
Factors Affecting Mobile Banking Adoption in Poland: An Empirical Study

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Małgorzata Solarz¹, Jacek Adamek²

Abstract:

Purpose: The research purpose of this study is to identify and assess the impact of factors in the adoption of mobile banking services (MB) based on the example of data from Poland.

Approach/Methodology/Design: The following research methods were used, critical analysis of the source literature, the diagnostic survey method and the Technology Acceptance Model (TAM). The empirical data come from the survey research conducted in 2021 using the CAWI (Computer-Assisted Web Interview) method and covering a representative sample of 1.030 Poles.

Findings: The research findings indicate the follows: a/ Self-efficacy shows a significant positive impact on the Perceived risk and Perceived ease of use of mobile banking, b/ Perceived risk presents a significant positive impact on the Perceived ease of use and a significant, however, negative impact on the Actual usage of mobile banking services, c/ Perceived ease of use has a significant positive impact on the Perceived usefulness and Behavioral intention associated with the use of MB, and d/ Perceived usefulness shows a significant positive impact on Behavioral intention, and the latter have a significant and positive impact on the Actual usage of the discussed distribution channel for banking services.

Practical Implications: The practical implications of this study suggest that, the managers of Polish banks should design mobile banking services perceived by their users as friendly, timely, uncomplicated, and safe.

Originality/Value: The originality and value of the research is based on two pillars: (1) this study fills in the research gap in terms of applying the TAM model to analyze the factors having impact on the adoption of MB services by Poles; (2) in this research we intend to use the factor associated with the consequences of this pandemic, which has not been included in the source literature as yet, and which is one of the elements influencing the Perceived risk variable.

Keywords: Banking, mobile banking, consumer intentions, technology acceptance model.

JEL classification: E44, F65, G21.

Paper Type: Research paper.

¹Wroclaw University of Economics and Business; Faculty of Economics and Finance, ORCID ID: 0000-0001-9538-0541, malgorzata.solarz@ue.wroc.pl

²Wroclaw University of Economics and Business; Faculty of Economics and Finance, ORCID ID: 0000-0003-2427-5052, jacek.adamek@Ue.woc.pl

1. Introduction

Innovation technologies create new choices and opportunities that allow companies to open up new channels for offering products or providing services tailored to the needs of their customers. Credit institutions are also aware of the requirement to conduct their business in a manner suited to the convenience of their customers. In recent years, banks have been gradually introducing electronic distribution channels for their services, starting from ATMs, through telephone and online banking, to mobile banking (Alalwan *et al.*, 2016). According to Giovanis *et al.* (2019) mobile banking (MB), also known as m-banking, is one of the recent technology-based financial services provided by banks and other financial service providers, which allows their customers to conduct banking transactions remotely through an application and on a 24 h basis. Mobile banking is defined by Laukkanen and Kiviniemi (2010) in a similar way. These authors approach it as the interaction between a consumer and a bank carried out via mobile devices. Great market potential is attributed to this banking, which results from its high usefulness reflected in its functionality and the possibility of using it at any time and place (Singh and Srivastava, 2017).

The research addressing the problem of mobile banking is the source of information and suggestions conducive to the development of this form of financial intermediation. One of the important areas related to the issues subject to scientific analysis is the identification and assessment of the impact exerted by the respective factors in the adoption of mobile banking services.

In theoretical terms, the presented study aims at filling in the research gap related to applying the TAM model in analyzing factors of mobile banking adoption in Poland, as such studies, conducted on the data representative for Polish society, have not been carried out so far. Another motive in favor of performing research in this area is the change in the conditions for the functioning of elements in the banking system, caused by the effects of the Covid-19 pandemic. For this reason, in our research we intend to use the factor associated with the consequences of this pandemic, which has not been included in the source literature as yet, and which is one of the elements influencing the Perceived risk variable.

The information collected based on the above-mentioned studies has a practical dimension as well. It can be used in management decisions made by bank managers. In the first quarter of 2021, out of 38.21 million Poles, only 14.55 million people (i.e., 38%) actively used banking mobile applications, including 7.23 million of them performing their financial operations via a smartphone alone (Raport NetB@nk Q1 2021). Despite the fact that comparing to the first quarter of 2020, an extensive increase in the number of mobile banking users was observed, i.e., by 17.52%, still many Poles (i.e., 62%) remain outside the area of banking based on mobile access channels. Changing this situation requires, i.a., identifying the motives underlying

the use of mobile banking services, which is why the results of our research can be used by managers to develop a consumer-friendly offer of banking products.

Having the above in mind, the primary research objective of this study is to identify and assess the impact of factors related to the adoption of mobile banking services based on the example of data from Poland.

The application of the following research methods facilitated carrying out the research purpose of the paper, critical analysis of the source literature, descriptive and comparative analysis, diagnostic survey method and the Technology Acceptance Model (TAM). The empirical data necessary to perform the analyses come from the Polish nationwide survey research conducted in 2021 using the CAWI (Computer-Assisted Web Interview) method on a representative sample of 1,030 Poles. The structure of the paper has been organized as follows. First, the source literature review is provided, to be followed by the research model and the adopted hypotheses. The methodology and the presentation of the research findings along with the discussion make up another component of the study. Theoretical and practical implications are included in the last section of the paper.

2. Literature Review

2.1 Technology Acceptance Model

The studies addressing determinants for the acceptance of new technologies, including banking technologies, are based on a wide set of theories deriving from the disciplines related to human behavior as well as the research on information systems and information technology (Alalwan *et al.*, 2016). As pointed out by Shaikh and Karjaluoto (2015), in the research covering the problem of the adoption of mobile banking, as the manifestation of technological progress in the operations of financial intermediaries, 11 different theories, models and conceptual frameworks are applied including, e.g.: Technology Acceptance Model (TAM), Innovation Diffusion Theory (IDT)/Diffusion of Innovation Theory (DOI), Elaboration Likelihood Model (ELM), Self-service Technology Attitude (SSTA)/Intention to Use Model (IUM), Task Technology Fit (TTF), Theory of Planned Behavior (TPB), Unified Theory of Acceptance and Use of Technology (UTAUT), Information System Success Model (ISSM), Ubiquitous Computing Framework (UCF), Benefit Cost Framework (BCF), Rasch Measurement Model (RMM) and Self-developed Model (SDM). Through their application, these tools create a theoretical background for the isolation and analysis of the factors and premises underlying the decision to adopt a mobile distribution channel for banking services.

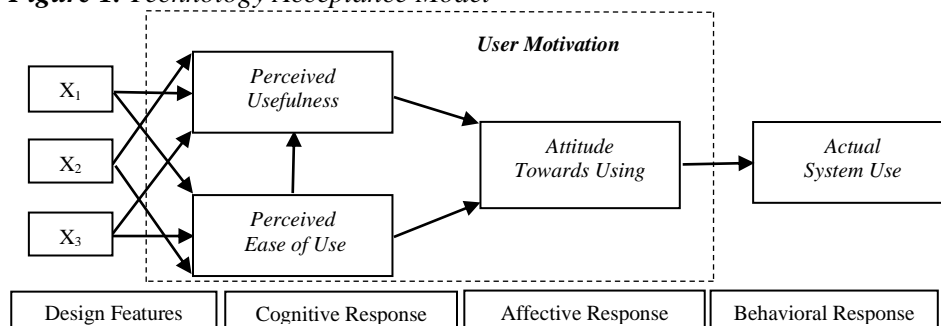
A review of contemporary studies discussing the adoption of mobile banking (Shaikh and Karjaluoto, 2015), (Shau and Deshmukh, 2020), (Souiden *et al.* 2021) and the bibliometric data available, e.g., on the Google Scholar platform indicate

that TAM (including its modifications) takes a leading position in the aforementioned set of research theories and models. This model is considered to be a widely used theoretical foundation for identifying and analyzing the intentions underlying the adoption of modern banking technologies, including mobile banking.

For example, based on, e.g., the Google Scholar indications, by the end of June 2021, 60,503 citations of the original paper by Davis and his colleagues (1989) were recorded, where they presented the assumptions and practical verification of the TAM model. The authors of the research focused on the analysis of the publication output regarding the acceptance of mobile banking highlight a strong, numerical dominance of TAM in the total number of used theories, models or conceptual frameworks verifying the intentions of such behavior. According to Shaikh and Karjaluoto (2015), out of 55 scientific papers addressing the problems discussed here (prepared in the period 2005-2014), in as many as 23 (42%) the TAM model was used as the theoretical basis for the conducted analyzes. A higher, i.e., 47% percentage of such a share in the analyzed source literature from the period 2005-2019 was indicated by Souiden, Ladhari, and Chaouali (2021). These numbers prove both high popularity and usefulness of this concept in explaining customer decisions combined with the use of mobile banking.

In its essence, TAM is based on the Theory of Reasoned Action (Fishbein and Ajzen, 1975) to examine the factors having impact on the intention to accept or reject information technology by its users. The concept of this model, proposed by Davis (1985), is based on the assumption that the decision to apply a new information technology by its user remains a behavioral response which can be explained or even predicted, based on its motivation influenced, in turn, by external stimuli resulting from the actual features and capabilities of technology. Following the above premise, Davis developed a conceptual model (Figure 1) explaining the motivations of an information technology user through three main factors, in the form of Perceived ease of use (PEOU), Perceived usefulness (PU) and Attitude towards usage (ATU).

Figure 1. Technology Acceptance Model



Source: Davis, 1985, p. 24.

The author of TAM model adopted as follows:

- the user's attitude towards the applied technology (ATU) is the most important determinant of their decision to use it or reject it,
- the user's attitude towards the applied technology (ATU) is, in turn, influenced by two primary beliefs regarding its perceived usefulness (PU) and ease of use (PEOU),
- the perceived ease of use (PEOU) is an element influencing the perceived usefulness of technology (PU),
- both the perceived ease of use (PEOU) and the perceived usefulness of technology (PU) are influenced by external factors, identified here with the so-called design features.

The presented form of the technology acceptance model was subject to modifications in response to the criticism formulated against its assumptions. For example, questioning the importance of the user's attitude towards new technology (ATU), here mobile banking, for the behavioral intentions associated with its acceptance or rejection resulted in the development of the TAM2 model (Venkatesh and Davis, 2000) and its application in the assessment of factors influencing the intention to adopt mobile banking (Gu *et al.*, 2009; Teo *et al.*, 2012; Chitungo and Munongo, 2013). On the other hand, recognizing that the perceived ease of use and usefulness of the new technology are not able to explain clearly and fully the individual intentions related to the acceptance or rejection of new technologies (Hanafizadeh *et al.*, 2014, Zhou, 2011; Riquelme and Rios, 2010; Wessels and Drennan, 2010) resulted in extending the classical set of factors by other elements, e.g., in the form of perceived trust (Kim *et al.*, 2009; Zhou, 2011), Social influence / Social norms / Subjective norms (Mohapatra *et al.*, 2020), Self-efficacy (SE) (Gu *et al.*, 2009; Luarn and Lin, 2005), facilitating conditions (Püschel *et al.*, 2010), perceived cost of use (Chitungo and Munongo, 2013; Lema 2017), compatibility with lifestyle and device (Chawla and Joshi, 2017; AlSoufi, 2014), perceived risk (PR) (Alalwan *et al.*, 2016; Hanafizadeh *et al.*, 2014; Riquelme and Rios 2010; Shaikh and Karjaluoto, 2015) and Demographic factors (DEM) (Chakiso, 2019; Haider *et al.*, 2018).

The characteristics of selected variables used in the authors' own research model are discussed below.

2.2 Perceived Ease of Use (PEOU)

Davis (1989) defines this variable of the Technology Acceptance Model as the degree to which a person believes that using a particular system would be free of effort. The existing online banking customers expect a similar ease of use of mobile banking. Mobile banking applications that have clear and simple interfaces are more likely to encourage customers to try out the remote channels for providing banking services. The perceived ease of use is defined, i.a., through recognizing the

respondents' opinions on whether they think learning to use mobile banking services is easy and if the interaction with mobile banking is clear and understandable. The review of previous studies indicates that the perceived ease of use significantly influences the people who decide to use the new IT system (Agyei *et al.*, 2020; Akhter, Hossain, and Karim, 2020; Alalwan *et al.*, 2016; Chawla, and Joshi, 2018; Deb and Lomo-David, 2014; Deng *et al.*, 2010; Hanafizadeh *et al.*, 2014; Kazemi *et al.*, 2013; Mehrad and Mohammadi, 2017; Mortimer *et al.*, 2015; Rehman and Shaikh, 2020; Vuong, Hieu, and Trang, 2020). The findings of the cited studies allow concluding that the condition for increasing the adoption scale of mobile banking services is to ensure both simplicity and ease of their use.

2.3 Perceived Usefulness (PU)

Mobile banking has an advantage over the traditional distribution channels of banking services, manifested, i.a., in its time independence, freedom of its usage place, flexibility, speed of access (Mallat, Rossi, and Tuunainen, 2004; Sulaiman, Jaafar, and Mohezar, 2007), confirming its usefulness, understood by Davis (1989) as the belief that using a particular technology would increase the performance. The pace of life makes people more inclined to use innovative solutions, including mobile banking, as long as it enhances productivity with low effort and convenience.

Therefore, one can conclude that users pay great attention to these aspects which they find useful and helpful for the efficiency of their work (Gu, Lee, and Suh, 2009). Efficiency refers to the perceived benefits customers receive in relation to the sacrifice or costs and is approached cognitively as the ratio of benefits and sacrifice (Laukkanen, 2007). Al-Somali, Gholami, and Clegg (2009), Gu *et al.* (2009), Malaquias, and Hwang (2019), Oliveira *et al.* (2014) and Zhou *et al.* (2010) assess the perceived usefulness of mobile banking based on the declarations of its users indicating that it facilitates and accelerates banking activities and increases their efficiency. The source literature review shows that PU is identified as one of the most significant factors having impact on the adoption of mobile banking (Alalwan *et al.*, 2016; AlSoufi, 2014; Silva Bidarra *et al.*, 2013; Chakiso, 2019; Changchit *et al.*, 2017; Deng *et al.*, 2010; Hanafizadeh *et al.*, 2014; Kazemi *et al.*, 2013; Lema, 2017; Luarn and Lin, 2005; Mortimer *et al.*, 2015; Vuong *et al.*, 2020; Wessels and Drennan, 2010).

2.4 Behavioral Intention (BI)

Many studies addressing the determinants of mobile banking adoption are focused on the analysis of factors influencing the behavioral intentions of using it (Giovanis *et al.* 2019; Gumussoy, Kaya, and Ozlu, 2018; Ho, Wu, Lee, and Pham, 2020; Luo *et al.*, 2010; Priya, Gandhi, and Shaikh, 2018; Singh and Srivastava, 2020; Teo *et al.*, 2012; Zhou, 2011). For example, to define these intentions, Zhou (2011) uses respondents' answers to the following questions: Given the chance, I intend to use

mobile banking; I expect to continue my use of mobile banking in the future; I have the intention to use mobile banking to make payments. In turn, Singh and Srivastava (2018), in addition to the declarations on the continued use of mobile banking or increasing the frequency of using digital banking services in the future, ask the respondents whether they are going to strongly recommend using mobile banking to others.

2.5 Actual Usage (AU)

In the context of the research covering the adoption of mobile banking, its actual usage is usually treated as a variable reflecting the actual and/or future frequency of usage of the discussed banking services distribution channel. Tam and Oliveira (2016) indicate that it is important not only to attract the potential users, but also to keep the current ones as a consequence of their experiences. The previously conducted research confirms a positive correlation between the existing customer satisfaction and his post-purchase intention or repurchase, i.e., continuous usage (Kuo *et al.*, 2009; Moon and Kim, 2001). Sharma and Sharma (2019) assessed the actual usage based on the following statements: I have many weekly requirements of m-banking, I use m-banking multiple times in a week, I use m-banking frequently.

Kim, Chan, and Gupta (2007) emphasized that the actual usage is a function of the expectations associated with the desired experiences and the usefulness attributed to mobile banking. Zhou (2013) observed that trust leads to flow, which then brings satisfaction and these two factors together influence the continuous intention to use m-banking and they also suggested that the service providers should improve quality dimensions to enhance users' experience, leading to the continuance usage.

2.6 Self-Efficacy (SE)

Using mobile banking services requires appropriate digital knowledge and skills. Self-efficacy in using mobile devices or applications plays a very important role in the new user's readiness to try out this channel. Self-efficacy is defined as the perception and confidence of individuals in their ability to manage and conduct a set of particular actions needed to achieve specified kinds of performances (Bandura, 1986). Bandura (1977) states that the belief in self-efficacy initiates a specific action, the effort invested in it and its duration, influenced by the encountered difficulties and negative experiences.

In their studies, Compeau and Higgins (1995) proved the important role of self-efficacy in contributing towards increasing the interest of individuals in adopting new technologies, but also in their perception towards the expectations of the outcomes by using such systems. They determined the degree of certainty about the successful completion of the task by asking the respondents whether they would be able to carry out transactions via the mobile banking system on their own, using the

support of third parties, or would they refrain from such a task altogether. Many scientific studies have verified the positive and significant impact of the belief in self-efficacy on the adoption of modern technologies, e.g., Alalwan *et al.* (2016), AlSoufi (2014), Dass and Pal (2011), Giovanis *et al.* (2019), Jeong and Yoon (2013), Kazemi *et al.* (2013), Püschel *et al.* (2010), Ramlugun and Issuree (2014), Singh and Srivastava (2018). Customers will only use mobile banking services if they feel confident and recognize that they have the necessary technical skills, especially that the latest and innovative banking technologies require the customer to conduct the financial transactions on their own, away from any support of the banking staff.

2.7 Perceived Risk (PR)

PR, as a subjective image of risks associated with purchasing decisions, was conceptualized in 1960 by Bauer. According to this author, it means (1960) the combination of uncertainty plus seriousness of the outcome involved. Peter and Ryan (1976) identify PR with the expectation of losses associated with the purchase, which acts as an inhibitor to purchase behavior. Pavlou (2001) interprets this category in a similar way. According to him, PR stands for the consumer's subjective expectation of suffering a loss in pursuit of a desired outcome. The optics adopted by these authors is based on the assumption that each decision to purchase goods or services is associated with the risk ingrained in the uncertainty associated with the achievement of goals underlying the purchase act. Thus, PR is a factor that creates appropriate consumer behavior, as they want to avoid making mistakes, and its level becomes the function of (Mitchell, 1999; Cox and Rich, 1964), the importance of the goals pursued through the purchased good and the subjective weight of the consequences resulting from these mistakes.

Featherman and Pavlou (2003), by approaching PR as a possible loss in the pursuit of the desired result related to the consumption of e-services, state that it influences the decision to accept information systems when it becomes the source of a/ feelings of uncertainty, b/ discomfort and/or anxiety, c/ conflict aroused in the consumer, d/ concern, e/ psychological discomfort, f/ making the consumer feel uncertain, g/ pain due to anxiety and h/ cognitive dissonance. These feelings and the accompanying assessments are derived from the subjective opinions of the potential user related to the broadly understood costs and benefits of consuming e-services.

PR accompanying purchasing decisions made via the Internet, including the use of mobile banking, can be analyzed in many dimensions (Featherman and Pavlou, 2003; Lee, 2009; Hong, 2015; Alalwan *et al.*, 2016; Papas, 2016). The components of this risk most frequently associated with mobile banking are as follows: financial risk, performance risk, privacy risk, psychological risk, time loss risk and social risk (Table 1).

Table 1. Dimensions of the perceived risk in purchase decisions combined with the use of mobile banking

<i>Dimension of perceived risk</i>	<i>Content of perceived risk</i>
Financial risk (FR)	It is associated with the risk of losing financial resources. The security of accumulated funds is treated as one of the most important factors determining the acceptance and use of mobile banking, while the gap between the expected and actual security of new technologies becomes a factor which determines the behavior of potential and current clients of these institutions.
Performance risk (PER)	It refers to working/functioning of the obtained product in a way that ensures meeting the expected needs/functions. It may result from the wrong choice being a consequence of the subjective inability to assess its quality. Information asymmetry and the absence of possibility to test mobile banking services limit the consumer’s ability to make a choice that meets their expectations, thus reducing confidence in the offered products/services.
Privacy risk (PR)	It is connected with the subjective feeling of the risk related to losing confidential information regarding personal data, wealth, family, etc.
Psychological risk (PSR)	The risk that the performance of the product will have a negative effect on the consumer’s peace of mind and the potential loss of self-esteem from the frustration of not achieving the goal of purchase.
Time loss risk (TLR)	The use of online tools as well as acquiring skills to take advantage of these facilities results in the need of proficiency in appropriate techniques, learning which often requires devoting an extensive amount of time, primarily in the case of senior citizens. According to the consumers of mobile banking services, this time may also be taken up by the need of repeating certain operations that were previously performed incorrectly.
Social risk (SR)	It refers to the social environment and its approach to, e.g., new technologies, including the use of mobile banking as a form of access to financial services. For example, in the era featuring the dynamic development of social networks, the expressed opinions and the promoted attitudes, if considered authoritative and desirable, on the one hand, may stimulate/influence purchasing decisions, whereas, on the other, constitute a platform for their evaluation and acceptance by the community members in which the consumer is functioning.

Source: Authors’ compilation based on Lifen Zhao et al., 2008.

A review of the research addressing correlations between the consequences of the Covid-19 pandemic and the pace of mobile and online banking development, carried out, i.a., by Khanra et al. (2021), Moşteanu et al. (2020), Crosman (2020), Baicu et al. (2020), Hoe (2020), Sreelakshmi and Prathap (2020), and the research gap we have noticed regarding the assessment of the impact related to the so-called risk of the Covid-19 pandemic (PAR) on the decisions to adopt mobile banking services, contributed to the inclusion of the above-mentioned risk in the spectrum of hazards

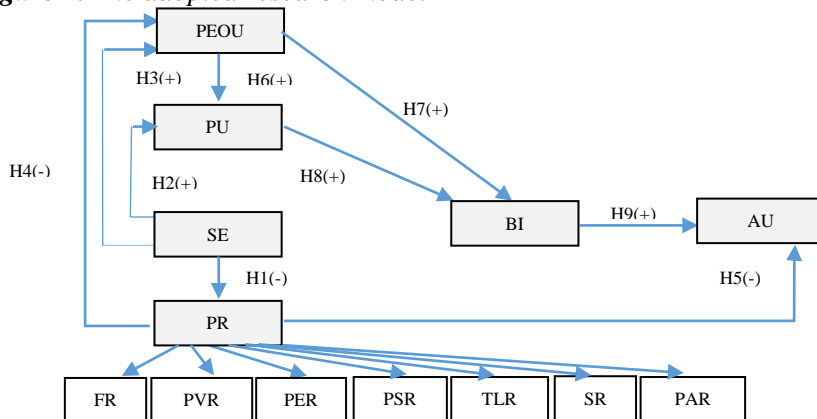
forming a set of the analyzed PR dimensions. In this case, the respondents' opinions will be open to a subjective assessment of the impact exerted by this risk on the behavior of a human being as well as the organizational and legal solutions conducive to the use of mobile banking services.

3. Research Model

In our study, the extended TAM model was used, based on: a/ the analysis and assessment of mutual correlations between such factors as self-efficacy, perceived risk, perceived usefulness, perceived ease of use, and b/ the assessment of the impact of these variables on behavioral intentions, ultimately influencing the actual usage of mobile banking services (Figure 2).

The assessment of the impact of self-efficacy (SE) on the perceived ease of use (PEOU), perceived usefulness (PU) and perceived risk (PR) of using mobile banking is a consequence of the assumption following which (Bandura, 1977) the subjective belief regarding self-efficacy (SE) is observed as an important factor supporting the acceptance of modern technologies, as well as the factor increasing motivation for using it (here combined with the perceived ease of use and usefulness). As indicated by Alalwan *et al.* (2016), people characterized by a high level of self-efficacy (SE) are more likely to perceive the use of MB as easy and useful in their lives. Similar conclusions can be drawn from the research conducted, i.a., by other researchers empirically confirming a significant, direct and positive correlation between self-efficacy (SE) and the perceived usefulness (PU) and the perceived ease of use (PEOU) in terms of MB (Zhao *et al.*, 2008; Singh and Srivastava, 2020; Ali *et al.*, 2021).

Figure 2. The adopted research model



Source: Authors' compilation.

Raising the level of self-efficacy along with confidence in one's own skills becomes a path towards lower level of perceived risk (PR) associated with the application of

modern technologies, including MB (Zhou, 2012; Alalwan *et al.*, 2016). For example, Wolker and Johnson (2006), while attempting to answer the question why people use online banking, telephone payments and online stores, prove that the risk of using these technological achievements perceived by their consumers is the lower the higher the level of positive perception related to their own abilities and skills in using these innovations. Similar conclusions, resulting from the empirical verification of the discussed correlation between self-efficacy and the perceived risk of mobile banking, can be found, e.g., in Kim *et al.* (2009).

Based on the results of the source literature review and searching for an answer to the research question regarding correlations between self-efficacy (SE) and perceived usefulness (PU), ease of use (PEOU) and the risk of using mobile banking (PR) by the studied population of Poles, the following research hypotheses were adopted:

- *H1: Self-efficacy has a significant negative impact on the perceived risk of using MB.*
- *H2: Self-efficacy has a significant positive impact on the perceived usefulness of MB.*
- *H3: Self-efficacy shows a significant positive impact on the perceived ease of use of MB.*

The assessment area analyzed in our research model also addresses the impact of perceived risk (PR) on the perceived ease of use (PEOU) and the actual usage (AU). In this case, we were guided by the premise following which the perceived risk attributed to modern technologies becomes the element naturally influencing the level of their acceptance and usage, both directly and indirectly, shaping, e.g., the perceived usefulness or ease of use of MB (Featherman and Pavlou, 2003; Yang 2009; Lee, 2009; Alalwan *et al.*, 2016). Appreciating the importance of perceived risk for the process of acceptance and use of mobile banking services by both current and potential consumers and searching for answers to the next research question regarding correlations between the discussed factor and the perceived ease of use (PEOU) and also the actual usage (AU) of the above-mentioned form of financial intermediation in Poland, two below hypotheses were formulated:

- *H4: The perceived risk of using mobile banking has a significant negative impact on the perceived ease of its use.*
- *H5: The perceived risk of using mobile banking has a significant negative impact on its actual usage.*

As shown by many previous studies, the perceived ease of use (PEOU) is a factor that significantly and positively affects both the perceived usefulness (PU) and the behavioral intentions (BI) related to the use of new banking technologies. Alalwan *et al.* (2016) argue that the prerequisite for accessing and using mobile banking is

presenting a certain level of knowledge and skills which allow approaching the used digital banking as easy. For this reason, the perceived ease of use (PEOU) plays an important role in noticing the benefits of mobile banking by customers and in developing their willingness towards using this type of technology.

Similar correlations are confirmed in the research conducted by, i.a., Agyei *et al.* (2020), Akhter, Hossain, and Karim (2020), Deng *et al.* (2010), Hanafizadeh *et al.* (2014), Koksal (2016), Sharma, *et al.* (2017). Therefore, by formulating another research question regarding correlations between the perceived ease of use (PEOU) and usefulness (PU) as well as behavioral intentions (BI) related to using MB, we have put forward the following hypotheses:

- *H6: The perceived ease of use of mobile banking has a significant positive impact on its perceived usefulness.*
- *H7: The perceived ease of use of mobile banking has a significant positive impact on the behavioral intentions associated with its use.*

Perceived usefulness (PU) represents one of the main factors in the adoption of new technologies used in the TAM model. Numerous scientific studies covering populations of different countries and discussing various innovative solutions, confirm the significant and positive impact of perceived usefulness (PU) on behavioral intention (BI) in adopting new technologies, including mobile banking.

According to Gumussoy, Kaya, and Ozlu (2018), if users find mobile banking useful, easy and performance enhancing, they will apply it more frequently and more willingly. The findings of the aforementioned researchers addressing Turkish citizens show that the perceived usefulness is the factor exerting the strongest direct impact on behavioral intention related to the usage. This relationship is also confirmed by the research on the adoption factors of innovative financial services conducted, i.a., in Jordan (Alalwan *et al.*, 2016), Vietnam (Vuong, Hieu, and Trang, 2020), Iran (Mehrad and Mohammadi, 2017), Ghana (Agyei *et al.*, 2020) or Australia (Wessels and Drennan, 2010). Therefore, we put forward another hypothesis, the verification of which will allow answering the research question regarding the existing correlations between the perceived usefulness (PU) and behavioral intentions (BI) of MB users:

- *H8: The perceived usefulness of mobile banking has a significant positive impact on behavioral intentions associated with its use.*

The last analyzed correlation is intended to provide an answer to the research question regarding the impact of behavioral intentions (BI) on the actual usage (AU) by the consumer of mobile banking services. An individual's behavior is predictable as it depends on his/her intentions, however, such intentions are not always translated into actual actions or decisions. Venkatesh and Zhang (2010) proved that

behavioral intentions have a significant impact on the application of modern technologies. The research on the adoption of mobile banking services conducted, i.a., by Alalwan *et al.* (2016), Sharma and Sharma (2019), Sripalawat *et al.* (2011) or Yu (2012) resulted in similar conclusions. Hence, we propose the following hypothesis:

- *H9: Behavioral intentions have a significant positive impact on the actual usage of mobile banking services.*

4. Research Methodology

The authors' own research was carried out through the Market and Opinion Research Agency SW Research in April 2021. It was based on the statistical data collected using the CAWI (Computer-Assisted Web Interview) method, on a nationwide sample of 1,030 respondents. The stratified random sampling was used. The swpanel.pl research panel was the sampling operator with over 200,000 active users aged 18+. The maximum statistical error for the entire sample was 3.1 percentage points.

A total of 4,905 invitations were issued, which translated into the rate of return at the level of 21%. The strata were determined based on the combined distribution of gender, age, and size of the place of residence. A total of 40 strata were identified. The obtained sample corresponds to the structure of Poles in terms of the above-mentioned socio-demographic variables.

The research questionnaire was divided into two parts, the first of which concerned demographic information and the second referred to the individualized assessments of the statements used in the construction of factors related to the adoption of mobile banking based on the modified TAM model. The adoption of this model was accompanied by our belief that its use was justified in the assessment of the factors influencing the adoption of new technologies, resulting from the previous analysis of the source literature (Shaikh and Karjaluo, 2015; Shau and Deshmukh 2020; Souiden *et al.*, 2021) when constructing the following variables: Perceived usefulness, Perceived ease of use, Self-efficacy, Perceived risk and Behavioral intention, 24 statements were used, taken from the review of the existing research covering this area and cited earlier in this study.

The answers provided by the respondents were based on a binary scale, in which 0 meant rejection of the statement and 1 its acceptance. In addition, the variables measured on an ordinal scale (AU) (E) and also a quotient variable (AG) was used in this model. The model was tested through a principal component analysis (PCA) and a structural equation model (SEM) analysis. The conducted analyzes were supported by R package with lavaan (Rosseel, 2012), semPlot (Epskamp, 2019) and semTools (Jorgensen *et al.*, 2021) packages.

5. Results

5.1 Respondents' Profiles

The selected descriptive statistics defining the analyzed population of respondents are presented in Table 2. This group consisted of almost 54% of women. The average age of the analyzed population was 44, with more than 41% people aged ≥ 50 . Over 45% of the respondents graduated from secondary and 41% from higher education. Almost 25% of the respondents reported their income at a level lower or close to the national applicable minimum wage (~ PLN 2060). The predominant places of the respondents' residence were rural areas (37.2%) and cities up to 99 thousand inhabitants (30.8%).

Table 2. *The research sample – characteristics*

Gender (N = 1030 - 100%)					
Women (n – 555)			Men (n – 475)		
53.9%			46.1%		
Age (N = 1030 - 100%)					
≤ 24 (n – 141)	25-34 (n – 210)		35-49 (n – 255)		≥ 50 (n – 424)
13.7%	20.4%		24.7%		41.2%
Education (N = 1030 - 100%)					
Elementary/lower secondary (n – 40)	Basic vocational (n – 91)		Secondary (n – 468)		Higher (n – 431)
3.9%	8.8%		45.4%		41.9%
Net income (PLN) (N = 1030 - 100%)					
≤ 1000 (n – 62)	1001-2000 (n – 205)	2001-3000 (n – 248)	3001-5000 (n – 555)	>5000 (n – 212)	Answer declined (n – 198)
6.0%	19.9%	24.1%	20.6%	10.2%	19.2%
Place of residence (N = 1030 - 100%)					
Village (n – 383)	City <20 thous. (n – 114)	City 20-99 thous. (n – 213)	City 100-199 thous. (n – 92)	City 200-499 thous. (n – 98)	City >500 thous. (n – 130)
37.2%	11.1%	20.7%	8.9%	9.5%	12.6%

Source: Authors' compilation

5.2 Correlation Coefficients

The assessment of the correlation between exogenous variables was based on the Pearson correlation test, considering it a helpful tool in detecting the multicollinearity issues in the model. It was adopted in the study that the proposed model shows no problems with collinearity when the analyzed variables are correlated at a level lower than 0.50. Table 3 presents the correlation test matrix.

Table 3. *Correlation coefficients*

	PU	PEOU	SE	PR	BI	G	AG	E
PU	1.0000							
PEOU	0.4998	1.0000						

SE	0.4434	0.4328	1.0000					
PR	0.3114	0.3311	0.2041	1.0000				
BI	0.6878	0.6048	0.6627	0.4121	1.0000			
G	0.2538	0.1096	0.0700	0.0643	0.2309	1.0000		
AG	0.1011	0.0751	0.0099	0.0333	-0.0843	0.0228	1.0000	
E	0.2507	0.2097	0.0606	0.1316	0.1549	0.0763	0.1048	1.0000

Source: Authors' compilation

The adopted model shows a weak correlation between the exogenous variables, which confirms no problems of multicollinearity in it. Although the BI variable shows the correlation above 0.5, it was found that the significance of this variable for the model is important enough to include it and, moreover, some authors adopt the correlation indicator values below 0.7 as acceptable (Dormann *et al.*, 2013).

5.3 Reliability Analysis

The internal consistency of a test or measurement is the condition of its reliability. One of the measures for assessing reliability is the alpha (α) parameter, referred to in the source literature as Cronbach's alpha. It is adopted that the minimum value of this parameter, indicating the accuracy of the applied measurement scales should be greater than 0.6 (Hair *et al.*, 2010). The measurement results indicate that our measurement instrument is reliable, as the Cronbach's alpha values for all items are greater than the minimum criteria of 0.60 (PU – 0.62; PEOU – 0.64; SE – 0.66; PR – 0.69; BI – 0.61; G – 0.72; AG – 0.75; E – 0.71) and therefore the adopted scales allowed for an accurate measurement of the model's characteristics.

5.4 Kaiser-Meyer-Olkin and Bartlett's Test of Sampling Adequacy

The Kaiser-Meyer-Olkin coefficient (KMO) and Bartlett's test measure the adequacy of selecting input variables for factor analysis. The desired KMO value should be greater than 0.5, informing about the grounds for the factor analysis application (Hair *et al.*, 2010). Bartlett's test of sphericity verifies the hypothesis about the identity correlation matrix. Its significance means that the factor model is appropriate for the analyzed variables, as they are statistically significantly correlated with each other.

According to the source literature, the probability value should be less than 0.05 to represent the significant differences in the properties of the correlation matrix and the identity matrix (Hair *et al.*, 2010).

In the case of the analyzed model (Table 4), the value of KMO measure reaches the level of 0.74, which means that the sampling adequacy is satisfactory as the KMO value is higher than the minimum criteria of 0.50, while the values of Bartlett's test of sphericity confirm the grounds for using the collected data in the factor analysis.

Table 4. Kaiser-Meyer-Olkin (KMO) and Bartlett's test results

KMO Measure of Sampling Adequacy	0.74
Approximately chi-square	2234.432
Df	28
P-Value	0.000

Source: Authors' compilation

5.5 Principal Component Analysis - Results

The correlation between the questionnaire statements is estimated by the Principal Component Analysis (PCA). Table 5 lists the standardized item loadings, communality, mean and standard deviation. Most of the factor loading for each item is higher than the acceptance criteria of 0.70. Communality is also an important statistic in the process of constructing a reliable tool presenting a stable internal structure. This indicator plays an essential role in assessing the reliability of the factor analysis results, their replicability and representativeness for the analyzed population. It should present the value >0.7 .

The analyzed factors, in most cases, met this borderline condition. The decision to keep the variables despite the failure to meet the condition of the critical load value and the communality measure value was made to avoid the occurrence of factors consisting of one observable variable. At this point, it should be added that some authors lower the adopted limit of a significant load to the level of 0.3–0.5 (Hair *et al.*, 2006).

Additionally, the standard deviation results further confirm that the variance in response to each construct (PU, PEOU, SE, BE, FR, PVR, PER, PSR, TLR, SR, PAR) is low as the values of standard deviation were below 0.5.

Table 5. The results of varimax rotation (factor loadings of observable variables)

<i>Observable Variables</i>	<i>Factor Loading</i>	<i>Communality</i>	<i>Mean</i>	<i>SD</i>
Perceived Usefulness (PU)				
(PU1) I believe that using MB services is convenient and useful in my everyday and professional life	0.990	0.980	0.802	0.399
(PU2) I believe that using MB services is a useful way to carry out banking transactions and contact the bank	0.734	0.539	0.455	0.498
Perceived Ease of Use (PEOU)				
(PEOU 1) I find it easy to download and install the application to use MB	0.980	0.961	0.796	0.403
(PEOU 2) I find MB easy to use	0.644	0.415	0.450	0.498
Self-efficacy (SE)				
(SE1) I have the knowledge and skills necessary to use MB owing to my technical resources	1.000	1.000	0.466	0.497

Behavioral Intention (BI)				
(BI1) I intend to use MB services	0.971	0.943	0.350	0.447
(BI2) I intend to use MB services to a greater extent	0.823	0.678	0.253	0.435
Financial Risk (FR)				
(FR1) Using MB services poses a risk of losing financial means	0.945	0.893	0.221	0.415
(FR2) Using MB services exposes me to financial losses related to, e.g., the disclosure of passwords and bank account numbers	0.952	0.907	0.206	0.405
Privacy risk (PVR)				
(PVR1) MB applications are vulnerable to hacking attacks	0.910	0.829	0.382	0.486
(PVR2) Using MB services may result in the loss of privacy through the data and unlawful use of data (including personal data)	0.943	0.890	0.253	0.435
(PVR3) Using MB services exposes me to collecting, tracking and analyzing information about my financial transactions	0.881	0.777	0.230	0.421
(PVR4) Using MB services poses a risk of losing control over the privacy of information about the carried out financial transactions	0.920	0.846	0.205	0.404
Performance risk (PER)				
(PER1) The functioning of MB may be faulty, which will impede or limit access to banking services and/or cause incorrect processing of the payments made	0.935	0.873	0.202	0.402
(PER2) MB security systems are not strong enough to protect my financial resources	0.870	0.757	0.177	0.382
Psychological risk (PSR)				
(PSR1) Using MB services causes unnecessary tensions and concerns about the consequences of the mistakes made in relation to its use or operation	0.663	0.440	0.220	0.414
(PSR2) MB system failures make its user feel concerned	0.926	0.857	0.398	0.490
Time loss risk (TLR)				
(TLR1) The user must invest a lot of time to set up and learn how to use MB	0.593	0.352	0.149	0.356
(TLR2) Correcting the mistakes made in MB by its user is time consuming	0.699	0.489	0.166	0.372
(TLR3) The instability and low speed of the Internet make it difficult to access MB, which exposes its user to the waste of time	0.917	0.842	0.288	0.453
Social risk (SR)				
(SR1) Using MB services has a negative influence on the user's image in the environment (family, friends, authorities)	1.000	1.000	0.105	0.307
Pandemic risk (PAR)				
(PAR1) In my opinion the risk of the Covid -19 pandemic to society speaks in favor of using MB	0.555	1.000	0.284	0.451
(PAR2) In my opinion using MB is a reasonable way to mitigate personal risks of the Covid-19 pandemic	0.901	0.308	0.427	0.495
(PAR3) In my opinion the organizational and legal consequences of the Covid-19 pandemic increase the use of MB services	0.699	0.812	0.427	0.495
Gender (G)	1.000	1.000	0.798	0.082
Age (AG)	1.000	1.000	45.626	15.136
Education (E)	1.000	1.000	3.311	0.750

Source: Authors' compilation

5.6 The Analysis of Goodness-of-Fit Model

The goodness-of-fit measures were used to evaluate the structural model. The structural equation model (SEM) approach analyses how well the model fits the data set. The following criteria were used to assess the goodness-of-fit of the model: Chi-Squared adjusted by degrees of freedom (CMIN/df); Comparative Fit Index (CFI); Root Mean Square Error Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR). The CFI is an incremental fit index representing an improved version of the normed fit index (NFI). The CFI is normed so that the values range between 0 and 1, with higher values indicating a better fit. As the CFI has many desirable properties, including its relative, but not complete, insensitivity to model complexity, it is among the most widely used indices. CFI values above 0.90 are usually associated with a model that fits well. The SRMR can replace RMSEA to represent badness of fit as well, whereas the others represent goodness-of-fit, therefore, the value of these indicators should be as low as possible. Table 6 lists the recommended and actual values of some fit indices for the model. Except CFI and CMIN/df, other fit indices have better actual values than the recommended values.

Table 6. *The recommended and actual values of fit indices*

Goodness of Fit Measures	Cut-off values Close to	Measurement model
CIMIN/DF	<3 (but 3-5 is acceptable) (Ullman 2006) (Schumacker and Lomax, 2004), (Kline 2010)	3.708
CFI	> 0.9 (Hair et al. 2010)	0.899
RMSEA	< 0.06 (Hu, Bentler, 1999) (Hair <i>et al.</i> , 2010)	0.051
SRMR	< 0.08 (Hu, Bentler, 1999)	0.051

Source: Authors' compilation

5.7 Hypothesis Testing

The standardized parameter estimates and the significant values for the hypothesized relationships are shown in Table 7. Except H2 other hypotheses are statistically significant. The findings suggest that Self-efficacy has a positive influence on the Perceived ease of use and the Perceived risk, therefore, H3 is supported, but H1 is no supported. The fourth hypothesis assumed that the Perceived risk would have a negative impact on the Perceived ease of use, while the obtained results have a positive statistically significant impact. Additionally, the Perceived risk has a negative impact on the Actual usage, which shows that H5 is supported. The Perceived ease of use was found to have a strong positive influence on the Perceived usefulness and Behavioral intention, so H6 and H7 are also supported. Finally, both the eighth and ninth hypotheses are accepted, because the Perceived usefulness has a significant positive influence on Behavioral intention and Behavioral intention on the Actual usage.

Table 7. Standardized regression weights for the model

<i>Structural Paths</i>	<i>Estimate</i>	<i>Std. Err</i>	<i>Z-Value</i>	<i>P(> z)</i>
H1: SE >> (- PR)	0.078	0.016	5.018	**
H2: SE >> (+PU)	- 0.157	0.060	- 2.635	
H3: SE >> (+PEOU)	0.252	0.023	10.881	**
H4: PR >> (- PEOU)	0.198	0.045	4.443	**
H5: PR >> (- AU)	- 1.440	0.343	- 4.196	**
H6: PEOU >> (+PU)	1.655	0.197	8.398	**
H7: PEOU >> (+BI)	0.208	0.061	3.402	*
H8: PU >> (+BI)	0.331	0.059	5.608	**
H9: BI >> (+AU)	3.441	0.458	7.512	**

Source: Authors' compilation

6. Discussion

The purpose of the paper was to identify and assess the factors influencing the adoption of mobile banking services by proposing and testing a theoretical model focused on analyzing and assessing the impact of the premises underlying the acceptance and use of the distribution channel of the above-mentioned banking services. Out of the adopted nine research hypotheses, eight showed statistical significance of which six were confirmed, which means that two out of eight statistically significant hypotheses were rejected.

The conducted research contributed to the rejection of H1, indicating that Self-efficacy of mobile banking increases the Perceived risk of its use. Although Self-efficacy of the discussed form of banking services distribution has a significant impact on the Perceived risk, this influence shows the opposite direction, which in the case of decisions made by the respondents does not confirm, e.g., the conclusions resulting from the studies conducted by Walker and Johnsn (2006) or Zhou (2012).

The rejection of the adopted hypothesis, in the opinion of the authors, is a consequence of the situation following which a higher percentage of the respondents who showed a high level of Self-efficacy noticed the risks associated with the discussed form of banking in relation to the percentage noticing these risks in the entire surveyed population. This situation can be explained by the assumption that a higher level of Self-efficacy is associated with a greater knowledge and understanding of the determinants for using MB which, in turn, directly affects the awareness and influence of the Perceived risk as a factor determining the use of MB. H4 was also rejected, indicating a negative impact of the Perceived risk on the Perceived ease of use of MB. The conclusion resulting from the conducted research, in this case, is in opposition to the conclusions formulated, e.g., by Elhajjar and Quaida (2020) or Yang (2009), however, it is confirmed by the findings of AlSoufi

(2014). In our opinion it should be adopted that the respondents, when accepting mobile banking services, are guided by the premise that lowering the potential of the perceived risks associated with the use of MB reduces the subjective feeling of the difficulties resulting from using the discussed form of access to banking services.

All the remaining statistically significant hypotheses were confirmed in the conducted research findings. And so, in the case of the respondents, the assumption about the positive impact of Self-efficacy on the Perceived ease of use (H3) was confirmed, which is consistent with the results of other analyzes describing, i.a., this correlation (Wang *et al.*, 2003; Zhao *et al.*, 2008; Alalwan *et al.*, 2016). In our opinion such situation means that the representatives of the surveyed population, in the process of accepting and using mobile banking services, are aware of the positive significance of increasing the level of Self-efficacy for the subjective assessment and perception of the ease of use of this form of financial intermediation.

Hypothesis 5 was also adopted, which defines the correlation between the decreasing level of the Actual usage of MB services and the growing potential of Perceived risk. In this case, the surveyed population of Poles shows similar characteristics to the subjects covered in the research carried out, e.g., by Lee (2009), Alalwan *et al.*, (2016) or Featherman and Pavlou (2003), adopting that the decline in the consumption of MB services is determined by the increasing level of the Perceived risk of its use. In this case, increasing the sense of security for the potential MB users becomes essential and justified from the development perspective. This approach should refer to a wide spectrum of the perceived risk dimensions, including, i.a., financial, privacy, time, and outcome risks. In the current situation the issue of the so-called pandemic risk is also of importance for the level of mobile banking usage. In this case, it is not only about raising the awareness regarding the risks associated with the Covid-19 pandemic, but most of all promoting mobile banking as a useful and safe, in both personal and social sense, tool for one's own finance management. This conclusion is confirmed by the subjective opinions of the respondents assessing the impact of pandemic risk on the behavior of a human being as well as organizational and legal solutions facilitating the application of mobile banking services.

The conducted analyzes allowed adopting the correctness of the assumption about the significant positive influence of the Perceived ease of use on the Perceived usefulness (H6) and Behavioral intention (H7) as well as the Perceived usefulness on Behavioral intention (H8). This situation cannot come as a surprise since both the mutual influence of PEOU on PU and the impact of these factors on BI constitute the basic assumption of the TAM model and its initial correction (TAM2) defining the basis for assessing the impact of certain beliefs on the acceptance of new technologies. In the case of mobile banking, the research findings are the same as the conclusions analyzing and defining the correlations between the aforementioned factors, included, i.a., in the studies by Giovanis, Assimakopoulos, and Sarmaniotis

(2019), Gumussoy, Kaya, and Ozlu (2018), Ho, Wu, Lee, and Pham (2020) and Zhou (2011). It can, therefore, be adopted that also for the Polish consumer of mobile banking services, the ease of use and the usefulness of this tool become the factors which influence the willingness of an individual to perform specific behaviors towards this form of financial intermediation.

Hence, it is clear that the efforts taken up by banking institutions operating in Poland and other parties interested in the development of mobile banking have to focus on the activities increasing the ease of use related to this tool and also its perceived usefulness. This inference stems from the empirically confirmed assumption that both potential and current MB users are going to use this tool only if they are convinced about its usefulness and ease of use (Gu *et al.*, 2009).

The last hypothesis (H9) was also adopted, which describes the relation between Behavioral intention and the Actual usage of mobile banking. In the case of this relationship, the results of the performed study are consistent with the analyzes carried out by other authors (Alalwan *et al.*, 2016; Afshan *et al.*, 2018; Le *et al.*, 2020) indicating that the behavioral intentions showed by the representatives of the surveyed population of Poles, influenced by a subjective sense of the usefulness and ease of use of mobile banking, have a positive impact on their actual usage of the mobile distribution channel of banking services.

7. Conclusions

Despite many previous studies discussing mobile banking, as shown by the conducted source literature review, from the theoretical perspective, our study makes a clear contribution to the literature focused on these problems.

Firstly, because this study examined the key factors predicting the intentions of Polish customers to adopt mobile banking and its use, thus contributing to the literature addressing online banking channels and technology acceptance in general. To the best of our knowledge, so far no research using the TAM model has been conducted in this area on the data representative for Polish society. We do hope that the content of this article will contribute towards initiating a scientific debate in Poland addressing the adoption factors of mobile banking services which are widely discussed in the world literature.

Secondly, the existing research on mobile banking adoption has not considered the factor associated with the consequences of the Covid-19 pandemic. The variable we have proposed, i.e., Pandemic risk (PAR), was finally included in the Perceived risk (PR), which according to the results of econometric modeling (TAM), has a significant impact on the adoption of mobile banking services by Polish customers.

Thirdly, due to the fact that the smartphone technology is developing very dynamically, the range of MB services offered to customers is expanding along with their changing attitudes and expectations towards the banking service providers, some constructs of factors included in our model, even though studied in the past, have given us different results. This refers to the correlations between Self-efficacy and Perceived risk as well as Perceived risk and Perceived ease of use described in detail in the discussion. In our opinion, the revealed correlations may constitute an impulse for further in-depth research, including that of international range.

From a practical perspective, the implications of this study relate primarily to bank managers. The research findings indicate that the factors significantly influencing the behavioral intentions of customers to use and adopt mobile banking include, among others, Perceived Ease of Use and Perceived usefulness. This correlation is important as it means that the mobile banking services provided by financial institutions should remain more user-friendly, timely, uncomplicated, and flexible comparing to the conventional financial services. It results in measurable financial and non-financial benefits realized both by banks and their clients. Among them the following can be highlighted: lower costs of banking operations, increased speed of service, expanding the customer base, including those originating from outside the immediate operation area of bank branches, or higher number of potential income sources.

Moreover, the results of the conducted research indicated that the risk perceived by the user influences negatively the probability of using mobile banking services. Thus, in our opinion banks being aware of this correlation should devote more attention and financial resources to ensuring the highest level of customer safety, as well as properly inform and educate them about this fact. MB is supposed to be technologically friendly to its clients, and therefore banks should adapt their marketing and promotional strategies so that customers could learn how to use the services they offer, and special attention should be paid to those clients who are technically less efficient. The presented activities would allow gaining greater acceptance of MB services among customers, which ultimately, through the economies of scale effect, could reduce the operating costs of financial institutions. The findings of this study have important implications for researchers and bank managers in the today's dynamic environment.

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