PERSONAL FINANCES IN THE ERA OF MODERN TECHNOLOGICAL SOLUTIONS

Anna Warchlewska[*], Alfred Janc[**], Rafał Iwański[***]

Abstract

The purpose of the article: the aim of the article is to present the essence of personal finance management using modern financial technologies. The paper seeks to answer the question of the impact financial literacy and the growth of the fintech solutions have on personal financial management.

Methodology: the analysis leads to an answer to the question of which determinants have an impact on consumers' financial decisions and what remote tools the market offers. The paper hypothesizes that the intensification of educational activities tailored to each age group by institutions offering financial services may influence the greater use of modern tools in the process of personal finance management. Theoretical considerations are based on an in-depth query of literature on the subject. Research and financial experimentation in the field of financial knowledge and skills are presented. The secondary empirical material is used to analyze the development of the FinTech industry.

Results: The effectiveness of financial education is observed only in specific financial behaviors. The financial industry is shaped by recipients, who instead of financial education, look e.g. financial coaching for a specific problem at different stages of their lives. Changes in population structure (aging population) and a large group of customers from disadvantaged groups (e. i. seniors, disabled people) require the development of new, matched strategies by banks and financial services providers. Too much self-confidence and a low level of consumer knowledge of cybersecurity is becoming a challenge for modern financial technologies.

Keywords: financial education, financial literacy, modern financial technologies.

JEL Class: D14, D18, D83, G53, I22.

---

[*] Doctor, Poznan University of Economics and Business; https://orcid.org/0000-0003-0142-7877.
[**] Professor, Poznan University of Life Sciences; https://orcid.org/0000-0002-0654-1241.
[***] Doctor, University of Szczecin; https://orcid.org/0000-0001-6345-9677.

155

INTRODUCTION

The motivation for writing this article was to determine whether and how the development of modern financial technologies and the current economic turmoil associated with the pandemic determine consumers' financial behaviour. The current economic situation related to the COVID-19 pandemic forces consumers to use remote channels to access their finances (Waliszewski and Warchlewska, 2021: 681–699). Increasing uncertainty, reduced income or a complete loss of livelihoods may lead to the ruin of households' finances and loss of liquidity. For this purpose, the internet and mobile applications may offer alternatives to traditional banking solutions. The prerequisite for proper and safe use of modern tools is to have the necessary knowledge and skills, not only financial. Minimizing concerns, the proper diagnosis of needs, and complementing the gaps in financial knowledge (ZBP, 2020a) are challenges for all the financial market institutions (Leibowitz, 2016). Especially in the case of groups digitally excluded due to: age, underdeveloped IT infrastructure in poorly urbanized areas, low level of basic competencies, and low income (Popiołek, 2013: 310–320; Tomczyńska, 2017: 1–17).

The issue of financial education is becoming more and more important, which is mainly due to the dynamic development of the global financial markets (Panos and Wilson, 2020: 297–301). Financial education is becoming a challenge for financial institutions, third party financial services providers, state authorities, and non-profit organizations alike. Central banks, apart from performing the stabilization and control functions, undertake initiatives referring to the real effects of their activities (Janc et al., 2015), among others in the area of economic education, determining positive behaviors and social habits. These activities are diverse in terms of the educational tools used and target groups. Signaled problems concerning the understanding of economic mechanisms in society and defined knowledge gaps have contributed to the increased activity of central banks in the area of education. The choice of tools that can be used to transfer economic knowledge and shape skills is wide, depending primarily on the target group. Information and economic knowledge transmission channels and content profiling to specific audiences are important. Especially as the aging of the population will increase the importance and share of the silver economy in the financial services market, including the banking sector. This requires new technologies to be adapted to consumers aged 65 and over (Frąckiewicz, 2019). It is worth stressing that seniors do not constitute a homogeneous group, and it is important to take into account both those entering the first stage of old age. Most often, the age of 60 or 65 is used as the threshold or a separate age limit is introduced for men 65, and for women 60. In ONZ studies, a uniform age of 65 is used for men and women. The aging of a given population is evidenced by the decreasing –

in the general population – number and share of children (0-14 years of age) and increasing number and share of elderly people (65 years and older) (GUS, 2021; Iwański, 2017: 119) when diagnosing needs and designing measures.

Globalization and the development of modern technologies are causing changes in the financial markets. A particularly complex situation is characteristic of the banking services market, where the digital revolution has an increasing impact on the business models of banks. The development of technology in banking undoubtedly shapes a new model of life.

The article aim is to present the essence of personal finance management using modern financial technologies. The paper focuses on personal finance management applications and robo-advisory platforms. The paper hypothesizes that the intensification of educational activities tailored to each age group by institutions offering financial services may influence the greater use of modern tools in the process of personal finance management. The article consists of three main sections. The first one presents an overview of theoretical considerations on personal finances and the development of modern financial technologies. The second section presents what the impact of financial education can have on consumer attitudes and behaviour. The third section presents the challenges of modern finance, both in education and in meeting consumers' daily financial needs. The whole article ends with a summary. The study is based on an in-depth query of literature and available secondary empirical data.

1. LITERATURE REVIEW

To place personal finances in modern financial science, taking into account the subjective criterion, it is possible to distinguish the finances of banks and financial institutions, finances of business insurance, finances of enterprises, and finances of households. The latter include personal finances. This is a field of science dealing with the collection of financial resources and their spending (Galperti, 2019), related to the management of financial resources by household members (Świecka and Musiał, 2014; Barembruch, 2012). According to Waliszewski (2011), finance of households is a sub-discipline of private finance separated according to the subjective criterion, which covers all processes and phenomena related to the collection, distribution, and spending of financial resources by households. Literature within the framework of household finances distinguishes and classifies sub-disciplines taking into account the criterion of subjectivity, as well as the criterion of object, instrument, and space (Owsiak, 2002). To appropriately match financial instruments to the recipient (Fig. 1), the following are distinguished: personal finances, finances of microenterprises, individual farmers, and microfinance (Flejterski, 2007).
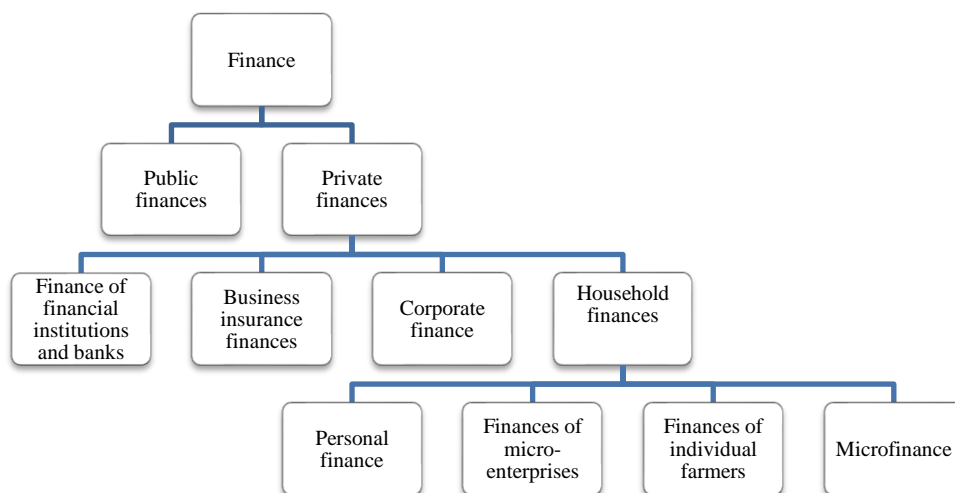
Figure 1: The place of household finances in modern financial science

Source: Barembruch, 2012: 241.

Personal finance is a narrower concept than household finance, covering all processes and phenomena related to the acquisition, accumulation, and disbursement of financial resources by individuals not engaged in economic activity. Finances of micro-enterprises refer to people running a business on their own (up to 9 employees). Farmers' finances are finances of the natural persons whose main source of income is agricultural production (without registration in the form of an enterprise, company, or cooperative). Microfinance is the processes and phenomena that arise in connection to the social and economic activity of people, related to the accumulation, distribution, and spending of money resources by people with low income (often affected by financial exclusion) (Barembruch, 2012).

A prerequisite for effective management of personal finances is an understanding of the principles of financial instruments. According to the Organisation for Economic Co-operation and Development and the International Network on Financial Education, financial literacy is a concept that includes: awareness, knowledge, skills, attitudes, and behaviors necessary to make appropriate financial decisions and achieve financial welfare (Włodarska-Zoła, 2018; OECD INFE, 2011). The literature on the subject through economic education generally emphasizes extensive activities aimed at the dissemination of knowledge and practical skills that help in the proper participation in social life and the achievement of assumed objectives in the private and professional sphere without negative consequences due to ignorance of the laws of economics

(Iwanicz-Drozdowska, 2011). The definition of the areas of education allowed to separate four components of economic education (Noga et al., 2016): financial (banking and insurance), entrepreneurship, consumer and macroeconomic. In many analyses and reports, the most frequently undertaken theme is financial education (Kovlačikova et al., 2011; EESC, 2018; OECD, 2019). Financial education leads to instilling in the society the financial knowledge necessary to create household budgets, initiate saving plans, and make strategic financial decisions (Janc and Warchlewska, 2018: 23–46; Świecka and Musiał, 2018: 129–140).

The problem of financial knowledge is analyzed in three aspects. The first mainly concerns defining the phenomenon. Most often the term refers to the ability of the consumer or his ability to function independently about to money management (Al-Tamimi and Kalli, 2009). Following Melitz's thought (1970) that money is a collection of symbols, financial knowledge can be described as the ability to read symbols (code). The second aspect refers to the relationship between the level of financial knowledge of consumers and the degree of economic development of the country (OECD, 2005; Lusardi, 2008). The third aspect concerns the relation between the level of financial knowledge and the demographic variables of consumers (Volpe et al., 2002). Particularly in the case of people whose main source of income after entering seniority is profited from capital or work.

A growing body of evidence suggests that financial literacy is among the most important determinants of financial well-being (Xiao, 2016). Informed financial decisions have shown to be a key factor in making effective financial choices (Lusardi and Mitchell, 2014). Differences in financial knowledge acquired early in life explain a significant part of wealth inequality during retirement (Lusardi et al., 2017).

Available consumers' knowledge surveys give a pessimistic picture of the financial services user (*Financial Literacy…*, 2014; OECD, 2016; *Consumer Financial…*, 2019). The lack of sufficient knowledge and understanding of complex investment instruments, combined with the complexity of products, causes the risk of misselling. The educational initiatives are taken by the supervisors, central bank, commercial and cooperative banks in Poland most often concern educational publications in various areas of finance, thus monitoring the risk of, for example, cyber attacks (ZBP, 2020b). Under conditions of market uncertainty, the lack of employment stability, the FinTech market may come out on top. FinTechs (Frame et al., 2018; Thakor, 2020) have entered this space by utilizing technology to offer effective training and education by creating apps or offering mobile training platforms.

2. IMPACT OF FINANCIAL LITERACY ON FINANCIAL BEHAVIOR

The available studies are inconclusive: in terms of effectiveness (Lusardi and Mitchell, 2014) of educational activities or lack thereof (Willis, 2011). Moreover, Fernandes et al. (2014) highlight the very spectacular effects of financial education, while Miller et al. (2015) indicate that financial education can only be effective with specific financial behavior.

The World Bank Group's metadatabase[1] on the assessment of the impact of financial education on the behavior of audiences (Kaiser and Menkhoff, 2017: 1–38) is important for applying for this issue. The data source was over 500 potentially relevant articles published in journals and over 600 results from working document databases, which overlapped to some extent. An in-depth meta-analysis led to the selection of 126 independent studies. The results of the analyses were aimed at verifying two objectives of financial education: improving financial literacy and financial behavior in a uniform environment. Besides, the analysis focused exclusively on the impact of cross-sectional differences in financial knowledge on financial behavior and how it is delivered to target groups. Determinants of positive impact on financial education, improvement of financial knowledge and financial behavior were examined. Based on the meta-analysis it was concluded that financial education has a significant impact on financial behavior and can have an even greater impact on financial literacy. The presented analysis expands the scope of available research by a sample of randomized experiments. The set of available data assumes that the main distribution channels of financial education programs are: schools, universities, workplaces (about 83% of all estimates). The second type of educational intervention is online financial education (about 8% of the estimates). The third type of available sources of financial education is individualized counseling interventions (about 2% of the estimates). Furthermore, the channel of educational intervention can be workplace information fairs, brochures (about 7% of the estimates).

In assessing the quality measurement of financial decisions, researchers use different measurement techniques. According to Ambuehl et al. (2017), good option is measuring the quality of financial decision-making built around the concept of financial competence. An experiment was conducted through the online labor market Amazon Mechanical Turk. An important feature of this population is that the typical member has a poor understanding of compound interest. Also, this group resembles the target populations for many financial education programs in terms of demographic characteristics such as age and

---

[1] Meta-analysis - a quantitative method of synthesis of results from many empirical studies on the same research question. In such a study, the dependent variable consists of aggregate statistics presented in reports from primary studies. Explanatory variables may include the essence of the study, characteristics of the sample tested and other impact assessments.

income. The experiment consisted of three stages. The first was to watch one of four educational videos, randomly selected. Secondly, they completed motivating valuation tasks. Finally, they took the interest test and answered the survey questions about the decision-making strategies they applied in the second stage. The performance of the test was motivated, and participants knew about it before watching the educational video. Broadly, experience to date indicates that AMT provides a useful and reliable platform for many types of behavioral research in social science. The experiment had eight sessions with a total of 504 subjects during April and May 2014, all on weekday mornings. They restricted participation to subjects who reside in the US and are at least 18 years of age. Subjects logged into our study from the AMT worker interface. Participants were welcomed by a two- and-a-half minute video recording of one of the authors who vouched that we would pay subjects exactly the amount we promised them within at most two days of the promised date. Before participating in the main stages of the experiment, subjects completed an unincentivized questionnaire concerning demographics, as well as a standard battery of five questions designed to assess financial literacy. The average length of a session was 62 minutes (s.d. 22 minutes). Attrition was negligible and unrelated to the treatments. On average, subjects earned $22.86, including a fixed $10 participation fee; earnings ranged from a low of $10 to a high of $30.47. In comparison, AMT participants typically earn about $5 per hour. The authors of this experiment said this notion to document the potential pitfalls of the types of brief rhetoric-laden interventions that are commonly used for adult financial education. Authors of the experiment deploy a new methods to examine the effects of a financial education intervention on the quality of decision making. This experiment involves:

a) a web-based financial education intervention narrowly focused on the concept of compound interest,

b) it is associated with a well-documented behavioral bias that an intervention, if effective, would counteract,

c) it is a fundamental concept in financial decision making and most financial education courses cover it. The experiment proved that measure admits a formal welfare interpretation even when consumers suffer from additional decision-making flaws, known and unknown, outside the scope of analysis,

d) its narrowness, and the corresponding brevity of treatments in standard investment guides and employer-sponsored financial education programs, make it suitable for an intervention of limited duration,

e) the experiment also demonstrated that conventional methods of evaluation do not reliably detect these deficiencies, thereby establishing the importance of including assessments of financial competence in evaluations of educational interventions.

Another interesting study is an experiment conducted at the University of Szczecin (Świecka and Musiał, 2018: 129–140) to assess whether a short financial education course has a positive impact on the subjective and objective evaluation of financial knowledge. Its idea is based on the Italian prototype (Brugiavini et al., 2015) in 2013/2014, in which the experiment was conducted online (among 579 people) and in a laboratory (100 people). The survey among students of the University of Szczecin was conducted using a paper survey (among 185 people) in the 2015/2016 academic year. The participants were undergraduate students in management, logistics, law, and administration. The survey aimed to analyze students' knowledge and financial awareness. The survey participants were divided into two groups. One of the groups was trained in basic economic concepts, while the other was the base group (reference group). Two questionnaires were used to collect data: *ex-post* and *ex-ante*. The first survey was conducted a week before the course. The second survey was conducted one month after the course. The questions were not the same as in the first survey, but the answers to these questions were fully comparable. A questionnaire developed by the Italian team (Brugiavini et al., 2015) was used to measure financial skills and investment attitudes. The questionnaire contained three questions for measuring financial skills: "Inflation", "Interest compounding" and "Diversification" and three questions to measure investment attitudes: "Real vs Nominal", "Investment plan", "Principle 72". An additional question referred to the self-assessment of respondents' financial skills according to a numerical scale from 1 to 7, where 1 is the lowest and 7 the highest.

The most important conclusions from the experiment are (Świecka and Musiał, 2018: 129–140):

a) all correlations were statistically insignificant ($p > 0,050$). The experiment in Poland was carried out on a pilot group, but it reveals limitations that may make such an experiment impossible,

b) lack of anonymity of the respondents, which in many cases resulted in a lack of consent to participate in the survey,

c) lack of the motivation of respondents to fill in the questionnaires – questions left unanswered or marked at random,

d) the control group was susceptible to other factors which could also lead to behavioral changes and increased financial knowledge,

e) the returns from the final research were unfortunately at a lower level than those carried out before the experiment.

Statistical analysis of the obtained results made it possible to show that taking a course in finance raises subjective assessment of the level of financial knowledge and objective evaluation of investment attitudes. Unfortunately, it was not possible to show that participation in a course in finance involves an objective assessment of

the level of financial knowledge, which is probably due to the methodological limitations of the pilot studies (Świecka and Musiał, 2018: 129–140).

A survey conducted (November 2015–March 2016) among consumers in selected CEE countries shows great similarities in both the real level of financial knowledge and their subjective approach to this type of education (Smyczek, 2016: 24–35). In all analyzed countries (Poland – 527 questionnaires, Romania – 495 questionnaires, Slovakia – 571 questionnaires, Ukraine – 504 questionnaires, and Hungary – 583 questionnaires) the level of financial knowledge (objective and subjective) was low. The characteristics (amounts) adopted in the survey were gender and education as variables, which in earlier available surveys showed significant differences in the consumers' knowledge. According to this research, the level of financial knowledge depends on gender, education, and professional experience. Financial knowledge was found to be perceived as boring and rather unnecessary in the countries studied.

The research shows that educational effects depend on the target group, the educational tool used, and the educational program. It seems that the large dispersion of educational program of banks and other entities does not increase the level of financial knowledge. What is important is that improving financial literacy has an indirect impact on financial behaviour. The question must therefore be asked as to what strategy and integrated tools can help to improve consumers' knowledge and attitudes on the financial market. Perhaps the answer is close cooperation between banks and the FinTech industry in terms of educating consumers?

3. PERSONAL FINANCE IN THE DIGITAL ERA

The application of modern financial solutions not only serves to minimise the costs associated with employment, but also to target action on the complex problems faced by customers. Robotics and artificial intelligence (Xie, 2019: 1–7) both significantly influence the financial industry, as the technology used there is a key element in the strategy of banks and emerging financial entities (Jung et al., 2018: 81–86). Replacing traditional consultancy services with innovations, especially at the beginning, is not met with much enthusiasm, mainly due to the novelty factor, competition, fear and lack of knowledge (Belanche et al., 2018: 1411–1430).

Digital technologies (Tanda and Schena, 2019) and their impact on consumer decisions currently stand at the forefront of international consumer policy discourse (Bhatia et al., 2019: 1–9). The use of modern technologies presents a clear opportunity to accelerate the transformation of the banking sector and give users greater control over their finances and increase the value of their

investments. The impact of modern financial technologies on data transfer and security, consumer privacy, as well as the responsibility of financial service providers on online platforms and digital consumer education are just some of the hot topics of our times (Świecka et al., 2020; Thorun and Diels, 2020). The growing popularity of mobile applications forces the banking sector to look at the market more broadly and to cooperate with the FinTech industry. In order to be able to compete with external entities for the user of their applications, banks must implement more advanced personalisation strategies to facilitate more targeted marketing and product development using artificial intelligence (Nicoll, 2019).

Banks, inter-bank entities, third party providers as well as other financial institutions play a major role in the development of FinTech industry. Apart from innovation, elements of the competitive advantage of FinTech industry entities are simplified procedures, relatively low fees, and modern technological solutions. The development of the potential of modern solutions requires an appropriate scale of business and consumer confidence - these elements are owned by banks. Banks now see the need for cooperation in implementing technological innovations. Improvements in the management of home finances can be made using appropriate tools:

a) PFM (Personal Finance Applications) – the PFM application market (Fig. 2) is divided into applications offered by financial institutions from the banking sector and applications offered by external entities (non-banking, community). Mobile applications on the global markets that help to manage personal finances are especially aimed at the young generation that is entering adulthood. They are characterized by a modern approach in terms of graphics, functionality, and availability for smartphones of different generations. It should be noted that developers of available applications on the market compete with each other in terms of the usefulness of their programs and their functionality. They are undoubtedly connected by a practical dimension, which in the case of the subject of finance is extremely important. The form of using PFM tools depends on the consumer's preferences and/or the form of making them available to the users offered by the provider. A combination of advances in technology, new uses of data, and changes in customer preferences and expectations are likely to create lasting structural changes in financial services (credit, digital payments, savings, investments & PFM, distributed ledger technology) (Marder, 2016).

b) Robo-advisor – class of financial advisers that provide financial advice or investment management online with minimal human intervention. the desire to use modern solutions is associated with the need to choose the right software, purchase a license, or install applications on a mobile device. The application of automated financial advice relies on generating financial signals in the sphere of financial instruments. A tool with a built-in algorithm is provided to the customer by the investment company and serves as an advisor in the process of entering into

a transaction. Research on robo-advice focuses on US users because it is the largest and oldest market. One indication that emerged is that users of robo-advisory services are young and confident in their financial abilities yet distrustful of traditional channels of financial advice (Woodyard and Grabe, 2018).

Non-banking applications	Banking applications
Mint, Kontomierz, mToken Asseco MAA, You Need a Budget, Money Lover, Kwitki, Wallet, Fuelio, Billy, Mój Portfel - My Money Tracker, Pan Paragon, Szybki Budżet,, Quicken, Robinhood, Prism, Spendee, Monefy, Personal Capital, Birch Finance, Acorns, Twine	• Alior Bank, Santander Bank Polska, Bank Millennium, NBP Paribas, Getin Bank, Nest Bank, PKO BP, mBank, ING Bank Śląski, Inteligo, Envelo Bank, BOŚ, T-Mobile, Credit Agricole, Eurobank, Citi Handlowy, Toyota Bank, Pekao SA
(worldwide applications: payable and free of charge)	(case: Poland, Banks in Poland in the Newsweek ranking (2019) of the best PFM applications)

Figure 2. Selected types of PFM applications

Source: own study.

Table 1. Worldwide and Poland – Robo Advisors characteristics

	2017	2018	2019	2020	2021	2022	2023
	Worldwide						
Assets under Management in million US$	240 025	543 188	980 541	1 442 028	1 863 438	2 231 721	2 552 265
Assets under Management Growth in per-cent	126,30	80,50	47,10	29,20	19,80	14,40	126,30
Users in thou-sand	13 104,6	26 100,50	45 773,9	70 508,60	97 397,70	123 538,6	147 018,4
Penetration Rate in percent	0,20	0,40	0,60	0,90	1,30	1,60	1,90
av. Assets under Management per User in US$	18 316,0	20 811,0	21 421,0	20 452,0	19 132,0	18 065,0	17 360,0
	Poland						
av. Assets under Management per User in US$	6 643,0	6 242,0	6 099,0	6 214,0	6 503,0	6 892,0	7 337,0
Users in thou-sand	3,60	8,80	17,70	29,60	42,80	56,00	67,90

Source: Statista.com; Warchlewska and Waliszewski, 2020: 54–55. Datebase: Statista, last update: 2019-09; exchange rate: 1000 USERS/USD.

According to data by Statista.com [2020], the number of robo-advise users, as well as world market penetration, are increasing, along with a concurrent forecast (as far as 2023) of a decline in growth and stable asset values (Tab. 1). "In terms of the Polish market, robo-advice is at a preliminary development stage, taking into account assets under management (AUM), several users, user assets, and market penetration rate. Statistical forecasts evidence this until 2023. The number of active users, according to Statista.com data, will increase from 3.6 thousand people up to 68 thousand. Comparing this on a global scale, the investment value per 1 user is almost 3 times higher. In terms of the value of assets per user, a stable increase will occur from 6.7 thousand USD up to 7.3 thousand USD. The market penetration rate stands at a minimal level, although there is an upwards tendency from 0.01% in 2017 to 0.1% in 2023" (Warchlewska and Waliszewski, 2020: 54–55).

Currently, the financial industry is shaped by clients who instead of financial education are looking for financial coaching which stands for individual approach to customers, financial advice at the right time of life. The global PMF software market reached $795 million in 2016 and is expected to grow rapidly to 2023 to $1,213 million (Fig. 3).
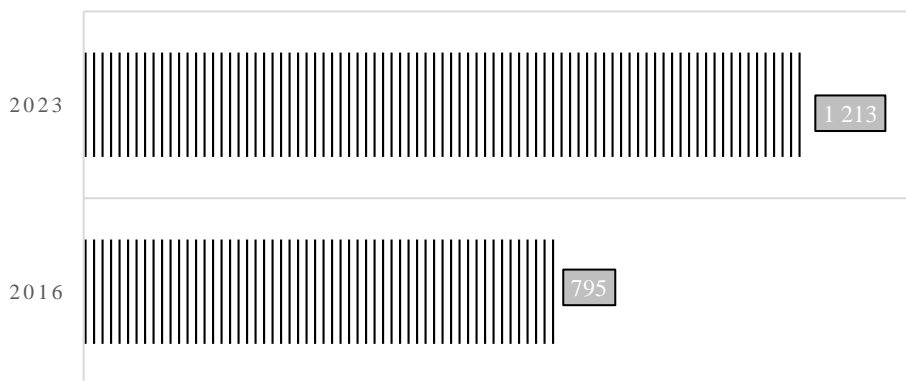

Figure 3. Global PMF software market ($ million)

Source: Allied Market Research, 2020.

The global personal finance software market is divided into segments according to the product type, end-user, and region. In terms of the product type (key for remote personal finance management), web-based software (websites) and mobile applications are distinguished (Fig. 4) The market saturation forecast assumes an increase from 60% in 2016 to 85% in 2023 for web-based software and an increase from 45% in 2016 to 79% in 2023.
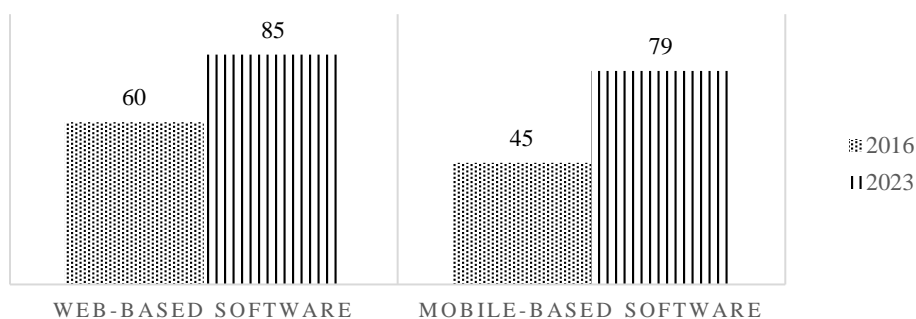
Figure 4. Global personal finance software market by product type (%)

Source: Allied Market Research, 2020.

Most of the PFM applications require integration with the bank profiles of customers to import data. They don't include the use of stand-alone apps, like Mint (budget tracker and planner) or Acorns – (savings automation and investment tool) with 20 and 30–40 million users in the US, correspondingly. These people can also be counted as PFM users (or at least PFM-features users), therefore the real adoption rate is much higher. The market research indicates the customers' global demand for FinTech services (Fig. 5). What is worth emphasizing is that the use of this type of service requires the user to be competent not only in the area of economic knowledge but also in the area of IT. Although service providers strive to make their products as functional and intuitive as possible, there may be barriers preventing the spread of the offer outside the group of recipients showing specific competencies and attitudes.

Figure 5. Comparison on FinTEch categories ranked by adoption rate from 2015 to 2019

Source: Ernst and Young, 2019: 10: the figures show the average percentage of respondents who reported using one or more FinTech services in that category. Data for 2015 differs from that originally published to align to the 2017 categorization and averaging methodology.

In the period 2015–2019, the number of people using FinTech services increased from 16% in 2015 and 33% in 2017 to 64% in 2019. This represents an increase of almost 100% every two years. According to EY's Global Fintech Adoption Index (Ernst and Young, 2019), China and India are leading in the development of the FinTech industry. According to a survey conducted by Ernst and Young (2019) among 27,000 consumers in 27 markets, it is concluded that the state of implementation of FinTech solutions is positive, and the growth of internet banking and mobile platforms drives the use of products and services remotely. Consumer awareness is at an all-time high with 96% of respondents stating they are aware of FinTech transfer or payment services. 89% are aware of in-store mobile phone payment platforms and 82% are aware of peer-to-peer payment systems and non-bank money transfers, the survey found. Money transfer and payments services are the most commonly used FinTech categories (75%), followed by financial insurance (48%), savings and investments (34%), and budgeting and financial planning (29%).
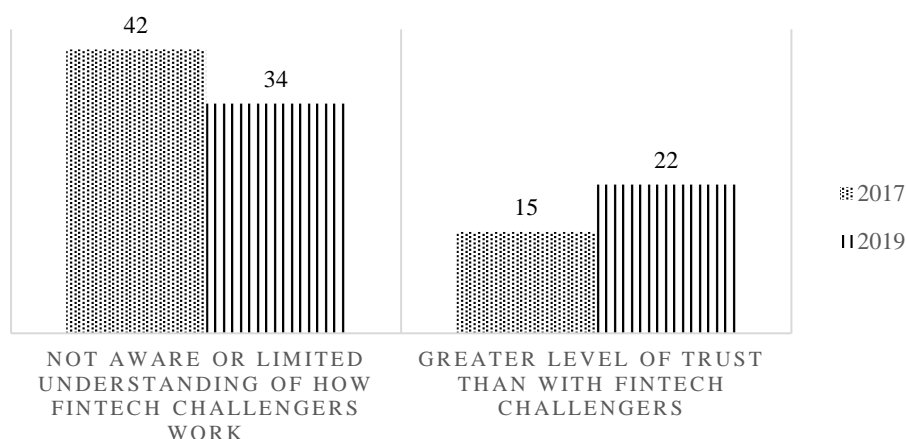

Figure 6. Select reasons for using incumbent financial institutions, from 2017 to 2019 (%)

Source: Ernst and Young, 2019: The figures show the percentage of non-adopters that chose each answer as the primary reason for using an incumbent financial institution in 2019 and 2017. Data for 2017 differs from that originally published to align with the 2019 categorization and averaging methodology.

Although the share and importance of FinTech services are growing rapidly, it is worth considering the barriers to further development that may result from changes in the demographic structure of individual populations. Particularly since the age of developed countries associated, among others, with the OECD or the EU, is increasing the number of older people, including those aged 85/90

and over, who are less susceptible to modern personal finance management solutions. In a context of market uncertainty and new, unknown solutions, financial service providers must gain the confidence of their customers. There is still a high level of public confidence in the main bank or insurer, with 33% confidence in the FinTech industry (confidence in an alternative financial services provider). As in 2017, the lack of awareness and understanding is still the main reason why consumers decide to use the services of a financial institution that is well established in the market. Trust is a major barrier to using FinTech's services in Chile, France and, Japan, among others. The internal technological development of the main entities (banks, insurers) is becoming more and more frequent, which makes their ability to build the popularity of new services new (Fig. 6).

Most adopters and non-adopters say they would turn first to their current bank or insurer when considering a new service. However, 34% of adopters said they would first turn to alternative providers, be it another incumbent, a price comparison web site, or a FinTech challenger. In contrast, 22% of non-adopters said they "did not know" where they would turn, suggesting they are underserved by their current banks and insurers while lacking knowledge of alternatives (Ernst and Young, 2019: 1–44; OECD, 2020).

CONCLUSION

The development of the financial market goes hand in hand with the creation of new financial institutions and instruments which, with a diagnosed social gap in financial knowledge, boosts the demand for professional advice and modern tools that support the process of personal financial management. Analysis conducted on the literature related to this subject, along with available results of research and experimentations, enables conclusions to be drawn regarding how modern financial technologies used for making financial decisions influence the level of customer expectations.

Lack of sufficient knowledge and understanding of complex investment instruments, combined with the complexity of products, gives rise to the risk of mis-selling. Available research is not clear on the effectiveness of educational measures. It should be stressed that the effectiveness of financial education is only observed in specific financial behaviour.

On the other hand, changes in population structure (aging population) and a large group of customers from disadvantaged groups (e.i. seniors, disabled people) require the development of new, matched strategies by banks and financial services providers. Due to their number, they may constitute a reservoir of future,

potential users and customers. Trust in new service providers is a major barrier to using FinTech's services. Moreover, too much self-confidence and a low level of consumer knowledge of cybersecurity is becoming a challenge for modern financial technologies. Service providers try to ensure the functionality and intuitiveness of modern solutions, but there may be barriers to the dissemination of the offer outside the group of recipients showing certain (expected by the bidders) attitudes and competencies.

The diagnosed consumer distrust in new financial solutions may be minimized through integrated actions on the bank - FinTech entity line. The banks' strategy of selling profitable products and services to promising customers only has to change in the long run. Compared to external entities, banks still enjoy high customer confidence, so they should be the main source of education and awareness-raising on the use of financial management applications and robo-advice platforms. Apart from the publication of scientifically and cognitively interesting guides and instructions, banks should focus their attention on changing the channel of contact, especially in conditions of social isolation, such as video chats, online chats, webinars, real-time online guides (step by step installation). Raising the already existing competencies or learning from the basics will allow for the popularisation of modern solutions for remote financial management and the expansion of financial knowledge.

The above considerations lead to the conclusion that the passivity of financial institustion in the area of financial education, especially in the area of modern technologies has an impact on conservative consumer financial attitudes. However, this is no reason to lose the confidence of customers.

REFERENCES

Allied Market Research. (2020). *Personal Finance Software Market by Product Type (Web-based Software and -based Software) and End User (Small Businesses Users and Individual Consumers). Global Opportunity Analysis and Industry Mobile Forecast, 2017–2023*, https://www.alliedmarketresearch.com/reports-store; https://www.researchnester.com/reports/portable-solar-charger-market-global-demand-analysis-opportunity-outlook-2023/247 [Accessed 11.12.2020].

Al-Tamimi, H.A.H. and Bin Kalli, H.A. (2009). Financial literacy and investment decisions of UAE inventors. *The Journal of Risk Finance*, 10(5), pp. 500–516.

Ambuehl, S., Bernheim, B.D. and Lusardi, A. (2017). A method for evaluating the quality of financial decision making, with an application to financial education. *National Bureau of Economic Research, NBER Working Paper Series, Working Paper*, 20618, pp. 1–46.

Barembruch, A. (2012). Personal finance management – theory and practice. *Scientific Journals of the University of Szczecin. Finances, Financial Markets, Insurance*, 50, pp. 239–248.

Belanche D., Casaló, L.V. and Flavián, C. (2018). Artificial Intelligence in fintech: understanding robo-advisors adoption among customers. *Industrial Management & Data System*, 119(7), pp. 1411–1430.

Bhatia, A., Chandani, A. and Chhateja, J. (2019). Robo advisory and its potential in addressing the behavioral biases of investors – A qualitative study in Indian context. *Journal of Behavioral and Experimental Finance*, 25(5), 100281, pp. 1–9, https://doi.org/10.1016/j.jbef.2020.100281

Brugiavini, A., Cavapozzi, D., Padula, M. and Pettinicchi, Y. (2015). Financial Education, Literacy and Investment Attitudes, *Netspar*, DP-06/2015-014, pp. 1–35.

Consumer Financial Literacy Survey, (2019). Harris on Demand. The Harris Poll., https://cdn2.hub-spot.net/hubfs/5146491/NFCC_2019%20FLS_datasheet%20with%20key%20find-ings_032519.pdf?utm_referer=https%3A%2F%2Fwww.nfcc.org%2Fresources%2Fclient-im-pact-and-research%2F2019-consumer-financial-literacy-survey%2F [Accessed 05.04.2020].

EESC, (2018), *Financial Education for all. Financial education strategies and best practices within the European Union*. Second edition, European Economic and Social Committee, https://www.eesc.europa.eu/sites/default/files/resources/docs/qe-02-16-362-en-n.pdf

Ernst and Young, (2019). *Global FinTech Adoption Index. As FinTech becomes the norm you need to stand out from the crowd*, https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/top-ics/banking-and-capital-markets/ey-global-fintech-adoption-index.pdf [Accessed 07.04.2020].

Fernandes, D., Lynch Jr., J.G. and Netemeyer, R.G. (2014). Financial literacy, financial education, and downstream financial behaviours. *Management Science*, 60(8), pp. 1861–1883.

Financial Literacy Around the Word, (2014). *Standard & Poor's Ratings Services Global FinLit Survey*, https://gflec.org/wp-content/uploads/2015/11/3313-Finlit_Report_FINAL-5.11.16.pdf?x22667 [Accessed 05.04.2020].

Flejterski, S. (2007). *Metodologia finansów*, Warszawa: Wydawcnitwo PWN.

Frąckiewicz, E. (2019). *Nowe technologie na rynku srebrnych konsumentów. Stan, uwarunkowania, perspektywy.* Warszawa: CeDeWu.

Frame, W.S., Wall, L.D. and White L.J. (2018). Technological change and financial innovation in banking: some implications for Fintech. *FRB Atlanta Working Paper*, 2018-11, pp. 1–33.

Galperti, S. (2019). A theory of personal budgeting. *Theoretical Economics*, 14, pp. 173–210.

GUS, (2021). *Ageing of population*, https://stat.gov.pl/metainformacje/slownik-pojec/pojecia-sto-sowane-w-statystyce-publicznej/3938,pojecie.html [Accessed 07.03.2021].

Iwanicz-Drozdowska, M., ed. (2011). *Education and financial awareness. Experience and perspec-tives.* Warsaw: Publishing Office of the Warsaw School of Economics.

Iwański, R. (2017). Nowe oblicza starości z perspektywy dalszego starzenia się populacji. *Studia Oeconomica Posnaniensia*, 5(11), pp. 113–128.

Janc, A. and Warchlewska, A. (2018). Educational activities of central banks in the area of economic knowledge and financial competence as a manifestation of corporate social responsibility. In: K. Waliszewski, ed., *Social responsibility of financial institutions. From theory to practice.* Warsaw: CeDeWu.

Janc, A., Jurek, M. and Marszałek, P. (2015). *Polish Financial System in the Age of Financialization*. Warsaw: C.H. Beck Publishing House.

Jung, D., Dorner, V., Glaser, F. and Morana, S. (2018). Robo-Advisory: Digitalization and Auto-mation of Financial Advisory, *Business & Information Systems Engineering*, 60, pp. 81–86, doi: 10.1007/S12599-018-0521-9

Kaiser, T. and Menkhoff, L. (2017). Does financial education impact financial literacy and financial behaviour, and if so, when? *The World Bank Economic Review*, 31(3), pp.611-630, doi: 10.1093/wber/lhx018.

Kovlačikova, Z., Smoroň, L. and Strenk, R. (2011). Fundamentals of financial literacy. In: K. Zvaríková and J. Majerová, Financial literacy in the Slovak Republic. *Procedia –Social and Behavioral Sciences*, 110, pp. 1106–1115.

Liebowitz, J., ed. (2016). *Financial literacy education*. New York: Auerbach Publications,

Lusardi, A. (2008). Households saving behaviour: the role of financial literacy. Information, and Financial Education Programs. *NBER Working Paper*, 13824, pp. 1–44, https://www.nber.org/papers/w13824 [Accessed 05.04.2020].

Lusardi, A. and Mitchell, O.S. (2014). The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature*, 52(1), pp. 5–44.

Lusardi, A., Michaud, P. C. and Mitchell O.S. (2017). Optimal Financial Knowledge and Wealth Inequality. *Journal of Political Economy*, 127(2), pp. 1–47.

Marder, T. (2016). Fintech for the Consumer Market: A Overview. *Consumer Compliance Outlook*, Third Issue, pp. 4–20, https://www.consumercomplianceoutlook.org/2016/third-issue/fintech-for-the-consumer-market-an-overview/ [Accessed 15.11.2020].

Melitz, J. (1970). The Polanyi School of anthropology on money: An economist's view. *American Anthropologist. New Series*, 72(5), pp. 1020–1040.

Miller, M., Reichelstein, J., Salas, C. and Zia, B. (2015). Can you help someone become financially capable? A meta-analysis of the literature. *World Bank Research Observer*, 30(2), pp. 220–246.

Newsweek, (2019). *The best online and mobile banks*, https://mobirank.pl/2019/09/24/najlepsze-internetowe-i-mobilne-banki-w-rankingu-newsweeka-2019/ [Accessed 07.04.2020].

Nicoll, A. (2019). *Millennials face $1 trillion of debt, and want money management tools to help them manage their way out of it. But mobile-banking apps are lagging*, https://www.businessinsider.com/millennials-want-money-management-features-in-mobile-banking-apps-2019-6?IR=T [Accessed 17.07.2020].

Noga, B., Noga, M. and Dejnaka A. (2016). *Economic education of Polish society*, Warsaw: CeDeWu.

OECD INFE, (2011). *Measuring financial literacy: questionnaire and guidance notes for conduction an internationally comaparble surver of financial fiteracy*. Paris OECD, https://www.oecd.org/finance/financial-education/49319977.pdf [Accesssed 5.12.2020].

OECD, (2005). *Improving Financial Literacy. Analysis of issues and policies*, https://www.oecd-ilibrary.org/finance-and-investment/improving-financial-literacy_fmt-v2005-art11-en [Accessed 05.04.2020].

OECD, (2016). *OECD/INFE International Survey of adult financial literacy competencies*, https://www.oecd.org/daf/fin/financial-education/OECD-INFE-International-Survey-of-Adult-Financial-Literacy-Competencies.pdf [Accessed 05.04.2020].

OECD, (2019). *Smarter Financial Education. Key lessons from behavioural insights for financial literacy initiatives*, http://www.oecd.org/financial/education/smarter-financial-education-behavioural-insights.pdf [Accessed 05.04.2020].

OECD, (2020). *Financial Literacy of Adults in South East Europe*, https://www.oecd.org/daf/fin/financial-education/Financial-Literacy-of-Adults-in-South-East-Europe.pdf [Accessed 15.11.2020].

Owsiak, S. (2002). *Podstawy nauki finansów (Basics of Finance Science)*, Warszawa: Wydawnictwo PWN.

Panos, G.A. and Wilson, J.O.S. (2020). Financial literacy and responsible finance in the FinTech era: capabilities and challenges, *The European Journal of Finance*, 26(4–5), pp. 297–301, doi.org/10.1080/1351847X.2020.171756

Popiołek, M. (2013). Wykluczenie cyfrowe w Polsce. *Nierówności społeczne a wzrost gospodarczy*, 32, pp. 310–320.

Smyczek, S. (2016). Wiedza finansowa konsumentów w krajach Europy Środkowo-Wschodniej. *Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Eknomicznego w Katowicach*, 303, pp. 24–35.

Statista.com, (2020). https://www.statista.com/ [Accessed 10.06.2020].

Świecka, B. and Musiał, M. (2018). Enhancing financial literacy – experiment results. *Argumenta Oeconomica Craconiensia*, 18, pp. 129–140.

Świecka, B., Yeşildağ, E., Özen, E. and Grima, S. (2020). Financial literacy: The case of Poland. *Sustainability*, 12(2), 700, pp. 1–17, https://doi.org/10.3390/su12020700.

Tanda, A. and Schena, C.M. (2019). *FinTech, BigTech and Banks. Digitalisation and its impact on banking business models*. Palgrave Macmillan, doi. 10.1007/978-3-030-22426-4.

Thakor, A.V. (2020). Fintech and banking: what do we know? *Journal of Financial Intermediation*, 41, 100833, pp. 1-13, doi.org/10.1016/j.jfi.2019.100833.

Thorun, C. and Diels, J. (2020). Consumer protection technologies: An investigation into the potentials of new digital technologies for consumer policy. *Journal of Consumer Policy*, 43(1), pp. 177–191, doi: 10.1007/s10603-019-09411-6.

Tomczyńska, W. (2017). Digital exclusion – definicje, przyczyny, przeciwdziałanie. *Adeptus*, 10, pp. 1–17, https://doi.org/10.11649/a.1503.

Volpe, R., Kotel, J. and Chen H. (2002). A survey of investment literacy among on-line investors. *Financial Counseling and Planning*, 13(1), pp. 1–16.

Waliszewski, K. (2011). *Financial advisory services in Poland*. Warsaw: CeDeWu.

Waliszewski, K. and Warchlewska, A. (2021). How we can benefit from personal finance management applications during the Covid-19 pandemic? The polish case. *Enterpreneurship and Sustainability Issues*, 8(3), pp. 691–699, doi.org/10.9770/jesi.2021.8.3(42)

Warchlewska, A. and Waliszewski, K. (2020). Who uses robo-advisors? The Polish case. *European Research Studies Journal*, XXIII(1), Special Issue, pp. 97–114, doi: 10.35808/ersj/1748

Willis, L.E. (2011). The financial education fallacy. *American Economic Review*, 101(3), pp. 429–434.

Włodarska-Zoła L. (2018). Edukacja finansowa w kontakście zarządzania finansami osobistymi, *Edukacja – Technika – Informatyka*, 9(3), pp. 184–191.

Woodyard, A.S. and Grable, J.E. (2018). Insights into the Users of Robo-Advisory Firms. *Journal of Financial Service Professionals*, 72(5), pp. 56–66.

Xiao, J. (2016). *Handbook of consumer finance research*. Second edition: Springer.

Xie, M. (2019). Development of Artificial Intelligence and Effects on Financial System. *Journal of Physics. Conference Series*, 1187, 032084, pp. 1–7, doi: 10.1088/1742-6596/1187/3/03208

ZBP, (2020a). *Level of financial knowledge of Poles 2020*. Congress of Financial Education and Entrepreneurship, https://zbp.pl/getmedia/f26b6c3e-f68b-472e-bd9a-f4384ea9b868/1-Poziom-wiedzy-finansowej-Polakow-2020_na-konferencje-prasowa_skrot_FINAL [Accessed 07.04.2020].

ZBP, (2020b). *Bankowość internetowa*, https://zbp.pl/dla-klientow/bezpieczne-bankowanie/bankowosc-internetowa [Accessed 14.11.2020].

FINANSE OSOBISTE W DOBIE NOWOCZESNYCH ROZWIĄZAŃ TECHNOLOGICZNYCH

Streszczenie

Cel: Celem artykułu jest przedstawienie istoty zarządzania finansami osobistymi z wykorzystaniem nowoczesnych technologii finansowych. W artykule podjęto próbę odpowiedzi na pytanie, jaki wpływ na zarządzanie finansami osobistymi ma alfabetyzacja finansowa oraz rozwój rozwiązań fintech.

Metodologia: W opracowaniu dokonano analizy wpływu posiadanej wiedzy i kompetencji finansowych na decyzje konsumentów w zakresie finansów osobistych. Poczynione analizy prowadzą do odpowiedzi na pytanie, które determinanty mają wpływ na decyzje finansowe konsumentów oraz jakie zdalne narzędzia oferuje rynek. W artykule postawiono hipotezę, że intensyfikacja działań edukacyjnych dostosowanych do każdej grupy wiekowej przez instytucje oferujące usługi

finansowe może wpłynąć na większe wykorzystanie nowoczesnych narzędzi w procesie zarządzania finansami osobistymi. Teoretyczne rozważania zostały oparte na pogłębionej kwerendzie literatury w przedmiotowym zagadnieniu. Przedstawiono badania i eksperymenty finansowe w zakresie wiedzy i umiejętności finansowych. Do analizy w zakresie rozwoju branży FinTech wykorzystano wtórne materiały empiryczne.

Wyniki: Skuteczność edukacji finansowej obserwowana jest jedynie w konkretnych zachowaniach finansowych. Branża finansowa jest kształtowana przez odbiorców, którzy zamiast edukacji finansowej poszukują np. coachingu finansowego dla konkretnego problemu na różnych etapach swojego życia. Zmiany w strukturze populacji (starzejące się społeczeństwo) oraz duża grupa klientów z grup defaworyzowanych (m.in. seniorzy, osoby niepełnosprawne) wymagają wypracowania nowych, dopasowanych strategii przez banki i dostawców usług finansowych. Zbyt duża pewność siebie i niski poziom wiedzy konsumentów na temat cyberbezpieczeństwa staje się wyzwaniem dla nowoczesnych technologii finansowych.

Słowa kluczowe: edukacja finansowa, świadomość finansowa, nowoczesne technologie finansowe.