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Users Supporting Multiple (Mobile) Electronic Payment Systems in Online Purchases: An Empirical Study of Their Payment Transaction Preferences

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ABSTRACT The online payment for products or for the access to payment-based services can be made by means of a range of (mobile) electronic payment systems – (M)EPS. Both the industrial sector and research community, mainly World Wide Web Consortium (W3C), are working on facilitating these payment methods on Web and supporting the multiple users on how they can select the suitable (M)EPS. However, to the best of our knowledge, there were no thorough studies considering consumer's preferences when they support multiple (M)EPS. To address this issue, we have performed a survey on an international participants (n=272) aiming to (i) developed a theoretical model to determine their preferences when they are supporting more than one (M)EPS, (ii) find the most valuable option according to them and (iii) determine the surrounding conditions that support their decision to use a specific (M)EPS. The theoretical framework of this study was based on the Technology Acceptance Model (TAM). According to our statistical analysis (Chi-square test), consumers that can pay using different (M)EPS during their online payment transaction, have a preferred payment system based on its security, fees, usefulness, and ease of use as well as on their favorite Web browser for these transactions. Factor analysis was also performed to identify factors that much influence the (M)EPS. Results revealed that the factors influencing online payment preferences differ from those involved in traditional payment methods. Our findings allowed, therefore, providing practical suggestions for supporting payment processes with Web browsers and the W3C payment Application Program Interface (API).

INDEX TERMS Electronic payment systems, mobile payment systems, payment preference, ease of use, perceived security, technology acceptance model (TAM).

I. INTRODUCTION

Internet shopping or web-based business is a reality that is seen to be in high presence recently. Buying goods and services online has become a common practice for many people around the world. Given this growing use, the consumer needs convenient payment methods as well as simple and easy ways to pay online. Some consumers choose to purchase in Web commerce sites for convenience, others for the

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competitive cost of some advanced e-commerce platforms. Online shopping is a growing trend. The Internet World Stats (2019) reported that there were more than four billion Internet users in March 2019 and the total volume of online retail e-commerce sales worldwide was about 3.5 trillion US dollars in 2019 and is expected to reach 4.9 trillion US dollars in 2021 [1]. Currently, these online payments can be made using either credit cards, or debit cards, or PayPal or Bitcoin, Apple Pay (a mobile payment system), etc...

A user of the online payment is able to support multiple payment methods but during the payment process, he

has to choose one of them for performing the transaction. In general, in an online payment transaction, the user has to choose one of the different payment systems either the electronic payment systems or the mobile payment systems. Moreover, online users have also to choose between several (Mobile) Electronic Payment Systems – (M)EPS. The World Wide Web Consortium (W3C) has led to new developments that affect electronic payment systems (e-payments). These developments have encouraged consumers to actively take part in the buying and selling of products and services in online market places and communities [2]. Among these developments, W3C has launched the Web Payments Working Group (WPWG) [3] to help streamline the online verification process for users across all navigation platforms by simplifying and securing all types of payments on Web. The WPWG has defined support for existing payment methods such as credit and debits cards and has planned the development, support and promotion of future payment methods and multiple digital currency formats, considering mobile payment systems, Bitcoin and distributed ledgers. Thus, the WPWG solution goes beyond the creation of a web browser plug-in [4]. In fact, the W3C has standardized the Payment Request API (Application Program Interface) [5] to allow merchants the use of one or more payment methods with a minimum integration and to enable user agents (e.g., Web browsers) to make easier the exchanges between merchants and consumers. They state [5] that in the future, users will be able to choose a preferred payment instrument for a given transaction and messages between the Web application and the payment service providers will be transmitted by the browser on behalf of users who have the ability to access Internet-connected computers, smartphones, and tablets, whether at home or in offices or public facilities. Consequently, facilitating the choice of the preferred payment instrument requires gathering information from users. Mainly, investigators need to know from users how many (M)EPS they are supporting and their most preferred payment systems, whether they know their features, and what options they consider. However, knowing how consumers made their choice for a suitable payment system in an online purchase is a complex issue since their financial and cultural backgrounds are heterogeneous [6]. Consumers also possess several options for making (M)EPS [7], [8], as well as payment applications that implement payment methods on behalf of the user [9]. So far, studies on (M)EPS have focused mainly on their acceptance and their use or the intention to use them [10]–[16]. It is now common for a user to have multiple instruments to perform an online payment (e.g. a user could pay by using a MasterCard, PayPal or Bitcoin). On the other hand, merchants tried to support several payment systems (at least the most common) in order to be able to receive the maximum number of payments from many customers with different cultural backgrounds. To facilitate the choice of payment method during the payment process, electronic payment frameworks appeared [17], [18]. Indeed, the work of the W3C with the Payment Request API was aligned with this issue.

However, to our knowledge, there was no comprehensive research on such a subject. In fact, several issues needed to be clarified. For instance, why users accepted to work with several (M)EPS while they choose a particular (M) PES for a particular online purchase. Why consumers were using always the same system (i.e., they have a preferred (M)EPS). Which were the main reasons given by a user to prefer a particular (M)EPS? How to improve the payment process and make it easier targeting consumers with different backgrounds and in different environments? Our study aims to examine electronic payment transaction preferences for users supporting multiple (M)EPS and the effect that the characteristics of electronic and mobile payment systems could have on the choice of the preferred payment methods during the payment transaction. Furthermore, we aimed to derive practical implications that can be useful for the design of the W3C payment API and for its development in web browsers. This research is based on the Technology Acceptance Model (TAM) [19] to study consumer's perceptions of specific services and payment methods in online purchases. We have used the TAM model because of it is generalized in diverse contexts [20] and it is the most robust model compared to other models such as Theory of Reasoned Action (TRA), Theory of planned behaviour (TPB), Innovations Diffusion theory (IDT), Extended technology acceptance model (TAM2), and Unified Theory of Acceptance and Use of Technology (UTAUT). More details in Section II.C were given to explain the behaviour of the adapted technique [20]–[22]. Based on the above theory, we have investigated the determinants of online purchasing intention (security, ease of use, confidence, and social influence) [23], as well as convenience and perceived usefulness on the choice of the most preferred payment methods for the online payment transaction [10], [24]–[26]. The rest of this paper was structured in several sections. Section 2 reviewed the literature of the present study area of knowledge and to address the state of the art on the user's choice of the (M)EPS for a purchase transaction. Section 3 described the theoretical context of this study and defined the key variables needed to develop our hypotheses. We have described the used research methods in Section 4. However, we report the results of our research in Section 5. Finally, in Section 6 we have discussed the results and highlighted the implications and limitations of the present research and we have proposed directions for future investigations.

II. LITERATURE REVIEW

Nowadays consumers have diverse methods to pay online: they can use credit cards, debit transactions, or (mobile) payment methods such as PayPal, Bitcoin, Samsung Pay and Google Checkout [27]–[29]. Generally, consumers usually supported more than one of these payment systems. In such a case where consumers can pay using multiple (M)EPS, several payment frameworks were established to support the choice of the electronic payment system in an easy way. The main objective of this section was to provide research literature related to the payment frameworks which support

the choice of the payment system used to perform an online payment in an e-commerce transaction and review the state of the art on user's choice of the electronic payment (mobile) for a purchase transaction. We have also presented the TAM, which was the model that we have applied to evaluate the preferences and the decisions of the users (consumers) concerning their payment methods used in an online purchase transaction.

A. STUDY BACKGROUND

The number of studies regarding (M)EPS acceptance, use or its intention to use is broad [8], [10]–[14], [30]. Still, the studies on the users' preferences for a payment method in an online purchase transaction were also scarce. The first study to understand how consumers choose between payment methods and the effects of their choices on consumption was conducted by Hirschman [31]. The author discovered that the lack of interest in users' preferences for payment methods can be explained by the fact that there were no important differences between these payment methods and at least differences did not affect consumer behaviour [32]. However, the situation today is completely different as the number of (M)EPS that users support is important. According to Turban *et al.* [30], the current number of payment systems is considerably higher than their number when electronic commerce started. Therefore, more studies were needed to know how consumers make suitable payment methods. We have discussed this issue with more details in Section II.B.

Due to the emergence of several (M)EPS, the consumer has to choose the best electronic payment transaction that suits his/her preferences or needs. Such choice may depend also on whether the consumer is going to perform the payment on the desktop computer or on the mobile phone. Previous studies have also shown that consumer's attitudes and their risk perception influence how they choose a payment method [14], [33], [34], [35]. Several studies have stated that consumers preferred the online methods because of their convenience and the wide range of products and information available online, as well as the lack of social contact [36]. Still, the most important features that consumers consider were security, ease of use, convenience, the timing of transactions and cost [33], [37]–[39]. To guarantee security, availability, and portability of (M)EPS, several frameworks were implemented to facilitate the support of the several payment systems [17], [30] such as SEMPER [17], Internet Open Trading Protocol (IOTP) [17], and Pay Frameworks [40]. If this kind of framework could be standardized, the use and interoperability of (M)EPS could be successful. Still, these solutions were not adopted by the industrial sector. The latest initiative to enhance the payment framework has been launched by the W3C, which has defined an API, the Payment Request API [5] that is currently supported by Web browsers. However, we considered that web browsers that supporting

this API did not take into account the preferences of the users when making their choice for the suitable payment method. Our study aimed to provide insights that facilitate the manner to support payment choice as well as other interesting features. The present study background can be divided into two objectives: (i) knowing of how consumers choose between various payment methods for an online purchase and (ii) knowing how users' preferences affect their choice of payment methods. These issues were covered in the next section. We have presented herein a review of the literature on the TAM which generally used to evaluate the acceptance of many electronic payment systems.

B. THE CHOICE OF A PAYMENT METHOD

Most studies of consumer payment behaviour attempt to understand how consumers choose between different payment methods [27], [32], [41], [42]. Hirschman [31] proved that consumers differentiate between diverse payment systems and they can evaluate these payment methods in different ways. According to Hirschman [31], consumers' choices between the various payment methods were based on payment system functionality, familiarity, situational factors, personal factors, place of purchase and the characteristics of purchases. Consumers can follow a hierarchical decision process, in which they eliminate alternatives based on their availability or acceptability in the situation. If the consumer does not find an acceptable means of payment, he/she may give up his/her attempt to purchase [7], [42], [43]. On the other hand, Trütsch [41] presented the impact of mobile payment on the choice of payment methods and offers another contributes to the economics payment with respect to consumer payment choice and highlighted the dynamics between mobile and traditional payment methods. Consequently, it appeared that the adoption and use of electronic payment instruments were primarily determined by personal, transactional and situational characteristics. Price characteristics and financial incentives were also important predictors of adoption and deployment. According to Prelec and Loewenstein [44], the decision to use the payment method was mainly influenced by convenience, acceptability, accessibility or habits. Bradley [37] examined, in particular, debit and credit card usage and the underlying factors influencing consumers to choose between them and he concluded that the consumer's preference for a payment method depending on both the attitude/habits of the consumer and the characteristics of the payment methods. In addition, Deufel and Kemper [27] have investigated the influences of demographics and consumer habits on the choice of payment method. They found that gender has the greatest effect on the choice of payment method, while female consumers tend to diversified payments methods more than men did. Consequently, according to this review, it seems that the choice of payment method was scarce and the few studies available were only based on a couple of (M)EPS choices. Given the considerable number of (M)EPS available

nowadays we considered in the present study most of these methods.

C. BACKGROUND OF TECHNOLOGY ADOPTION THEORY IN (M)EPS

There are several theories that modeling how users accept and use technology. Several empirical research studies on the adoption of new technologies suggested that technologies that do not help the individuals to improve their performances were not very probable [21], [20]. Among others, Davis [19] and Dwivedi *et al.* [22] showed a positive relationship between the usefulness of technology and the intention of its adoption by users for which it is intended. Recently, among the most dominant technology and acceptance theories we found the: (i) TPB [45] that was developed by Ajzen [46] and derived from the TRA [47] by Fishbein and Ajzen [48], (ii) TAM that was built by Davis [19] to assess the acceptance of a new technology/invention, (iii) IDT [49] and (iv) the UTAUT [50], derived from TAM. The result has been valuable for consumers since they have access to more efficient, easy, transparent and flexible (M)EPS. Both TAM and UTAUT have been applied in a plethora of research works related to (M)EPS [7], [51]–[56]. Particularly, we can point out Extended TAM [57]–[60], as the most commonly used theory to study the use of mobile payment systems [7], [43], [61]. TAM Model is largely adopted and checked [62]–[64]. In addition, many researchers have to attempt to personalize the model to adapt it to various contexts [65], [66] since it is a powerful theory for predicting technology acceptance by users. In fact, certain empirical tests showed that TAM was a robust model for information technology [19], [62]. Consequently, many types of research related to electronic commerce adopted the TAM method to identify ways to ensure that consumers accept e-commerce [67], [68]. This model was based on two main constructs: perceived usefulness and perceived ease-of-use. According to Davis [19], perceived usefulness was defined as: “The degree to which a person believes that using a particular system would enhance his or her job performance.” and perceived ease-of-use was defined as: “The degree to which a person believes that using a particular system would be free of effort”. In addition, Davis [19] proposed a model of acceptance of electronic commerce technology, based on TRA. The TAM variables of perceived usefulness and ease of use were integrated with confidence, trust, and perceived risk. The TAM model showed the preferred mode of (M)EPS used by the users when making an online payment and it determined the actual use of the system, as well as their attitude towards the use of intentions. Moreover, the perceived usefulness and perceived ease of use adopt affected the attitude of the users with regard to this use. In our research, we considered TAM as a starting model of the research and we have extended it with extra constructs, which we thought important when we discuss the users’ preferred payment methods.

III. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

This section described our theoretical framework based on the TAM and it introduced and developed the mechanistic hypotheses for the present study.

A. THE TECHNOLOGY ACCEPTANCE MODEL

The theoretical framework of this study was based on Davis’s TAM theory [19] to provide better ways to measure, predict, and explain the use of technology. As mentioned previously, TAM was the model that revealed the main factors that drive consumers to accept (M)EPS. The described consumer behaviour provided a basic model that predicts its acceptance through (M)EPS by explaining its intentions. The present study provided important contributions to this field of knowledge. First of all our study contributed greatly to reviewing the TAM model. The main studies performed on TAM were mainly concentrated on general information on the intentions of use [51], [53], [54], [69]. Secondly, this study supplemented the TAM model with the prospects for the characteristics of the electronic payments and we did focus mainly on perceptions of the individuals, their specific preferences in order to choose the most preferred (M)EPS for their transaction payment on the Web. Indeed, apart from using Perceived Usefulness and Perceived ease of use, we have considered also other variables as security, cost, trust, and availability to obtain our enhanced theoretical framework.

B. KEY VARIABLES AND HYPOTHESIS DEVELOPMENT

The main objective of this section was to introduce and highlight the key variables needed to develop the mechanistic hypothesis helping to achieve our objectives.

1) DEMOGRAPHIC FACTORS THAT INFLUENCE CONSUMER’S CHOICE OF THE ONLINE PAYMENT SYSTEM

Studies on the intention to use payment methods revealed that consumer demographic features, such as gender, age, education, and Internet experience could explain how consumers choose a particular payment method from several methods existing [36], [70], [71]. For instance, young consumers with a high level of education and Internet experience have more tendency to use modern payment methods, such as mobile payments or online transactions [68], [72]–[74]. The social psychology studies suggested that there were significant behavioural differences between women’s and men’s groups in various online purchasing decision-making situations [75]. Women and men tend to adopt different attitudinal and behavioural orientations [76]. For example, using a distinct socially-formed cognitive logic, women and men differ when they search for information and evaluate products [77]. As a result, women were more often involved in security and privacy behaviours in order to avoid potential financial losses in online environments [78]. These studies indicated

that positive beliefs about the security and reliability of institutional structures would be stronger for women than for men. According to the above literature, we can define the following hypothesis for the present study:

H1. There is a relationship between some demographic aspects including gender, age, and the educational level and the security of the preferred payment system.

H1a. There is a relationship between gender and the security of the preferred payment method.

H1b. There is a relationship between the age and the security of the preferred payment method.

H1c. There is a relationship between the educational level and the security of the preferred payment method.

H1d. There is a relationship between the gender and the modern payment systems such as PayPal, Bitcoin or mobile payments.

H1e. There is a relationship between the age and the modern payment systems such as PayPal, Bitcoin or mobile payments.

H1f. There is a relationship between the educational level and the modern payment systems such as PayPal, Bitcoin or mobile payments.

H2. When users are performing an online purchase, they are able to choose between different (M)EPS to perform the payment of the transaction and this choice is based on the features (security, ease of use and usefulness) of the (mobile) payment method they consider more suitable for the transaction.

2) THE MODERATING EFFECT OF SECURITY, TRUST, PERCEIVED RISK AND WEB BROWSER ON THE CONSUMER PREFERENCES

It is generally accepted that the positive perception of security and trust increase the use of electronic and mobile commerce [79]. Security, trust, and confidentiality were, therefore, key factors that influence the intention of consumers when using online payment methods [72], [76], [80]. In fact, security represented the perception of customers for institutional structures such as guarantees, regulations, and promises of transactions in the payment process, as in online payment. According to Chen [72], privacy concerns have a significant effect on overall perceived risk. Moreover, security was considered an important factor in protecting customer information against risky transactions [81], [82]. This suggested that consumers' intention to purchase online was suppressed when consumers know that the transaction is risky [83]. Kim *et al.* [76] stated that clients' perceptions of multiple security assurances are essential to build confidence in electronic payment systems [84]. Likewise, mobile buyers were also concerned by both security and trust issues, such as the potential disclosure of the credit card accounts and password information to unauthorized parties [73]. Perceived risks and security concerns influenced the confidence of mobile buyers and affected their intention to engage in mobile shopping. Additionally, research studies suggested that the lack of trust was one of the key reasons that

avert consumers from the online purchase of products which later will reduce their electronic transactions [82]. Numerous studies of e-commerce and mobile commerce suggested that trust was correlated with consumer behavioural intentions and was a crucial part of the adoption behaviours [14], [85].

Shao *et al.* [26] also suggested that security could significantly enhance the confidence in mobile payment systems. Therefore, our third, fourth and fifth hypotheses were:

H3. There is a relationship between the perception of security of the preferred payment method and the willingness of the user to store the payment information in his/her browser for future payments.

H4. There is a relationship between consumers' most preferred/useful web browser and their preferred payment method on the desktop computer and the smartphone.

H5. Users preferred that the choice of the payment method to use in a transaction was made automatically.

3) HOW PAYMENT FEATURES MODULATE THE CONSUMER PERCEPTION TOWARDS ONLINE PAYMENT SYSTEM

It was demonstrated that the perceived convenience of the methods of online payment by consumers was related to perceived consumer confidence in online payment systems. If the consumer found the payment system inconvenient, then his/her perceived trust in the payment method was reduced. Therefore, for a payment method to be perceived as trustworthy, it also needed to be convenient to use [76]. It can be concluded that uncertainty was particularly important for consumers who do not know the payment method. However, a recent study by Schuh and Stavins [86] found that not all consumers find security factors to be important. They also indicated that consumers were satisfied with the existing security of payments. In addition to considering the influencing factors of knowledge contributors, the perceived price was important among existing customers and it influenced the purchasing decision more than among potential customers [87]. Actually, customers' price sensitivity increased with the performed transactions, since the price was almost always useful information that users can get on products before paying for the product online. Kim *et al.* [87] argued that, in accordance with market rules, the price was a moderator of the relationship between the decision to choose the payment method based on the price of the product, the transaction fees, and its determinants.

Accordingly, we have defined the following hypothesis:

H6: There is a relationship between the preferred payment method chosen and the different characteristics of the payment method.

H6. a. There is a relationship between convenience and the preferred payment method.

H6. b. There is a relationship between ease of use, usefulness and the preferred payment method.

H6. c. There is a relationship between fees, price, transaction timing, and the preferred payment method.

H7. A user will try to perform all his/her online payments using his/her preferred payment system.

In our research model, which was shown in Fig. 1, the users' preferred payment method (the user's most preferred choice) was posited to be directly affected by the characteristic of payment (knowledge contributor characteristic), the consumers' demographic profiles and the choice of web browsers in the process of online payment. Moreover, Fig. 1 described the hypotheses derived from the theoretical framework and depicted the conceptual model of the relationships between the characteristics of payment (security, privacy, ease of use, convenience, etc.) and the most preferred payment method for users who support more than one payment method in her or his online payment transaction.

IV. METHODOLOGY

The main objective of this section was to highlight the methodological aspects that guided the empirical phase of this study. As showed by the research model (Fig. 1), four constructs were used in this study: the demographic description, the choice of the web browser, the most preferred payment method using desktop computers and mobile phones and the knowledge contributor characteristics (e.g. convenience, ease of use, portability, security, etc.). Each of the constructs was based on several elements.

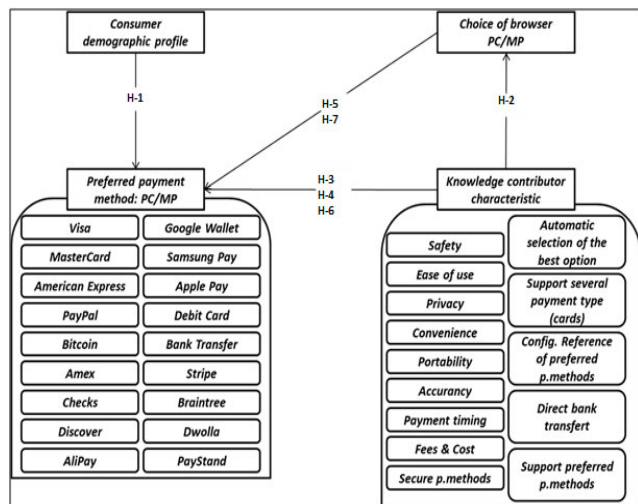


FIGURE 1. Theoretical research model.

A. MEASUREMENT AND QUESTIONNAIRE DESIGN

The measurement elements used in this study have been adapted from previous literature (see Section II and Section III.B). Based on previous studies [32], [81], [82], [88] we highlighted the importance of some online payment characteristics, such as convenience, ease of use, security and the support of the web browsers for the online transaction.

A questionnaire was developed following these important characteristics to highlight the effects of the payment characteristics on the choice of the preferred payment method for users who support more than one payment method for making their online purchases. All the questions included

in our research questionnaire were found in Appendix A. In this questionnaire based on a total of 24 questions, 4 demographic questions (Questions 1– 4) described profiles answers and 6 questions (Questions 5 – 10) described the respondents experience using the Internet and the online purchase (Internet access, Internet experience), 5 questions (Questions 11 – 15) concern the availability and usefulness of the payment methods in the desktop and the mobile phone. We performed a Likert scale question for the effect of perceived security on the choice of payment method and the choice of the secure preferred payment method (Question 16). A Likert scale was also used to measure 11 sub-questions dealing with the storage of personal payment information (Question 17). All the questions of our Likert scale ranged from 1 = strongly disagree to 5 = strongly agree. Four questions were used to treat the choice of the web browser in the function of whether it is useful (questions 18 to 21) and 21 statements focused on revealing the different important criteria for the web browser that respondents preferred for their online payment transactions. Question 24 was related to the preferences of the user during a payment online. 14 statements were performed on the knowledge contributor characteristics (security, ease of use, portability, etc) and the payment method (questions 22 to 24).

B. SAMPLING AND DATA COLLECTION

To conduct data collection and to create the questionnaire, we used Google Forms as it is free, easy to use and allowed the design of low-cost basic surveys. The survey distribution was based on sharing the form link directly on the Web, social media (Facebook, LinkedIn, and WhatsApp) and sending it via emails from December 2018 to March 2019. As can be seen, convenience sampling was used when researchers were testing a large population. Convenience sampling was the most commonly used sampling technique because respondents have easy access to specific distribution channels. Among the 400 questionnaires sent out, we received 274 of them back.

Only two questionnaires were discarded because they had an unacceptable amount of missing data. Consequently, 272 usable questionnaires were accepted for data analysis. The usable responses represented a 68% response percentage, which is considered adequate for this type of study. The profiles of respondents (Table 1) revealed that most respondents were male participants (61.8%); while the female percentage was 38.2%. The highest percentages of participants were aged 26 to 35 (37.5%), which is the typical age of the working adult population and a relatively mature segment of the online shopper population. The participants aged from 18 to 25-year-old had a percentage of 32.7% and those aged from 36 to 45 had a percentage of 21.3%. Almost all respondents have a higher education level (97.1%). 65.4% of respondents used the Internet at home, 24.6% used it at work and the rest at public facilities. Most respondents (91.2%) reported using the Internet for more than 7 years. In terms of Internet use per week, the majority of respondents (32%) reported spending

TABLE 1. Demographic profiles of respondents (N = 272).

Characteristics	Items	Number	Percentage
Gender	Male	168	61.8
	Female	104	38.2
Age	<18	5	1.8
	[18-25]	89	32.7
	[26-35]	102	37.5
	[36-45]	58	21.3
	[46-55]	10	3.7
	[56-65]	7	2.6
	>65	1	0.4
Citizenship	Tunisia	97	35.7
	Spain	38	14
	France	34	12.5
	United Kingdom	17	6.3
	Rest of the world	86	31.5
Education level	Illiterate	2	0.7
	Primary	0	0
	Secondary	6	2.2
	University	264	97.1
Internet access	Home	178	65.4
	Work	67	24.6
	Public Facilities	24	8.8
	Other	3	1.1
Internet experience	< 6 months	4	1.5
	[6-12] months	3	1.1
	[1-3] years	2	0.7
	[4-6] years	15	5.5
	>7 years	248	91.2
Internet usage (Hours)	[1-5]	26	9.6
	[6-10]	46	16.9
	[11-20]	40	14.7
	[21-40]	73	26.8
	>40	87	32

more than 40 hours per week on the Internet, while others spent less than 5 hours (9.6%). Users were from 52 different countries, with different cultural backgrounds, mainly from Tunisia (35.7%), followed by Spain (14%), France (12.5%), the United Kingdom (6.3%) and the rest of the world (31.5%).

V. RESULTS

During this study, we adopted the Factor Analysis and the cross-tabulation (contingency tables) statistical methods in order to compare collected data using IBM SPSS Statistics 19. The cross-tabulation was used to quantitatively analyze the relationship between users' preferences and the characteristics of (M)EPS such as security, ease of use, and usefulness. Besides, Factor Analysis was employed to determine the relationship between the various characteristics, the choice of the preferred payment method and the preferred chosen browser. Before considering the structural model, we initially analyzed the reliability and validity of our

measurement model. Two measurements were applied: the Cronbach's α and Composite Reliability (CR). Cronbach's α (or *coefficient alpha*) measured reliability or internal consistency. "Reliability" is how well a test measured what it should. This coefficient tests to see if multiple-question Likert scale surveys are reliable. Cronbach's α will tell you if the test you have designed is accurately measuring the variable of interest. The results were interpreted and analyzed using the Cronbach's α (Table 29, Appendix) and correlation coefficients (Table 30, Appendix).

A. THE MEASUREMENT MODEL

Cross-tabulation was performed to test the hypotheses using the Chi-square test aiming to highlight the independence relationship between variables. A Chi-square test is generally designed to analyze categorical data. Factor analysis is deployed to have unique core elements instead of redundant attributes. Factor analysis was also used to describe the variability of the observed correlated variables in terms of the potentially lower number of unobserved variables, called factors, as this allowed a more accurate evaluation of the data [89]. This technique extracts maximum common variance from all variables and puts them into a common score.

As an index of all variables, we can use this score for further analysis. Cronbach's α coefficients were measured for all elements used in Factor Analysis to assess the internal consistency of the scales using the coefficient of reliability. A pilot study was conducted to examine both construction and content validity. We have used the cross-tabulation method to discover if there was a relationship between some demographic aspects including the gender, age, and educational level and the security of the preferred payment method.

The chi-square test for independence was used for this purpose. We found no statistically significant relationship between the groups of both gender and age with the security of the preferred payment choice ($P > 0.05$). The detailed statistical analyses were presented in (Table 31, and Table 32, Appendix).

However, it appeared that the male participants were more aware than female participants about the security of their transactions when purchasing a product online. In fact, about 117 male participants have declared that security was important to very important against only 76 female participants who declared that (Table 31, Appendix). Moreover, it seems that the most age groups aware by security were those between 18 and 45 years (65% of participants from the total number of participants declared that security was important to very important for their purchasing activities online). The participant older than 65 years did not give any importance to the security factor (Table 32, Appendix).

Our results showed that among the 272 participants in this study (total number of participants), 160 participants indicated clearly that the security was a very important factor when using the online method for purchasing products (Table 32, Appendix). Furthermore, we found a significant relationship between the groups of educational level and the

TABLE 2. The relationship between the educational level and the security of the preferred payment choice.

Educational level		The preferred payment method is secure					Total
		(Security)					
		1	2	3	4	5	
Primary school	Count	0	0	2	0	0	2
	% within Security	0.0%	0.0%	6.1%	0.0%	0.0%	0.7%
Secondary school	Count	1	0	0	2	3	6
	% within Security	4.5%	0.0%	0.0%	6.1%	1.9%	2.2%
Higher Education	Count	21	24	31	31	157	264
	% within Security	95.5%	100%	93.9%	93.9%	98.1%	97.1%
Total	Count	22	24	33	33	160	272
	% within Security	100%	100%	100%	100%	100%	100%
Coefficient		Value		Significance level			
Pearson Chi-square		18.703		0.017			

TABLE 3. Relationship between gender and using bitcoin as a payment method.

Gender		Bitcoin used by mobile		Total
		phone		
		Yes	No	
Male	Count	1	167	168
	% within Bitcoin	16.7%	62.8%	61.8%
Female	Count	5	99	104
	% within Bitcoin	83.3%	37.2%	38.2%
Total	Count	6	266	272
	% within Bitcoin	2.2%	97.8%	100.0%
Coefficient		Value		Significance level
Pearson Chi square		5.284		0.022
Phi (Cramer'V)		0.139		0.022

security of the preferred payment choice with a significant level of up to 5% (Table 2). In fact, the probability of the chi-square test statistic (chi-square = 18.703) was $P=0.017$ which was less than the alpha level of significance of 0.05. Surprisingly that there was a large percentage (17%) of participants with higher education levels did not give any or very low importance to security when using the internet for their transactions (Table 2).

Our results showed that most of the participants (266 from a total of 272 participants) did not use Bitcoin for their transactions (Table 3). All persons using the Bitcoin (22) were a teenager (Table 33, Appendix). Still, there was a significant relationship (Chi-square = 5.284, $P = 0.022 \leq 0.05$) between Bitcoin when used via mobile for payment and the respondent gender (Table 3). Still, the female participants were using Bitcoin better than males. However, the strength of the association between the variables is moderate (Cramer'V = 0.139). PayPal was preferred by a relatively considerable

TABLE 4. Relationship between age and using paypal as a payment method.

Age		PayPal used by mobile		Total
		phone		
		Yes	No	
<18	Count	2	3	5
	% within age	40%	60%	100%
	% within PayPal	3.8%	1.4%	1.8%
[18-25]	Count	26	63	89
	% within age	29.2%	70.8%	100%
	% within PayPal	50%	28.6%	32.7%
[26-35]	Count	11	91	102
	% within age	10.8%	89.2%	100%
	% within PayPal	21.2%	41.4%	37.5%
[36-45]	Count	13	45	58
	% within age	22.4%	77.6%	100%
	% within PayPal	25%	20.5%	21.3%
[46-55]	Count	0	10	10
	% within age	0.0%	100%	100%
	% within PayPal	0.0%	4.5%	3.7%
[56-65]	Count	0	7	7
	% within age	0.0%	100%	100%
	% within PayPal	0.0%	3.2%	2.6%
>65	Count	0	1	1
	% within age	0.0%	100%	100%
	% within PayPal	0.0%	0.5%	0.4%
Total	Count	52	220	272
	% within age	19.1%	80.9%	100%
	% within PayPal	100%	100%	100%
Coefficient		Value		Significance level
Pearson Chi square		16.52		0.011
Phi (Cramer'V)		0.246		0.011

number of participants on their mobile phone (19.1 % of the total number of participants). According to the statistical analysis, no significant effect of gender was shown on the use of these payment methods (Table 34, Appendix). Still, when PayPal was used via mobile phone, there was a significant relationship (chi-square=16.25; $P=0.011 \leq 0.05$) between this payment method and age (Table 4). About 71.2% of the users using PayPal were in the ages ranging between 18 and 35 years. There was no significant influence of the educational levels on the use of PayPal on a mobile phone (Table 35, Appendix). Still, 33.3% of participants with secondary school level preferred this method of payment against only 18.9% of the participants with higher education level. Google Wallet, Samsung Pay, and Apple Pay were preferred by a very few numbers of participants on their mobile phone (about 3.7%, 1.1%, and 8.1% respectively from the total number of participants).

Their utilization did not differ significantly according to gender groups (Table 36, Table 37, Table 38, Appendix). Still, for Apple Pay 11.5% of the female participants preferred this method against only 6.0% of the male participants.

TABLE 5. Relationship between age and using apple pay as a payment method.

Age		Apple Pay used by mobile		Total
		phone		
		Yes	No	
<18	Count	0	5	5
	% within age	0.0%	100%	100%
	% within Apple Pay	0.0%	2%	1.8%
[18-25]	Count	12	77	89
	% within age	13.5%	86.5%	100%
	% within Apple Pay	54.5%	30.8%	32.7%
[26-35]	Count	5	97	102
	% within age	4.9%	95.1%	100%
	% within Apple Pay	22.7%	38.8%	37.5%
[36-45]	Count	3	55	58
	% within age	5.2%	94.8%	100%
	% within Apple Pay	13.6%	22%	21.3%
[46-55]	Count	0	10	10
	% within age	0.0%	100%	100%
	% within Apple Pay	0.0%	4%	3.7%
[56-65]	Count	1	6	7
	% within age	14.3%	85.7%	100%
	% within Apple Pay	4.5%	2.4%	2.6%
>65	Count	1	0	1
	% within age	100%	0.0%	100%
	% within Apple Pay	4.5%	0.0%	0.4%
Total	Count	22	250	272
	% within age	8.1%	91.9%	100%
	% within Apple Pay	100%	100%	100%
Coefficient	Value	Significance level		
Chi square	18.58	0.005		
Phi (Cramer'V)	0.261	0.005		

Furthermore, the present results showed that there was a significant relationship (chi-square=18.58; $P=0.005 \leq 0.05$) between Apple Pay used via mobile phone and the respondent age (Table 5). About 77.2% of the users using Apple Pay were in the ages ranging between 18 and 35 years. When used via mobile phone, there was a significant (chi-square = 5.26; $P = 0.072$) relationship between Apple Pay payment and education level (Table 7). There was a highly significant relationship (chi-square = 21.43; $P=0.000 \leq 0.05$) between the use of Bitcoin on mobile phones and the educational Level (Table 6). About 83.3% of the respondents that using Bitcoin were with higher education level.

The utilization of Bitcoin via mobile phones did not differ significantly according to age groups (Table 33, Appendix). Still, 66.7% of the participants' groups preferring Bitcoin for their online activities were in the range between 26-35 years participants. Very few were the participants using this method in the other groups of age. The utilization of the Google Wallet method via mobile phone did not differ significantly according to age groups (Table 39, Appendix).

Still about 20% of the participants around 18 years preferred this online payment more than other groups of age.

TABLE 6. Relationship between education level and using bitcoin as a payment method.

Education level		Bitcoin used by mobile		Total
		phone		
		Yes	No	
Primary School	Count	1	1	2
	% within Education Level	50%	50%	100%
	% within Bitcoin	16.7%	0.4%	0.7%
Secondary School	Count	0	6	6
	% within Education Level	0.0%	100%	100%
	% within Bitcoin	0.0%	2.3%	2.2%
Higher Education	Count	5	259	264
	% within Education Level	1.9%	98.1%	100%
	% within Bitcoin	83.3%	97.4%	97.1%
Total	Count	6	266	272
	% within Education Level	2.2%	97.8%	100%
	% within Bitcoin	100%	100%	100%
Coefficient	Value	Significance level		
Pearson Chi square	21.43	0.000		
Phi (Cramer'V)	0.281	0.000		

TABLE 7. Relationship between education level and using apple pay as a payment method.

Education Level		Apple Pay used by		Total
		mobile phone		
		Yes	No	
Primary School	Count	1	1	2
	% within education level	50%	50%	100%
	% within Apple Pay	4.5%	0.4%	0.7%
Secondary School	Count	0	6	6
	% within education level	0.0%	100%	100%
	% within Apple Pay	0.0%	2.4%	2.2%
Higher Education	Count	21	243	264
	% within education level	8%	92%	100%
	% within Apple Pay	95.5%	97.2%	97.1%
Total	Count	22	250	272
	% within education level	8.1%	91.9%	100%
	% within Apple Pay	100%	100%	100%
Coefficient	Value	Significance level		
Pearson Chi square	5.26	0.072		
Phi (Cramer'V)	0.139	0.072		

In addition, results showed that there was no significant influence of the educational level groups on Google Wallet and Samsung Pay preference (Table 40, Table 41, Appendix). Still, all participants indicating their preference for Google Wallet and Samsung Pay on mobile phone belongs to the higher education level group. Furthermore, there was no significant influence of the age groups Samsung Pay preference (Table 42, Appendix). Still, all participants declared their preference for Samsung Pay were the group of age between 26-35 years.

TABLE 8. Relationship between gender and type of product they buy the most.

Kind of products mostly purchased online						
Gender / Product		Hedonic	Utilitarian	Digital	Non-digital	Total
Male	Count	35	16	60	39	168
	%Within gender	31.5%	9.5%	35.7%	23.2%	100%
	Adjusted Residual	2.2	-4.5	2.9	-1.4	
Female	Count	20	32	20	32	104
	%Within gender	19.2%	30.8%	19.2%	30.8%	100%
	Adjusted Residual	-2.2	4.5	-2.9	1.4	
Total	Count	73	48	80	71	272
	%Within gender	26.8%	17.6%	29.4%	26.1%	100%

TABLE 9. Relationship between age and type of product.

Type of products mostly purchased online						
Age / Products		Hedonic	Utilitarian	Digital	Non-digital	Total
<18	Count	2	0	3	0	5
	%Within age	40%	0%	60%	0%	100%
	Adjusted Residual	0.7	-1	1.5	-1.3	
[18-25]	Count	26	26	20	17	89
	%Within age	29.2%	29.2%	22.5%	23.2%	100%
	Adjusted Residual	0.6	3.5	-1.8	-1.8	
[26-35]	Count	23	14	31	34	102
	%Within age	22.5%	13.7%	30.4%	33.3%	100%
	Adjusted Residual	-1.2	-1.3	0.3	2.1	
[36-45]	Count	17	5	21	15	58
	%Within age	29.3%	8.6%	36.2%	25.9%	100%
	Adjusted Residual	0.5	-2	1.3	0.0	
[46-55]	Count	3	3	1	3	10
	%Within age	30%	30%	10%	30%	100%
	Adjusted Residual	0.2	1	-1	0.3	
[56-65]	Count	1	0	4	2	7
	%Within age	14.3%	0%	57.1%	28.6%	100%
	Adjusted Residual	-0.8	-1.2	1.6	0.2	
>65	Count	1	0	0	0	1
	%Within age	100%	0%	0%	0%	100%
	Adjusted Residual	1.7	-0.5	-0.6	-0.6	
Total	Count	73	48	80	71	272
	%Within age	26.8%	17.6%	29.4%	26.1%	100%

The results showed that there was a relationship between gender and the type of product most purchased by a customer (Table 8). Digital products (35.7%) and hedonics (31.5%) were mostly bought online by men, while women mostly purchase utilitarian (30.8%) and non-digital (30.8%) products. The statistical analyses confirmed these findings where the adjusted residual was greater than the critical value (1.96). The adjusted residuals were 2.2 and 2.9 for hedonic and digital products respectively when purchased by men. However, adjusted residuals were 4.5 and 1.4 for utilitarian and Non-digital products respectively when purchased by the female. As well there was a relationship between age and type of product purchased (Table 9). People aged from

18 to 25 purchased more utilitarian products (29.2%) with higher adjusted residual (3.5), than the other groups. The participant aged between 26 and 35 purchased more Non-digital products (adjusted residual of 2.1). Still, digital products were mainly purchased by teenagers <18 years.

Table 10 depicted the payment methods supported for users (available), used and preferred by them either on desktop or mobile phone. On the desktop, Visa with 28.5% was the most supported payment method followed by MasterCard with 21.22% and PayPal with 18.35% of total respondents. Still, 30.15% and 24% of the participants were effectively used MasterCard and PayPal with the desktop. However, on mobile phone, PayPal and MasterCard with respectively

TABLE 10. Payment methods supported, used and preferred by users.

Payment methods	Desktop						Mobile phone					
	Supported		Used		Preferred		Supported		Used		Preferred	
	NB	(%)	NB	(%)	NB	(%)	NB	(%)	NB	(%)	NB	(%)
Visa	149	28.5	16	4.9	4	20.70	10	3.18	5	2.12	51	23.94
MasterCard	111	21.22	98	30.15	60	26.43	74	23.56	54	22.98	41	19.24
PayPal	96	18.35	78	24	56	24.66	75	23.88	52	22.12	42	19.71
Debit card	40	7.64	30	9.23	21	9.25	31	9.87	25	10.63	17	7.98
Bank transfer	37	7.07	27	8.30	10	4.40	22	7	20	8.51	11	5.16
American Express	16	3.06	12	3.69	7	3.08	13	4.14	11	4.68	9	4.22
Apple Pay	15	2.86	12	3.69	7	3.08	25	7.96	22	9.36	17	7.98
Bitcoin	10	1.9	5	1.5	3	1.32	9	2.86	6	2.55	4	1.87
Amex	9	1.72	8	2.46	7	3.08	11	3.50	8	3.40	7	3.28
Checks	7	1.33	6	1.84	1	0.44	3	0.95	2	0.85	2	0.93
Discover	3	0.57	3	0.92	1	0.44	1	0.31	2	0.85	1	0.46
Ali Pay	8	1.52	9	2.76	3	1.32	7	2.22	7	2.97	5	2.34
Google Wallet	6	1.14	3	0.92	1	0.44	13	4.14	10	4.25	4	1.87
Samsung Pay	5	0.95	4	1.23	7	2.22	3	1.27	1	0.44	1	0.46
Stripe	4	0.76	3	0.92	1	0.44	3	0.95	2	0.85	0	0
Braintree	3	0.57	3	0.92	0	0	6	1.91	1	0.42	1	0.46
Dwolla	2	0.38	5	1.53	0	0	1	0.31	3	1.27	0	0
Pay Stand	2	0.38	3	0.92	1	0.44	3	0.95	2	0.85	0	0
Total	523		325		227		314		235		213	

(NB: Number of Users)

TABLE 11. Analysis of the group of users supported mastercard and visa altogether with others payment methods.

	Desktop		Mobile Phone	
	Used	Preferred	Used	Preferred
MasterCard	77.6%	46.6%	51.7%	41.4%
Visa	3.4%	31%	0%	34.5%
Other PM	19%	22.3%	48.3%	24.1%
Total	100%	100%	100%	100%

TABLE 12. Analysis of the group of users supported paypal altogether with others payment methods.

	Desktop				Mobile Phone			
	Used		Preferred		Used		Preferred	
	Yes	No	Yes	No	Yes	No	Yes	No
PayPal	74%	26%	49%	51%	49%	51%	37.5%	62.5%
Total	100%		100%		100%		100%	
Visa	8.34%	91.6%	22.9%	77%	2.1%	97.9%	25%	75%
Total	100%		100%		100%		100%	
MasterCard	46.9%	53.1%	21.9%	78.1%	27.1%	72.9%	15.6%	84.3%
Total	100%		100%		100%		100%	

23.88% and 23.56% were the most supported methods. Only 22.98% and 22.2 % were effectively using MasterCard and PayPal on their mobile phone. MasterCard, PayPal and Visa were the most preferred payment methods either on desktop

or on mobile. For the group of users that supported both Visa and MasterCard, 77.6% of these users effectively used MasterCard with their desktop against 3.4% for Visa (Table 11). However, about 46.6% and 31% from this group mentioned

TABLE 13. Number of supported payment methods using the desktop.

NB of supported payment method	NB of respondents	Percentage
0	38	13.97
1	91	33.45
2	71	26.10
3	34	12.5
4	14	5.14
5	8	2.94
6	6	2.20
7	6	2.20
8	2	0.73
9	1	0.36
11	1	0.36
Total	272	100

TABLE 14. Number of respondents supported two payment methods on desktop.

Payment Methods	NB of Respondents
MasterCard and Visa	22
MasterCard and PayPal	11
Visa And PayPal	7
Visa and Debit	4
Visa and Bank	4
Paypal and Debit Card	3
Visa and Alipay	2
MasterCard and Apple Pay	2
Visa and Bitcoin	1
MasterCard and Bitcoin	1
MasterCard and Samsung Pay	1

that MasterCard and Visa respectively were their preferred payment method on desktop. On the mobile phone, a lesser percentage of participants from those supporting both Visa and MasterCard have mentioned their effective use or they preferred to make transactions. Table 12 showed that 74% of the group of users supported only PayPal mentioned that PayPal was the most used when performing an online purchase on the desktop while only 49% of them mentioned that their preference for this payment method. Still, 49% of users supported PayPal with the mobile phones. Table 13 showed the number of supported methods using the desktop to perform the online payment (from 0 to 11 supported methods all together). About 14% of the total participants did not support any payment method on the desktop. However, most of the users (60%) supported one or two payment methods on desktop. Within the group of users that supported 2 methods together on desktop, MasterCard and Visa were ranked as the most 2 payment methods supported all together on desktop followed by MasterCard and PayPal (Table 14). Table 15 presented the number of respondents who supported three or more payment methods using their desktop.

TABLE 15. Number of respondents that supported three or more payment methods on desktop.

Payment Methods	NB of respondents
MasterCard, Visa, and PayPal	12
MasterCard, Visa, PayPal, Bitcoin, and American Express	3
MasterCard, PayPal, and Bank Transfer	2
MasterCard, Visa, PayPal, American Express, Debit Card and Bank Transfer	2
MasterCard, Visa, and Debit Card	1
MasterCard, PayPal, and Apple Pay	1
MasterCard, PayPal, and Debit Card	1

TABLE 16. Number of supported payment methods on mobile phone.

NB of supported payment methods	NB of respondents	Percentage
0	134	49.26
1	68	25
2	28	10.29
3	17	6.25
4	12	4.41
5	4	1.47
6	4	1.47
7	3	1.10
9	1	0.36
17	1	0.36
Total	272	100

TABLE 17. Number of respondents supported two payment methods on mobile phone.

Payment methods	NB of respondents
MasterCard and PayPal	11
MasterCard and Apple	2
Visa and Debit Card	2
MasterCard and Visa	1

TABLE 18. Number of respondents supported three or more payment methods on mobile phone.

Payment method	NB of respondents
MasterCard, Visa, and Debit Card	2
MasterCard, PayPal, and Google Wallet	2
MasterCard, PayPal, and American Express	2

Results showed that most of the participants supported 3 or less payment method all together using the desktop. The payment methods often supported were MasterCard, Visa, and PayPal altogether. The respondents that supported MasterCard, Visa, PayPal, Bitcoin, and American Express altogether were also considerable in number (Table 15).

TABLE 19. Main reasons for not having a preferred online payment method.

Causes	NB of responses	Percentage
It is not available	185	45%
An advantageous condition to use another option	82	20%
Support for payment method is not available	65	16%
Credit amount is in its maximum	44	10%
Absence of payment identifier	38	9%
Total	414	100%

TABLE 20. Important characteristics of a web browser that help users in performing online payment.

Causes	NB of responses	Percentage
Support of preferred payment method	192	38.5%
Support all available payment choice	82	16.5%
Support payment with several credit cards, PayPal and coupon	71	14
An automatic selection of the best payment option	64	13%
Support bank transfer with all major credit cards	50	10%
Possibility to configure the preferred payment in order to use it later	40	8%
Total	499	100%

TABLE 21. Characteristic of the preferred payment method.

Characteristic	Ease of use	Security	Convenience	Privacy	Fees & Cost	Timing	Portability	Accuracy	Others	Total
Number	166	148	97	79	75	67	54	39	2	727
Percentage (%)	22.83	20.35	13.34	10.86	10.3	9.21	7.42	5.36	0.27	100

Table 16 showed the number of supported payment methods using the mobile phone to perform the online payment (from 0 to 17 used methods all together). The results showed that 49.2% of the total participants did not support any payment method on mobile phones. Still, most of the users (35.3%) supported one or two payment methods on mobile phones. Within the group of users that supported 2 methods together on mobile phones, MasterCard and PayPal was ranked as the most 2 payment methods supported all together (Table 17). Table 18 showed that the number of respondents that supported three or more payment methods on mobile phones. MasterCard, Visa and Debit card or MasterCard, PayPal, and Google Wallet or MasterCard, PayPal, and American Express were the payment methods the most supported on mobile phones. Table 19 depicted the main reasons that explain why the users did not prefer a specific online payment method. Results showed clearly that about 45% of users choose different payment method than their preferred one if this method was not available for him. About 16 % of the participants choose different methods from their preferred one if it is not supported by the online store or they found another valuable option at that time (20%). The results showed that the main characteristics of the web browser

that help users to perform online payment where indicated in Table 20.

The highest percentage of respondents (38.5%) declared that the best web browser was the browser that supported their preferred payment method. Another group of participants (16.5%) declared that their preferred web browser was supported by all available payment choices. Some participants choose the browser that supports payment with several methods (14%) or automatically selected for them the best payment option (13%). I seem that the ease of use (22.83% of the participants) and security (20.35%) were the most required characteristics that users ask for when they choose their preferred payment method (Table 21). These characteristics were followed by convenience (13.34%) and privacy (10.86%). Our results (Table 22) showed that Google Chrome (28.8%), Safari (27.3%) and Opera (15.12%) were the most useful browsers for the online payment process on mobile phones. However, Google Chrome (40.31%), Mozilla Firefox (12.54%), and Microsoft Edge (12.66%) were respectively the most useful browser for performing online payment on desktop. Table 23 showed that users shop online more by their desktop (86% of the total participants) than by their mobile phone (67%). The highest percentage was also registered for

TABLE 22. Preferred browsers using the desktop and the mobile phone.

	Chrome	Firefox	Microsoft Edge	Safari	Brave	Opera	Total
NB of users' desktop	156	95	49	33	24	30	387
Percentage (%)	40.31	24.54	12.66	8.527	6.20	7.75	100
NB of users' mobile phone	78	34	19	74	25	41	271
Percentage (%)	28.78	12.54	7.01	27.30	9.22	15.12	100

TABLE 23. Frequency of online purchase using the desktop and the mobile phone.

Purchase online	Using the desktop		Using the mobile phone	
	Number	Percentage	Number	Percentage
Never	39	14%	90	33%
Only in sale period	76	28%	61	22.3%
1-2 times per month	111	41%	92	34%
3-4 times per month	32	11%	21	8%
5-6 times per month	7	3%	2	0.7%
>= 7 times per month	7	3%	6	2%
Total	272	100%	272	100%

users who purchase 1 or 2 times per month using the mobile phone (34%) and the desktop (41%). Purchasing online was not only restricted to sale periods. We have asked participants about the features that they may prefer their incorporation into the web browser to better perform the payment process. Several statements were given to the users to agree, disagree on them. The neutral response was also given (Table 24).

Results showed that 39.1% of the participants agreed with our statements and 27.2 % were neutral. Only 33.7% disagreed with our statements.

B. THE ANALYSIS OF THE STRUCTURAL MODEL

Cronbach's α was used as an indicator of stability and consistency in our study. This index was widely used to test reliability in several studies. The results of the reliability analysis summarized in Table 25 confirm that all scales have good to excellent levels of consistency, with Cronbach's α values being above the minimum threshold (Cronbach's $\alpha \geq 0.8$). This indicated clearly that the instrument is stable and consistent in measuring the concept of the respective variables. Furthermore, it was possible to state that the respondents really understood the questions in the survey. The correlation coefficient and Cronbach's α of 0.915, 0.888, 0.941 represent a good positive linear relationship between respectively fees/cost, storage of personal information payment preferences in one side and the online payment system on the second side (Tables 25, Table 29, Appendix). This implies that the total of the 3 component explained, influenced and affected 92.4 % of the variation in the online payment method. In the present study we used direct and indirect questions in order to explore the characteristics of the preferred online payment method. Still to measure the association and strength of the relationship between each preferred payment method and the different characteristics;

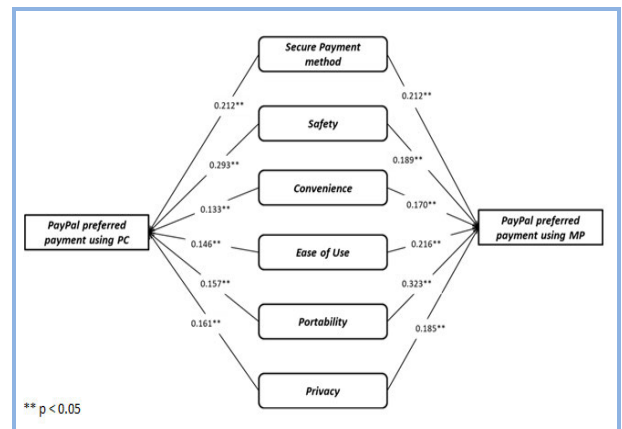


FIGURE 2. PayPal as the preferred payment method on the desktop and the mobile phone.

the cross-tabulation method was used to display the relationship between them. The dependent variable was the preferred payment method and the independent variables were the different characteristics (Fig. 2 and Fig. 3). For the relationship between the dependent variables including PayPal preference using either the desktop or the mobile phone and the payment methods in one side and the independent variables including the ease of use, convenience, portability, privacy, and safety, on the other side, Pearson Chi-square showed a significant relationship (Fig. 2).

The crosstab was a 2 by 2 table and Phi or Cramer's V was used to measure of association between factors. The maximum value of Phi was 0.32, which means that it was a very strong association between the preferred PayPal payment method via mobile phone and portability. As well as a very strong relationship between PayPal as preferred payment method via desktop and security (Phi = 0.29).

TABLE 24. Preference for the support of possible web browser features related to a payment transaction.

Statements	Agreement		Neutral		Disagreement	
	Frequency	%	Frequency	%	Frequency	%
I would like that the browser only showed me only which of my payments options are supported by the online shop (merchant)	129	2.3	78	1.4	65	1.1
I would like the web browser selected automatically the best option to perform the payment in an online shop	87	1.5	61	1.1	124	2.2
I would like that when I decide to buy an item in an online shop, the payment method is selected automatically, and the payment is also made automatically in a transparent way for me	58	1.0	63	1.1	151	2.6
I would like that, although the payment method is selected automatically, I can confirm the payment option selected	142	2.5	49	0.9	81	1.4
I would like the payment option is selected automatically based on my preferences	84	1.5	75	1.3	113	2.0
I would like that all payment options are shown, and I can choose the payment option to use	168	2.9	39	0.7	65	1.1
When I store in my browser a payment system (e.g. a credit card) to work with, I would like to configure a preference order in its use as for the other payment options I have	103	1.8	84	1.5	85	1.5
I would like to configure in my web browser a default payment system	78	1.4	74	1.3	120	2.1
I would like to use my configured default payment system when I perform a payment and only if it is not supported show me the rest of the payment systems, I support	75	1.3	84	1.5	103	1.8
I would like to be able to specify in my web browser which payment method should be used with each online shopping	111	1.9	73	1.3	88	1.5
I would like to be able to define a default payment system in function of the amount to be paid	92	1.6	70	1.2	110	1.9
I would like to be able to associate a default shipping address for any payment transaction	121	2.1	68	1.2	83	1.5
I would like to be able to associate different shipping addresses for a payment system	110	1.9	77	1.4	85	1.5
I would like to be able to associate different shipping addresses for each payment system	102	1.8	84	1.5	86	1.5
I would like to be able to have a default billing information stored in my web browser	91	1.6	82	1.4	99	1.7
I would like to be able to associate a default billing information for each payment system	102	1.8	74	1.3	96	1.7
I would like to be able to associate different billing information for a payment system	84	1.5	93	1.6	95	1.7
I would like that merchant would send automatically to the web browser a receipt of the transaction	136	2.4	77	1.4	59	1.0
I would like that automatically the web browser would be able to store a receipt of the transaction	116	2.0	76	1.3	80	1.4
I would like that merchant would send automatically to the web browser a bill/invoice of the transaction	131	2.3	83	1.5	58	1.0
I would like that automatically the web browser would be able to store a bill/invoice of the transaction	108	1.9	86	1.5	78	1.4
Total	2228	39.1	1550	27.2	1924	33.7

Moreover, a moderate relationship was registered between the PayPal method and the portability and security elements ($\Phi = 0.32$ and $\Phi = 0.18$). However, a weak relationship

was shown between the rest of the features (i.e. convenience, ease of use, and privacy) ($\Phi = 0.17$, $\Phi = 0.21$ and $\Phi = 0.18$).

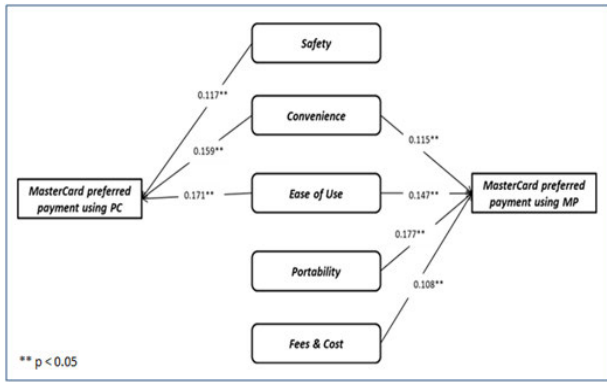


FIGURE 3. MasterCard as the preferred payment method for the desktop and the mobile phone.

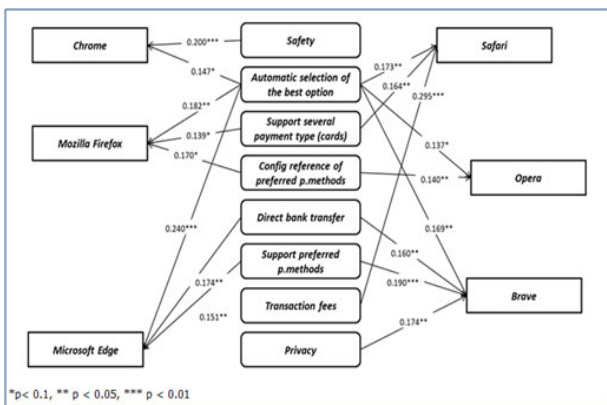


FIGURE 4. Useful browsers and the payment features on the desktop and the mobile phone.

Fig. 3 showed the relationship between the different characteristics and MasterCard as a preferred payment method either on desktop and mobile phone. We recorded a moderate to strong associations between security ($\Phi = 0.11$), convenience ($\Phi = 0.16$) and ease of use ($\Phi = 0.17$) and MasterCard as the preferred payment method on desktop. There was a strong relationship between MasterCard as the preferred payment method on mobile phone and portability ($\Phi = 0.18$). As well a moderate relationship was registered between fees and cost and MasterCard as the preferred payment method on the mobile phone ($\Phi = 0.108$).

Fig. 4 showed the relationship between the most useful web browsers, the payment method on desktop and mobile phone and the payment features.

We found a very strong relationship between Safari and transaction fees ($\Phi = 0.29$). Strong relationships were recorded between Chrome and security ($\Phi = 0.20$) as well between Microsoft Edge and automatic selection of the best option ($\Phi = 0.24$) (TABLE 43, Appendix).

Discriminant validity was evaluated by testing whether the matrix with an equal diagonal element (square root of AVE) holds the maximization of value [90].

TABLE 25. Internal consistency.

Construct	Number of items	Cronbach's α	Internal consistency
Fees & cost	5	0.915	$\alpha \geq 0.9$: Excellent
Storage information	10	0.888	$0.8 \leq \alpha < 0.9$: Good
Payment preferences	21	0.941	$\alpha \geq 0.9$: Excellent
Total	36	0.924	$\alpha \geq 0.9$: Excellent

Table 26 showed that all the values in the diagonal position were larger than those of the independent columns, indicating good discriminant validity [89], [91].

The square root of AVE should be superior to its correlations with other constructs. The discriminant validity tests whether a construct is really distinct from other constructions [89].

The square root of the AVE was superior to the construction correlations in all cases.

To assess reliability, we tested the Composite Reliability (CR) and the Average Variance Extracted (AVE) following a pre-study (Table 26).

We observe that the CRs were all greater than 0.70 and the AVE was greater than 0.6, exceeding the accepted threshold of 0.50 and showing well-constructed reliability.

Factor analysis is a statistical technique for identifying which underlying factors are measured by a (much larger) number of observed variables.

Factor analysis was performed on the 36 items used to measure the independent variables (Table 28, Table 44, Appendix).

The factor analysis probably measures 7 underlying factors (components). After interpreting all components we arrived at the following descriptions:

Component I: Storage toward ease of use

Component II: Storage toward security on mobile phone

Component III: Fees/cost

Component IV: Web browser to sustain the users' security, privacy, and preferences

Component V: Rapidity and convenience online transactions

Component VI: Usefulness and Reliability of the web browser and payment system

Component VII: Accuracy of the Web browser

The first two components accounted for 69.15% of personal information storage. The third component explained about 74.67% of the fees characteristic. Component 1 and 2 were deduced from 10 sub-questions in the survey (Question 17).

Component 3 was obtained from 5 sub-questions in the survey (Question 22). Component 4, 5, 6 and 7 resulted from 21 sub-questions (Question 24). The factor load ranged from 0.652 to 0.913.

The Kaiser-Meyer-Olkin (KMO) values were 0.922, 0.868, and 0.842 for all three constructed objects: preferential

TABLE 26. Descriptive statistics of constructs and inter-construct correlations*.

Constructs	CR	AVE	I	II	III	IV	V	VI	VII
I	0.898	0.599	0.774						
II	0.879	0.646	0	0.804					
III	0.936	0.746	0.378	0.113	0.864				
IV	0.924	0.575	0.224	0.360	0.243	0.758			
V	0.887	0.568	0.086	0.381	0.133	0.601	0.754		
VI	0.929	0.767	0.325	0.212	0.348	0.534	0.412	0.876	
VII	0.839	0.567	0.479	0.171	0.467	0.499	0.444	0.529	0.753

*Square root values of average variance extracted are indicated on the diagonal cell

TABLE 27. Linear regression between fees, storing information and the preferred payment method.

Coefficients						
Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
(Constant)	0.193	0.023			8.454	0.000
Fees	0.018	0.025		0.044	0.721	0.471
Storage information	0.342	0.059		0.357	5.808	0.000

payments, storage of personal information, and fees, consecutively. KMO values were higher than 0.5. Thus, the use of factor analysis was justified. The anti-image correlation was greater than 0.50 and the Eigenvalues were greater than 1, which confirmed well the adequacy of each individual variable in explaining the variance of the dependent one (the preferred payment method). The factor load ranged from 0.65 to 0.91. Thirty-six (36) elements were maintained to compensate for the 7 factors. The results of the factor analysis for the dependent variable (the preferred payment method) indicate that the condition of the factor analysis has been satisfactorily fulfilled. A linear regression analysis has been done.

The dependent variable was the weighted preferred payment issued from factor analysis and the explanatory variables were the storing information and fees issued from the factor analysis (Table 27). We have performed a linear regression to detect the effect of storing information and fee variables on determining the preferred payment method. The results showed a significant positive effect of storing information on the preferred payment method.

VI. DISCUSSION, IMPLICATIONS, LIMITATIONS AND FUTURE RESEARCH

The objectives of this study were to better understand the consumer’s online purchase attitudes. In particular, the

purpose of our research was to determine the user’s preferences when they were supporting more than one (M)EPS, what features they value more and the conditions in which they decided to use a specific (M)EPS when they perform an online payment transaction. In this perspective, the concept of consumer buying intent has been introduced as a key factor in determining the preferred payment method.

A. DISCUSSION OF THE RESULTS

Buying goods and services online has become a common practice for many people around the world. Still, in an online payment transaction, users have to choose between different (M)EPS and this choice is based on the features of the (mobile) payment method they consider more suitable for the transaction [92], [93]. Depending on the nature of a given transaction, certain payment methods may be relevant or not depending on their specific characteristics. Our results suggested that there was a relationship between the preferred online payment method and its characteristics. In fact, the ease of use (22.8% of the participants), security (20.35%) convenience (13.34%), privacy (10.86%) and cost and fees (10.3%) were the most required characteristics that users ask for when they choose their preferred payment method (Table 21). In accordance with this, many researchers found that consumers’ characteristics were the strongest indicators for the payment method usage intention [92], [93].

TABLE 28. Factor analysis on variables.

Construct	Sub-Items	I	II	III	IV	V	VI	VII
Storage personal payment information ¹	STORE1	0.861						
	STORE2	0.849						
	STORE3	0.821						
	STORE4	0.709						
	STORE5	0.704						
	STORE6	0.679						
	STORE7		0.866					
	STORE8		0.809					
	STORE9		0.782					
	STORE10		0.756					
Payment fees ²	FEES1			0.900				
	FEES2			0.872				
	FEES3			0.869				
	FEES4			0.855				
	FEES5			0.822				
Payment preferences ³	Paypref1				0.875			
	Paypref2				0.835			
	Paypref3				0.828			
	Paypref4				0.810			
	Paypref5				0.804			
	Paypref6				0.780			
	Paypref7				0.711			
	Paypref8					0.791		
	Paypref9					0.788		
	Paypref10					0.768		
	Paypref11					0.764		
	Paypref12					0.753		
	Paypref13					0.652		
	Paypref14						0.913	
	Paypref14						0.881	
	Paypref16						0.856	
	Paypref17						0.853	
	Paypref18							0.846
	Paypref19							0.782
	Paypref20							0.698
	Paypref21							0.676

¹ These elements which present 10 sub-questions belong to question 17 from the survey. See Appendix A.
² These elements which present 5 sub-questions belong to question 22 in the survey. See Appendix A.
³ These elements which present 21 sub-questions belong to question 24 of the survey. See Appendix A.

Perceived usefulness was also found to significantly affect the payment method usage intention [33], [38], [72], [94], [95]. Besides, most of the participants of this study were using their own desktop at home or their own mobile phones (65.4%) for their shop online. Still, those using the public facilities were very low. This clearly showed that most of the users were conscious about the security factor during the shopping

online. Furthermore, among the total number of participants (272), 160 participants indicated clearly that security was a very important factor when using online payments. Therefore with the increased visibility of security breaches, the consumer has become more conscious of threats associated with technology-based transactions. Despite, no statistically significant relationship was detected between the groups of

gender and age regarding the security of the preferred payment choice ($P > 0.05$), it appeared that the male participants were more aware than female participants about the security of their transactions when purchasing the product online. Moreover, it seems that 18 – 45 age groups were the most awake about their online shopping security. The participant older than 65 years did not give any importance to the security factor. Generally, these old customers prefer more personal interaction in shopping situations and do not like to use new technology as they associate the adoption and usage of innovative technologies with uncertainty and risks, and they did not give any importance to the security factor in their online activities [23], [24].

Besides, we found a significant relationship between the groups of educational level and the security of the preferred payment choice ($\chi^2 = 18.703, P = 0.017 \leq 0.05$, Table 2). Surprisingly that there was a large percentage (17%) of participants with higher education levels did not give or give very low importance to security when using the internet for their transactions (Table 2). A recent study found that not all consumers find security is an important factor for performing their preferred choice of payment method [86].

Participants from 52 different countries with different cultural background were used in the present study. Our results revealed that most respondents were male (61.8%) which supports previous findings showing that men shop more often online because of the lower price. The largest numbers of participants were aged between 18 and 35 (70.2%). Generally, the respondents of this age group more often choose shopping online for several reasons such as the lack of time and a wide range of products [36], [82]. The most beneficial factor of shopping online was identified as a possibility to compare prices and buy at a lower price. Almost all respondents have a higher education level (97.1%). Outstandingly the present study mentioned that gender, age, education level, had a significant effect on the choice of payment methods as well as on online shopping behavior [96]. In fact, there was a relationship between gender and age groups and the type of product most purchased (Table 8). Digital products (35.7%) and hedonics (31.5%) were mostly bought online by men, while women mostly purchase utilitarian (30.8%) and non-digital (30.8%) products. As well results showed people aged from 18 – 25 years purchased more utilitarian products (29.2%) than the other groups (Table 9). However, the participant aged from 26 - 35 years purchased more Non-digital products. Still, digital products were mainly purchased by teenagers (<18 years).

Recent studies stated that despite the fact that credit/debit card payments are less secure, users perceived them as more secure than Bitcoin. In accordance with this, our results showed that most of the participants (2.2%) did not use Bitcoin for their transactions (Table 3). Still, most of those using Bitcoin for their online shop on a mobile phone was a young person with a higher education level (Table 4). Besides, it seems that female participants were using Bitcoin better than males. Most of these users did not have enough

TABLE 29. Cronbach's α interpretation.

Cronbach's α	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

TABLE 30. Value of thumb about correlation coefficient sizes.

Coefficient range	Strength of association
$\pm 0.91 - 1.00$	Very strong
$\pm 0.71 - 0.90$	High
$\pm 0.41 - 0.70$	Moderate
$\pm 0.21 - 0.40$	Small, but definite relationship
$\pm 0.00 - 0.20$	Slight, almost negligible

knowledge about Bitcoin's benefits, or they were just following the trend of using Bitcoin. Still, the strength of the association between gender and the Bitcoin use was moderate (Cramer's $V = 0.139$) and these findings need to be studied further. PayPal was preferred by a relatively considerable number of participants on their mobile phone (19.1 %) when compared to Google Wallet, Samsung Pay and Apple Pay (3.7%, 1.1%, and 8.1% respectively). Our results showed significant relationships between PayPal and Apple Pay with regard to the respondents' ages were found (Table 4, Table 5) maybe this due to the security and confidentiality of information [35]. More than 71% of the participants were in the ages ranging between 18 - 35 years.

The educational level and gender groups did not significantly affect the use of PayPal, Google Wallet, and Samsung Pay. The use of Apple Pay on mobile phones was significantly influenced the education level groups (Table 7). There may be times when your preferred payment method cannot be used. In fact, the availability of certain payment methods may be limited based on a particular seller or the third-party website you are using to complete the transaction. Results showed clearly that about 45% of users choose different payment method than their preferred one if this method was not available for him (Table 19). About 16% of the participants choose a different method from their preferred one if it is not supported by the online store or they found another valuable option at that time (20%). MasterCard, PayPal, and Visa were the most preferred payment methods either on desktop or on mobile phones (Table 10). Most of the participants were effectively using MasterCard and PayPal either on desktop (24-30%) or mobile phone (23%). However, Visa was trivially used on both instruments. Generally credit and debit cards, not always the most trusted option, only account for half of the online transactions globally [73], [82].

TABLE 31. The relationship between gender and the security of the preferred payment choice.

Gender		The preferred payment method is secure (Security)					Total
		1	2	3	4	5	
Male	Count	13	13	25	20	97	168
	% within Security	59.1%	54.2%	75.8%	60.6%	60.6%	61.8%
Female	Count	9	11	8	13	63	104
	% within Security	40.9%	45.8%	24.2%	39.4%	39.4%	38.2%
Total	Count	22	24	33	33	160	272
	% within Security	100%	100%	100%	100%	100%	100%

TABLE 32. The relationship between age and the security of the preferred payment choice.

Age		The preferred payment method is secure (Security)					Total
		1	2	3	4	5	
<18	Count	1	1	0	1	2	5
	% within Security	4.5%	4.2%	0.0%	3%	1.3%	1.8%
[18-25]	Count	5	7	8	16	53	89
	% within Security	22.7%	29.2%	24.2%	48.5%	33.1%	32.7%
[26-35]	Count	12	8	14	8	60	102
	% within Security	54.5%	33.3%	42.4%	24.2%	37.5%	37.5%
[36-45]	Count	4	7	8	7	32	58
	% within Security	18.2%	29.2%	24.2%	21.2%	20.0%	21.3%
[46-55]	Count	0	1	1	1	7	10
	% within Security	0.0%	4.2%	3.0%	3.0%	4.4%	3.7%
[56-65]	Count	0	0	1	0	6	7
	% within Security	0.0%	0.0%	3.0%	0.0%	3.8%	2.6%
>65	Count	0	0	1	0	0	1
	% within Security	0.0%	0.0%	3.0%	0.0%	0.0%	0.4%
Total	Count	22	24	33	33	160	272
	% within Security	100%	100%	100%	100%	100%	100%

On the desktop, Visa (28.5%), MasterCard (21.22%) and PayPal (18.35%) were the most supported payment method. However, on mobile phones only PayPal and MasterCard were supported. About 77.6% of the user’s group that supported MasterCard and Visa altogether were effectively using MasterCard with their desktop but not much Visa (Table 11). Compared to the desktop, the lower percentage of participants has mentioned that they were effectively used or preferred Visa and MasterCard on a mobile phone. About 74% of the group of users supported PayPal altogether with other payment methods mentioned that PayPal was the most used when performing an online purchase on the desktop while only 49% of them prefer this method. Still, on a mobile phone a lesser percentage (49%) of the participant were effectively using PayPal and only 37% preferred this method (Table 12).

The results showed that there were more supported payment methods on desktop (86%) than on a mobile phone (50.8%; Table 13-16). About 60% and 35.3% of the total participants supported one or two payment methods on respectively desktop and mobile phone (Table 13). When using

desktop, MasterCard, Visa, and PayPal was the most supported tree method all together (Table 15). However, MasterCard, Visa and Debit card or MasterCard, PayPal and Google Wallet were the payment methods the most supported altogether on mobile phone (Table 18). MasterCard altogether with Visa or PayPal were the most supported methods on desktop, while MasterCard altogether with PayPal was the most supported in mobile phone (Table 14 and Table 17). A large percentage of respondents (38.5%) declared that the best web browser was supported their preferred payment method (Table 20). Lesser percentage (16.5%) declared that their preferred one was those that supported all available payment choices. Some participants choose the browser that supports payment with several methods (14%) or automatically selected for them the best payment option (13%).

Results showed that MasterCard and PayPal were the most used payment methods either on desktop or mobile phone. The ease of use and security [98] of these payment methods could be the main reasons for their selection by our participants.

TABLE 33. The relationship between age and using bitcoin as a preferred mobile payment method.

Age		Bitcoin used by mobile phone		Total
		Yes	No	
<18	Count	0	5	5
	% within Age	0.0%	100%	100%
	% within Bitcoin	0.0%	1.9%	1.8%
[18-25]	Count	0	89	89
	% within Age	0.0%	100%	100%
	% within Bitcoin	0.0%	33.5%	32.7%
[26-35]	Count	4	98	102
	% within Age	3.9%	96.1%	100%
	% within Bitcoin	66.7%	36.8%	37.5%
[36-45]	Count	2	56	58
	% within Age	3.4%	96.6%	100%
	% within Bitcoin	33.3%	21.1%	21.3%
[46-55]	Count	0	10	10
	% within Age	0.0%	100%	100%
	% within Bitcoin	.0%	3.8%	3.7%
[56-65]	Count	0	7	7
	% within Age	0.0%	100%	100%
	% within Bitcoin	0.0%	2.6%	2.6%
>65	Count	0	1	1
	% within Age	0.0%	100%	100%
	% within Bitcoin	0.0%	0.4%	0.4%
Total	Count	6	266	272
	% within Age	2.2%	97.8%	100%
	% within Bitcoin	100%	100%	100%

TABLE 34. The relationship between gender and using paypal as a preferred mobile payment method.

Gender		PayPal used by mobile phone		Total
		Yes	No	
Male	Count	33	135	168
	% within Gender	19.6%	80.4%	100%
	% within PayPal	63.5%	61.4%	61.8%
Female	Count	19	85	104
	% within Gender	18.3%	81.7%	100%
	% within PayPal	36.5%	38.6%	38.2%
Total	Count	52	220	272
	% within Gender	19.1%	80.9%	100%
	% within PayPal	100%	100%	100%

Still, these two methods were the most preferred by users on both instruments. In contrast, Visa was also highly preferred by users, while a very low percentage used effectively this method either on a mobile phone (0%) or desktop (3.4%, Table 21). Generally, if a user selected a credit card as his preferred payment method and the card has expired, he will not be able to pay with that card. Our results stated that the users shop online more by their desktop (86% of the

total participants) than by their mobile phone (67%). The highest percentage was also registered for users who purchase 1 or 2 times per month using the mobile phone (34%) and the desktop (41%). Purchasing online was not only restricted to sale periods (Table 23).

The present questionnaire discussed the relationship between the web browser and the users' preferred payment choice (Table 22 and Table 24). According to the participants,

TABLE 35. The relationship between education level and paypal as a preferred mobile payment method.

Education Level		PayPal used by mobile phone		Total
		Yes	No	
Primary School	Count	0	2	2
	% within Education Level	0.0%	100%	100%
	% within PayPal	0.0%	0.9%	0.7%
Secondary School	Count	2	4	6
	% within Education Level	33.3%	66.7%	100%
	% within PayPal	3.8%	1.8%	2.2%
Higher Education	Count	50	214	264
	% within Education Level	18.9%	81.1%	100%
	% within PayPal	96.2%	97.3%	97.1%
Total	Count	52	220	272
	% within Education Level	19.1%	80.9%	100%
	% within PayPal	100%	100%	100%

TABLE 36. The relationship between gender and using google wallet as a preferred mobile payment method.

Gender		Google Wallet used by mobile phone		Total
		Yes	No	
Male	Count	6	162	168
	% within Google Wallet	3.6%	96.4%	100%
Female	Count	4	100	104
	% within Google Wallet	3.8%	96.2%	100%
Total	Count	10	262	272
	% within Google Wallet	3.7%	96.3%	100%

TABLE 37. The relationship between gender and using samsung pay as a preferred mobile payment method.

Gender		Samsung Pay used by mobile phone		Total
		Yes	No	
Male	Count	2	166	168
	% within Gender	1.2%	98.8%	100%
	% within Samsung Pay	66.7%	61.7%	61.8%
Female	Count	1	103	104
	% within Gender	1.0%	99.0%	100%
	% within Samsung Pay	33.3%	38.3%	38.2%
Total	Count	3	269	272
	% within Gender	1.1%	98.9%	100%
	% within Samsung Pay	100%	100%	100%

Google Chrome (28.8%), Safari (27.3%) and Opera (15.12%) were the most useful browsers for the online payment process on mobile phone. However, Google Chrome (40.31%), Mozilla Firefox (12.54%) and Microsoft Edge (12.66%) were the most useful browser on desktop (Table 22). According to Statista world browser rank, Google Chrome occupies first place [88], [97]. Therefore, we can see that our data were consistent with this rank. Besides, a relationship between the most useful web browsers, the payment method on desktop

and mobile phone and the payment features were also determined. We found a very strong relationship between Safari and transaction fees ($\Phi = 0.29$). However, strong relationships were also recorded between Chrome and security ($\Phi = 0.20$) as well between Microsoft Edge and automatic selection of the best option ($\Phi = 0.24$).

We have asked participants about the features that they may prefer their incorporation into the web browser to better perform the payment process. Several statements were given

TABLE 38. The relationship between gender and using apple pay as a preferred mobile payment method.

Gender		Apple Pay used by mobile phone		Total
		Yes	No	
Male	Count	10	158	168
	% within Gender	6.0%	94.0%	100%
	% within Apple Pay	45.5%	63.2%	61.8%
Female	Count	12	92	104
	% within Gender	11.5%	88.5%	100%
	% within Apple Pay	54.5%	36.8%	38.2%
Total	Count	22	250	272
	% within Gender	8.1%	91.9%	100%
	% within Apple Pay	100%	100%	100%

TABLE 39. The relationship between age and google wallet as a preferred mobile payment method.

Age		Google Wallet used by mobile phone		Total
		Yes	No	
<18	Count	1	4	5
	% within Age	20%	80%	100%
	% within Google Wallet	10%	1.5%	1.8%
[18-25]	Count	2	87	89
	% within Age	2.2%	97.8%	100%
	% within Google Wallet	20%	33.2%	32.7%
[26-35]	Count	3	99	102
	% within Age	2.9%	97.1%	100%
	% within Google Wallet	30%	37.8%	37.5%
[36-45]	Count	3	55	58
	% within Age	5.2%	94.8%	100%
	% within Google Wallet	30%	21.0%	21.3%
[46-55]	Count	0	10	10
	% within Age	0.0%	100%	100%
	% within Google Wallet	0.0%	3.8%	3.7%
[56-65]	Count	1	6	7
	% within Age	14.3%	85.7%	100%
	% within Google Wallet	10%	2.3%	2.6%
>65	Count	0	1	1
	% within Age	0.0%	100%	100%
	% within Google Wallet	0.0%	0.4%	0.4%
Total	Count	10	262	272
	% within Age	3.7%	96.3%	100%
	% within Google Wallet	100%	100%	100%

to the users to agree, disagree on them. The neutral response was also given (Table 24). Results showed that 39.1% of the participants agreed with our statements and 27.2 % were neutral. Only 33.7% disagreed with our statements. The participants were agreed mainly on the following statements: (i) I would like that, although the payment method is selected automatically, I can confirm the payment option selected (ii) I would like that all payment options are shown, and

I can choose the payment option to use (iii) I would like that the browser only showed me only which of my payments options are supported by the online shop (merchant) (iv) I would like that merchant would send automatically to the web browser a receipt of the transaction (v) I would like that merchant would send automatically to the web browser a bill/invoice of the transaction. The participants disagreed on the following statements: (i) I would like that when I decide to

TABLE 40. The relationship between education level and google wallet as a preferred mobile payment method.

Education Level		Google Wallet used by mobile phone		Total
		Yes	No	
Primary School	Count	0	2	2
	% within Education Level	0.0%	100%	100%
	% within Google Wallet	0.0%	0.8%	0.7%
Secondary School	Count	0	6	6
	% within Education Level	0.0%	100%	100%
	% within Google Wallet	0.0%	2.3%	2.2%
Higher Education	Count	10	254	264
	% within Education Level	3.8%	96.2%	100%
	% within Google Wallet	100%	96.9%	97.1%
Total	Count	10	262	272
	% within Education Level	3.7%	96.3%	100%
	% within Google Wallet	100%	100%	100%

TABLE 41. The relationship between education level and samsung pay as a preferred mobile payment method.

Education Level		Samsung Pay used by mobile phone		Total
		Yes	No	
Primary School	Count	0	2	2
	% within Education Level	0.0%	100%	100%
	% within Samsung Pay	0.0%	0.7%	0.7%
Secondary School	Count	0	6	6
	% within Education Level	0.0%	100%	100%
	% within Samsung Pay	0.0%	2.2%	2.2%
Higher education	Count	3	261	264
	% within Education Level	1.1%	98.9%	100%
	% within Samsung Pay	100%	97.0%	97.1%
Total	Count	3	269	272
	% within Education Level	1.1%	98.9%	100%
	% within Samsung Pay	100%	100%	100%

buy an item in an online shop, the payment method is selected automatically, and the payment is also made automatically in a transparent way for me (ii) I would like to configure in my web browser a default payment system (see more details in Table 24). Consequently with all these statements participants locate a future web browser that meets their needs in security, simplicity, and convenience for future payment methods.

The discriminant validity tests showed good discrimination validity between all constructs. Furthermore, the Composite Reliabilities (CRs) were all the time greater than 0.70 shows, therefore, well-constructed reliability (Table 28). Cronbach’s α is a statistic commonly quoted by authors to demonstrate that tests and scales that have been constructed or adapted for research projects are fit for purpose. It is considered to be a measure of scale reliability. Our analysis confirmed that all scales have “good” to “excellent” levels of consistency, with

Cronbach’s α values being above the minimum threshold (Cronbach’s $\alpha \geq 0.8$). Still, these results showed clearly that the respondents really understood the questions of our survey. Furthermore, the correlation coefficient and Cronbach’s α of 0.915, 0.888 and 0.941 showed a good positive linear relationship respectively between fees/cost, storage of personal information and payment preferences with regards to the online payment system (Table 25, Table 29, Appendix). This implies that the three components namely fees/cost, storage of personal information and payment preferences explained, influenced and affected 92.4 % of the variation in the online payment method.

In the present study, we used direct and indirect questions in order to explore the characteristics of the preferred online payment method. The determination of the Pearson Chi-square test showed a significant relationship between the dependent variables mainly PayPal preference and the

TABLE 42. The relationship between age and samsung pay as a preferred mobile payment method.

Age		Samsung Pay used by mobile phone		Total
		Yes	No	
<18	Count	0	5	5
	% within Age	0.0%	100%	100%
	% within Samsung Pay	0.0%	1.9%	1.8%
[18-25]	Count	0	89	89
	% within Age	0.0%	100%	100%
	% within Samsung Pay	0.0%	33.1%	32.7%
[26-35]	Count	3	99	102
	% within Age	2.9%	97.1%	100%
	% within Samsung Pay	100%	36.8%	37.5%
[36-45]	Count	0	58	58
	% within Age	0.0%	100%	100%
	% within Samsung Pay	0.0%	21.6%	21.3%
[46-55]	Count	0	10	10
	% within Age	0.0%	100%	100%
	% within Samsung Pay	0.0%	3.7%	3.7%
[56-65]	Count	0	7	7
	% within Age	0.0%	100%	100%
	% within Samsung Pay	0.0%	2.6%	2.6%
>65	Count	0	1	1
	% within Age	0.0%	100%	100%
	% within Samsung Pay	0.0%	0.4%	.4%
Total	Count	3	269	272
	% within Age	1.1%	98.9%	100%
	% within Samsung Pay	100%	100%	100%

independent variables including the ease of use, convenience, portability, privacy, and security (safety). A very strong association between the preferred PayPal payment method via the mobile phone and portability ($\Phi = 0.32$) was stated. As well as a very strong relationship between PayPal as preferred payment method via desktop and security ($\Phi = 0.29$). However, a weak relationship was shown between PayPal and the rest of the features (i.e. convenience, ease of use, and privacy) ($\Phi = \Phi = 0.17$, $\Phi = 0.21$ and $\Phi = 0.18$). Furthermore, we recorded moderate to strong associations between MasterCard as the preferred payment method on desktop and security ($\Phi = 0.11$), convenience ($\Phi = 0.16$) and ease of use ($\Phi = 0.17$). As well there was a strong relationship between MasterCard as the preferred payment method on mobile phone and portability ($\Phi = 0.18$). However, a moderate relationship was registered between fees/cost and MasterCard as the preferred payment method on a mobile phones ($\Phi = 0.108$).

Factor analysis is a statistical technique for identifying which underlying factors are measured by a (much larger) number of observed variables. It was performed on the 36 items used to measure the independent variables (Table 28, Table B-44, Appendix). The factor analysis probably measures 7 underlying factors (components). After interpreting

TABLE 43. Interpretation of Phi and cramer's V.

Phi and Cramer's V	Interpretation
> 0.25	Very strong
> 0.15	Strong
> 0.10	Moderate
> 0.05	Weak
> 0	No or very weak

all components we arrived at the following descriptions: Component I: Storage toward ease of use, Component II: Storage toward security on mobile phone, Component III: Fees/cost, Component IV: Web browser to sustain the users' security, privacy and preferences, Component V: Rapidity and convenience online transactions, Component VI: Usefulness and Reliability of the web browser and payment system, Component VII: Accuracy of the Web browser. The first two components accounted for 69.15% of personal information storage. The third component explained about 74.67% of the fee characteristic.

The Kaiser-Meyer-Olkin (KMO) values were 0.922, 0.868, and 0.842 for all three constructed objects: preferential payments, storage of personal information, and fees, consecutively. KMO values were higher than 0.5. Thus, the use of factor analysis was justified. The anti-image correlation was

greater than 0.50 and the Eigenvalues were greater than 1, which confirmed well the adequacy of each individual variable in explaining the variance of the dependent one (the preferred payment method). The factor load ranged from 0.65 to 0.91. Thirty-six (36) elements were maintained to compensate for the seven factors. The results of the factor analysis for the dependent variable (the preferred payment method) indicate that the condition of the factor analysis has been satisfactorily fulfilled. A linear regression analysis has been done. The dependent variable was the weighted preferred payment issued from factor analysis and the explanatory variables were the storing information and fees issued from the factor analysis (Table 27). We have performed a linear regression to detect the effect of storing information and fee variables on determining the preferred payment method. The results showed a significant positive effect of storing information on the preferred payment method.

B. THEORETICAL AND PRACTICAL IMPLICATIONS

Understanding how consumers choose their payment methods has many benefits for online retailers, Web commerce sites, online payment method providers and Web browsers developers. The main purpose of this research was to understand the user's preferences when they were supporting more than one (M)EPS, what features they value more and the conditions in which they decided to use a specific (M)EPS when they perform an online payment transaction. Our results suggested that for the group of users who supported more than one payment method, PayPal, MasterCard and Visa were successively the most preferred payment method on desktop and the mobile phone. In addition, the users preferred using Google Chrome web browser as the most supportive of her or his preferred payment methods for online purchases, with important consideration given to the payment characteristics including security, ease of use, privacy, usefulness, storing information, the automatic selection of the best option of payment, convenience, timing, accuracy and cost/fees of transaction. The use of PayPal, Visa, and MasterCard via the desktop seems to be due mainly to the ease of use and security of these payment methods. Still, the credit cards were the dominant payment methods in online purchases. Therefore our results endorse the decision of W3C for starting the definition of the Payment Request API with the support of credit cards. Our results also confirm that web browsers are currently supporting in different cases as follows: when payment was going to be made, all payment options were shown, and the user can choose the payment option to use. However, to speed up the payment process, the web browser may consider further options like the automatic selection of the payment method followed by its obligate confirmation by the user to proceed with the payment (this was detailed further in Table 27). This study also provided support for offering the most popular online payment methods. MasterCard and PayPal were rated in the highest of the scale of use among all payment methods. The second-highest rating was for Visa credit and debit card payments.

Furthermore, knowing how different payment methods might affect how satisfied consumers are with their purchases is essential for online retailers. Based on their usefulness and their ease of use, all payment methods scored very well for all characteristics. As well, all payment methods were rated quite low on perceived risk levels. PayPal was the only payment method that was perceived as riskier than other payment methods. However, the perceived risk was still not found to significantly affect the adoption rate. Even though this study did not seek to understand how the presented payment methods might affect purchasing intention, it is important to take this issue into consideration when choosing the payment methods in an online store. The reasons that make consumers perceive PayPal to be riskier than other methods should also be taken into consideration. After all, PayPal is marketed to be the safer payment option than others, since the consumer does not have to provide their card details directly to retail stores. Consequently, the perceived security is a critical factor that should be always tackled in the very first place when designing strategies for the adoption of new payment systems. Perceived ease of use on the desktop and the mobile phone was only found to be important under PayPal conditions. As a result, online payment method providers should market their payment options from their usefulness aspect in order to gain more reception.

C. LIMITATIONS AND FUTURE RESEARCH

Similar to other research, this study has several limitations. For instance, the data collection was done through a survey in which we have limited control of the cultural and demographic backgrounds of the participants. Future research will require a much larger sample size and more convenient sampling method that takes into consideration several cultural, demographic and geographic aspects. Furthermore, in order to gain more participants, the questionnaire should be kept open for several weeks or months. May be it would be better to include in our next study the participants that they did yet accepted a payment system as the present study was performed to analyze the behaviour of users who had already accepted a payment system. Furthermore in order to obtain more complete results on payment method preference, a normal distribution of the respondents (gender, education levels, ages, internet experience, geographic distribution...) and variables (payment characteristics, perceived usefulness, perceived risk, web browser selection....) should be taken in more considerations. A more specific feature might require a more detailed analysis. Additionally, the questionnaire statements of the present study were written in English because it was proposed for an international public. Therefore, in the future, such matters should be solved by providing questionnaires with several languages so that the users who do not understand English can complete it. Thus we will have a greater choice of the report from different countries around the world. The questionnaire was designed in a way that the respondents concentrate on the questionnaire while answering. The respondent has to read the long descriptive texts while

TABLE 44. Factor analysis.

	Sub-Items	Str1	Str2	fees	Pref1	Pref2	Pref3	Pref4
Storage personal payment information	I do not like to introduce payment information each time I have to make a payment	0.861						
	It allows me to save time and effort when I make a payment	0.849						
	I think it is secure storing my payment information in the web browser	0.821						
	I like that my payment information is stored in the online merchant website to facilitate me the payment process (as in Amazon)	0.709						
	I prefer to introduce my payment information each time I have to make a payment	0.704						
	I would prefer to store my payment information in a third-party entity such as PayPal	0.679						
	I would prefer to introduce my payment information in my device (PC, laptop or mobile phone) and each time I have to make a payment, the system asks me permission to read it		0.866					
	I would like to receive a notification on my mobile phone each time a payment is made		0.809					
	I would like that before a payment is made, a confirmation to my mobile phone is sent		0.782					
	I would like that when I use a service of payment to didn't redirect me away from the website to a checkout page.		0.756					
Payment fees	Transaction fees			0.900				
	Cross-border fees			0.872				
	Cost or Fees			0.869				
	Chargeback fee			0.855				
	Setup fee			0.822				
Payment preferences	I would like that the browser only showed me only which of my payments options are supported by the online shop (merchant)				0.875			
	I would like Web browser selected automatically the best option to make the payment in an online shop				0.835			
	I would like that when I decide to buy an item in an online shop, the payment method is selected automatically, and the payment is also made automatically in a transparent way for me				0.828			

TABLE 44. (Continued.) Factor analysis.

I would like that, although the payment method is selected automatically, I can confirm the payment option selected				0.810			
I would like the payment option is selected automatically based on my preferences				0.804			
I would like that all payment options are shown, and I can choose the payment option to use				0.780			
When I store in my browser a payment system (e.g. a credit card) to work with, I would like to configure a preference order in its use as for the other payment options I have				0.711			
I would like to configure in my web browser a default payment system				0.791			
I would like to use my configured default payment system when I make a payment and only if it is not supported show me the rest of the payment systems, I support				0.788			
I would like to be able to specify in my web browser which payment method should be used with each online shopping				0.768			
I would like to be able to define a default payment system in function of the amount to be paid				0.764			
I would like to be able to associate a default shipping address for any payment transaction				0.753			
I would like to be able to associate different shipping addresses for a payment system				0.652			
I would like to be able to associate different shipping addresses for each payment system					0.913		
I would like to be able to have a default billing information stored in my web browser					0.881		
I would like to be able to associate a default billing information for each payment system					0.856		
I would like to be able to associate different billing information for a payment system					0.853		
I would like that merchant would send automatically to the web browser a receipt of the transaction							0.846
I would like that automatically the web browser would be able to store a receipt of the transaction							0.782
I would like that merchant would send automatically to the web browser a bill/invoice of the transaction							0.698
I would like that automatically the web browser would be able to store a bill/invoice of the transaction							0.676

thinking about all the circumstances made for him although the questionnaire statements. Consequently, the results on perception of ownership might be distorted because the respondents were not imagining this as specifically as the research required them to do. For future research, it might be necessary to observe true online purchase situations rather than ask respondents to imagine them in order to obtain more reliable results. Future research should also take into account not only consumers' perceptions of payment methods; it should also examine their perceptions of the entire online shopping concept and how this affects their intentions to use various online payment methods. Further investigation should be undertaken on Web payment, especially in an online context, and on the development of the payment APIs that respond to the preferences of users who support multiple payment methods. This, in turn, would allow merchants to use one or more payment methods with multiple integrations and user agents (such as web browsers) to facilitate exchanges between merchants and users. It would also be interesting to see if the unavailability of certain payment methods would significantly decrease the consumer's likelihood of making a purchase. Future research should also take into account the processing time of different payment methods, and it might be necessary to have more demographic variables on the questionnaire, in order to provide more reliable results. The questionnaire could also be alternated to give some respondents more information, for example, on security issues related to payment methods, while other respondents are expected to rely on their own experience and knowledge.

VII. CONCLUSION

(M)EPS are increasingly used to perform online purchases. So far research was mainly focused on its acceptance and its intention of use. The present study investigated the user's preferences for a specific payment method, while several payment methods were available for him or supported him. We have guided an online questionnaire with international participants. The respondents came from 52 countries, principally from Tunisia, Spain, France, and the United Kingdom. The collected data were analyzed using several statistical tests. The people questioned in this study agreed on several characteristics of the payment methods: ease of use, security, cost, usefulness, privacy, and convenience. The cross-tabulation method was used to discover the relationships between the various functionalities and the preferred payment method given by the different respondents. Among these functionalities, the perceived security and ease of use were most sought by a large percentage of users. Results showed that 18 – 45 age groups were the most awake about their online shopping security. We found also a significant relationship between the groups of educational level and the security of the preferred payment choice ($\chi^2 = 18.703$, $P = 0.017 \leq 0.05$). Outstandingly the present study mentioned that gender, age, education level, had a significant effect on the choice of payment methods as well as on online shopping behaviour.

Furthermore, results showed clearly that about 45% of users choose different payment method than their preferred one if this method was not available for him. MasterCard and PayPal were the most used and preferred payment methods either on desktop or mobile phone. Visa was also highly preferred by users, while a very low percentage used effectively this method. Strong relationships were stated between the most useful web browsers (mainly Chrome, Microsoft Edge and Safari) and the payment method features and preference. Users mainly used Safari to consider the lesser fees of the transactions ($\Phi = 0.29$). However, for users that give more importance to security they use more Chrome ($\Phi = 0.20$). The Microsoft Edge was used by participants seeking simplicity and those need an automatic selection of the best option ($\Phi = 0.24$). We have also performed a Factor analysis technique on the 36 items (used to measure the independent variables) aiming to identify which factors are measured by a (much larger) number of observed variables. The analysis allowed the description of three components (preferred payment method, fees, and personal information storage). A simple linear regression demonstrated that storage information had a significant effect on the preferred payment method and the user can be eager to store information in the web browser. This study can be further improved by overcoming several limitations. Even with these limitations, this paper have enhanced our understanding of the users' preferences and guided the provision of future payment methods mainly related to supporting the W3C payment API. We have identified some directions for future research. These include observing actual purchasing situations, rather than asking participants to remember them in detail, comparing how "painful" and pleasurable purchases affect usage intention of payment methods, and investigating the development of APIs (W3C) that respond to preferences of users who support multiple payment methods—developments that would facilitate exchanges between merchants and users.

APPENDIXES

APPENDIX A QUESTIONNAIRE

The Google Form questionnaire is available in:

<https://docs.google.com/forms/d/e/1FAIpQLSduqnqyowd7rlbxIKj2AJh0xYoBSfmXHHAlXYemK-tuEon4HQ/viewform?fbzx=2912499237653051493>

A PDF document with all the questions can be found in:

<https://webs.um.es/arm/web-payments-final-questionnaire.pdf>

APPENDIX B MEASUREMENT ITEMS IN THE QUESTIONNAIRE

See Tables 29–44.

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