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FinTech payments in the era of COVID-19: Factors influencing behavioral intentions of “Generation X” in Hungary to use mobile payment

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ABSTRACT

Organizations, such as the World Health Organization, encouraged consumers to use contactless payment methods instead of payment methods such as cash, which can be carriers of the SARS-2 virus. This study aims to evaluate factors that influence Hungarian Generation X's behavioral intentions to use mobile payment services during the pandemic. We conducted an electronic questionnaire-based survey among 1120 Generation X individuals. Using structural equation modeling to analyze the study's conceptual model, our results confirm that perceived COVID-19 risk, perceived usefulness, and subjective norms significantly influence Hungarian Generation X's behavioral intentions to use mobile payment services. Moreover, perceived usefulness mediates the relationship between perceived ease of use and behavioral intention to use mobile payment systems. Overall, our results show that the model of perceived COVID-19 risk, perceived usefulness, subjective norms, and perceived ease of use explains 62.9% of the variance in intention to use mobile payment systems. Our study contributes to the technology acceptance model and highlights its effectiveness in explaining the behavioral intention to adopt mobile payments during the COVID-19 pandemic.

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1. Introduction

In the last two decades, the Information and Communications Technology (ICT) sector has multiplied and become a landmark for countries' economic development (Toader et al., 2018). The expansion of the ICT sector has been accompanied by the widespread use of mobile phones and significant growth in the electronics market, changing customer expectations, and the availability of funding and support from regulators and governments (Horner and Cunnane, 2017). In light of that, ICT paved the way for a paradigm shift in the financial sector (Gai et al., 2018).

The FinTech industry has boomed in recent years, enabling simple, secure, and high-quality online banking services (Kang, 2018). FinTech is a technological financial innovation that offers new products, applications, and business models that could influence the provision of financial services and the development of the financial industry, and create a market culture of

competition and reputation among service providers (Thakor, 2020; Chandler and Krajcsák, 2021). Accordingly, technology and financial institutions have increased their investment in FinTech innovation. Mobile payment service, also known as mobile wallet or mobile money, is a payment service directly linked to financial institutions and FinTech payment services (Kang, 2018). Mobile payment is defined as an electronic payment instrument that uses a mobile device to transfer funds between the payer and the payee (Karthikeyan, 2012). Mobile payments have changed the way people view mobile usage. It is no longer limited to communication, entertainment and browsing the internet. Direct contact and cash are no longer necessary to conduct transactions and exchange value. Mobile payments have reshaped the way customers and merchants transact. It has made transactions simple, easy and fast. Moreover, people can now transact anywhere and anytime. The increased trend toward cashless payments has also provided commercial banks with detailed data on the behavior of their customers (Königstorfer and Thalmann, 2020).

SARS-CoV-2 poses a major threat to human health worldwide and caused a shock to the global economy (Popkova et al., 2021). According to health experts, the COVID-19 attacks humans'

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respiratory system and can cause death in some people with health problems; the risk increases with the age of the affected (WHO, 2020). The virus is transmitted primarily through salivary droplets or contact with people and surfaces that carry the pathogen (WHO, 2020). In response to the threat, various measures and laws have been enacted in most countries, including Hungary, to ensure social distancing and curb the causes of infection, such as mandatory wearing of masks in public areas, distance education, and banning of gatherings. The socio-economic consequences of these measures are no less significant than the health aspect (UNDP, 2020; Urbanovics et al., 2021). Based on a report by Statista, the global real Gross Domestic Product (GDP) reaches a decrease of 3.03 percent in 2020 due to the impact of COVID-19 (Statista Research Department, 2020). Meanwhile, at International Monetary Fund, digital financial inclusion has been seen as a critical factor in mitigating the socio-economic impact of the crisis (Sahay et al., 2020). To achieve this, Shaikh et al. (2017) advocated for promoting financial inclusion by investing in technology, adopting innovative customer solutions, and developing digital financial products and services for the unbanked and underbanked population.

The World Health Organization (WHO) has called on consumers to use digital contactless payment methods in their financial activities (Ather et al., 2020; Auer et al., 2020). The call responds to health reports that have proven that coronaviruses can live on surfaces such as cash and banknotes for 2 to 4 days (Pal and Bhadada, 2020). In Hungary, the government called on banks to triple the limit for contactless card purchases to reduce the need for physical contact with the pin terminal. The perceived risk of contracting the virus has influenced consumer behaviors and views toward payment systems, banking and everyday tasks that require face-to-face transactions (Deloitte, 2020). Against this backdrop, the FinTech industry in general and the digital payments sector in particular have experienced remarkable growth during the pandemic (World Bank and CCAF, 2020; Belgavi, 2020).

The current study examined mobile FinTech payments as a means of reducing COVID-19 risk among Gen X in Hungary. Gen X, individuals born between 1965 and 1980, was selected in this study based on several considerations. First, according to (Statista, 2020a), the average age of the population in Hungary was 43.3 years in 2020, and it is expected to reach 45.1 years by 2025, suggesting that Gen X may represent the age of Hungarian society. Second, medical studies have shown that older adults are more prone to worse disease progression and higher mortality rates when infected with the SARS-2 virus. Therefore, this generational segment is more likely to take precautions to avoid infection (WHO, 2020). Third, within society, Gen X forms the backbone of the family as they often have children and care for the elderly, thus playing a bonding role between other generations (Blue@Work, 2020). This, combined with Gen X's tendency to help their parents review their finances as they are considered a financially savvy group (Brannan, 2019). Fourth, although (Abu Daqar et al., 2020) have argued that Millennials, people born between 1980 and 2000, and Gen Z, people born after 2000, are the main drivers of the FinTech industry and they have the highest willingness to use technology in their activities. However, other studies have found that Gen X can also adopt technology (Calvo-Porrall and Pesqueira-Sanchez, 2019; Walker, 2019). This generational segment uses technology in their personal and professional lives. According to studies, Gen Xers are among the most popular users of social media and are also the most connected to their smartphones: They spend 21 h per week on their devices, compared to only 19 h for Millennials (Brannan, 2019). Finally, findings from OCED's Financial Literacy Report study in 26 countries around the world, including Hungary, showed that respondents who were able to use digital

devices had significant levels of financial knowledge, attitudes, education and well-being. The same report also showed that Gen X was among the group with the highest levels of financial knowledge (OECD, 2020; Anastasia et al., 2019). This suggests that Gen X in Hungary can engage with FinTech solutions introduced by providers because they are financially enlightened, educated and develop high attitudes toward financial products.

Several studies have addressed factors that influence consumers' intentions regarding mobile payment adoption (Abrahão et al., 2016; de Luna et al., 2019; Kim et al., 2010; Liébana-Cabanillas et al., 2020; Nguyen et al., 2016; Shankar and Datta, 2018; Singh et al., 2020). However, to our knowledge, there are no studies that have examined factors that may influence Gen X's intentions in adopting mobile payments during the COVID-19 pandemic. The authors point out the current research gap in this area: 'There is a gap between what we know about Gen X and the factors contributing to their payment behavior.'

This paper aims to contribute to the literature by using the extended technology acceptance model to investigate the effects of subjective norms (SN), perceived ease of use (PEOU), perceived usefulness (PU) and perceived COVID-19 risk (PC19R) on the behavioral intentions (BI) of Gen X in Hungary to adopt mobile payments.

After this introduction, Section 2 describes the background of research on FinTech and Gen X. Section 3 explains how hypotheses are developed and variables are measured. Section 4 identifies the hypotheses to be tested, and Section 5 provides the discussion and implication about the behavioral intentions of Hungarian Gen X to use FinTech mobile payment services under the influence of COVID-19. The closing Sections 6 and 7 provide concluding remarks as well as limitations and future directions.

2. Background and hypothesis development

2.1. Reality of FinTech industry in Hungary before the pandemic

Over the past decade, banks and FinTech companies have invested heavily in digitizing their banking services, leading consumers to use them instead of traditional banking services such as ATMs and bank branches (Giatsidis et al., 2019). In 2018, Deloitte Center for Financial Services surveyed 17,100 banking customers from 17 different countries to measure the current level of digital engagement. The results show that customers have a high intention for digital banking engagement. However, ATMs and branches are still the first choice of bank customers to withdraw cash and do their banking transactions (Deloitte, 2018).

The Hungarian payment system is dominated by cash. According to Magyar Nemzeti Bank, about 80% of payments were made with cash in 2019 (Hergár, 2019). Meanwhile, the increase in the average transaction value per user is noticeable in digital payments. According to reports, digital payments will reach an average value of US\$869 per user in 2020, compared with US\$728, US\$752, and US\$756 in the previous three years (Statista, 2020b). Moreover, Statista, a company specializing in market and consumer data, predicted that the total transaction value of digital payments in Hungary will reach US\$4.225 billion in 2020 (Statista, 2020b).

To drive the FinTech industry forward, Hungary should make more efforts to promote financial inclusion. Reportedly, about 74.7% of Hungarians have a bank account (Brusnahan, 2019). Besides, internet and smartphone penetration rates are considered important prerequisites for adopting FinTechs and the main factors for financial inclusion (Lewan, 2019). In Hungary, the penetration rate of Internet users was 76.87% and that of smartphone users was 74.19% in 2020, and they are expected to reach 80.25% and 85%, respectively, by 2025 (Johnson, 2020; O'Dea, 2020).

2.2. 'Generation X', the need for FinTech mobile payment services during the pandemic!

Calvo-Porrall and Pesqueira-Sanchez (2019) argue that age is one of the main factors influencing the level of engagement with technology. However, studies suggest that Gen X moves toward digital adoption in a similar pattern to Gen Z and Millennials. Based on a Pew Research Center survey to measure the level of technology adoption among different generations in the United States, the research found a significant growth in technology adoption with age. More precisely, it reaches about 90% in Gen X (Amily, 2019). In Europe, the situation is not much different, as the Global Web Index report shows a significant increase in smartphone usage among Gen X. The report also states that the reason for this adaptation is that most Gen X members are busy professionals, most of them have families and often have significant purchasing power.

Moreover, such a rigorous lifestyle and the limitation of available time for Gen X make the use of digital services a useful and quick tool for conducting their daily professional and business activities (Mander and Valentine, 2019). However, the level of financial literacy and knowledge is a critical factor for Gen X in terms of adopting FinTech services. A study by Anastasia et al. (2019) found a high level of financial knowledge among Gen X and Millennials, while it was low among Baby Boomers. The study cites the reason that both Gen X and Millennials grew up in a relatively similar technological age and most of them are well educated. As a result, Gen X is able to take steps toward adopting digitized financial services. It is the matter of circumstances, though, whether the financial literacy (i.e. the knowledge of digital services) is then to be turned into financial decisions positively affecting the individual's wealth (the latter is referred as financial awareness).

COVID-19 affected individuals of varying ages around the world. However, the complications of the disease varied between different generations. For example, baby boomers, individuals born before 1965, have a higher risk of disease complications. Interestingly, Gen X is considered the generation most likely to adhere to social distancing measures (Stieg, 2020). Gen X is considered risk averse because they are at an age where disease complications can be fatal. In addition, Gen X is considered the backbone of the family; they often have children who need to be cared for and elderly parents who need help and support (Blue@Work, 2020). Since direct contact with people and surfaces contributes to the transmission of infections, it has become necessary for people to avoid direct contact in their business and banking transactions. Social distancing has a significant impact on digital payments, as measured by the volumes and values of individual transactions (Alber and Dabour, 2020). Online shopping has increased since the beginning of the pandemic (Runkel, 2020). In addition, a study by MasterCard found that 80 percent of customers use contactless cards for their payments. The same report showed that contactless payments have increased 2.5 times in the Asia Pacific region as people seek more secure means for their business transactions (Mastercard, 2020). Nonetheless, online payment can help reduce the risk of exposure to viruses and germs. It is also seen as a valuable source of data for banks, payment platforms and FinTech companies, helping them understand consumer buying patterns.

2.3. Hypotheses development for the proposed model

Researchers have developed several theoretical models to examine the factors influencing consumers' behavioral intentions when using technology. These models include the Theory of Reasoned Action (TRA) by Hill et al. (1977), the Technology Acceptance Model (TAM) by Davis (1989), the Theory of Planned

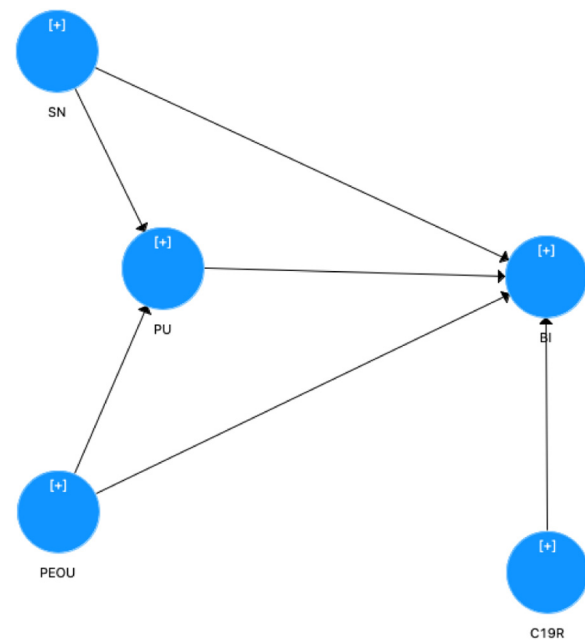


Fig. 1. Research model.

Behavior (TPB) by Fishbein and Ajzen (1991), the Innovation Diffusion Theory (IDT) by Rogers (1995), and others. In this research, we used TAM to assess Hungarian Gen X's intentions regarding mobile payment usage. TAM is one of the most commonly used models in technology adoption research. It is also considered an appropriate model for evaluating consumer behavior in e-commerce payments and the FinTech sector in general (Stewart and Jürjens, 2018). In addition, TAM is mostly used to study the technology adoption of individual consumers (Ajibade, 2019; Zhang et al., 2018).

While the original TAM ignored SN as a predictor of consumers' technology acceptance intention due to its uncertain theoretical and psychometric status, it depended on PEOU and PU as main antecedents of technology acceptance. However, an extension of TAM (TAM2) proposed by Venkatesh and Davis (2000) included SN as a factor that has a direct influence on BI and an indirect influence on PU (Rondan-Cataluña et al., 2015; Varannai et al., 2017).

TAM components have been addressed in various research types related to the COVID-19 effect on technology system acceptance. A study by Koch et al. (2020) examined the relationship between hedonic, utilitarian, and normative motives and Germans' intentions to adopt online shopping during curfew hours. At the same time, C.C and Prathap (2020) found that perceived usefulness mediates the effect of perceived health threat on consumers' intention to continue using mobile-based payments. Moreover, the study by Aji et al. (2020b) showed similar results when examining consumers' intention toward e-wallet. Therefore, we expect this study to make a theoretical contribution to the extended model TAM by adding PC19R to the variables of TAM2 (SN, PEOU and PU) to investigate whether these variables influence Generation X's BI to use mobile payments during the pandemic. The proposed model is shown in Fig. 1.

2.3.1. Perceived usefulness and behavioral intention

PU is the extent to which people believe that using a particular system would improve their activity performance (Davis, 1989). PU is a direct predictor of users' intention to adopt a technology (Al-Marroof and Al-Emran, 2018; Park et al., 2014). In general,

it can be assumed that consumers are more willing to consider or use digitized services that offer them added value, such as efficiency, less effort, and time savings. For example, consumers have found online shopping to be a useful method as it allows them to obtain helpful information and provides a quick shopping experience (Liébana-Cabanillas et al., 2020; Vijayasathya, 2004). Several studies have expressed that there is a positive correlation between PU and consumers' intention to adopt mobile payments (de Luna et al., 2019; Lara-Rubio et al., 2020; Liébana-Cabanillas et al., 2020; Singh et al., 2020). As described above, Gen X are often working and responsible individuals who weigh benefits and costs in their daily decisions. We hypothesize that the PU use of mobile payments, which intensified during the COVID-19 era, positively influences the behavioral intention of Hungarian Gen X to adopt mobile payments. Therefore, we hypothesize the following:

Hypothesis 1 (H1). PU positively affects gen X's BI to use Mobile payments.

2.3.2. Perceived COVID -19 risk and behavioral intention

Bauer (1960) was the first to argue that perceived risks (PR) influence consumer behavior in purchase decisions. Several scholars have discussed that PR has a significant impact on a user's intention to use technology (Hu et al., 2019). In terms of digital payments, most studies have found that "privacy and security" are the primary risk concerns that influence consumers' intention to use mobile payments (Abrahão et al., 2016; El Haddad et al., 2018; Liébana-Cabanillas et al., 2020; Sinha et al., 2019). However, few studies have focused on "disease risk" as a factor influencing consumers' intention to use digital payments. Aji et al. (2020a) reported that the outbreak of COVID-19 negatively affected Indonesian and Malaysian consumers' intention to use physical money. However, it increased the use of e-wallets in their financial activities. In the same context, mobile payment is considered as a preventive health behavior that reduces the possibility of contracting the virus (C.C and Prathap, 2020).

Since the use of cash, banknotes and contact-based payment methods could contribute to the spread of COVID-19, the WHO encourages consumers to use contactless digital payment methods in their financial activities (Durr, 2020). Based on the current literature and reports from government and healthcare organizations, we hypothesize that PC19R will have an impact on BI Hungarian Gen X to use mobile payments for their shopping and banking activities. Therefore, we propose the following hypothesis:

Hypothesis 2 (H2). PC19R positively affects BI of gen X to use Mobile payments.

2.3.3. Perceived ease of use (PEOU), perceived usefulness, and behavioral intention

Perceived usefulness and perceived ease of use are considered critical predictors that can influence users' technology acceptance intention (Davis, 1989). PEOU refers to freeing the system from complexity and making it more user-friendly (Olumide, 2016). More specifically, PEOU is described as the level of comfort and confidence users feel when learning and using FinTech services (Hu et al., 2019). Moreover, there is a significant positive relationship between PEOU and intention to use technological services, including FinTech mobile payment services (Abrahão et al., 2016; Kim et al., 2010; Nguyen et al., 2016; Shankar and Datta, 2018). However, other studies such as Oliveira et al. (2016) failed to significantly influence PEOU on BI to use mobile payments.

Nevertheless, PEOU is significant for the expected usefulness of adopting mobile financial services (Kim et al., 2010; Raza et al.,

2017a). Such a positive correlation between PEOU and BI arises from considering that ease of use is considered beneficial (Davis, 1993). Based on the literature, we hypothesize that the PEOU of mobile payments will positively influence Hungarian Gen X's behavioral intentions to use mobile payments. They will find it useful and beneficial during the pandemic COVID-19. Therefore, we hypothesize the following:

Hypothesis 3 (H3). PEOU positively affects BI of gen X to use mobile payments.

Hypothesis 4 (H4). PEOU is positively related to PU.

Hypothesis 5 (H5). The relationship between PEOU and BI to use Mobile payments is mediated by PU.

2.3.4. Subjective Norms (SN), perceived usefulness, and behavioral intention

SN is an important behavioral intention in TRA and TPB (Hill et al., 1977; Fishbein and Ajzen, 1991). It is a construct related to social influence (Davis, 1989). SN's importance in the field of technology acceptance is that TRA provides a primary theoretical basis for TAM theory development (Momani and Jamous, 2017). While the original TAM did not consider SN (Davis, 1989; Malhotra and Galletta, 1999) argued the importance of including subjective norms/social factors in TAM, before adding SN to TAM2 the following year. In the context of mobile payments, SN can be defined as the extent to which individuals are influenced by their social environment (family, friends, experts, celebrities) to view mobile payments as more desirable (Flavian et al., 2020). Such influence is often described as opinions/views shared with the individual either face-to-face or through other means of communication such as social media interactions (Al Nawayseh, 2020; Oliveira et al., 2016). Schepers and Wetzels (2007) conducted a meta-analysis to investigate the role of SN in TAM. They reported that a significant influence of SN on PU was found in 91.67% of the articles studied, which used in TAM. PU was also found to mediate the relationship between social image and Chinese consumers' intention to use a Facial-Recognition Payment system (Zhang and Kang, 2019).

Xie et al. (2011) argued that during dangerous circumstances such as SARS, individuals' behavior is influenced by the social environment. News, safety measures, and concerns from COVID-19 often disseminated through traditional media sources, social media, or other means, lead to serious changes in the way people in Hungary and the rest of the world perform their usual daily activities. Koch et al. (2020) found that expert opinions and media reports directly influenced consumers' behavioral intentions regarding online clothing purchases during the COVID-19 pandemic. In addition, a study by Revathy and Balaji (2020) found that social influence encouraged Indian customers to use e-wallets during the COVID-19 outbreak. It also focused on the role that family, friends and peers played in raising awareness about the risk of physical transactions and the priority to avoid them during the pandemic. In this study, we hypothesize that such communication forms to share information and concerns about the current pandemic represent SN that influence individuals' decisions when it comes to conducting their daily business transactions. More specifically, we predict that SN will influence Gen X BI, leading them to use security measures such as mobile payments instead of cash. Therefore, we hypothesize the following:

Hypothesis 6 (H6). SN positively affects BI of gen X to use Mobile payments.

Hypothesis 7 (H7). SN is positively related to PU.

Hypothesis 8 (H8). The relationship between SN and BI to use Mobile payments is mediated by PU.

3. Methodology

3.1. Data collection

We conducted an empirical study to test the constructs that may influence Gen X's behavioral intention in Hungary to use mobile payments in light of the circumstances of COVID-19. For this purpose, we developed a questionnaire consisting of five constructs: SN, PEOU, PU, PC19R, and BI. Similar to [Giatsidis et al. \(2019\)](#) and [Hu et al. \(2019\)](#), we used the five-point Likert scale from (1, strongly disagree) to (5, strongly agree) to capture personal behaviors in a digitized environment. Before sharing the questionnaire and sending it to the target group, we conducted a pilot study with 50 people. The results showed evidence of the validity and reliability of the instrument used.

Our study conducted a survey with the adult Hungarian population and followed the OECD International Network Financial Education to ensure representativeness ([Sági and Lentner, 2019](#)). The distribution of the survey and data collection were influenced by the communication restrictions of COVID-19 and nationwide blocking in Hungary. The survey was distributed through various social networking platforms. A total of 1120 responses were withheld and analyzed as they met the approved criteria and were the target audience of this research. Microsoft Excel, SPSS and SmartPLS 3.3.2 were used for data collection and analysis. The demographic data in [Appendix A](#) shows that 53.9% of the respondents were male and 46.1% were female. Fifty-six percent of the respondents had a bachelor's degree, and 22.8% had a master's degree or higher. The educational level of the respondents varied. The majority of the respondents, 69.2%, are employed, 16.4% are self-employed, and the remaining 14.4% do not have a job.

3.2. Common Method Bias (CMB)

As the data were collected from the same respondents using an electronic questionnaire survey, possible common method bias (CMB) may have occurred. CMB is a systematic covariation that adds to the true relationships between scale items and biases the tested relationships between constructs ([Malhotra et al., 2006](#)). CMB arises from the possibility that the relationship between constructs is inflated, which can create systematic covariation across the relationship of scale items ([Malhotra et al., 2017](#)). Therefore, researchers adopted a multi-pronged approach to address the CMB problem. First, the researchers included unrelated variables in the survey to ensure that respondents' attention was secured. Then, the researchers tested the model for common method bias (CMB) using Harman's one-factor. Harman's one-factor test indicates whether a single factor is responsible for most of the data variance. In general, if a single factor accounts for less than 50% of the variance, there is less potential for a CMB ([Rodríguez-Ardura and Meseguer-Artola, 2020](#)). The results showed that the total variance explained by one factor was 41.69%, which is below the threshold for CMB. Finally, the CFA marker variable technique was also applied to test for the presence of CMB, a test that can also be effective in correcting method bias and detecting CMV ([Lindell and Whitney, 2001](#)). [Williams et al. \(2010\)](#) pointed out numerous advantages of the CFA marker test, including the ability to model CMV at the item level, the ability to model random error between the marker variable, the ability to account for substantive constructs, and the ability to account for congenetic and non-congenetic

CMV ([Richardson et al., 2009](#)). Therefore, the researchers performed two-stage least squares (2SLS) bootstrapping to estimate the model's robustness after the marker variable was included in the model. The results showed that the correlation coefficient between the unrelated theoretical variable and the model constructs was low. Moreover, the results showed that adding the marker variable to the model resulted in slight changes (1%) in the variance R^2 that explained consumers' behavioral intention. Thus, the results provide evidence for the absence of CMB.

4. Results

Structural equation modeling (SEM) was used to test the hypothesis. Partial Least Square (PLS) SEM was used as the parameter estimation method. PLS allows the simultaneous evaluation of different variables within a model ([Lutfi et al., 2020](#)). It is also considered suitable for exploratory research in economic and behavioral science fields ([Hair et al., 2019](#)). SmartPLS 3.3.2 software was used to test the research hypotheses. The data were analyzed in 2 stages, starting with the measurement model and followed by the structural model.

4.1. Measurement model

To test the model, a Confirmatory Factor Analysis (CFA) was initiated to determine if the constructs' measurements were consistent with the hypothesized measurement model ([Brown, 2007](#)). The scale included tests of reliability and validity of the data.

Reliability refers to the consistency and stability of the scale results ([Heale and Twycross, 2015](#)). To test item loadings, indicators with loadings above 0.70 were considered acceptable based on the item reliability scale ([Hair et al., 2019](#)). According to the data in [Table 1](#), all items were considered acceptable. In addition, Cronbach's alpha and composite reliability (CR) were used to assess the data's internal consistency reliability. Constructs with CR above 0.70 and Cronbach's alpha above 0.80 are more likely to have good internal consistency ([Fornell and Larcker, 1981](#)). This also confirms that all constructs have achieved the required level of consistency.

To estimate the validity of our model results ([Borsboom et al., 2004](#)), we included the parameters of convergent validity (CV) and discriminant validity (DV). To assess CV, we used the average variance extracted (AVE) and considered constructs with values above 0.50 ([Hair et al., 2019](#)). As shown in [Table 1](#), the results indicate that all constructs exceeded the CV scale's minimum level. However, we also used the DV to ensure that the constructs' measures differed from each other and that there was no correlation between the constructs. [Fornell and Larcker \(1981\)](#) suggested that the value of AVE of a particular construct should be above its correlation with the other constructs. [Table 2](#) shows that all constructs' values are higher than the squared inter-scale correlation in all constructs, indicating that the DV of all constructs is good. However, [Henseler et al. \(2014\)](#) argue that cross-loading and the Fornell-Larcker approach are inefficient in detecting the lack of discriminant validity; they argue that they have unacceptably low sensitivity. Therefore, they strongly recommend using the heterotrait-monotrait ratio (HTMT) scale to assess discriminant validity in variance-based SEM. The threshold is acceptable if it is less than 0.90 for the similar constructs and less than 0.85 for the distinct constructs. [Table 3](#) shows that all HTMT values are below the threshold.

Table 1
Results of the measurement model analysis.

Constructs	Item loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Subjective Norm (SN)		0.922	0.941	0.762
SN1	0.849			
SN2	0.858			
SN3	0.917			
SN4	0.894			
SN5	0.844			
Perceived Ease of Use (PEOU)		0.857	0.913	0.777
PEOU1	0.903			
PEOU2	0.869			
PEOU3	0.872			
Perceived Usefulness (PU)		0.891	0.924	0.754
PU1	0.86			
PU2	0.868			
PU3	0.862			
PU4	0.883			
Perceived COVID-19 Risk (PC19R)		0.873	0.913	0.725
C19R1	0.888			
C19R2	0.827			
C19R3	0.852			
C19R4	0.837			
Behavioral Intention (BI)		0.902	0.939	0.836
BI1	0.904			
BI2	0.902			
BI3	0.937			

Table 2
Discriminant validity – average variance extracted (AVE) values.
Source: SmartPLS (v.3.3.2).

	BI	PC19R	PEOU	PU	SN
BI	0.915				
PC19R	0.691	0.851			
PEOU	0.616	0.574	0.881		
PU	0.739	0.670	0.737	0.868	
SN	0.516	0.522	0.462	0.487	0.873

Table 3
Discriminant validity – heterotrait–monotrait Ratio (HTMT).
Source: SmartPLS (v.3.3.2).

	BI	PC19R	PEOU	PU	SN
BI					
PC19R	0.776				
PEOU	0.698	0.658			
PU	0.822	0.758	0.841		
SN	0.563	0.579	0.516	0.534	

4.2. Structural Equation Model (SEM)

SEM is a statistical method for examining the relationships between constructs based on their covariance matrix (Hu et al., 2019). After ensuring that the data met the reliability and validity criteria, the next step was to evaluate the structural model by examining the model's explanatory power and the *t*-value of the path coefficients. For this purpose, we tested the collinearity between the constructs and all items to eliminate all items with variance inflation (VIF) above 5 to avoid the problem of collinearity (Hair et al., 2019). Table 4 shows that all items have VIF values less than 5. Therefore, all items of the constructs were retained.

On the other hand, the coefficient of determination (R^2) was used to assess the model's explanatory power. R^2 represents the variance in the endogenous constructs explained by all the associated exogenous constructs. Table 5 shows that the exogenous constructs can interpret 62.9% of the dependent variable's variance (behavioral intention), which can be considered moderate explanatory power.

A full bootstrapping procedure with 5000 samples was used to obtain the standardized path coefficients' statistical significance. Fig. 2 shows the results of the structural model analysis.

Table 4
Variance inflation (VIF) values.
Source: SmartPLS (v.3.3.2).

	VIF
BI	
BI1	2.660
BI2	2.764
BI3	3.617
PC19R	
C19R1	2.578
C19R2	2.080
C19R3	2.155
C19R4	2.020
PEOU	
PEOU1	2.457
PEOU2	2.175
PEOU3	1.955
PU	
PU1	2.409
PU2	2.499
PU3	2.358
PU4	2.574
SN	
SN1	2.543
SN2	2.721
SN3	3.802
SN4	3.412
SN5	2.399

Table 5
Coefficient of determination (R^2) values.
Source: SmartPLS (v.3.3.2).

	R square	R square adjusted
BI	0.629	0.623
PU	0.570	0.567

Table 6 shows that all hypotheses except H3 are supported. The results show that PEOU has an insignificant positive relationship with BI ($\beta = 0.077$; $P > .05$). Simultaneously, it has a significant positive relationship with PU ($\beta = 0.651$; $P < .05$). However, PEOU has an indirect significant positive association with BI via PU ($\beta = 0.275$; $P < .05$). Thus, H4 and H5 are

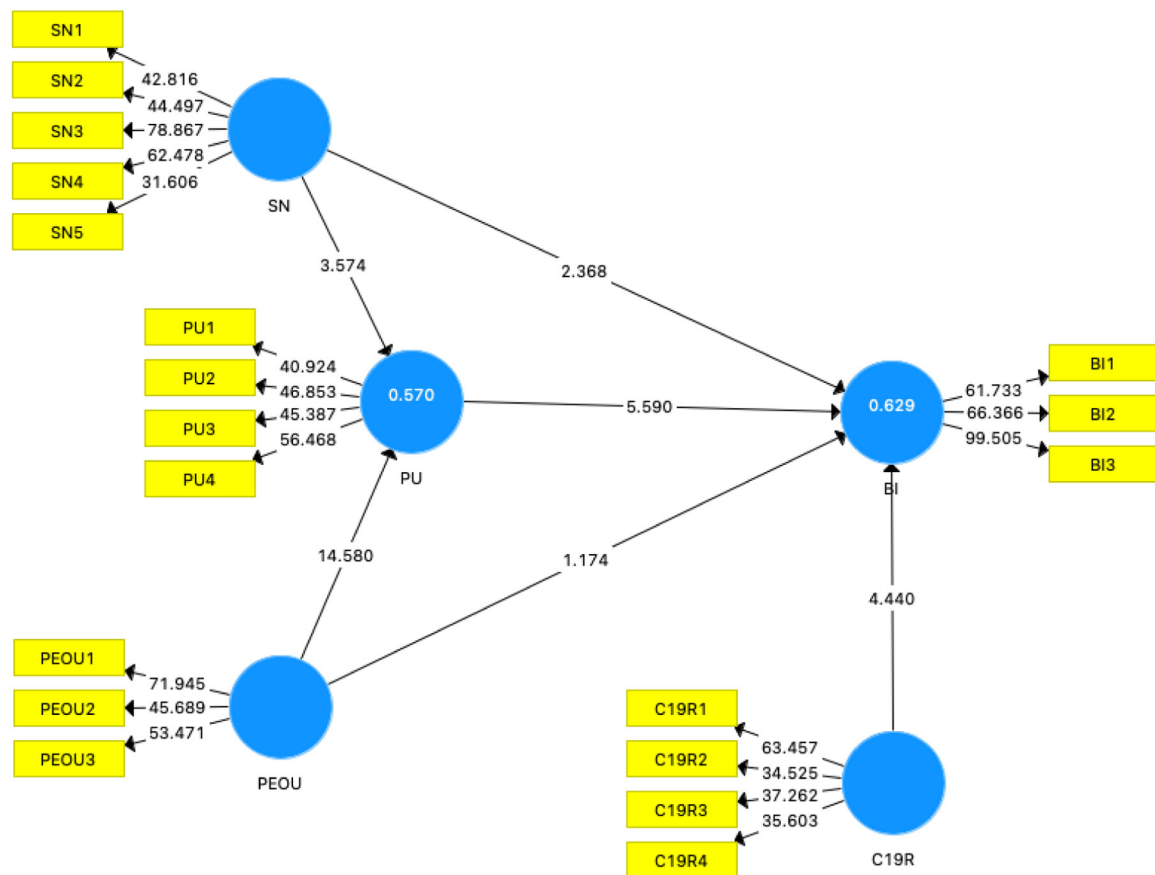


Fig. 2. Hypotheses tests results.

supported while H3 is not. SN has a direct significant positive relationship with BI and PU ($\beta = 0.116$; $P < .05$ and $\beta = 0.186$; $P < .05$, respectively). It also has a significant positive indirect relationship with BI via PU ($\beta = 0.078$; $P < .05$). Therefore, H6, H7, and H8 are supported. In addition, PU has a significant positive relationship with BI ($\beta = 0.422$; $P < .05$). Thus, H1 is supported. Finally, C19R has a significant positive association with BI ($\beta = 0.303$; $P < .05$). Therefore, H2 is supported.

5. Discussion and implications

The world is making steady progress toward a cashless society, aided by the growing proportion of people who have access to the internet and mobile devices (Liébana-Cabanillas et al., 2020). The FinTech industry in developing countries such as Hungary is in its early stages. Among FinTech industries, payment services are the most widespread in Hungary (KPMG, 2020). The Hungarian online market grew by 121% in the first half of 2020, with an estimated 3.35 million Hungarian online shoppers during this period (Horák, 2020). This is not surprising considering the impact of the COVID-19 crisis on people's daily lives and behavior. Such an impact on consumer buying behavior is attributed to the influence of pandemic news and reports, as well as the sharing of information from the surrounding community such as family, friends, etc. Therefore, mobile payment was used to conduct financial transactions while reducing the risk of the virus.

This empirical study's objective was to evaluate the factors influencing Hungarian Gen X's behavioral intentions to use FinTech mobile payment services during the pandemic COVID-19. We conducted an electronic questionnaire-based survey among

1120 individuals in the Gen X age group to achieve this objective. Structural Equation Modeling (SEM) was used to analyze the eight hypotheses developed based on the research's conceptual model. The study results showed that PU, PC19R and SN are factors that directly influence BI of Hungarian Gen X to use mobile payments. The study also found that perceived ease of use of mobile payments indirectly influences BI of Hungarian Gen X via PU.

Our results show that perceived usefulness has the most significant influence on Gen X's intention to adopt mobile payments. Social distancing and full and partial blocking led Hungarian consumers to adopt mobile payments as a useful alternative. Moreover, mobile payments benefit Gen X by reducing the time, cost, and effort required to complete such transactions. Our findings are consistent with Al Nawayseh (2020) study, which reported that PU is the most important factor influencing the use of FinTech applications by Jordanians BI during the pandemic. Another study found that PU in Germany's online shopping was an important influencing factor during the outbreak, as consumers viewed online shopping as a useful substitute for in-store shopping (Koch et al., 2020).

The results showed that PC19R directly influences the BI of Hungarian Gen X when it comes to using mobile payments, as they are afraid of catching and spreading the virus. According to public health reports, Gen X is one of the generational segments that fall into a higher risk category for COVID-19 infection and health complications due to their age and active professional role in society. In addition, Gen X is often described as the generational segment of society who are responsible and concerned about their well-being and that of the people around them, such

Table 6

Hypotheses results.

Source: SmartPLS (v.3.3.2).

No.	Relationship	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Direct						
H1	PU → BI	0.422	0.426	0.073	5.795	0.000
H2	PC19R → BI	0.303	0.303	0.066	4.580	0.000
H3	PEOU → BI	0.077	0.073	0.064	1.211	0.226
H4	PEOU → PU	0.651	0.647	0.046	14.230	0.000
H6	SN → BI	0.116	0.117	0.049	2.385	0.017
H7	SN → PU	0.186	0.189	0.050	3.721	0.000
Indirect						
H5	PEOU → PU → BI	0.275	0.276	0.053	5.184	0.000
H8	SN → PU → BI	0.078	0.080	0.023	3.343	0.001

as children and the elderly. Considering that using cash has been described as a vehicle for the spread of viruses (WHO, 2020; Daqar and Daragmeh, 2021), it is understandable and logical that Gen X would consider switching to cashless transactions. Overall, our findings are consistent with other studies and reports that point to the need to replace cash and direct contact payment methods with contactless digital payments (Aji et al., 2020a; Auer et al., 2020; C.C and Prathap, 2020; Durr, 2020).

The survey results showed no significant direct impact of PEOU on BI of Hungarian Gen X mobile payment usage. Such results have also been reported by other studies (Daştan and Gürler, 2016; Liébana-Cabanillas et al., 2014; Oliveira et al., 2016). This can be interpreted by the reasonable level of smartphone and internet penetration in Hungary. This implies that Hungarian Gen X has no significant difficulties in using mobile payments and the barriers to adopting such payment methods have been removed. This is supported by previous studies that argued that PEOU has a significant impact on BI and is observed only in early technology adoption periods. In later periods, users take such services for granted and the effort required to use them is minimal (Liébana-Cabanillas et al., 2020; Venkatesh et al., 2003).

Nevertheless, we argue that PEOU has an indirect effect on BI of Hungarian Gen X to use mobile payments via PU. Based on our results, PEOU is significantly and directly associated with PU, a factor that directly influences BI. Previous studies have also shown that PEOU has a significant relationship with PU (Davis, 1989; Meyliana et al., 2019; Raza et al., 2017b). This simply suggests that if Gen X feels that it is easy to use mobile payments, they will perceive them as useful. Overall, our statistical results suggest that the influence of PEOU on BI is entirely mediated by perceived usefulness, which can be explained by the lower effort required to learn and use mobile payments. This may raise Gen X's expectations of the potential benefits and performance of mobile payments adoption.

SN significantly influences the intention of "Gen X" to adopt mobile payments. The results are consistent with pre-pandemic (Liébana-Cabanillas et al., 2014; Oliveira et al., 2016), and post-pandemic studies (Koch et al., 2020; Xie et al., 2011). The result also shows that SN is significantly associated with PU, similar to previous studies (Aji et al., 2020b; Koenig-Lewis et al., 2015). Sathye et al. (2018) found that PU mediates the influence of SN on BI. Following Sathye's analysis, we argue that if Hungarian family members and friends adopt a mobile payment system, this will add value to the mobile payment system's spread as they will influence others to use it. This is done by sharing information and views about the risks, costs and benefits of using such types of services. More specifically, the pandemic and adherence to social distancing forced people to rely more on social media and other forms of communication to exchange opinions and share information. We believe that family, friends,

influencers, celebrities, health professionals, and others influence consumers' views and behaviors through various communication channels. The influence of SN on BI was evident in our study, as most respondents who adopted mobile payments mentioned the influence of people they considered important to their decisions. The influence of SN on BI of consumers during COVID-19 crisis is expected as previous studies before COVID have shown that this relationship is significant during the crisis (Boomgaarden et al., 2011; Koch et al., 2020; Mason et al., 2020).

Currently, the future of epidemiological characteristics of COVID-19 is still unclear. Nevertheless, we now know that it has a clear and profound impact on consumer behavior (Mason et al., 2020). It prompts individuals to avoid activities that could jeopardize health and safety. Therefore, our study provides significant managerial implications for financial institutions and retailers to formulate payment marketing strategies based on expected consumer behavior changes.

Banks, along with FinTech companies and retailers, are suggested to develop campaigns that increase consumer awareness of the use and potential benefits of FinTech mobile payment services (Sági et al., 2020). Financial inclusion remains essential to improve access to finance and support vulnerable individuals and households during the COVID-19 crisis (Ozili, 2020). We also suggest that mobile payment service providers adopt electronic payment applications that are easy to use and compatible with Gen X technological capabilities. Since the average age of the Hungarian population is in the 40s, making them part of the Gen X segment, banks and FinTech companies have a responsibility to promote financial inclusion in this segment. Therefore, they can leverage the high financial literacy of Gen X and the adequate penetration of the internet and digital devices among Hungarians to offer financial and banking services through digital channels, which can improve access to financial and banking services for the financially underserved Hungarian population in general and Gen X in particular.

COVID-19 has led to an exponential increase in social media users due to remote work and constraints (Medve, 2020). Therefore, mobile payment providers should target their campaigns to online social media to increase user numbers. Moreover, the study results provide decision makers with additional arguments for FinTech solutions to promote social distancing imposed to control the virus's spread. The adoption of mobile payments by older adult consumers reduces the need to go to stores to buy their supplies, which reduces direct contact with potentially infected individuals. It also reduces the need for physical money, which is seen as an intermediary for transmitting the virus. Therefore, policy makers should encourage Gen X to use mobile payments as a "healthy financial tool" during the pandemic. The Hungarian government is suggested to promote the efficient functioning of the financial market by stimulating competition

and encouraging financial innovation, and the establishment of the necessary payment systems infrastructure. In addition, it also recommended to induce policies and regulations that will encourage financial institutions to offer new and innovative transaction tools such as mobile banking, e-Wallets, branchless banking, etc.

This study has made a theoretical contribution to understanding the factors influencing mobile payments' adoption during COVID-19. Our research has confirmed that health threat plays a role in encouraging consumers to adopt mobile payments during the pandemic. Therefore, we consider adopting mobile payments during this phase as a health-protective behavior that is a necessity.

6. Conclusion

The purpose of this empirical study was to examine the factors that influence Hungarian Gen X intention to make digital payments during the COVID-19 pandemic. The direct and indirect effects of subjective norms, perceived ease of use, perceived usefulness, and perceived COVID-19 risk were assessed to examine their influence on Gen X's behavioral intention to use digital payments.

The study found that all variables had a significant effect on BI except PEOU, which had an indirect effect. PU was seen as a mediator for the indirect effect of PEOU on BI. In contrast, PU was also a partial mediator of the effect of SN on BI. Overall, all of these factors contributed to Hungarian Gen X's use of digital payments during the COVID-19 pandemic. The inclusion of the physical risk of COVID-19 in the technology acceptance model represents a theoretical contribution to the literature. Finally, our study provides practical implications for FinTech payment services during crises such as COVID-19.

Given that Hungary's financial services sector is largely under foreign control and faces similar challenges raised by the diffusion of FinTech solutions in the context of the pandemic, our findings may have implications for policy makers in other countries where financial inclusion of Gen X is a priority. As the pandemic continues to reinforce changing payment habits. We believe that COVID-19 has increased society's acceptance of smart payment solutions and influenced Gen X intentions by raising awareness of the risks associated with traditional payment methods.

7. Limitations and future directions

Our study focused on the physical risk of becoming infected when using non-digital means of payment. Future studies should also consider other risks such as privacy risk, financial risk, and security risk. In addition, the study did not examine the moderating influence of Gen X demographic characteristics such as gender, income, and education level. For further research on mobile payment usage, we propose considering these factors along with respondents' place of residence (i.e., rural/urban), household type (i.e., single without children/single with children/married with children/etc.), and employment status. According to the research model proposed by Allada and Dubey, these factors can be included as control variables to test the degree of their influence on Gen X behavior patterns (Allada and Dubey, 2014). Finally, future research should include longitudinal studies comparing digital payment adoption before, during, and after the COVID-19 pandemic.

Appendix A

	N	%
Sex		
Male	604	53.9
Female	516	46.1
Total	1120	100%
Education level		
Secondary school	236	21.1
Bachelor	628	56.1
High studies	256	22.8
Total	1120	100%
Education level		
Employee	775	69.2
Self-employed	184	16.4
Unemployed	161	14.4
Total	1120	100%

Appendix B

Subjective Norm (SN), [Hill et al. \(1977\)](#)

1. People who are important to me (e.g., family, friends, celebrities, and experts) think I should use mobile payment.
2. People whose opinions I value are prefer me to use mobile payment.
3. People who are important to me support me to use mobile payment.
4. People who are important to me would recommend me to use mobile payment.
5. People who are important to me influence my decision to use mobile payments.

Perceived Ease of Use (PEOU), [Kim et al. \(2010\)](#)

1. Learning to use the mobile payment is easy for me.
2. My interaction with mobile payment procedure would be clear and understandable.
3. It would be easy for me to become skillful at using the mobile payment.

Perceived Usefulness (PU), [Davis \(1989\)](#)

1. using mobile payment would enable me to pay more quickly.
2. using mobile payment make it easier for me to conduct payments.
3. using mobile payment would be advantageous rather than traditional payment methods (cash/contact payments).
4. I would find mobile payment a useful possibility for paying.

Perceived COVID-19 Risk (PC19R), [Aji et al. \(2020a\)](#)

1. I am worried to get infected by coronavirus when using physical cash and contacted financial services.
2. I am not comfortable making payment using physical cash and contacted financial services.
3. I am afraid to get infected by coronavirus when using physical cash and contacted financial services.
4. I am worried there is a coronavirus droplet in physical cash and contacted payment methods.

Behavioral Intention (BI), [Kim et al. \(2010\)](#)

1. Assuming that I have access to the Mobile payment, I intend to use it.
2. I will always try to use mobile payment in my daily life.
3. During the next period I intend to pay for purchases with a mobile phone.

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