR "Intention" OR "Success" OR "Satisfaction". Although 109 studies appeared in initial search results, it was found that only 80 studies were directly appropriate for inclusion in the literature analyses focussed on consumer adoption and use of digital payment methods. It is important to note that some conference papers were not accessible through researcher's library, hence the total number further reduced to 75 studies. A further detailed screening and analysis was conducted to identify various independent variables (IVs) employed to determine influence on different dependent variables (DVs) such as behavioural intention (BI), usage (U), satisfaction and continuance intention. This was achieved by collecting the information regarding name of IVs and DV along with types of relationships (significant, insignificant or conceptual) reported between them (see Tables 1-2). Although several different relationships were identified through literature analysis, we decided to focus on 23 existing studies that had examined effects of attitude, cost, mobility, price value and innovativeness on determining intention to adopt digital payment systems. This is simply due to page limits and other reasons as

discussed in the previous sections. Further details about these 23 studies have been provided in both Table 1 and Table 2.

The second step of this study was to undertake a narrative review for descriptively analysing 23 studies focussing on the effect of each independent construct on behavioural intention, which is presented in Section 3. This was then followed by undertaking meta-analysis (quantitatively integrating and synthesising results from existing research) for the purpose of generative cumulative effect sizes and significance values (Dwivedi et al., 2011; Dwivedi et al. 2017). It is a methodical alternative to a qualitative and descriptive literature analysis and praised by many researchers for being better than a literature analysis (Rana et al., 2015; Rosenthal and DiMatteo, 2001; Wolf, 1986). As illustrated in Table 2, we collected path coefficients relating to each relationship along with sample size in order to perform the meta-analysis, which was conducted using comprehensive meta-analysis software tool. Further details about meta-analysis and results obtained from it are described in Section 4.

3. Descriptive Review

The literature related to areas of digital payments, mobile payments and mobile banking has already been reviewed by existing studies (Patil et al. 2017; Slade et al, 2013; 2014). So, it was not considered necessary to conduct a review on digital or mobile payments in general. Rather, focus of review presented in this section is given on evaluating and summarising the role of constructs (i.e. attitude, cost, mobility, price value and innovativeness) examined in this study. As shown in Table 1, a number of existing studies have already empirically examined the role of antecedents such as attitude, cost, mobility, price value and innovativeness. A brief discussion about these studies is provided in remaining part of this section.

Table 1: Existing studies that have utilised Attitude, Cost, Mobility, Price Value and Innovativeness as antecedents of behavioural intention

I.V.	D.V.	Sig	Non-Sig	App Example	Context	Respondent Types
AT	BI	Tian and Dong (2013) Liebana-cabanillas (2015) Hossain & Mahmud (2016) Schierz et. al (2010)	None	Mobile Payment QR Mobile Payment System	China Spain Bangladesh Germany	University Students Civil Service College Students Consumers
CO	BI	Hongxia et. al (2011) Lu et al. (2011) Phonthanukitithaworn et. al (2015) Zhou (2011) Yang et.al (2011) Yang et al (2012)	Yang et al (2012)	Mobile Payment	China Finland Thailand	University Students Alipay Users Consumers
MO	BI	Liu (2012) Schierz et. al (2010)	Liebana-cabanillas (2015)	Mobile Payment QR Mobile Payment System	China Germany Spain	University Students Consumers
PV	BI	None	Oliveira et al. (2016)	Mobile Payment	Portugal UK	University Students

			Slade et al. (2015a)			Online Consumers
IN	BI	Makki et al (2016) Slade et al. (2015b) Oliveira et al. (2016) Thakur & Srivastava (2014) Liebana-cabanillas (2015) Yang et al (2012)	None	NFC Based MP Technology Mobile Payment QR Mobile Payment System	UK India China Portugal Spain USA	Online Consumers University Students Consumers

[Legend: ATT: Attitude; COS: Cost; D.V.: Dependant variable; INN: Innovativeness; I.V.: Independent Variable; MOB: Mobility; PV: Price Value]

As listed in Table 1, four existing studies (Hossain & Mahmud, 2016; Liebana-cabanillas, 2015ab; Schierz et al., 2010; Tian and Dong, 2013) have examined the role of attitude for determining consumer intention to adopt digital payment systems in the contexts of both developed (Germany) and developing (Bangladesh, China and Spain) countries. The results suggest that the attitude has significant influence on consumer intention across all four studies. This may provide the case for employing this construct for further examination of emerging digital payment systems adoption across various contexts subject to demonstrating significant cumulative effect size across all existing work. This will be in line with recommendation from a recent meta-analytic study (Dwivedi et al. 2017) that argued for considering role of attitude as a core to a modified UTAUT model.

Five studies (e.g. Lu et al. 2011; Phonthanukitithaworn et al., 2015; Zhou 2011) have examined and reported significant effect of Cost/Perceived Cost/Perceived Fee on BI but only one such study (Yang et al., 2012) has reported non-significant effect of this construct. The effect of cost has been found significant in the context of both developed (Finland) and developing (China and Thailand) countries. Contrastingly, two existing studies (Oliveira et al. 2016; Slade et al. 2015a) reported non-significant effect of a similar construct (Price Value from UTAUT2 Theory) for explaining consumer BI. This suggests a synthesis of existing results using method such as meta-analysis is needed in order to establish whether cost or perceived value is a more relevant construct for examining issues related to digital payment adoption.

The role of 'mobility' as an antecedent of consumer intention to adopt has been examined by three existing studies with two reporting significant (Liu 2012; Schierz et al. 2010) influence in the context of China and Germany and one with non-significant effect (Liebana-cabanillas, 2015) in a Spanish context. Given the inconsistency in existing results relating to this construct, it was deemed appropriate to estimate overall effect size and significance of this construct by employing a meta-analytic approach.

Existing literature of innovation adoption (Kapoor et al. 2014bc) has argued and illustrated important role of 'innovativeness' towards influencing intention formation for variety of systems in various contexts. In line with this, seven existing studies (Liebana-cabanillas 2015; Makki et al. 2016; Oliveira et al. 2016; Sam et al. 2014; Slade et al. 2015b; Thakur & Srivastava 2014; Yang et al. 2012) have examined the role of innovativeness for determining intention to adopt digital payment systems in various contexts namely the UK, India, China, Portugal, Spain and the USA. All these

studies have suggested that innovativeness consistently exerts significant influence on BI to adopt digital payment systems in a variety of contexts. This shows that innovativeness is a relatively robust and important construct, hence should be considered by future adoption studies in this and other similar domains. Therefore, it was considered appropriate to establish its cumulative effect size using meta-analysis approach.

Literature presented in Table 1 also suggests that that existing studies have mainly examined issues related to mobile-based payment methods, mobile payment devices such as smartphones, NFC, contactless mobile payments and QR mobile payment system. This suggests that other forms of digital payments[1] are yet to be examined. Hence, the term digital payments in this paper largely represents mobile payments and may have less relevance for any other forms of digital payments.

4. Meta-analysis

Table 2 presents data (path coefficients (β), significance (p) and sample size) utilised for conducting meta-analysis for relationships between IVs (attitude, cost, price value, mobility and innovativeness) and behavioural intention to adopt digital payment methods that have occurred two or more times across 23 existing studies. Table 2 also presents different theories and models employed by the existing studies that have examined these constructs. Details of constructs and their path-coefficients with BI presented in this table suggest that these constructs were integrated with frequently utilised adoption and diffusion theories and models such as Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Innovation Diffusion Theory (IDT), UTAUT/UTAUT2 theories, Trust Transfer Theory and self-efficacy and risk constructs. Table 2 also suggests that in a number of studies (#1, 2, 3, 5, 7, 8, 9, 11, 12, 14, 16, 18, 21, 23 in Table 2) sample size was below 300, which is frequently recommended minimum threshold for theory testing particularly for studies that have utilised SEM as a theory testing technique. This may have impact on generalisability and validity of results reported by these studies. This provides added reason and basis for conducting the meta-analysis, which utilise cumulative sample size to overcome such problems. Table 2 also illustrates that some relationships are reported significant by some studies whilst non-significant by some other studies leading to inconsistency and lack of generalisation. In such scenario, meta-analysis helps to determine overall significance of such relationships with inconsistent *p* values.

Table 2: Details of Existing studies that have utilised Attitude, Cost, Mobility, Price Value and Innovativeness as antecedents

#	Study	TU	IV	DV	β	*p*	Sample Size
1	Tian and Dong (2013)	TAM, TPB, IDT	AT	BI	0.82	<0.001	178
2	Liebana-cabanillas (2015)	TAM, TRA, IDT	AT	BI	0.917	<0.001	168
3	Hossain & Mahmud (2016)	TAM + AT	AT	BI	0.797	<0.001	75

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[1] http://cashlessindia.gov.in/digital_payment_methods.html

4	Schierz et. al (2010)	TAM, TRA, IDT	AT	BI	0.24	<0.01	1447
5	Hongxia et. al (2011)	UTAUT	CO	BI	-0.27	< 0.01	186
6	Lu et al. (2011)	Trust Transfer Theory + IDT	PCO	BI	-0.072	< 0.05	961
7	Phonthanukitithaworn et. al (2015)	TAM, TRA, IDT	PCO	BI	-0.128	<0.05	265
8	Zhou (2011)	TAM	PCO	UI	-0.26	< 0.001	277
9	Yang et.al (2011)	IDT	PFE	BI	-0.163	<0.05	157
10	Yang et al (2012)	IDT	PFE	BI	-0.071	<0.05	483
11	Yang et al (2012)	IDT	PFE	BI	-0.013	ns	156
12	Liu (2012)	IDT	MO	BI	0.143	<0.05	177
13	Schierz et. al (2010)	TAM, TRA, IDT	IMO	BI	0.07	<0.01	1447
14	Liebana-cabanillas (2015)	TAM, TRA, IDT	IMO	BI	0.032	0.768 (ns)	168
15	Oliveira et al. (2016)	UTAUT2, IDT	PV	BI	0.03	ns	301
16	Slade et al. (2015a)	UTAUT2	PV	BI	-0.024	0.847 (ns)	244
17	Makki et al (2016)	SE + Risk	IN	BI	0.38	<0.01	450
18	Slade et al. (2015b)	UTAUT	IN	BI	0.22	<0.001	268
19	Oliveira et al. (2016)	UTAUT2, IDT	IN	BI	0.16	<0.01	301
20	Thakur & Srivastava (2014)	TAM	PIN	BI	0.13	<0.001	803
21	Liebana-cabanillas (2015)	TAM, TRA, IDT	PIN	BI	0.244	0.014	168
22	Yang et al (2012)	IDT	PIN	BI	0.2	<0.001	483
23	Yang et al (2012)	IDT	PIN	BI	0.263	<0.01	156

Legend: AT = Attitude; β = Path coefficient (Beta); BI= Behavioural Intention; C = Cost; DV = Dependent Variables; IDT = Innovation Diffusion Theory; IN = Innovativeness; IV = Independent Variable; IMO = Individual Mobility; MO = Mobility; ns = non-significant; p = Significance; PCO = Perceived Cost; PFE = Perceived Fee; PIN = Personal Innovativeness; PV = Perceived Value; SE = Self Efficacy; TAM = Technology Acceptance Model; TPB = Theory of Planned Behaviour; TRA = Theory of Reasoned Action; TU = Theory Used; UI = Usage Intention; UTAUT = Unified Theory of Acceptance and Usage of Technology; UTAUT2 = Extended Unified Theory of Acceptance and Use of Technology

Table 3 presents the results generated from the meta-analysis. In addition to the independent (IV) and dependent (DV) variables, the table presents the number of times the specific relationships were examined, total sample size (TSS) for relationships across different studies, effect size (β), 95% lower (L(β)) and upper U(β) confidence intervals and significance level for effect size (β) (i.e. p(ES)) as part of meta-analysis for all relationships examined.

Table 3: Meta-analysis Results

IV	DV	TSS	#	Effect Size (β)	95% L(β)	95% U(β)	p(ES)
ATT	BI	1868	4	0.767	0.279	0.940	0.006
COS	BI	2485	7	-0.135	-0.203	-0.066	0.000
MOB	BI	1792	3	0.074	0.027	0.120	0.002
PV	BI	545	2	0.006	-0.078	0.090	0.892
INN	BI	2629	7	0.227	0.152	0.300	0.000

The meta-analysis results indicate that four from five relationships are significant. There are relatively strong links between attitude and behavioural intention (β=0.767, p=0.006) and innovativeness and intention (β=0.227, p=0.000). Two relationships (Cost-BI and Mobility- BI) are found to be overall significant but with relatively low strength in terms of effect size. The results also demonstrate that the cost has negative influence on BI. The findings also suggest that cumulative effect of causal relationship between Perceived Value (PV) and BI was found to be non-significant. Moreover, the 95% confidence intervals for the ES(β) between MOB-BI and INN-BI presented in Table 3 indicate that their range difference (i.e. 95% High (β) - 95% Low (β)) of less than two, which is narrow enough to provide one confidence to the level of variance that could be explained.

5. Discussions

Figure 1 presents a meta-analytic model with antecedents of BI for digital payment systems. Figure 1 provides a visual representation of all relationships (strengths in terms of path coefficients and significance) examined in this study. As presented in Table 3, the model clearly indicates that attitude, cost, mobility and innovativeness are significant predictors of BI.
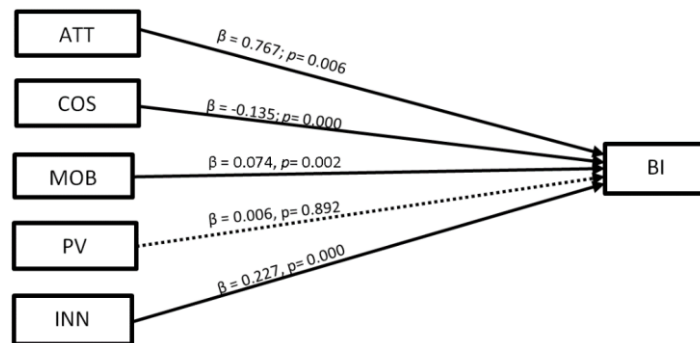

Fig. 1: Influence of Attitude, Cost, Mobility, Price Value and Innovativeness as per Results obtained from Meta-analysis

Both studies (i.e. Oliveira et al., 2016; Slade et al. 2015a) that had examined role of price value found that its effect on BI was non-significant. The meta-analysis result is in line with these two previous studies, as shown in Figure 1 where PV has non-significant effect on BI. According to Slade et al. (2015a) effect of this construct on BI was non-significant possibly due to type of sample employed for data collection. They collected data from non-adopters of mobile payments, which possibly "unable to evaluate whether NFC MPs represent value for money" (Slade et al. 2015a, p.218) as respondents had not experienced actual benefits that can be gained by using mobile payments. Oliveira et al. (2016) provided no reason why effect of price value was non-significant. However, it was noted that they collected data from students who

were more likely to be non-adopters than adopters, and so they might have been unable to evaluate trade-off between price for acquiring and using such technologies and benefits obtained from using it. In conclusion, both studies have utilised same questions to measure this construct and similar data sample employed to collect data, which suggest a strong possibility of non-significance due to data collected from non-adopters. So in order to confirm whether this construct is still relevant for investigating digital payment adoption, it is suggested that the future studies should test its effect on BI using data collected from adopters.

Other salient finding of this meta-analysis is that attitude plays an extremely strong and central role for determining BI to adopt mobile payment systems. This is not in line with dominant adoption models such as TAM, UTAUT and UTAUT2 as they excluded attitude construct from their core model. However, the central role of attitude for influencing BI is in line with recommendations from recent studies (Dwivedi et al. 2017a, 2017b; Rana et al. 2017; 2016; Williams et al. 2015) that have found that attitude significantly influences BI in technology adoption research. Dwivedi et al. (2017a) argued that aforementioned models measure technological and environmental attributes but they lack individual attributes. They demonstrated this based on a meta-analysis of a large number studies that utilised attitude along other UTAUT constructs, which was also tested by utilising primary data and found similar results (Dwivedi et al. 2017b; Rana et al. 2017; 2016). Given that attitude is a well tried and tested construct in various domains including information systems and marketing, it should be included as an integral part of models such as TAM, UTAUT and UTAUT2. So it is suggested that future studies in mobile payment adoption should consider including attitude as an antecedent of both BI and actual behaviour constructs.

6. Conclusions

This study has performed the meta-analysis of all 23 studies that have examined influence of attitude, cost, mobility, price value and innovativeness on behavioural intention to adopt digital (m-payment) systems. The findings from this research suggest that attitude, cost, mobility and innovativeness are significant antecedents of consumers' intention to adopt digital (m-payment) systems. However, effect of price value on consumers' intention to adopt was found as non-significant. Both attitude and innovativeness emerged as stronger predictors in comparison to cost and mobility. Although effect of cost is relatively less strong (yet significant), results confirmed that it has negative influence on the intention to adopt. Hence, it is recommended that future studies employing intention-based theories/models for examining digital (mobile) payment adoption should integrate attitude and innovativeness as antecedents of intention along with other standard antecedents from respective theories/models. Cost/perceived cost/perceived fee should be considered as an external construct in an adoption model only when there is some form of charge/fee/commission being deducted per transaction either by mobile payment providers and/or their partners. Mobility construct should be carefully considered in terms of its measurements utilised to collect data and context of the study in order to gain stronger effect. Finally, it would be fruitful not to utilise price value construct if data is being collected from non-adopters due to its inconsistent and non-significant

performance. Both cost and price value are conceptually similar in nature, but cost is better defined than later. For this reason, it would be better to consider cost as an alternative to price value when determining intention to adopt mobile payment systems.

6.1 Limitations and Future Research Directions

There are few limitations that need to be accounted when interpreting results of this study. Only a limited number of studies have utilised antecedents meta-analysed in this research, so results of this study may not hold in differing contexts. Therefore, further observations and analyses are needed to confirm if results of this study are applicable in diverse contexts. The future research may also increase the number of studies used for meta-analysis by considering other forms of digital payment ecosystems and emerging FinTech applications. This study has utilised only Scopus database for identifying relevant research articles so studies that are not indexed in this database would have been excluded from being considered for this meta-analysis. This study included only five antecedents of BI but there are other important antecedents and results about them, which also need to be considered in future meta-analysis based studies. A recent study by Patil et al. (2018) has conducted a meta-analysis on the role of Trust and Risk constructs on determining BI. Similarly, role of other constructs such as anxiety, privacy, security, self-efficacy and core constructs of various adoption models should also be examined. The future research can comprehensively search the related keywords across all other databases and Google Scholar to maximise the number of potential studies to perform meta-analysis. In this study, effect of each construct is individually estimated. It is recommended that future studies should also conduct meta-regression or meta-analytic structural equation modelling (MASEM) for testing effect of all constructs together at one time (See Dwivedi et al. 2017a as an example). The future research can also collect primary data for different constructs presented in the proposed conceptual model and validate the performance of the proposed research model.

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