Determinants of digital financial exclusion as a barrier to the adoption of mobile banking services in Poland

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Abstract

Motivation: the contemporary phenomenon of financial exclusion, in the sphere of its
reasons, consequences and activities aimed at its reduction can be connected, e.g., with
using new technologies and financial innovations. The new dimension of such exclusion
is created by the digital financial exclusion developed through a diverse set of behavioral,
environmental and demographic factors. Their identification and analysis has become an
essential activity influencing, e.g., the effectiveness of selective choice and application
of proper tools to reduce this exclusion.
Aim: identification and assessment of the determinants related to digital financial exclu-
sion as a barrier in the adoption of mobile banking services, considered from the perspec-
tive of their impact on the segmentation of the analysed population.
Results: the ranking, identified by the authors, regarding the importance of predictors
indicated that the dependent variable — Y (i.e. people who have an online bank account
classified based on the mobile forms of its use) is most influenced by the generation fac-

tor — X_4 (1.0), followed by: personal innovativeness — X_2 (0.92), digital skills — X_1 (0.90) and the perceived risks of new technologies — X_3 (0.66).

Keywords: digital finance; digital financial inclusion; financial exclusion; mobile banking; CART
JEL: E44; F65; G21

1. Introduction

Financial Inclusion[1] is a process aimed at providing access to basic financial services offered by formal representatives of the financial sector to all interested in using them, with particular focus on the poor. As Ozili (2020, p. 3) points out, the popularity of financial inclusion problem among the decision-makers and scientists is a consequence of the fact that: (1) the discussed inclusion is approached as a very important condition facilitating and influencing the implementation of sustainable development goals; (2) it is the way towards the reduction of social exclusion; (3) such inclusion supports the activities aimed at reducing the level of poverty, and (4) it is a tool, the application of which creates other socio-economic benefits (achieved at the macro, mezzo and micro levels).

The implementation of financial inclusion incentives, present in the public space of every country (regardless of its development level) follows various paths. Among them there is also the one indicating that the relationship between new technologies and the accompanying innovations[2], taking the form of, e.g., digital finance can be the method for extending financial integration of the people excluded from the formal financial market (Gabor & Brooks, 2017; Manyika et al., 2016). This integration, however, has to take into account the need for, e.g., avoiding and/or reducing barriers/factors that determine digital financial exclusion[3] acting, on the one hand, as the manifestation of financial exclusion and, on the other, as its causative factor.

The problem constituting the basis of the considerations presented in the article and, at the same time, its purpose, is the identification and assessment of the determinants related to digital financial exclusion as a barrier in the adoption of mobile banking services, considered from the perspective of their impact on the segmentation of the analysed population. Its implementation, on the one hand, will allow, in the authors' opinion, to fill in the perceived research gap regarding the limited number of nationwide research covering the issues presented above, and on the other, the conclusions resulting from the authors' own

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[1] Financial exclusion is the opposite of this phenomenon.

[2] The importance of combining technology and innovation for financial exclusion has been confirmed, e.g., by the words of Bill and Melinda Gates who stated, that "…If we solve these large problems of financial inclusion, it will be with new business models, technologies and innovations" Rodger Voorhies, Bill and Melinda Gates Foundation 2014.

[3] The authors assume that depending on the intensity/strength of a given factor, it may affect both the intensification of exclusion and the increase in inclusion. For example, older age of the respondents reduces their use of digital financial services — acting as an excluding factor, whereas their younger age has the opposite effect, becoming an inclusive factor.

research may become the basis for management decisions taken up by, e.g., bank managers.

The adopted purpose determined the structure and content of the study as well as the applied research methods, among which the following were included: source literature overview, descriptive and comparative analysis, survey studies carried out using CAWI (Computer-Assisted Web Interview) method and CART (Classification and Regression Tree) method. The analysis and interpretation of the collected research material has become the basis for the verification of the adopted research hypothesis stating as follows: *limited personal innovativeness and low digital skills are the most important determinants of digital financial exclusion, which is a barrier to the adoption of mobile banking services.*

2. Literature review

One of the elements characteristic for the world of the 21st century is the ubiquitous use of new digital technologies as well as pro-innovativeness. These activities refer to every dimension of human life and its products, taking the form of, e.g., economic organizations operating both in the real and financial sphere. Digital technology and innovative activity stand for the factors changing the contemporary face and rules of the game in many industries, which is clearly evidenced by, e.g., the occurring transformations in the manner and scope of providing financial services. Today, digital finance is not only a way for describing the reality of the financial institutions' operation, but also fulfils the role of a category that defines and shapes the relationships between these entities and their economic, social, political and cultural environment.

The idea of digital finance is not a clear-cut concept. Following its most common understanding, it is identified with the provision of financial services via mobile telecommunications, personal computers, the Internet or bank cards using digital payment systems. When searching for the definition of digital finance one can, e.g., use terms indicating that it stands for (Manyika et al., 2016, p. 8) financial services provided via digital infrastructure — including a smartphone and the Internet — with little use of cash and traditional bank branches. According to the assumptions of this definition authors, its content covers as follows: (1) all types of financial services (payments, savings accounts, loans, insurance and other financial products); (2) all users, including: natural persons earning income within any range of values, economic entities of any size and government units, as well as (3) all financial service providers, e.g., banks, payment service providers and others.

Shen and Huang (2016, p. 221) who level digital finance with the so-called Internet finance indicate that they represent a new business model for using the Internet as well as the information and communication technologies allowing the implementation of a wide range of financial activities, such as, e.g., payments to third parties, online loans, crowdfunding, online insurance and banking. In turn, Gomber et al. (2017, p. 539) highlight that the term dig-

ital finance describes, in general, the digitization of financial sector. Adopting the above perspective allows these authors to state that the type of finance under study covers all electronic products and services offered by the financial sector representatives. Another approach to the essence of digital finance may be defining them from a subjective point of view. For example, the description of a start-up operating in the area of the discussed finance indicates that it is an economic entity which develops: innovations integrating the distribution of digital banking products, new mobile solutions and exchange platforms, microfinance services, payment platforms, social loans and crowdfunding (Gomber et al., 2017, p. 539), whereas Hu and Zheng (2016, p. 32) adopt that digital finance can be identified with any organization that publicly, via the Internet or another IP network offers its financial applications. Finally, Ozili (2018, p. 330) in the summary of the discussion addressing the concept of digital finance emphasizes that although there is no unanimity in the public space as to its content, there is consensus regarding the definition of this finance essence. And so, his analysis allows concluding that the nature of digital finance is to cover all products, services, technologies and/or infrastructure and enable both natural persons and economic entities to access online payments, savings or loans without the need of visiting a bank branch or contacting a financial services provider directly.

The role and importance of digital finance in the modern world is determined by the resulting advantages and disadvantages. These characteristics can be approached as socio-economic distinguishing features assigned to this formula of financial intermediation. The set of benefits implied by digital finance includes, e.g. (Hu & Zheng, 2016, pp. 44–48; Manyika et al., 2016, p. 3; Ozili, 2018, p. 330; Shen & Huang, 2016, p. 221; World Bank, 2016, pp. 94–96): (1) a strong influence on the financial inclusion of the residents of developing countries, which is a function of reducing limitations connected with the access to financial services (using mobile phones), reducing costs of this access, limiting negative consequences of information asymmetry; (2) increasing the efficiency and profitability of the activities carried out by both financial intermediaries and their clients as a result of reducing the costs of financial transactions, increasing their number and security; (3) stimulating financial innovations in the area of both products and platforms for their provision and service; (4) creating favourable conditions for the growth of gross national income (GNI) and the economy stabilization owing to the digitization of the financial sector treated as a tool to increase the speed and quality of accessing both financial products and services, including loans addressed to all groups of their consumers; (5) providing a platform for the growth of aggregated spending which consequently generates higher tax revenues resulting from the increase in the volume of performed financial transactions; (6) reducing cash turnover and its potential negative consequences (e.g. forgery, concealing cash flows), increasing the control of natural persons over their personal finance.

The description of the advantages offered by digital finance can be summed up using the words of the authors of the report entitled *Digital finance for all: powering inclusive growth in emerging economies.* Manyika et al. (2016, p. 4) highlight that in the global dimension, by 2025, digital finance can provide access to financial services for 1.6 billion people and increase the volume of loans granted to natural persons and enterprises by 2.1 trillion USD. This finance, by rationalizing government spending and increasing tax revenues can also result in saving 110 billion USD, and by reducing direct costs can increase the savings of financial service providers by 400 billion USD annually offering, at the same time, the source of value growth for their new deposits by 4.2 trillion USD. These authors also estimate that 95 million new jobs will be created by 2025 as a result of digital finance. The necessary condition for the implementation of these effects are: modern digital infrastructure, a dynamic and pro-innovative market of financial services operating in a favourable regulatory environment, and also cheap and useful digital products providing an alternative to the traditional offer of financial intermediaries.

It is obvious that digital finance, apart from the offered benefits also entails risks or challenges related to its use. In this case, the following can be mentioned, e.g. (Ketterer, 2017, p. 16 et seq.; Ozili, 2018, p. 333; World Bank, 2016, pp. 97–98): (1) the danger of incompatibility between the traditional financial regulations and the activities of the rapidly expanding network of intermediaries, exchange platforms and other providers of digital financial services; (2) the need to take measures aimed at reducing the systemic risk of the banking sector (including, e.g., credit, liquidity or operational risk) created by the dynamic development of financial innovations. Although the prudential regulations referring to digital finance reduce such risks, their implementation and compliance is associated with high costs creating entry barriers; (3) concerns that digital finance will become, e.g., the cause of an increased number of frauds in the financial system and the tool enabling the implementation of financial flows used for illegal purposes, which may ultimately contribute to reduce confidence in the entire financial system and its components; (4) limiting inclusive activities, e.g., as a result of: (1) the primacy of maximizing the profitability of their operations adopted by digital financial service providers and addressing their offer to high or medium-income clients providing higher returns on investments compared to poor or low-income ones; (2) concentrating activities in the areas characterized by the reduced operational risk and/or extensive infrastructure determining access to digital banking services and (5) the need to intensify activities aimed at financial and digital education of consumers, combined with the active protection of their interests, fraud prevention, developing adequate dispute resolution mechanisms and data protection (these activities become a function of the state in which digital finance is observed as a factor favouring the application of digital services by a large number of new consumers entering the financial system for the first time).

The implementation of benefits associated with digital finance, considered from the perspective of their consumers, naturally progresses towards the issues of digital financial inclusion and the analysis of determinants underlying the use of mobile banking as one of the services offered by their digital providers.

The phenomenon of digital financial inclusion in its content and meaning should be combined with digital and financial inclusion[4]. According to the European Microfinance Platform CGAP (Lyman & Lauer, 2015b), digital financial inclusion is identified with digital access and the use of formal financial services by the part of society either excluded or poorly using this type of service. CGAP analysts (Lyman & Lauer, 2015a) indicate that these services should be tailored to the needs of customers and provided in a responsible manner at a price affordable for their consumers and also ensuring a sustainable business for their suppliers. Ozili (2018, p. 331), when referring to the essence of this type of inclusion, indicates that the process of digital financial inclusion begins with the assumption that the individuals so far excluded or poorly using formal bank accounts need the respective digital access allowing them to perform basic financial transactions. If this population understands this need and accepts the benefits of digital financial services, an effective digital financial inclusion program should be implemented, meeting both the expectations of the excluded and the criteria defined by its providers.

Digital financial inclusion is approached as an instrument to achieve economic, social and political goals. For example, Ferrata (2019, p. 446) states that such inclusion supported by digital technologies reduces financial exclusion, at the same time contributing to the achievement of the Sustainable Development Goals. Manyika et al. (2016, p. 9) indicate that owing to this form of inclusion, the costs of functioning and customer service are lowered and the amount of work with traditional documents is reduced. Ozili (2018, p. 331) argues that this type of financial inclusion contributes, e.g., towards increasing the quality of provided financial services, limiting cash turnover and improving the well-being of individual clients and the financial standing of enterprises owing to a cheap and reliable platform facilitating their financial transactions. In the summary of the second *Standard-setting bodies and financial inclusion* conference (World Bank, 2014), its participants state that digital financial integration as a path towards the inclusion of approx. 2.5 billion people who do not use the formal financial market facilities offers a tool to access financial services, reduces the costs of using transaction platforms for all parties to such operations, creates additional financial services tailored to customer needs, lowers the risk of loss or theft of funds as well as other financial crimes and also contributes towards strengthening the economic position (primarily of women) by accumulating assets and increasing their participation in economic life.

The use of mobile banking is one of the tools and dimensions of digital financial inclusion. The essence of this form in distributing services provided by

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[4] The authors consciously ignore the considerations on the essence of digital and financial inclusion and the relationship between these categories and digital financial inclusion.

financial intermediaries is using a smartphone to perform financial banking transactions. Laukkanen and Pasanen (2008) indicate that this type of banking is a channel through which a customer using a smartphone or a personal digital assistant interacts with a bank. Mobile banking is described in a similar way by Alampay et al. (2017, p. 4) who observes that mobile banking is a financial service provided via mobile networks by using a mobile phone. The essence and use of the mobile distribution channel for banking services has been and is the research subject of many scientists, however, from the perspective of the discussion presented in this article, the authors' attention has been focused on the problem of identifying factors which determine consumers' choice of this form of access to banking services.

The research addressing attitudes to the application of mobile banking and the factors determining the choice of this form of access to banking services has a long history. As Shaikh and Karjaluoto (2015, p. 8) observe, the analysis of the acceptance models applied in these studies indicates the use of as many as 11 various theories, models and analysis frameworks allowing the articulation and assessment of the impact of specific behavioural characteristics, environmental factors and demographic attributes on the acceptance and use of mobile banking services by its consumers. This set includes, e.g.: Technology Acceptance Model — TAM (e.g. Bidarra et al., 2013; Nhat Vuong et al., 2020), Innovation Diffusion Theory — IDT (e.g. Kim et al., 2009; Sulaiman et al., 2007), Unified Theory of Acceptance and Use of Technology — UTAUT (e.g. Bankole & Cloete, 2011; Savić & Pešterac, 2019; Yu, 2012) as well as other original analytical models (e.g. Chakiso, 2019; Szopiński, 2016).

While analysing factors underlying the choice of mobile banking services, several examples can be presented which, on the one hand, show the diversity of research tools used for this purpose and, on the other, indicate the changing set of analysed characteristics determining this choice. For example, Bidarra et al. (2013), using TAM model placed the perception of: transaction security and the service provider, privacy of information flow, service usefulness, ease of use, attitude and trust as well as risk in the set of factors influencing the choice of mobile banking services by the surveyed group of Spaniards. The conducted analyses showed that in the case of current and potential customers of mobile banking, a favourable attitude towards using online applications presents a strong correlation with accepting this type of services, whereas the perception of high risk they bring about reduces, to a great extent, their application. Kim et al. (2009), based on IDT assumptions examined the impact of: (1) relative benefits achieved by consumers; (2) their trust tendencies; (3) the financial intermediary reputation and (4) the availability of formalized quality and safety guarantees of an intermediary's operation influencing the acceptance of mobile banking services by the surveyed group of Koreans. The analyses carried out by these authors indicated that three variables, i.e. relative benefits, propensity to trust and structural guarantees had a significant impact on the initial confidence in mobile banking. Also, the perception of trust and relative ben-

efits was crucial for promoting personal intentions to use the related services. The service provider's reputation turned out to be irrelevant from the perspective of the choice made. In turn, Szopiński (2016) having analysed the impact of such factors as using other banking products, confidence in the bank, the respondent's age, education level, using the Internet and the income earned indicated, applying the model he developed based on linear regression analysis, that in the case of Polish society representatives, the factors which have the strongest impact on using mobile banking services are as follows: the use of the Internet as well as other banking products and confidence in commercial banks, while the group of products having the greatest impact on using online banking includes mortgage loans and credit cards. The summary of the discussion addressing the aforementioned problems has been presented in the Table 1 listing the most important factors influencing the use of mobile banking based on the information resulting from the analysis covering the source literature.

3. Research method and sample description

The segmentation of people with an online bank account was based on the results of surveys conducted by the authors through the SW Research, the Market and Opinion Research Agency, in April 2020. Statistical data were obtained using the CAWI (Computer-Assisted Web Interview) method. The nationwide research sample included 1040 respondents. It was based on stratified random sampling. The operator was the swpanel.pl research panel with over 200,000 active users aged 18+. The maximum statistical error for the entire sample was 3.1 percentage points. A total of 4905 invitations were issued, which translated into the rate of return at the level of 21.2%. The strata were determined based on the combined distribution of gender, age category, and the place of residence size class. A total of 40 strata were identified. The obtained sample corresponds to the structure of Poles in terms of the aforementioned socio-demographic variables. Through assessing the responses provided to the question about having an online bank account, a group of 658 people who confirmed the possession of such a banking product was selected from the surveyed population (see Chart 1). Their questionnaires, after assessing their correct completion, were further analysed, adopting the size of this group as 100% (n=658).

The analysed population included 53.6% women and 46.4% men (Table 2). The survey was addressed to people presenting a diverse age profile, ranging from 18 to 78 years-of-age, next assigned to the groups representing the following generations: Baby boomer, X, Y, Z (born in 1946–1964, 1965–1979, 1980–1994 and 1995 and later, respectively). Almost 60% of the population included in this group covered people born before 1980 (204 Baby Boomer representatives and 189 generation X representatives), 26.3% (173 respondents) represented generation Y and 14% (92) of the respondents, on the day of conducting the survey, declared their age below 26, thus belonging to generation Z. Approx. 47% of the respondents indicated having graduated from higher educa-

tion institutions, 45% secondary and 8.2% of the respondents completed basic vocational, primary or lower secondary education.

Five income groups were distinguished in the studied population. The most numerous one, covering 24.3% of the respondents included people earning net income in the range of PLN 2001–3000. The lowest income, i.e. less than PLN 1,000, was achieved by 6% of the respondents, whereas the highest, i.e. over PLN 5,000, was earned by 8.1% of the respondents with an online bank account. The analysis of the surveyed population distribution by place of residence shows that approx. 36% of people came from rural areas, while the remaining respondents lived in cities of various sizes. The largest group of respondents (21.4%) includes the representatives of cities where the number of residents ranges between 20 and 99 thousand people.

The CART method (Classification and Regression Trees) was used to segment the research group. Its key task was to identify the optimal number of segments and assign people having an online bank account to the appropriate group. The intention of the authors was that the obtained segmentation results should allow the choice of the appropriate tools for the selected populations limiting the phenomenon of digital financial exclusion. The calculations were performed using Statistica 13 program and adopting the assumptions presented in Table 3.

In the conducted survey, the respondents provided answers to a number of questions regarding their attitudes and behaviour towards new technologies and determinants for their use. When asked — "Do you use mobile banking applications with a smartphone/tablet?" 245 people provided a negative answer, i.e. 37.2% of the respondents, whereas an opposite declaration was made by 413 out of 658 respondents (62.8%). The answers to this question were used to encode the dependent variable of the model for the classification of people having an online bank account based on the mobile forms of its use (Y), where 1 — a person not using mobile banking services, and 0 — a person using mobile banking services.

Independent variables of a demographic, behavioural and socio-economic nature were selected for the analysis. After verifying their degree of variability (coefficient of variation V_x exceeded 30%), the selection of candidates for explanatory variables was carried out. C-Pearson method was used to examine the correlation adopting the significance factor at the level of $p < 0.05$. Ultimately, four non-parametric variables were selected for further research, which were most strongly correlated with the dependent variable and, at the same time, weakly correlated with each other. They are as follows:

- X_1 — digital skills (non-parametric, multi-category ordered variable, where 2 — high level of digital skills; 1 — basic level of digital skills; 0 — no digital skills);
- X_2 — personal innovativeness (non-parametric binary variable, where 1 — a person open to new technologies; 0 — a person not open to new technologies);

– X_3 — the perceived risks of new technologies (nonparametric binary variable, where 1 — a person perceiving new technologies as highly risky; 0 — a person not perceiving new technologies as highly risky);
– X_4 — generation — (non-parametric, multi-category ordered variable, where 4 — people from generation Z; 3 — people from generation Y; 2 — people from generation X; 1 — people from the Baby boomer generation).

While X_4 variable was described when discussing the research sample, the preceding X_1, X_2 and X_3 variables require a short comment.

X_1 variable — digital skills, was encoded based on the answers provided by the respondents to the following questions: "Can you download and install a new application on your smartphone?" and "Do you have high digital skills?" The first of these questions was answered positively by 509 people (77.30% out of 658 respondents). A negative answer to this question was given by 149 people (22.70%). In turn, the second question had 189 positive responses (28.70%) and 469 negative ones (71.30%). The final encoding of X_1 variable was based on the rule that the value of 2, reflecting high level of digital skills, was the function of providing two affirmative answers to the above-mentioned questions, the value of 1, indicating the basic level of digital skills, corresponded to one confirming answer, and 0 value was the consequence of two negative responses.

X_2 variable — personal innovativeness was encoded based on the answer to the question "Are you open to new technologies?" 465 respondents, i.e. 70.70% of the respondents who have an online bank account, confirmed their openness. This group was assigned the value of 1. Simultaneously, 193 respondents (29.30%) indicating no openness towards new technologies were assigned the value of 0.

The declarative attitude of the respondents to the risk of new technologies was used to encode X_3 variable — the perceived risks of new technologies. And so, 60 out of 658 people considered technological innovation to be highly risky. This population was assigned the value of 1. Such concerns were not shared by 598 respondents. This group, in turn, was assigned the value of 0.

4. Research results

As a result of the applied CART method, the sequences of five classification trees were obtained. In the course of the next stage the best of them were selected based on the analysis of the graph showing the level of cross-validation costs and the cost of resubstitution against the tree complexity (the smallest difference between the cost of the cross-validation and the cost of resubstitution was taken into account). Next, the tree was assessed in terms of complexity as well as the number and importance of predictors used in the division, with the usefulness of the generated rules playing an important role. Ultimately, the classification tree with five split and six terminal nodes was considered the best (Chart 2). In this case the cost of resubstitution was 0.26, and the error rate after ten-fold cross-validation was 0.02. This means that 74% of the cases (i.e.

385 out of 658) were correctly classified and, as a result, the model fits the data very well.

The ranking of predictor importance indicated that the largest impact on the dependent variable (i.e. people who have an online bank account classified according to mobile forms of its use) is exerted by the generation factor — X_4 (1.0), followed by personal innovativeness — X_2 (0.92), digital skills — X_1 (0.90) and the perceived risks of new technologies — X_3 (0.66).

On the basis of the conducted research, three groups of people who do not use mobile banking services were identified and analysed (terminal nodes in the classification tree labelled as 1, which stands for success — Chart 2).

The first of these groups (ID=4) consists of 45 respondents, most of whom 62.22% (i.e. 28 people) do not use mobile banking services. The common feature of this class members is the absence of digital skills, none of these individuals can download and install the application on their smartphone. At the same time, all of them declared their openness to new technologies. Only one respondent represented generation Z, i.e. a person aged 25 or younger, the remaining representatives originated from older generations. In this case the main reason for no interest in mobile banking seemed to be the lack of basic digital skills.

77 respondents were assigned to the second segment (ID=7), of which the vast majority, i.e. 83.12%, declared not using mobile banking services. The common features describing this group allow concluding that these people do not have digital skills, declare low personal innovativeness and do not belong to generation Z, i.e. born before or in 1994. This group is dominated by people representing the Baby boomer generation (48.05%).

The final, third group (ID=20) consists of 30 people who have basic digital skills, but as many as 66.67% of them do not use mobile banking services and, importantly, all of them unanimously consider technological innovations to be highly risky. When it comes to age, this group did not include people from the youngest generation covered by the analysis.

5. Discussion

In Poland, the number of individual customer accounts with agreements enabling access to online banking services amounted to 37.34 million in the first quarter of 2020 and 12.38 million Poles actively used banking mobile applications, including 6 million of which can be referred to as mobile only (NetB@nk, 2020). These customers do not log into online banking, because they handle their finance from their smartphones only. In turn, according to the Statistics Poland (2020) survey, in Poland 28.1% of people aged 16–74 use banking via a mobile application, which means that still a large group remains either voluntarily or not outside the area of banking based on electronic access channels. In order to be able to counteract this type of financial exclusion, it is crucial to identify the factors having a stimulating and a dissimulating impact on the adoption of mobile banking, as well as designate homogeneous segments

of the surveyed population and also address these groups with appropriate actions of financial intermediaries, aimed at increasing interest in the use of digital financial services.

The source literature offers only few scientific studies addressing the impact of digital skills on the adoption of online or mobile banking. Meanwhile, the results of the research conducted by the authors of this article proved that the level of digital skills turned out to be the essential and the most important predictor deciding about the use of mobile banking services. The more digital skills a person has acquired, the more likely they are to take advantage of mobile banking. In the group of respondents not using mobile banking, as many as 62.45% declared that they could not download and install a new application on their smartphone, while for the total number of respondents there were only 22.7% of such indications. Beyond any doubt, the level of knowledge and skills required to operate a mobile device plays a major role in the use of mobile banking. It happens because the individuals who can use a smartphone and install the respective applications will easily learn all the procedures related to mobile banking. The results collected by the authors turned out to be consistent with the ones obtained by Elhajjar & Ouaida (2020) or Garín-Muñoz et al. (2019), who underline that the level of both the Internet and computer skills are all significant in explaining the adoption of electronic banking services.

Bearing in mind the fact that all people who make up the three segments indicated in the survey (see Chart 2) are characterized by a low level of digital skills, it becomes important, from the perspective of financial intermediaries, to take up actions focused on digital education, create simple, intuitive mobile banking applications, as well as provide technical support for customers.

Another essential factor that determines the use of mobile and internet banking services is belonging to a specific generation. The youngest respondents representing generation Z are the least prone to self-exclusion in the area analysed by the authors, among them as many as 81.52% use mobile and internet banking services, while in the case of generation X the respective percentage amounts to 67.72%, whereas for the BB generation only 48.04%. Many researchers point out that age is very important for the adoption of the latest technology and remains negatively related to technology acceptance (Camilleri & Grech, 2017; Das & Das, 2020; Flavián et al., 2006; Garrett et al., 2014; Li et al., 2020; Liébana-Cabanillas et al., 2014; Porter & Donthu, 2006; Yousafzai & Soriano, 2012). However, only few studies confirmed low adoption and use of internet or mobile banking among older adults, even in the developed countries where the availability and easy access to facilities indispensable for using the discussed technology is provided. The study by Camilleri & Grech (2017) focused on the relevance of age categories in explaining online banking adoption rates and customer attitudes towards this service. The study explored the adoption rate of bank customers to internet banking in Malta with a relative importance of age categories. The results revealed that younger adults (aged 18–34) had a high preference for internet banking, while the preference for IB among

older adults (aged 50–68) was low, which implies that younger adults used IB more than the older ones. Moreover, it was noted that the absence of information about internet banking service, faceless banking, computer illiteracy and unavailability of the Internet were the major reasons for the low rate of internet banking adoption among the older adults. Similar relationships were confirmed by the results of research conducted by the authors investigating correlations between age and the adoption of FinTech (FinTech refers to the integration of technology into offerings by financial services companies in order to improve their use and delivery to consumers). Das & Das (2020) indicated that 66.6% and 62.3% of the people included in the age groups 18–28 and 29–39 represent the regular users of FinTech services, whereas only 26.9% were included in the 50 years-of-age and older category. Similarly, Li et al. (2020) found that younger consumers are more likely to adopt mobile payments than the older ones — the predicted likelihood of using mobile payments for an adult aged 20 is almost 10 times higher than that for an adult aged 75. Older users are less familiar with the latest technology and their ability to adopt it depends on their willingness, computer self-efficacy and dependence on prior knowledge. They have lower confidence in their own cognitive abilities, frequently acting as a self-fulfilling prophecy when adopting new technologies (Yousafzai & Soriano, 2012).

The same conclusion can be drawn from the analysis of the research results obtained by the authors, because only 15.59% of the respondents from the BB generation declared having high digital skills, while in the case of generation Z this percentage was already at the level of 29.10%, five percentage points more for the representatives of generation Y and over 46.24% for the youngest of the surveyed generations.

The obtained original research findings may have important implications for the entities providing mobile banking services. They should focus their activities on senior citizens, which, from the viewpoint of the offer and the way of using it, makes it simpler, communicative, and adapted to the possible health dysfunctions of these people. It is also important to provide them with personal contact with an employee of a financial institution.

Personal innovativeness is another determinant influencing the adoption of mobile banking (Malaquias & Hwang, 2016). Personal innovativeness stands for an individual's innate willingness to try out and adopt new technologies as well as the related services to achieve the specific goals (Chitungo & Munongo, 2013). The research findings of Agarwal & Prasad (1998) indicate that people characterized by higher personal innovativeness are more likely to develop positive attitudes towards adopting it than the less innovative individuals. In the case of mobile banking, personal innovativeness is a quality which contributes to the reduction of uncertainty (Montazemi & Qahri-Saremi, 2015), and thus may positively influence the perception of mobile technologies as both trustworthy and easy to use (Lu et al., 2005). Moreover, personal innovativeness shows a negative correlation with computer anxiety and a positive relationship

with the intention to adopt internet banking (Yiu et al., 2007), mobile credit cards (Tan et al., 2014) and mobile banking (Malaquias & Hwang, 2016). This finding is an expected one because it makes sense that the individuals who like to experiment with new technologies are more likely to use internet and mobile banking services. Similar correlations are confirmed by the research results collected by the authors, because as many as 81.11%, i.e. 335 out of 413 respondents who use internet and mobile banking services declared personal innovativeness.

Identifying the segment of people not using mobile banking services, formed by the representatives of older generations, who do not present digital skills and feature a low level of personal innovativeness (ID=7) should imply the activities of financial intermediaries aimed at identifying the benefits of using digital financial services. According to the authors, making them aware of these advantages may positively influence the increase of personal innovativeness, which is a personality trait, and therefore difficult to develop.

Benamati & Serva (2007) believe that making a decision about using e-banking requires consumers to consider concerns related to password integrity, privacy, data encryption, hacking and the protection of personal information. As the research findings show, the perceived risks of losing information during mobile banking transactions — firstly, it is an important factor that customers take into account when accessing the services based on modern technology and secondly, it has a negative impact on the adoption of mobile banking (Laforet & Li, 2005). Moreover, Wu & Wang (2005) found that there is a significant relationship between the perceived risk and the intention to use mobile payments, while Li et al. (2020) confirmed that the probability of using mobile payments will show an increasing tendency along with risk tolerance. An interesting research analysing the impact of broadly understood risk on the intention to use the services offered by FinTechs was conducted by Ryu (2018). This author examined four main dimensions of perceived risk: financial, legal, security and operational risk. He proved that the perceived risk affects negatively the adoption of FinTech, with legal risk having the greatest negative impact. Referring to the results of the research conducted by the authors of this study, it should be stated that the vast majority of the surveyed Poles (90.88%) do not perceive modern technologies as highly risky. Nevertheless, this predictor was among the variables significantly influencing the use of mobile banking services. The group of respondents not using this distribution channel for banking services included 6 percentage points more people perceiving modern technologies as highly risky than in the case of all respondents covered by the study.

Having considered the aforementioned results of own research, in particular regarding the identification of the third segment of the analysed population (ID=20), it seems founded to indicate the desired actions taken up by the entities interested in increasing the adoption of digital financial services focused on understanding the essence and types of the associated risks, along with the promotion of appropriate behavior in the face of emerging threats.

6. Conclusion

The conducted research allowed verifying the hypothesis stating that the limited personal innovativeness and low digital skills are the most important determinants of digital financial exclusion, which constitutes a barrier to the adoption of mobile banking services. Apart from them, the perceived risks and belonging to a given generation were also important. Finally, the directions of activities aimed at counteracting and the reduction of digital financial exclusion should be outlined. Considering the above, it can be easily indicated that education should become the instrument of financial inclusion in the analysed area of online and mobile banking. First of all, it solves the problem of low digital competences and should be primarily addressed to older generations. Secondly, it turns out to be a good tool for the reduction of the perceived risk related to information/ data loss during mobile banking transactions, since the concerns about using mobile banking services may largely result from the ignorance of security measures and the rules of safety procedures. Thirdly, education also means making people aware of the benefits resulting from using new technologies in contacts with the bank, which may cause an increase in the likelihood of adopting mobile banking services.

Education focused on the reduction of digital financial exclusion in the society should be carried out by the state, banks and the society itself in a holistic manner (Solarz et al., 2018). In the first case, it may take place through the education system, the active participants of which are not only the youngest members of society or the youth, but also senior citizens — students of universities of the third age. The Ministry of Digitization (2020) has prepared the Digital Competence Development Program until 2030 aimed at an ongoing increase in the level of digital competences by providing every Pole with the possibility of their development according to individual needs, which ultimately is supposed to contribute towards building an inclusive, open and modern society, and thus a better quality of life for the citizens. Obviously, through education the state develops general digital skills of its citizens, but as the results of the research conducted by the authors have shown — people with higher general digital skills also have higher skills used in online and mobile banking (Adamek & Solarz, 2020). The latter should be developed by banks, e.g., as part of Corporate Social Responsibility (CSR), which nowadays is extended to include Corporate Digital Responsibility (CDR) (see Lobschat et al., 2019). The concept of CDR means recognizing that the organizations acting in favour of technology development as well as the ones using technological innovation to deliver services have a duty to carry it out in a way that essentially leads to a positive future. In other words, this concept adopts, on the one hand, counteracting risks resulting from the advancing digitization and, on the other, takes advantage of the opportunities it provides attempting to find a balance and lead digital progress towards the direction in which technology affects the environment in a positive way (Suchacka, 2019, p. 13).

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Acknowledgements

Appendix

Table 1.
Factors underlying the choice of mobile banking: literature overview

Significant choice factors	Source/author
perceived usefulness	AlSoufi & Ali (2014), Elhajjar & Ouaida (2020), Nhat Vuong et al. (2020), Ramlugun & Issuree (2014)
perceived ease of use	AlSoufi & Ali (2014), Chakiso (2019), Elhajjar & Ouaida (2020), Karma et al. (2014), Nhat Vuong et al. (2020), Ramlugun & Issuree (2014)
trust/credibility	Chakiso (2019), Flavián et al. (2006), Karma et al. (2014), Nhat Vuong et al. (2020)
perceived risk	Benamati & Serva (2007), Chakiso (2019), Elhajjar & Ouaida (2020), Harridge-March et al. (2008), Karma et al. (2014), Laforet & Li (2005), Li et al. (2020), Ryu (2018), Wu & Wang (2005)
perceived relative benefits	Chakiso (2019)
compatibility with the followed values and standards/attitude to the service	Chakiso (2019), Harridge-March et al. (2008), Nhat Vuong et al. (2020), Ramlugun & Issuree (2014)
perception of the limitations in using new technologies/ability to use	Agarwal & Prasad (1998), Chitungo & Munongo (2013), Lu et al. (2005), Malaquias & Hwang (2016), Montazemi & Qahri-Saremi (2015), Nhat Vuong et al. (2020), Ramlugun & Issuree (2014), Tan et al. (2014), Yiu et al. (2007)
pressure of a specific behaviour	Nhat Vuong et al. (2020)
demographic characteristics (age, gender, income, education)	Das & Das (2020), Flavián et al. (2006), Garín-Muñoz et al. (2019), Georgieva (2018), Laukkanen & Pasanen (2008), Li et al. (2020), Liébana-Cabanillas et al. (2014), Omotayo & Akinyode (2020)
digital skills	Camilleri & Grech (2017), Elhajjar & Ouaida (2020), Garín-Muñoz et al. (2019), Garrett et al. (2014), Liébana-Cabanillas et al. (2014), Porter & Donthu (2006), Yousafzai & Soriano (2012)
financial knowledge (objective/subjective)	Li et al. (2020)

Source: Own preparation.

Table 2.
Research sample: characteristics (%)

| Gender (n=658)					
women			men		
53.60			46.40		
Generation (n=100%)					
baby boomer	X		Y		Z
31.00	28.70		26.30		14.00
Education (n=100%)					
elementary/lower secondary	basic vocational		secondary		higher
1.80	6.40		45.00		46.80
Net income (PLN) (n=100%)					
<1000	1001–2000	2001–3000	3001–5000	>5000	answer declined
6.00	20.50	24.30	22.30	8.10	18.80
Place of residence (n=100%)					
village	city <20 thous.	city 20–99 thous.	city 100–199 thous.	city 200–499 thous.	city >500 thous.
36.30	10.20	21.40	10.60	9.00	12.50

Source: Own preparastion based on the conducted survey studies.

Table 3.
The assumptions adopted in CART procedure

Specification	Assumptions
misclassification costs	equal
measures of fit (split rule)	Gini index
stop criterion	in the case of a misclassification error
minimal number	65
maximum number of tree levels (depth)	10
maximum number of nodes	1000
error estimation	10-fold test validation

Source: Own preparation.

Chart 1.
Share of people with an online bank account in the nationwide sample of respondents (%)
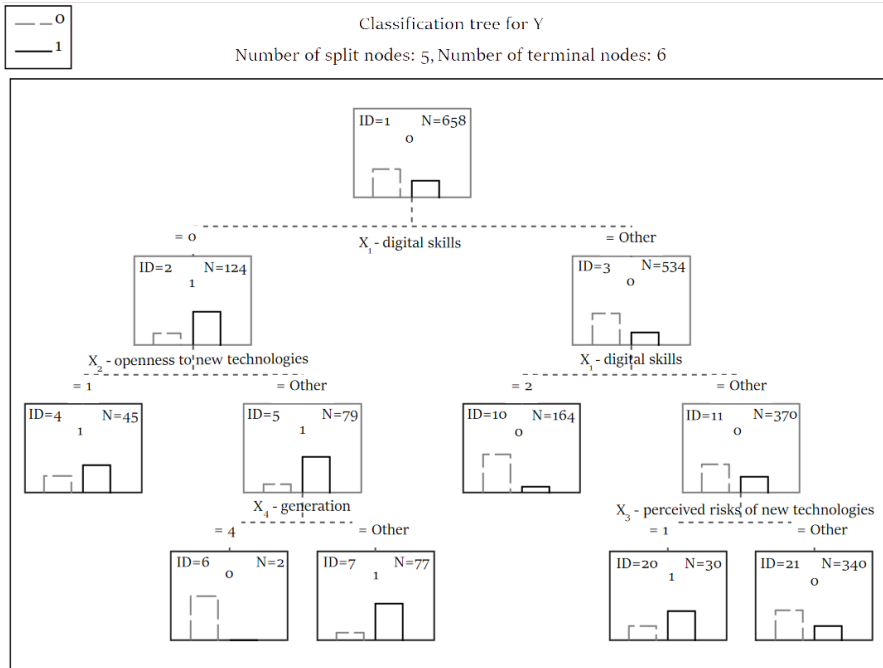

37

63
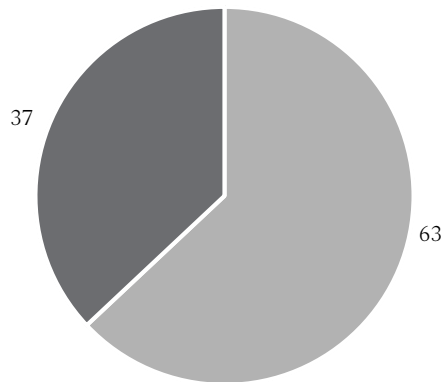
■ people with an online bank account (658)   ■ people without an online bank account (352)

Source: Own preparation based on the conducted survey studies.

Chart 2.
Classification tree

Classification tree for Y

Number of split nodes: 5, Number of terminal nodes: 6

| ID=1 | N=658 |
| 0 |

X_1 - digital skills

= 0 — = Other

| ID=2 | N=124 |
| 1 |

| ID=3 | N=534 |
| 0 |

X_2 - openness to new technologies

= 1 — = Other

X_1 - digital skills

= 2 — = Other

| ID=4 | N=45 |
| 1 |

| ID=5 | N=79 |
| 1 |

| ID=10 | N=164 |
| 0 |

| ID=11 | N=370 |
| 0 |

X_4 - generation

= 4 — = Other

X_3 - perceived risks of new technologies

= 1 — = Other

| ID=6 | N=2 |
| 0 |

| ID=7 | N=77 |
| 1 |

| ID=20 | N=30 |
| 1 |

| ID=21 | N=340 |
| 0 |

Source: Own preparation.