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## The mediating role of technology perception in the relationship between customer experience and the adoption of e-payment cards during the COVID-19 pandemic

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### ABSTRACT

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By integrating the technology acceptance model, the theory of planned behavior, and regulatory focus theory, this study assesses the mediating role of technology perception attributes (i.e., perceived ease of use and perceived usefulness) in the relationship between customer experience and the adoption of e-payment cards during the COVID-19 pandemic in Sudan. A questionnaire survey was conducted with 368 e-payment users in Khartoum and Southern Darfur, the two most highly populated states in Sudan. This study employed convenience sampling and quantitative methodology to clarify the relationship based on structural equation modeling. The empirical findings showed that the customer experience dimensions of cognition and emotion had a significant influence in e-payment adoption and technology perception. Further, they indicated that technology perception had a significant mediating role in the relationship between customer experience and e-payment adoption.

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## 1. Introduction

The adoption of internet-related technologies relies heavily on internet users' perception, skills, abilities, and application expertise (Goudarzi *et al.*, 2013). Rogers (1995) claims that technology adoption depends on a variety of factors. E-payment cards are a form of e-banking service that is used by customers to conduct e-banking and trade transactions. Sudan possesses a well-developed e-payment system that is continuously improving to guarantee users' security. The Sudan Central bank has established clear regulations that promote and encourage e-payment. Therefore, the necessary e-payment infrastructure, unlimited access to online payment options, a rapid e-payment transaction cycle, and reduced e-payment risks for online e-transactions have been made available nationwide. The nationwide diffusion of e-payment requirements has increased retail banks' opportunities to develop customized services and enhance their engagement with users. This has also encouraged banks to improve e-payment users' experience to gain a competitive advantage in the market, aiming to enhance customers' experience at different levels—rational, emotional, sensorial, physical, and spiritual (Rodriguez *et al.*, 2016). Further, all local banks' e-banking platforms are prepared to provide e-payment services and quickly obtain feedback on customers' usage behavior; they have various applications such as in points of sale, smart mobile money transfers, automated teller machines, and online payments. Individuals' reasons to use e-payment tools include borrowing money, making e-purchases, and timesaving. In the context of customer services, some authors have stated that customer adoption and technology adoption behavior are essential aspects leading to customer satisfaction (Oh *et al.*, 2013; Kashik *et al.*, 2015). We argue that users' adoption of e-payments differs depending on customers' geographical area. Moreover, we posit that e-payment usage depends

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on users' income and age. Furthermore, it is also necessary to take into account that customers' cognitive and emotional background factor into their decision to adopt e-payment usage. As a result of the COVID-19 pandemic, the global service industry has seen extensive changes (Zhan et al., 2020). Social distancing measures have established e-payments as the safest way for customers to pay for goods and services. This new environment has highlighted the importance of online services. Thus, researchers have examined the changes in customers' behavior during the pandemic period. In the present study, we aim to explore why and when Sudanese users utilize e-payment services during the pandemic period. Customers' technology adoption is a fundamental driver of consumer satisfaction and loyalty in the retail industry (Nadiri, 2011; Rodriguez *et al.*, 2016). Thus, understanding the effects of customer experience on e-payment adoption is crucial for banks to develop e-products and gain profit.

The concept of customer experience has evolved from a cognitive and rational process toward a more holistic practice involving both the rational and hedonic aspects of consumption (Becker and Jaakkola, 2020); as such, it has been linked with both sensations and implicit meanings and emotions (Carù and Cova, 2007). Accordingly, Gentile et al. (2007) and Bratianu (2015) identified the emotional and cognitive dimensions of customer experience; the former stimulates the affective system, while the latter is connected with rational thought or conscious mental processes. Therefore, customer experience encompasses users' cognitive and emotional assessments when making purchases (Klaus & Maklan, 2013). From the perspective of Meyer and Schwager (2007), customer experience can be defined as a customer's internal and subjective response to any direct or indirect contact with a company. Thus, users' cognition and emotions are the two dimensions of customer experience that determine decision-making for transactions and sense-making for the adoption of e-payments. This way, the concept of customer experience links users' thoughts, culture, and habits to reveal their behavior. Consumer cognition has become an important research subject for academics (Briz and Ward, 2009), while the concept of an emotion system has been applied in various fields (Lin *et al.*, 2021). User cognition and emotion regarding e-payments varies according to individual and geographical differences, which influence users' adoption of new technologies. Perceived usefulness and perceived ease of use are technology perception attributes (Son et al., 2012) that have a significant impact in users' intention to use internet applications (Moslehpour et al., 2018; King and He, 2006) and e-commerce (Featherman & Pavlou, 2003). According to the technology acceptance model (TAM), perceived usefulness and perceived ease of use are strong predictors of users' successful acceptance of technology (Davis, 1989; Venkatesh & Davis, 2000; King & He, 2006; Schepers & Wetzels 2007; Korteland & Bekkers, 2008; Hameed & Counsell, 2014; Kim et al., 2018). Together, these factors determine consumers' attitudes toward the use of technology, which can influence their intention to use, depend on said technology's Perceived usefulness and perceived ease of use (He et al., 2018). The specific role of perceived ease of use (PEOU) and perceived usefulness (PUFN) in users' adoption of e-payment services is to save users' time and to help them obtain additional benefits. In line with their success in predicting the adoption and acceptance of technology products by end users, in the present study, we used the TAM, the theory of planned behavior (TPB), and regulatory focus theory (RFT) to examine the relationship between customer experience and the adoption of e-payments. To our knowledge, no prior studies have taken into account these constructs when attempting to examine technology adoption and consumers' behavioral changes. The goal of the TAM is to explain user behavior and the determinants of general computer technology acceptance across a broad range of end-user computer technologies and user populations (Rondan-Cataluña et al., 2015). The TAM suggests that, when users are presented with new technologies, several factors influence their decision about how and when they will adopt said technologies (He et al., 2018; Taufik & Hanafiah, 2019; Ardiansah et al., 2020; Tahar et al., 2020). When a behavior intention is established, there is a high likelihood of actual usage (Ajzen, 1991). Thus, understanding the factors that influence user technology acceptance has become one of the goals of information systems research (He et al., 2018). The theoretical framework of this study employs the following operational definitions: emotion (EMO) is the value derived from customer satisfaction when using e-payment services (Van Le and Suh, 2019). Cognition (COG) refers to customers' experiential knowledge regarding how they live their consumption experiences (Ietto et al., 2020). PUFN refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). PEOU is the degree to which a potential adopter views the use of a target technology to be relatively free of effort (Davis, 1989).

The main scientific contribution of this study is reviewing prior field-relevant studies in light of the changes in the e-market environment caused by the COVID-19 pandemic, specifically vis-à-vis the adoption of e-payment cards. We posit that there is a significant relationship between customer experience and e-payment adoption that is mediated by technology perception attributes. This study is structured as follows: Section 2 explains the theories that support this study's and describes the theoretical background, Section 3 presents this study's data and methodology, Section 4 presents our analyses and results, and Section 5 discusses the findings, academic implications, managerial implications, as well as the limitations and directions for future work, and concludes this paper.

## 2. Supported theories and theoretical background

This study used three theories to guide its theoretical framework: the TAM, the TPB, and RFT. As these are the most useful theories to explain individuals' interaction with IT products from a psychological and social perspective, we opted to integrate these theories to analyze how users decide to adopt IT products as well as their behaviors. The TAM is an IT theory that is widely used to assess users' acceptance of specific technologies and to model their usage intention (Davis, 1989; Davis *et al.*, 1989). Researchers have successfully used the TAM to explain users' adoption of different technologies, such as e-banking (Barkhordari *et al.*, 2017; Al-Smadi, 2012), e-learning (Tan *et al.*, 2012), mobile shopping (Kim *et al.*, 2009), and social

networks (Pinho & Soares, 2011). For many researchers, users' adoption of IT products or their acceptance to use them are determined by two fundamental factors: PEOU and PUFN (Davis, 1989; Davis *et al.*, 1989; Venkatesh and Davis, 2000; King and He, 2006; Hameed & Counsell, 2014; Hansen *et al.*, 2018). In the present study, the TAM is used to explain users' adoption intention and predicts their adoption intention for IT products. The TPB constitutes a paradigm for customers' intention for purchasing and their engagement decisions (Holdsworth, 2020; Arango *et al.*, 2021; Greenacre & Akbar, 2019; Singh *et al.*, 2018). Moreover, RFT—proposed by Higgins (1997, 2000)—outlines how people pursue specific goals and experience emotions related to the attainment of positive outcomes or the thwarting of negative ones. Extending RFT to IS adoption, users who are more promotion-focused would “center on the realization of positive goals and desired end states and view the decision with eagerness” (Keller, 2006, p. 109). Moreover, it is important to consider that customers' cognition and emotions form their interaction behaviors.

Bagozzi *et al.* (1999) discussed the role of emotions in consumption experiences. Moreover, Wrigley and Straker (2019) noted that emotions are digital drivers of consumer experience. Further, consumers' emotion has been reported to be crucial in purchases (Steg, 2005). Additionally, consumers' emotional response has been reported to have a powerful effect on subsequent behavioral responses (Vieira, 2013; Dong *et al.*, 2020). Emotions comprise chemical reactions that prepare an individual's body for a specific response (Adolphs and Anderson, 2018). Furthermore, emotions are necessary for communication (Lin *et al.*, 2021). Gupta and Kim (2007) analyzed consumers' emotions to appraise their perceived value in consumption. Doyle (2004) argued that customers do not normally care for actual products or services in isolation; rather, they consider whether said goods suit their needs in terms of both emotion and price. Users' cognition plays a major role in the continued usage of commercial services, such as mobile internet services (Li *et al.*, 2019). For instance, Behnam *et al.* (2020) revealed a positive relationship between customers' cognitive management and their intention to use sports-related services. Han and Mu (2018) found that consumer cognition has a significant guiding role in the online purchase of fresh agricultural products. Having good financial knowledge and engaging in responsible financial behaviors are important qualities for credit card users when purchasing goods and services (Robb, 2011; Xiao *et al.*, 2011). Muniz *et al.*, (2020) found that customer knowledge is essential to the improvement and innovation of tourism products and services. Therefore, insufficient knowledge (cognition) on the usage of e-payment services increases customers' reluctance to perform payments electronically, while also decreasing the level of trust and security customers perceive when using e-payment systems (Goudarzi *et al.*, 2013). Thus, it is important for users to possess adequate knowledge of the technical procedures involved in the usage of e-payment cards to be able to adopt them. Therefore, emotion and cognition comprise self-efficacy elements that affect customers' purchasing decisions. These effects can be identified in e-payment adoption behaviors. Thus, we proposed the following hypotheses:

**H<sub>1a.1</sub>:** *EMO significantly influences PEOU.*

**H<sub>1b.1</sub>:** *COG significantly influences PEOU.*

**H<sub>1a.2</sub>:** *EMO significantly influences PUFN.*

**H<sub>1b.2</sub>:** *COG significantly influences PUFN.*

**H<sub>2a</sub>:** *EMO significantly influences the adoption of e-payment cards.*

**H<sub>2b</sub>:** *COG significantly influences the adoption of e-payment cards.*

Past studies showed that PUFN positively influences the adoption of electronic banking (Lee, 2009), e-payments (Salloum *et al.*, 2019), online travel services (Li & Liu, 2014), corporate websites (Teoh *et al.*, 2013), and e-shopping (Hansen *et al.*, 2018). PUFN also plays a significant role in online purchases (Gefen & Straub, 2000). Wibisono and Ang (2019) found that PUFN strongly affects behavioral intention to use ITs. Moreover, He *et al.* (2018) reported that PUFN enhances IS users' response efficacy and confidence to perform the necessary functions. Patel and Patel (2018) found a significant positive effect of PUFN on the adoption of internet banking services. Moreover, PUFN may help guarantee the continued use of e-payment services.

Numerous authors have shown that PEOU has a positive effect on technology adoption and users' intention to conduct transactions (Venkatesh & Davis, 2000; Alalwan *et al.*, 2016; Novindra & Rasmini, 2017). He *et al.* (2018) argued that PEOU may increase individuals' self-efficacy for IS adoption. Moreover, PEOU creates a friendly environment for users that increases their satisfaction with IT products (Li *et al.*, 2019). Thus, we developed the following hypotheses:

**H<sub>3a</sub>:** *PEOU has a significant influence on the adoption of e-payment cards.*

**H<sub>3b</sub>:** *PUFN has a significant influence on the adoption of e-payment cards.*

### 2.1 The mediating role of technology perception attributes

PEOU and PUFN have been reported to have a significant effect on users' intention to use self-service technologies (Demoulin & Djelassi, 2016; Marakarkandy *et al.*, 2017; Wibisono & Ang, 2019). Similarly, Gefen and Straub (2000) found a significant effect of both PEOU and PUFN on e-commerce adoption. Moreover, Shin and Kim (2008) confirmed that PEOU and PUFN

are critical antecedents in the adoption of social media technology. These two attributes lead to users' continued intention to use e-payment cards. Since they comprise a bountiful source of user information, these attributes also determine technology adoption and improve our understanding of customers' desires and needs, which leads to enhanced customer relationship management when developing new services and products and in decision-making related to pricing and promotion. Depending on H1, H2, and H3, customer experience (EMO and COG) will increase the adoption of e-payment cards through PEOU and PUFN. Regarding the mediating role of these technology perception attributes, Zhao et al., (2010) argued that their mediating role was confirmed by the presence of a significant indirect influence in the dependent variable. Therefore, we derived the fourth hypothesis as follows:

**H<sub>4a.1</sub>:** *PEOU positively mediates the relationship between users' EMO experience and their adoption of e-payment cards.*

**H<sub>4a.2</sub>:** *PEOU positively mediates the relationship between users' COG experience and their adoption of e-payment cards.*

**H<sub>4b.1</sub>:** *PUFN positively mediates the relationship between users' EMO experience and their adoption of e-payment cards.*

**H<sub>4b.2</sub>:** *PUFN positively mediates the relationship between users' COG experience and their adoption of e-payment cards.*

### 3. Data and Methodology

#### 3.1 Data collection

Four hundred sixteen questionnaires were distributed to e-payment card users from various branches in 32 banks that worked in Sudan during the period ranging from October 15, 2020, to January 15, 2021. The customer service department of each bank branch was given about 13 questionnaires. Among them, 368 usable questionnaires were recovered (88% response rate). Table 1 shows participants' characteristics. Data were collected by customer service departments in the studied bank branches after informing them of the research objectives and giving us verbal consent. Participants are e-payment users who visited the banks' branches during the data collection period and voluntarily agreed to participate in our survey after they were informed about its goal and procedures prior to the start of the study. Participants were Sudanese individuals from Khartoum and Southern Darfur, the two most highly populated states in the country. All participants had online experience using e-payments, were knowledgeable regarding e-payments, satisfied banks' e-payment procedure requirements, and considered the banks to be trustworthy enough to provide e-payment services. Further, participants were assured that their personal information and responses would be kept strictly confidential. We used SPSS 24 software and structural equation modelling (SEM) to assess the collected data.

**Table 1**  
Participant characteristics

	Category	N=368	Percent
<b>Participant's State</b>	Khartoum State	204	55%
	Southern Darfur State	164	45%
<b>Gender</b>	Male	272	74%
	Female	96	26%
<b>Age</b>	s < 30 year	121	33%
	30–39	163	44%
	40–49	63	17%
	≥ 50 years	21	6%
<b>Job status</b>	Businessperson	42	11%
	Employee	210	57%
	Student	50	14%
	Other	66	18%
<b>Educational level</b>	Graduate	194	53%
	Post-graduate	123	33%
	Other	50	14%
<b>Income (in SDP)</b>	< 25,000	91	25%
	25,000– 49,999	139	38%
	50,000–74,999	54	15%
	≥ 75,000	84	23%
<b>Frequency of e-payment card usage</b>	Rarely	17	5%
	Sometimes	57	15%
	Once per week	45	12%
	Several times per week	147	40%
	Daily	102	28%

Note. SDP = Sudanese pound.

We employed a questionnaire survey and a convenience sampling method. The original questionnaire was in Arabic; however, an English language version was developed by a bilingual academic to support participants' understanding. The questionnaire's items were rated on a 5-point Likert scale (ranging from 1 = "strongly disagree" to 5 = "strongly agree"). Further, in September 2020 we pretested the questionnaire with 10 postgraduate students from the University of Nyala who worked in the banking sector. In this study, three second-order constructs were used: the two customer experience dimensions (COG and EMO) were established as the independent variables, the two technology perception attributes (PEOU and PUNF)

were established as the mediators, and the adoption of e-payment cards was established as the dependent variable. It is worth noting that we did not use all three dimensions of the customer experience pyramid, namely, skill, cognition, and emotions in our study. We excluded the skill dimension, as all participants in our study had experience conducting practical e-payment transactions and, therefore, had at least some skill for making e-payments.

### 3.2 Measurement of the variables

We made minor modifications to the measures used in past studies. (1) We used 5 PEOU and 4 PUFN items used by Davis *et al.* (1989) that were validated by Wibisono and Ang (2019 and Taufik and Hanafiah (2019). (2) For the adoption of e-payment services, we used 3 items implemented by Venkatesh and Bala (2008) and Venkatesh and Davis (2000) that were validated by Wibisono and Ang (2019). (3) For COG, we used 3 items used by Khodakarami and Chan (2014) that were validated by Behnam *et al.* (2020). (4) Lastly, for EMO, we developed 8 items based on Alepis and Virvou (2011) and Lin *et al.* (2021).

### 3.3 Non-response bias and common method bias countermeasures

Following Armstrong and Overton's (1977) suggestion for non-response bias (NRB) assessment, we compared 25% of responses from the first two weeks of the study period with 25% of responses from the last two weeks and performed a t-test that revealed our study was free of the NRB problem. Additionally, it was verified that there was no difference between the answers of the respondents in the two states using the ANOVA analysis, which revealed that there were no fundamental differences. To mitigate the negative effects of common method bias (CMB), we performed various tests. We used Muthen and Muthen's (2007) M-plus software loading check, Harman's single factor test (Gomez-Conde *et al.*, 2019), and Podsakoff *et al.*'s (2003) NRB test. These tests showed that our study was free of CMB. Moreover, we conducted pre-testing for the questionnaire to ensure the understandability of the statements presented therein.

## 4. Results

### 4.1 Kaiser-Meyer-Olkin's test, Bartlett's test, and pattern matrix results

Table 2 shows the Kaiser-Meyer-Olkin's (KMO) test, Bartlett's test, and pattern matrix results. The KMO value was .868, while Bartlett's test of sphericity yielded a value of 2330.804 (degrees of freedom [DF] = 105;  $p < 0.000$ ). Therefore, our data were appropriate to use principal components analysis, which indicates the simple structure and unidimensionality of the used tools. The primary exploratory factor analysis with 23 items detected a five-factor structure that explained 70.62% of the total variance. The remaining items of the five-factor loadings ranged from 0.724 to 0.916, which were higher than the cutoff point of 0.5. It is worth mentioning that some items, such as COG1, EMO1, EMO2, EMO3, PEOU2, PEOU3, PUFN1, and PUFN4, were deleted in the factors runs due to insufficient factor loadings; however, no cross loading was observed. Further, the Cronbach's alpha of the five factors ranged between .706 and .896, well above the required level of .700.

**Table 2**  
Kaiser-Meyer-Olkin's test, Bartlett's test, and pattern matrix results

	Components				
	1	2	3	4	5
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.868				
Bartlett's Test of Sphericity/Approx. Chi-Square	2330.804				
DF	105				
Significance	.000				
Cronbach Alpha	.890	.896	.759	.794	.706
COG2: I have extensive knowledge of e-payment cards.				.916	
COG3: I have knowledge related to e-payment cards that enhances my ability to use them.				.866	
EMO5: I defend the use of e-payment cards when someone criticizes them incorrectly because I believe in them.	.763				
EMO4: I have a positive feeling and emotional about the e-payment cards.	.724				
EMO6: E-payment cards are my first choice when purchasing goods.	.809				
EMO7: I can always motivate myself to interact with e-payment cards.	.803				
EMO8: I have great trust in e-payment cards and I will not change my opinion about them.	.800				
PUFN2: E-payment cards speed up my payments.					.888
PUFN3: Everywhere I go, e-payment cards allow me to make payments easily.					.825
PEOU1: I feel that using e-payment cards is quite easy.			.775		
PEOU4: I feel that using e-payment cards skillfully is quite easy.			.812		
PEOU5: I feel that using e-payment cards is very easy to learn.			.754		
Adoption1: I often consider using e-payment cards for my purchases.		.875			
Adoption2: I use e-payment cards for all my purchases during the COVID-19 pandemic.		.903			
Adoption3: I plan to use e-payment cards in the future.		.887			
<b>Variance explained</b>	<b>27.43</b>	<b>14.49</b>	<b>10.76</b>	<b>9.35</b>	<b>8.59</b>

Note. KMO = Kaiser-Meyer-Olkin; DF = degree of freedom.

### 4.2 Reliability and validity tests

After testing the internal consistency, sustainability of reliability, and validity of the measures used in this study, we obtained the following values: Cronbach's  $\alpha = > 0.7$  (Nunnally, 1994), composite reliability (CR) =  $> 0.7$ , average variance extracted

(AVE) = > 0.5, maximum shared variance = < AVE, and  $\sqrt{AVE}$  > max correlation (Hair *et al.*, 2009; Fornell & Larcker, 1981). Table III shows that all measures' Cronbach's  $\alpha$  ranged between 0.706 and 0.896, their CR ranged between 0.869 and 0.717 (except for PUFN, which was 0.690), their AVE was greater than .5, and their  $\sqrt{AVE}$  was greater than the max correlation coefficients. This indicates that the internal consistency, convergence, and discriminant validity were greater than the threshold values. Likewise, our study met the content validity criteria for all questionnaire items (Chen & Chengalur-Smith, 2015).

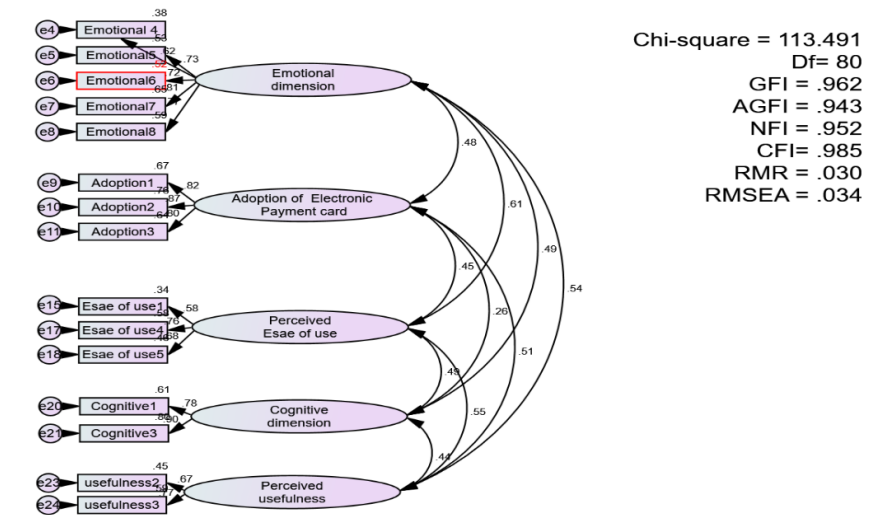
**Table 3**  
Psychometric properties of the research model (model validity measures)

	CR	AVE	MSV	MaxR(H)	COG	EMO	Adoption	PEOU	PUFN
COG	0.828	0.707	0.241	0.850	0.841				
EMO	0.850	0.533	0.373	0.859	0.491	0.730			
Adoption	0.869	0.689	0.263	0.874	0.258	0.479	0.830		
PEOU	0.717	0.461	0.373	0.735	0.488	0.611	0.449	0.679	
PUFN	0.690	0.524	0.298	0.697	0.443	0.537	0.513	0.546	0.724

Note. COG = cognition; EMO = emotion; PEOU = perceived ease of use; PUFN = perceived usefulness; CR = composite reliability; AVE = Average Variance Extracted; MVE = maximum shared variance; MaxR (H) = maximum reliability.

4.3 Confirmatory factor analysis

Table IV and Fig. 1 show the results of the structural model of confirmatory factor analysis (CFA) and the goodness-of-fit measures. Following Anderson and Gerbing's (1988) two-stage model-building procedure, the results revealed an excellent interpretation compared with criteria of testing suitability and validation of measures recommendations, which indicated each factor as dominant items as well as the items basically linked with their specified groups of the literature and highly reliable. Regarding CFA, no items were deleted because of weak factor loading.



Note. DF = degrees of freedom; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; NFI = normal fit index; CFI = comparative fit index; RMR = standardized root mean square residual; RMSEA = root mean square error of approximation.

**Fig. 1.** Model Fit Measures

**Table 4**  
Model fit measures

Measure	Estimate	Threshold	Interpretation
CMIN	113.491	--	--
DF	80	--	--
CMIN/DF	1.419	1-3	Excellent
CFI	0.985	> 0.95	Excellent
SRMR	0.035	< 0.08	Excellent
NFI	0.952	> 0.95	Excellent
GFI	.962	> 0.95	Excellent
AGFI	.943	> 0.90	Excellent
RMSEA	0.034	< 0.06	Excellent
PClose	0.000	> 0.05	Excellent

Note. CMIN = chi-square value; DF = degrees of freedom; CFI = comparative fit index; SRMR = standardized root mean square residual; NFI = normal fit index; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; RMSEA = root mean square error of approximation; PClose = p-value.

4.4 Descriptive Statistics and Correlations

Table V shows the correlation coefficients, averages, and standard deviations of this study variables. Referring to the mean values that range between 4.04 and 4.43, and the assumed average of 3.00 these values showed higher averages as well as the standard deviations that do not exceed 1. This table shows that participants have a mean level of consent towards the study variables. All the variables exhibited a standard deviation lower than 1. Furthermore, the correlation coefficients indicate positive and strong relationships between the variables at the .01 level of significance (two-tailed). Additionally, multicollinearity was not a major concern in this study.

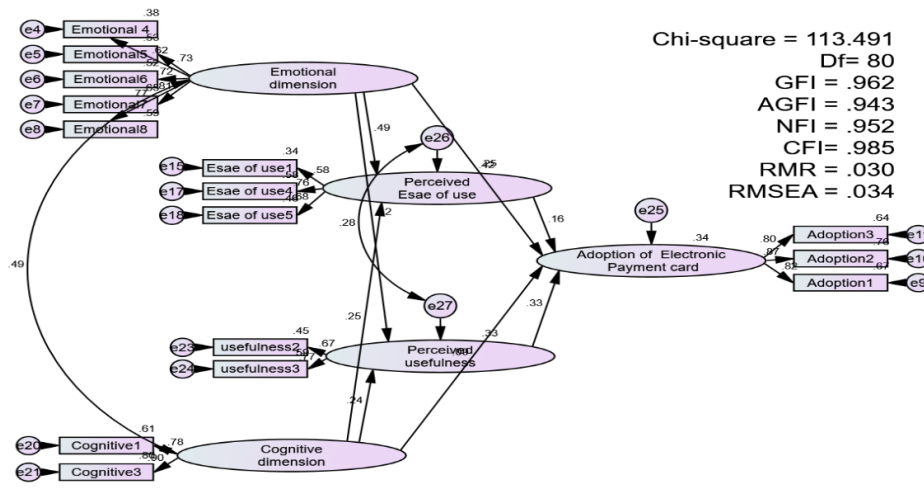
**Table 5**  
Averages, standard deviations, and correlations

	Mean (SD)	PUFN	COG	PEOU	ADOPTION	EMO
PUFN	4.43(.69)	1				
COG	4.43(.84)	0.443	1			
PEOU	4.33(.63)	0.546	0.488	1		
ADOPTION	4.39(.63)	0.513	0.258	0.449	1	
EMO	4.03(.76)	0.537	0.491	0.611	0.479	1

Note. PUFN = perceived usefulness; COG = cognition; PEOU = perceived ease of use; EMO = emotion; SD = standard deviation.

4.5 Hypothesis testing

Before hypothesis testing, we assessed the goodness-of-fit indicators (as shown in Fig. 2). The model proved apt to evaluate the structural paths utilizing SEM. Structural path relationships in Table 6 support hypotheses H1a.1, H1b.1, H1a.2, and H1b.2.



Note. DF = degrees of freedom; GFI = goodness of fit index; AGFI = adjusted goodness of fit index; NFI = normal fit index; CFI = comparative fit index; RMR = standardized root mean square residual; RMSEA = root mean square error of approximation.

**Table 6**  
Regression weights of the model

			Estimate	S.E.	C.R.	P	Result
PEOU	←	EMO	.297	.051	5.776	****	Supported
PEOU	←	COG	.140	.040	3.497	****	Supported
PUFN	←	EMO	.295	.058	5.060	****	Supported
PUFN	←	COG	.154	.049	3.163	.002	Supported
Adoption	←	EMO	.193	.064	3.002	.003	Supported
Adoption	←	COG	-.064	.049	-1.306	.191	Not Supported
Adoption	←	PEOU	.205	.116	1.769	.077	Not Supported
Adoption	←	PUFN	.371	.098	3.805	****	Supported

Note. PUFN = perceived usefulness; COG = cognition; PEOU = perceived ease of use; EMO = emotion; S.E = standard error; C.R = critical ratio; P = level of significance; \*\*\*\*p < 0.001, \*\*\*p < 0.010, \*\*p < 0.050, \*p < 0.10.

4.6 Mediating test

We employed bootstrapping ten thousand times to analyze all indirect relationships to reach the 95% confidence interval (Hayes & Preacher, 2010; Hayes, 2018). The bootstrapping approach provides more accurate assessments than causal stepwise

regression (Montoya & Hayes, 2017; Zhang *et al.*, 2015). According to Edwards and Lambert (2007), to determine statistical significance, the confidence interval should not include zero. Tables 7–8 show the mediating role of PEOU and PUFN on the analyzed relationship. Under 95% confidence interval Table 7 shows that the indirect influence of COG and EMO on the adoption of e-payment cards via PUFN is significant. Thus, H4b.1 and H4b.2 are supported. Further, Table VIII shows that the indirect influence of COG and EMO on the adoption of e-payment cards via PEOU was significant. Thus, H4a.1 and H4a.2 are supported.

**Table 7**  
Indirect effects for PUFN

	Indirect effects Adoption	Lower bounds Adoption	Upper bounds Adoption	Significance (P) Adoption
COG	0.070	0.019	0.174	<b>0.003</b>
EMO	0.126	0.053	0.269	<b>0.000</b>

Note. PUFN = perceived usefulness; COG = cognition; EMO = emotion; P = level of significance; \*\*\*\*p < 0.001, \*\*\*p < 0.010, \*\*p < 0.050, \*p < 0.10.

**Table 8**  
Indirect effects for PEOU

	Indirect effects Adoption	Lower bounds Adoption	Upper bounds Adoption	Significance (P) Adoption
COG	0.047	0.008	0.136	<b>0.013</b>
EMO	0.098	0.023	0.235	<b>0.012</b>

Note. PEOU = perceived ease of use; COG = cognition; EMO = emotion; P = level of significance; \*\*\*\*p < 0.001, \*\*\*p < 0.010, \*\*p < 0.050, \*p < 0.10.

## 5. Discussion

This study investigated eight hypotheses (four main hypotheses divided into 8 sub hypotheses) regarding the mediating role of technology perception attributes (PEOU and PUFN) in the relationship between customer experience (COG and EMO) and the adoption of e-payment cards in Sudan. Of those eight hypotheses, six were confirmed. This study's findings support prior studies, which posit that PUFN encourages individuals to adopt new technologies (Davis, 1989). For instance, Wong *et al.* (2013) showed that PUFN is an accurate predictor of consumers' attitude towards laptop use. Moreover, researchers have found that the more knowledge consumers can obtain from shopping websites, the higher their cognitive level for purchasing products online (Han and Mu, 2018). Jalonen (2014) and Chen *et al.* (2013) found that emotions affect online users' rational behavior and trigger specific behaviors (Lin *et al.*, 2021).

In addition, this study tested four hypotheses regarding the mediating role of PEOU and PUFN on the relationship between customer experience and the adoption of e-payment cards. We found that PEOU and PUFN had a significant mediating role in said relationship. Our findings confirm prior studies wherein technology perception attributes serve as mediators (e.g., Mustapha & Sheikh Obid, 2014; Moslehpour *et al.*, 2018; Ashraf *et al.*, 2016; Alalwan *et al.*, 2016).

Regarding hypothesis H3a, our findings support prior quantitative meta-analyses, which posit that PUFN is the stronger predictor of IT acceptance and intention to use and that it has higher correlation coefficients with usage behavior than PEOU (Ma & Liu, 2004; King & He, 2006; Schepers & Wetzels, 2007). This finding is also consistent with prior studies. For instance, Gefen and Straub (2000) showed that when a website was used to purchase products, PEOU did not affect IT adoption because IT-related ease-of-use is not an inherent quality of the purchased product. If customers do not perceive a given technology to be easy to use, they are unlikely to utilize it (Curran & Meuter, 2005). For instance, Moses *et al.* (2013) reported that PEOU did not directly influence teachers' attitude towards laptop use. Further, the finding that users' COG did not influence the adoption of e-payment cards is surprising; however, this may be because during the COVID-19 pandemic it was not necessary to have extensive knowledge of e-payments before adopting them, as they became a standard safety protocol.

### 5.1 Theoretical implications

This study provides valuable insights for scholars aiming to identify which customer experience factors influence the adoption of e-payment cards and similar e-services. Further, the findings of this study can assist researchers acquire a better understanding of e-payment users' emotions and behavior. This study builds on the TAM, the TPB, and RFT to investigate the direct and indirect impact of customer experience and technology perception on the adoption of e-payment cards. This study also explores changes in customers' adoption of e-payment within the context of the COVID-19 pandemic. Thus, our study contributes to COVID-19 research by analyzing customer experience and technology perception in the banking sector during the pandemic period. Additionally, our study shows that users' technology adoption does not depend on PEOU, as the health safety protocols serve as a sufficient incentive.

### 5.2 Managerial implications

This study's findings provide practitioners with valuable insights regarding consumers' adoption of e-payment services, which allows them to better understand their customers and gain a competitive advantage in the market. Further, they help web developers create programs that establish an emotional connection with their users, which may be useful when preparing website training programs and videos to educate users and improve their cognition and skills. Additionally, they can help



practitioners improve the quality and effectiveness of e-payment services, which could increase usage of their e-products and foster positive customer attitudes toward the implementation of e-payment services due to their ease of use and usefulness.

Moreover, this study's findings may assist bank managers in fostering e-payment among their users. To this end, it is necessary for managers to understand the significance of users' emotions and cognition regarding e-payment adoption. Further, managers should consider PEOU and PUFN as crucial aspects of customer experience, especially in developing countries, where research on this subject is scarce. Thus, our findings will serve as a valuable reference for e-banking managers aiming to increase the adoption of e-payment cards. Accordingly, managers should imbue their e-payment services with PEOU and PUFN. In line with our findings, banks may benefit from creating campaigns to guide users' toward new IS services and taking into account customers' experiences in product planning, development, innovation, and customization. Finally, the present study may assist banks to reduce their dependence on monetary rewards when attempting to motivate users, by highlighting the importance of the integration of technology perception and users' experiences into their strategies.

### 5.3 Limitations and direction of future work

This study has several limitations that should be addressed. First, this study recruited bank customers that had already adopted e-payment cards in the two highest populated states in Sudan. Thus, our findings may only be representative of individuals from these states. Moreover, the study was conducted after the lift of a two-decade global trade ban on Sudan, specifically within the context of the COVID-19 pandemic. However, considerable changes may be observed regarding the adoption of e-payment services following the pandemic period; thus, the generalizability of our findings should be approached with caution. Future studies should be conducted in different countries and analyze different populations of e-payment adopters in other industries in order to confirm the robustness of our findings. Moreover, the current study tested only two dimensions of technology perception vis-à-vis customer experience and the adoption of e-payment cards; however, other dimensions may also be significant, such as perceived payment risk and perceived religiosity. Moreover, our model only explained 70.62% of the total variance in the adoption of e-payment services. Therefore, future studies can identify more variables (e.g., local environment, facilitating conditions, and interest rates), which could increase the total variance explained by our model. Third, to optimize our model, future studies should control for respondents' characteristics such as gender, age, job status, education level, income, and frequency of e-payment card usage; by doing so, our model's relationship paths may change. Fourth, although the TAM, the TPB and RFT offer very fertile ground insight IS practices we think conducting social cognitive theory may add advantage on the adoption of e-payment models too. Finally, to obtain a more comprehensive understanding, it is substantial to moderate the culture background of the customers in this study model.

### 5.4 Conclusion

The main contribution of this study is that it explores the factors influencing e-payment adoption during the COVID-19 pandemic, which has brought about significant changes in many consumer behaviors. It highlights the importance of improving e-payment services' convenience for users, based on a comprehensive theoretical framework. Scarce empirical work has been conducted on the adoption of e-payment services in developing countries such as Sudan. Five of the six relationships hypothesized in our model were found to be significant, providing numerous significant theoretical and practical implications. The constructs analyzed in this study present the possibility of directly and indirectly positively influencing the relationship between customer experience and e-payment adoption.

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## Appendix 1

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### Deleted items

**PEOU2:** I feel that using e-payment cards is very clear and easy to understand.

**PEOU3:** Interacting with the e-payment system does not require a significant mental effort.

**PUFN1:** E-payment cards enhance my effectiveness in completing payment processes.

**PUFN4:** E-payment cards enhance my payment efficiency.

**COG1:** I acquired a well cognition level at e-payment cards that makes me innovator purchaser.

**EMO1:** I pay attention to the messages and emotional cues of the e-payment system.

**EMO2:** I am interested in the messages and emotional cues of the e-payment system.

**EMO3:** I think about what makes the e-payment cards produce such emotions.

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