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**EVALUATING THE ROLE OF TECHNOLOGY IN PERSONAL
FINANCE MANAGEMENT**

Bachelor's thesis

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I hereby declare that I have compiled the thesis independently and all works, important standpoints and data by other authors have been properly referenced and the same paper has not been previously presented for grading.

The document length is 8191 words from the introduction to the end of the conclusion.

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ABSTRACT

This study focuses on the effect and association that technology has had on personal finance management (PFM). Numerous tools have become available and common in peoples' everyday lives and have completely changed the ways personal finances are managed. Technologies such as mobile banking apps, investing platforms and mobile payments have become integrated in the way people do business and view their finances. The main goal of this study is to produce information whether the adaptation of technology into PFM has a relationship with financial literacy and inequalities in financial management between various demographic groups in Finland.

The empirical study was built based on a survey that consisted of 104 participants within all age ranges. The survey was conducted in order to notice differences and challenges affecting demographics; moreover if the implementation of technology has had a notable relationship in managing and understanding their finances. The results show partial perceived improvement within financial literacy, however faced limitations to accurately conclude on multiple areas. Despite the limitations, the study allows policymakers and individuals to gain insight on the positives and negatives of the technological advances in personal finance management.

Keywords: PFM, financial literacy, financial inequality, Finland

INTRODUCTION

The advancements within the digital realm and the rise of personal finance management applications have changed the way many people handle their finances. Questions arise whether the general public is better at handling their finances than before, or has a gap been born between demographics? “By staying out of the market, the wealth of poor investors grows less than that of rich ones“ (Mihet, 2018). This gap could potentially be between not only financial situations, but with age and gender as well. In this study personal finance management (PFM) is defined as the ways of planning, budgeting, managing, and spending personal income and assets (Yogasnumurti et al., 2021).

In the past decade, the rapid growth of digital technology has revolutionized numerous sectors, with PFM being one of the most significantly impacted areas. “... the so-called “FinTech“, has offered new investment opportunities as well as risks for individual investors in direct control of their personal finance“ (Lo Prete, 2022). Technological advancements have brought numerous tools and platforms that affect the most common ways of handling individual finances. These technologies include platforms such as mobile banking apps, investment platforms and countless budgeting and saving tools. The promise of a more efficient and accessible way of interacting with finances is exciting and includes new opportunities. Therefore, these factors with the new, more autonomous environment of PFM have the potential of influencing financial behaviour and literacy, especially when comparing data from various demographics.

The importance of understanding the effect that technology has had on personal finance as a whole is straightforwardly justified, with excellent reasoning. The first, and considerably most acute reason, is the potential development of more user friendly and secure financial technologies. The study can shed light on potential areas which need more focus from decision makers and developers. This can heavily impact the catering for a more diverse population and allow for a more comprehensive financial literacy education, which then leads to a more financially well-being society. The policymaking and regulatory aspects of financial technologies are also notable; a large portion of partially experimental financial technologies are still not sufficiently regulated and could produce

potential harm for users if not regulated properly. Regulation and consumer protection should be within the top interests of any democratic and working society that wishes to prosper. Lastly, exploring how technology affects PFM can also shed light on the inequalities within the realm, giving potential solutions and ideas. There are multiple different areas that potentially cause disparities, such as age and gender, which was highlighted by Mikelionytė & Lezgovko (2021) in their study regarding the difference between personal investment strategies among genders. These disparities often relate to the accessibility of financial tools and resources, which can vary significantly across different socioeconomic and demographic groups. Lack of financial literacy is cited as the reason for additional failures to meet financial inclusion targets in the majority of developing nations (Kebede & Kuar, 2015).

The terminology referred to within this study are often misunderstood, and will therefore require further clarification:

Technology refers to the tools and platforms that individuals use to manage their finances, including but not limited to mobile banking apps and budgeting tools, and digital investment platforms.

“Financial Literacy is a combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and ultimately achieve individual financial wellbeing“ (Atkinson & Messy, 2012 p. 14).

Inequality in PFM reflects the disparities in access to financial resources, tools, and knowledge, which can be influenced by factors such as educational background, age and technology usage.

The main goal of this study is to produce information whether the adaptation of technology into PFM has a relationship with financial literacy and inequalities in financial management between various demographic groups in Finland. And whilst focusing on the the hypotheses in the realm of financial literacy and financial inequality. This study will revolve around the following research question: How does the use of technology in personal finance management affect users' financial literacy levels? The research question allows for a comprehensive and insightful study, in a way that has not been sufficiently studied yet. The four hypotheses developed to support the main research question:

H1: More active use of technology has a positive association with the subjective perception of improvement in financial literacy

H2: There is a notable relationship between demographic factors and PFM technology association with financial equality

H3: More active use of technology has a positive association with accessibility of financial resources

H4: More active use of technology has a positive association with convenience in PFM

The hypotheses produce information in many areas, as e.g. inequality in PFM, which can often be referred to the inability to get access to quick and easy PFM technologies, at least partially. As this study is limited to Finland, it is unlikely that same amount of effects are found when considering inequalities than in countries that have larger wealth or Gini-coefficient gaps between its residents. That in itself is only speculation, which this study attempts to produce logical answers to.

The study starts with a literature review, discussing and comparing topics around the research question, giving insight into PFM and finance as a whole. The review will also consist of historical notes in order to lay groundwork for the understanding of modern technology and its effects in PFM. After literature review, there is a subchapter justifying and explaining the hypotheses, which goes in depth into each of the chosen hypotheses. The methodology part will consist of the explanation of the chosen methodology and justification for the method and sample. In addition, the study design and demographic divides of the survey results will be in this chapter. The empirical analysis section will contain the descriptive statistics and regression results from the survey answers, giving the necessary data to conclude. Within the survey, an open word section was brought as the last question, in order to gain more from simple numerical survey data. Some of the insights provided by the participants will also be discussed in the conclusion and discussion part respectively.

1. LITERATURE REVIEW

The purpose of this chapter is to give insight into the effect of technology in personal finance management and a historical context on already seen phenomena. The digitalisation of many financial tools has revolutionized how people manage their finances, making quick decision-making and fast tracking possible for most people, at least in Finland. The financial industry has been one of the first to adopt mobile technologies (Jun & Palacios, 2016), which has led to many different innovations to improve the consumer experience. A great example of these type of innovations is the “gamification“ of PFM apps, for instance numerous PFM apps allow users to set saving goals and are motivated to stick to them through game-like challenges (Bitrian et al., 2021).

1.1. History of technology in finance and PFM

To understand the modern picture of finance and PFM, it is important to pay attention to the previous generations of financial technology and how it has changed the realm. “Financial technology is concerned with building systems that model, value, and process financial products suchs as bonds, stock, contracts and money” (Freedman, 2006, p. 1). PFM in this essence is no different, as its purpose is to serve as a tool for individuals to manage their finances, not only large entities. Excessively archaic instruments such as the adding machine, invented by Blaise Pascal in 1642 or double-entry bookkeeping from the late 1400s will not be discussed in this particular study, but conentrate on instruments that are more aligned with the research question.

The first technological tools used in finance include the first transatlantic cable (1866) and Fedwire (1918), which were built for fund transferring using now-archaic technologies including Morse code and telegraph. These technologies in essence are not so different to what are used in the modern world, only the means of fund transferring has changed. From a PFM perspective, the development of credit cards is one of the major turning points of PFM technology. Although the concept of credit in

some form has been around for centuries, the first universal credit card can be traced back to 1950 in the United States. The introduction of Diner's Club Card and later, the American Express (1958) simplified consumer finances dramatically. In fairness, while it may not have been the first revolving charge account, it was the first effort to forge a universal card (Starzec, 2013), on the introduction of the Diner's Club Card. American Express considered Diner's Club as a threat to their business, which led them then to buy out many Diner's Clubs competitors to even out the playing field (Starzec, 2013). Credit cards allowed for a much more convenient way of doing business and hence substantially affecting consumer spending habits, although arguably also in a bad manner. The original credit cards in many ways do not differ much from modern day payment methods, just that most tools are now digital and other additional nuances. Adding to the convenience and usability of credit cards, Automated Teller Machine (ATM) is another revolutionising PFM technology within the last 100 years. Invented by an engineering team led by John Shepherd-Barron, the first ATM was installed in 1967 in London, England (Konheim, 2016). The added convenience of around clock cash withdrawals and balance checks turned PFM into a more digital form than ever before, hence providing a background for the modern digital PFM realm to flourish.

The earliest PFM technologies that really revolutionized the modern day finance field can be pointed to the popularisation of early softwares and personal computers such as Quicken (1983) and Commodore 64 (1982), which made significant changes to how the common man could interact with their finances, such as manage all of their financial accounts in one place, plan budgets, track investments, and analyse spending habits. The next step history of technology in finance, moreover the term FinTech can be traced back to the early 1990s (Anyfantaki, 2016). Additionally, the most major turning point towards the digital financial environment can be placed to the financial crisis of 2008, after which the investments in FinTech rose substantially. Between 2010 and 2023, the investments in fintech worldwide had grown from 9 billion US dollars to 225,8 billion US dollars, and the number of investments grew from 319 to 8055 (Statista, 2024). The investments toward FinTech and appearance of smart phone technology can be widely connected to the modern standard of PFM. Rarely does one handle ones financials on any other platform than digital in today's environment, leading to numerous new applications and technologies altogether in order to make digital PFM more accessible and enjoyable. (Mijic & Cebic, 2023)

1.2. Current technological tools

The landscape of financial technologies is wide and used in multiple different ways. An accurate note is that, if there is money involved, a person has made a technological tool to handle it. This ranges from simple mobile banking apps to cryptocurrency applications and robo-advisors. The main benefits often discussed revolve around the simplicity and speed of PFM along with increased accessibility to get business deals and investments done in a matter of seconds.

Modern technological tools and the rise of cryptocurrencies in the finance sector have not been unproblematic. In the realm of bank deposits it changes the way financial services will be delivered, it requires a discussion on resilience, security and competition in payments, it provides a building block for better cross border money transfers and it raises the question of private and public issuance of money (Broby, D. 2021). Another note in the modern world is the battle with climate change and sustainability which often seems to dictate the direction where where technologies, PFM included, are directed towards. “The application of technology to finance can provide an important contribution in the transition towards a more equal and inclusive social context” (Cosma & Rimo, 2023). Therefore it is handy to recognise current trends in finance and PFM, further promoting more progress – in the right direction.

The future of PFM looks interesting, with countless innovations yet to be integrated completely to a standard users financial management techniques. Artificial intelligence (AI) and Machine learning (ML) are widely spoken topics in the tech realm in general, thus have the possibility to provide a higher quality information and recommendation at a rapid pace. Although already partially in use, AI and ML have the capability to analyse massive quantities of data, while providing more detailed and personalised advise for each individual. The introduction of blockchain technologies, as seen in cryptocurrency realm also are changing the toolpack of PFM. The transparency and security of blockchain technologies offer significant upsides to PFM allowing for a more trusting and safe financial environment. The blockchain technologies can be seen to be at the very heart of decentralized finance (DeFi). “DeFi is neither a legal nor a technical term. It is nonetheless increasingly used in the context of discussions about the future evolution of finance and its regulation“ (Zetzsche et al., 2020, p. 173). The main aim of DeFi is to remove control from traditional financial institutions, such as banks, in order to create a more open and transparent ecosystems that would also positively impact financial inclusion. Additionally, as according to Zetzsche et al. (2020), in the past financial hubs were necessary, since most services were provided locally and the hubs were protected

by high regulatory and supervisory standards. DeFi, in essence tries to challenge that logic and norm. The main benefit of DeFi, regarding financial inclusion, is its capability to reach areas where financial services are not sufficiently provided. These technologies are only on the step to becoming a more popular reality and provide unique solutions for ordinary people, however the future of financial technologies looks bright, or at least interesting.

1.3. Impact on financial literacy

Financial literacy is one of the most important aspects of PFM, as it dictates a persons decision making process and accuracy. “Most of the investors [make investment decisions using two or more sources of information]. Most of the investors discuss with their family and friends before making an investment decision“ (Kebede & Kuar, 2015, p. 94). This most likely is not the case when discussing an average human that is not concerned with investing continuously, therefore highlighting the importance of basic financial literacy.

The previously mentioned gamification has risen to popularity within PFM applications, giving more incentives for users to interact with their finances more regularly. Bitrian et al. (2021) studied the impact of gamification in PFM apps to how it influences the users motivation to use them. “The results of this study provide support for the use of gamification in PFM apps.“ Although not quite aligned with the research question of this study, it provides insight on the attitudes that are common regarding PFM.

A study by Gunawan (2023) reflects on the effect of financial literacy and the use of financial technology. The study found that “Financial literacy and financial technology payment have a positive and significant effect on consumptive behavior. This shows that the higher the use of financial technology payments , the higher the consumptive behavior of students of the Faculty of Economics and Business, Muhammadiyah University, North Sumatra“. This in itself is not surprising as mobile payments have made access to money quicker and can potentially cause impulsive consumption decisions.

In Walsh & Lim (2020) article about millennials’ adoption of PFM technology, results suggest that heavy adopters of PFM technology are more likely to “own an emergency fund, payoff their credit card in full every month, own a retirement account, own an investment account, save for retirement, and own a will“. However, along with the Gunawan (2023) study, the spending habits resonated

strongly with the usage of PFM technology. The more one uses PFM technologies, the easier they are likely to spend it. This in essence sounds logical and reasonable to assume; if you own a Ferrari, why would you drive it like a Fiat? Meaning if a person has quick and easy access to their bank account and financials, obviously they are more likely to spend it in all types of products or things. The quick accessibility resonates highly with the modern world in all sorts of ways, the pace of living has become quicker and everyone wants everything at this exact moment. Financial satisfaction can be divided into two primary categories when relating financial technology and financial behaviour; technology that facilitates transactions and technology that facilitates planning (Farida et al. 2021). This is logical, as the main components usually consist of either saving or paying in some form; investments, budgeting and more. The study recognises that “the use of financial technology can affect financial behaviour“ which is in line with both Gunawan (2023) and Walsh & Lim (2020).

1.4. Financial inequalities

Financial inequalities are common around the world and often discussed in politics and news broadcasts. Inequalities link closely to financial literacy, as they affect a persons access to learning tools and other valuable resources that need to be bought or require a certain level of education or the ability to learn quickly. It begs the question whether modern technology, in PFM specifically, has had an impact. A paper by Frost et al. (2022) studied the role of financial development and financial technology in driving inequality in returns to wealth. Although a different perspective, the study resonates with questions regarding technology in PFM and financial inequality. The study concluded that while households of all wealth deciles benefit, these benefits increase starkly moving toward the top of the wealth pyramid. It could potentially point towards the conclusion that technology in PFM has also had a growing impact on financial inequality.

Previously mentioned study by Cosma & Rimo (2023) navigate the emerging literature on the interaction between fintech, financial inclusion, and social inequality. Stating that new technologies can reduce costs while increasing speed and accessibility, which help promoting economic growth and solve a range of social problems including poverty and income inequality. This clashes with the findings of Frost et al. (2022), however it is mentioned that the positives of FinTech are more or less goals and not actual data as per the United Nations 2030 agenda towards the achievement of the

Sustainable Development Goals (SDGs). By reviewing these studies, it seems that majority of things are still within the reach of policymakers and that the direction can take a path to any direction. As per the Nordic model of economics that Finland generally tries to follow, the effect that technology has on consumption, financial literacy and other variables are important to monitor. “The existing empirical evidence points to a significant impact of financial development on poverty and inequality reduction” (Aslan et al. 2017), however can the same be said about PFM and its subcategories? Although closely related to the topics often covered in research papers, concrete studies regarding the association of technology usage affecting PFM are somewhat rare to come by.

1.5. Hypothesis development

The development of the hypotheses is a tricky process, as the effects of technology in PFM can be considered widely varied, with numerous opinions and approaches on the matter. After conducting the literature review, many questions and assumptions rose to mind, which made the process of concentrating on singular topics rather interesting. Hypothesis H1: More active use of technology has a positive association with the subjective perception of improvement in financial literacy, was tailored especially from Walsh & Lim, (2020) and Gunawan (2023) studies regarding PFM, technology usage, and financial behaviour. The studies led the author to believe more active use of technology affecting the understanding and subjective perception of various factors in the PFM realm. This hypothesis was partially also developed due to the simplicity of the analysis process and potential use for later studies.

The second hypothesis developed for this study is H2: There is a notable relationship between demographic factors and PFM technology association with financial equality. The hypothesis argues that demographic factors, such as age, usage, or gender affect the opinions and perceptions of people regarding financial inequalities. The hypothesis was built on the foundation of Mihet (2018) article about financial technology and the inequality gap, and Cosma & Rimo (2023) chapter about the role of financial technology in social inequality. Reviewing the papers lead the author to believe initially that active tech users might have an overall more positive opinion on the effect toward financial equality, as the people who use these technologies the most are most likely more aware of the opportunities and possibilities that financial technologies have brought. Another note that the author

sees as a potential division between results is age and gender, as these two demographic factors often have notable differences in statistics about perceived changes in surroundings. It is probable that older participants may not perceive technologies as an equalizing phenomenon in the same manner younger participants do.

The third hypothesis considered to this study was H3: More active use of technology has a positive association with accessibility of financial resources, which was inspired by reviewing (Song et al., 2020) paper on the accessibility of financial services and household consumption in China. “We first show that access to financial services should not be taken for granted.” The statements and research made in this study do not clearly point towards the chosen H3 itself, however hover around similar topics that the author can use as the base of the idea. The main idea behind H3 was to see if the amount of use of technology in PFM has a positive association with the general consensus of “Has technology made personal finance resources more accessible?” It would make sense, that frequent and avid users of PFM technologies consider the resources more accessible, as they are more familiar with them (Probably more tech-savvy, as well). This however, is only speculation, and possibilities for surprises are endless, which is a positive factor in any study.

H4: More active use of technology has a positive association with convenience in PFM, proposes that a higher frequency of PFM technology use is associated with increased convenience in managing personal finances. This hypothesis development was rather straightforward, as an educated guess, one could argue that “The more you do, the better you’ll be“. Although, it is not quite as simple as that, however reviewing Haikel-Elsabeh et al. (2016) article on how PFM influences consumers’ motivations and behaviour regarding online banking services, some educated guesses can be made. It seems that technology usage in general, not only for PFM purposes is associated with the convenience of digital PFM, which is logical. Also according to Susanto et al. (2023), “The level of convenience directly impacts how easily customers can obtain these services, and individuals with busy schedules and numerous daily activities perceive higher convenience when they can save time, energy, and effort while using banking services.“ An article, regarding mobile banking and factors affecting the convenience, usefulness and security of it. The articles inspired the development of the third hypothesis, as they can be noted as evidence towards the hypothesis in question, even though not exactly similar.

2. METHODOLOGY AND DATA

This study uses a questionnaire as the basis for data collection, as the research question in hand is most efficiently answered by analyzing the questions answered by participants. The survey consisted of 19 of questions which recognizes demographics and the familiarities and associations with PFM technologies. The answers for the questions were cleaned using Excel software and changed into binary, then they were analysed in a logit binary regression model using Gretl software. The method of analysing the responses included changing independent variables in accordance with preliminary results and in order to find out the capabilities of the regression model. The questionnaire consisted of questions using Likert scaling, as well as yes/no and multiple-choice questions as the base for regression models. Within the regression results notable variables are marked with an asterisk (*) symbol to point out scientifically significant p-values. The more asterisks are next to the variable, the more scientifically significant the result. Additionally, within the questionnaire, “N/A already understood the topic”, “No change”, “Slightly improved”, “Moderately improved” and “Significantly improved” were the options for four questions linked to H1. Due to the nature of the analysis, only the last two categories will be counted towards a positive effect in each variable, “1”.

2.1. Study design

Design of the survey and the study following it consisted of examining previous literature regarding financial literacy and financial inequality. A pilot survey was constructed first to see potential flaws within the questions and other notes. The pilot survey was answered and modified by the help of 15 participants using convenience sampling. The participants of the pilot test were all Finnish nationals and included all age ranges available within the main survey.

The survey consisted of 4 sections and a “free word” section at the end of the questionnaire, helping to gather non numerical data and further evidence on various opinions. The first section was purely demographic, which assisted to ensure a wide range of participants to draw a comprehensive study from. The second section revolved around technology usage in PFM and highlighted the platforms and

frequencies of usage. The third section concentrated on the effect these PFM technologies have had on participants financial literacy levels; the questions followed a similar design as Thapa & Nepal (2015) survey analysis regarding the financial literacy of college students. Lastly, 3 questions were part of the final section regarding financial inequality, inspired by Mihet (2018), gives limited but valuable information regarding potential problems with technology and PFM. Therefore, while mainly quantitative, this study also consisted of qualitative aspects to help strengthen the conclusions. To protect the ethical standards of this study, the survey was anonymous, conducted with Google Forms, which is regarded as one of the safest online survey instruments. The first step in analysing the data is to show general patterns found in the survey. To test whether the use of technology has a relationship on financial literacy, multiple different tables were created to analyse the general patterns of the survey answers. Some questions were not included in the actual analysing part of the study, as they proved ineffective in portraying anything else than simple descriptive statistics to justify and explain the data further.

2.2. Sampling

The sampling method chosen for the participants is a mixture of self-selection sampling and convenience sampling, with no particular qualification for participating. This attempts to ensure that there is lesser bias within the answers and also that the demographic scale is wide enough to draw an insightful conclusion from. The questionnaire was open for participants in Finnish discussion forums. The method chosen was somewhat limited and has potential skews, as discussion forums often have a larger population of tech-savvy users. However, it is also a positive aspect in the sense that people with experience in technology might also be able to answer questions more accurately and provide important opinions in the open word section. Simple random sampling is usually optimal in this type of study, regarding quite homogenous populations (Noor et al., 2022). However, due to the nature of the study and resources, self-selection sampling was the most accessible and accurate while also producing a wide range of ages and educational backgrounds. Vehovar et al. (2016) states in the SAGE Handbook of Survey Methodology, that many examples of successful results from online panel surveys exist when well spread and conducted, hence the sampling technique is justified, although keeping possibilities for errors in mind. Due to the survey answers being 100% of Finnish nationality, it is important to recognise that the results could vary drastically between countries and continents.

When regarding a sufficient sample size, some differentiating opinions can be found. However this study followed the requirement: “The sample should be 100 or greater and the minimum sample should have a desired ratio of five observations per item” (Hair et al., 2010, as cited in Mien & Tran, 2015, p. 7). This requirement checks out as the needed sample for this particular survey is then 95. The sample consisted of 104 people in all age ranges, of which 101 were found suitable. Due to limitations, all non Finnish participants were not qualified in the calculations and analysis. The sample size being on the smaller side, non Finnish nationals could potentially skew the answers, therefore this study decided to focus on Finland.

2.3. Demographic notice of the participants

When analysing the answers of 101 survey participants, the following results are seen. These demographic divides were noticed during the survey process:

The gender division of the participants were 77,2% male and 22,8% of female respondents. As for the sake of this study, the age range will be divided into two groups: Under 35 year olds, consisting of 68,3% of the participants. 35+ year olds, consisting of 31,7% of the participants. The two age groups will be analysed and the difference between the two will be investigated in order to evaluate possible differences in conviction and results. The academic division of the participants was the following: 36% had at least a masters degree, 40% had a Bachelor’s degree (BA), 21% had completed a high school diploma, 1% had undergone trade/vocational training and 2% had no high school diploma or other such certificates. For the sake of this study, the academic education was also divided into two larger groups: Below BA degree, and BA degree and over. According to the Ministry of Education and Culture in Finland¹, in 2021, 42.3% of adults aged 25-64 in Finland had attained tertiary education, which includes both bachelor's and master's degrees. This statistic resonates with the survey respondents education level and due to the overall academic literacy rate in Finland, these results are coherent. These statistics summarize the claim of a wide demographic and diversity within Finland.

¹ Ministry of Education and Culture, 03.10.2022, can be found at URL: <https://valtioneuvosto.fi/en/-/1410845/oecd-comparison-educational-attainment-of-finnish-young-people-fallen-below-average>

Additionally, the employment status of the participants were as follows: 59,4% employed (full or part-time), 29,7% identified as students, 5% were self employed, 4% unemployed and lastly 2% were retired. The employment status was divided into two categories for the analysis, “Employed”, consisting of employed and self-employed, and “Student and other” which consisted of the rest of the options. According to Tilastokeskus², Finland's employment rate in november 2023 was 76,9%, which is sufficiently similar to the survey respondents total rate of 64,4%.

Regarding the frequency of PFM technology usage, 38,4%% of the respondents uses some form of PFM technology daily, 43,4% several times a week, 14,1% weekly and 4% monthly. For the analysis, again, two categories were made: Several times a week or more, and less than that. Similarly, duration of usage was divided into “I have used PFM technologies for five years or less” and “I have used PFM technologies for over five years”. These divisions were mandatory for the sake of the study, as the rather nimble sample size show better results with the independent variables being as large as possible, whilst keeping the research question and hypotheses in mind.

² Tilastokeskus, Tiedote 22.12.2023 | Työvoimatutkimus 2023, marraskuu, can be found at URL: <https://stat.fi/tilasto/tyti>

3. EMPIRICAL ANALYSIS

3.1. Descriptive statistics

This chapter provides descriptive statistics that portray the seen phenomena and gives visual and explanatory insight as a part of the findings. The descriptive statistics were also partially used as a measure for leading the study to focus on the most important metrics. For clarity in Table 1, the 4 questions regarding perceived improvement in financial literacy were calculated in the following manner: N/A, already understood the topic = 0, No change = 1, Slightly improved = 2, Moderately improved = 3, Significantly improved = 4.

Table 1. Descriptive statistics

	Budgeting	Investing	Borrowing	Saving	Total
Average	1.99	2.39	1.79	2.02	2.05
Median	2	3	2	2	2
Mode	2	3	1	2	2
St. Dev.	1.15	1.26	1.17	1.24	1.22

Source: Survey questionnaire conducted by the author

Table 1 shows the descriptive statistics for the question “How has the use of financial management technologies affected your understanding on the following topics?” As seen, 4 different topics were covered within this question. It is noticeable from the statistics, that the participants perception of understanding has on average, most improved in investing, which is not surprising as even many mobile banking apps have some form of investment possibilities built in them. Also, 34,3% of participants use some form of investment applications which was the second most popular answer after regular online/mobile banking-related options in question 7: “Types of technologies used (Select

all that apply).” Additionally, 60,6% of participants answered that they use online stock and fund brokerage (Nordnet etc.), which further supports these statistics.

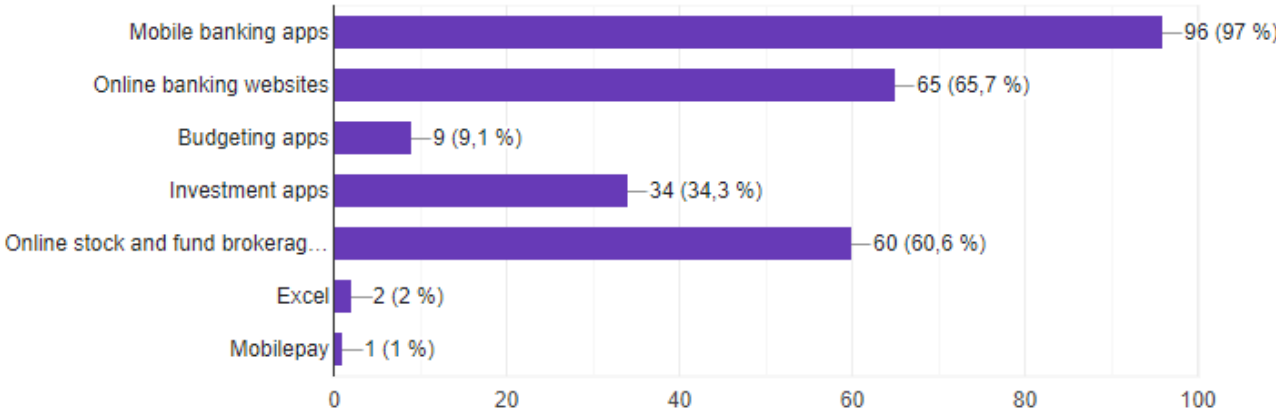


Figure 1. Number of answers in each category to question 7.
 Note: “Excel” and “Mobilepay” options were written by participants within the “Other...” option
 Source: Survey questionnaire conducted by the author

Additionally, as seen from Figure 1, the low rate of independent budgeting applications can be pointed to many mobile and online banking applications, such as Nordea, having built in budgeting tools thus making the use of independent applications rather useless for many.

3.2. Regression results

Due to visual reasons, the first regression table is split into two different visuals all consisting of the same initial question since it consisted of 4 different dependent variables, as for the sake of clarity to the reader. The dependent variables regarding financial literacy included “Borrowing”, “Budgeting”, “Investing” and “Saving”. The results of the first regressions are in Tables 2 and 3.

Table 2 portrays the subjective perception of improvement in each dependent variable. The main aim of this model is to find results regarding differences of perceived improvement and relationships between demographics, and produce answers to H1: More active use of technology has a positive association with the subjective perception of improvement in financial literacy.

Table 2. Regression Results

Variables	Dependent variable: Improved Borrowing		Dependent variable: Improved Budgeting	
	Odds ratios	p-values	Odds ratios	p-values
Constant	0,03	***	0,12	***
Female	0,15	*	0,49	
Age below 35	15,35	**	0,97	
Below BA degree	1,63		2,39	
Student and other	0,76		2,22	
Several times a week +	1,96		3,47	*
Less than 5 years	0,51		-	
N	101		101	
Adj. R squared	0,084		0,002	

Note: * <0.1 , ** <0.05 , *** <0.01

Source: Authors calculations

Below 35-year-olds have a larger rate of technology improving their knowledge of borrowing, which includes loans, credit, and other borrowing tools. The model states that under 35-year-olds are 1435% more likely to have answered positively as compared to the 35 and over year-old counterparts. This in essence is logical, as most young people have not been subject to multiple ventures that needs loans or other similar instruments. A mortgage is for many, the first step into the “heavyweight” category of loans, and seemingly more the buying power has gradually decreased throughout the years, so the results of the regression model in that sense are coherent. A mentionable factor also is the unpopularity of credit card usage among young people, compared to the United States, as e.g. credit score is a barely existing factor in the Finnish PFM realm.

Comparing males to females had a notable difference in the improvement in investing and borrowing. Women are 77% less likely to have answered positively for the impact of technology affecting their knowledge on investing. This could be due to multiple reasons, which most likely all play a part. Firstly, investment is still a highly male dominated field and often tends to be talked more among men. It could be a potential point for improvement in education and atmosphere, focusing on

improving the general investment knowledge and excellence among genders. Additionally, a question of interest in the subjects can be brought to light, which the evidence points towards. This however cannot be concluded solely on the basis of this particular survey, but give insight for possible future research.

Table 3. Regression Results

Variables	Dependent variable: Improved Investing		Dependent variable: Improved Saving	
	Odds ratios	p-values	Odds ratios	p-values
Constant	1,19		0,48	
Female	0,23	**	1,09	
Age below 35	0,33	*	0,52	
Below BA degree	0,67		1,15	
Student and other	1,95		1,35	
Several times a week +	2,80	*	1,39	
Less than 5 years	-		1,39	
N	101		101	
Adj. R squared	0,004		-0,090	

Note: *<0.1, **<0.05, ***<0.01

Source: Authors calculations

More frequent users of PFM technologies are seen to be more likely to be positively impacted by the use of the said technologies, which points towards a positive relationship on investing and budgeting. This could be due to many mobile banking apps including a growing amount of different budgeting tools built within. The tools often include goals and game-like features that make saving feel like a past-time instead of a chore. This phenomenon was discussed in-depth in Bitrian et al. (2021) study, as referenced previously. The knowledge in investing also seemingly grows with the amount of PFM technology usage, which similarly can be partially regarded as the result of mobile banking applications improvements. The rise of multiple investment platforms, including cryptocurrency platforms and online stock and fund brokerage platforms are also a possible reason for many active technology users growing investment knowledge. The popularity of platforms such as Nordnet – the first internet broker in Sweden – have grown the capabilities and accessibility of investment

opportunities. This popularity amongst the continuous advancement of the applications are all evidently reasons towards the results shown in the regression model.

Improvements in saving knowledge could not be effectively analysed with the model, as it did not show a positive R squared, even after switching independent variables. This means that there is no sufficient evidence to point towards any direction, when regarding saving. This could be due to, as stated by (Gunawan, 2023), people tend to use money quicker now that technology has made PFM so fast paced and easily accessible in a matter of seconds. People tend to use applications in a rapid manner to purchase things without much of an afterthought, at least that seems to be a common theme.

Table 4. Regression Results

Dependent variable:				
Financial equality				
Variables	Odds ratios	Std. error	z	p-values
Constant	2,22	0,61	1,31	0,19
Female	0,59	0,53	-1,00	0,32
Age below 35	0,92	0,54	-0,16	0,87
Below BA degree	0,84	0,54	-0,31	0,76
Student and other	1,05	0,51	0,10	0,92
Several times a week +	1,07	0,54	0,13	0,90
Less than 5 years	0,58	0,45	-1,22	0,22
N	101			
Adj. R squared	-0,081			

Note: *<0.1, **<0.05, ***<0.01

Source: Authors calculations

Participants opinions on whether technology in PFM has reduced financial inequalities, on a scale of 1 to 5, with the range being 1: Totally disagree, 5: Completely agree. The average answer to the question whether the participant believes that technology has reduced financial inequalities was 3,71, showing that a mildly positive opinion on the relationship of technology on the reducing of financial inequalities can be noted. Additionally, 96% of participants answered that technology has made PFM resources more accessible to them, highlighting the availability of information and easier tracking of

finances to be the main positives. The hypothesis testing on the effect on financial equality was straightforward, answers “4” and “5” were considered as evidence towards the general opinion being positive. “1”, “2” and “3” were counted as opposing opinions, due to the hypothesis only being interested whether or not the effect has been positive. The results of the regression Table 4 were ineffective, as the adjusted R squared remained negative after countless tries to adjust variables and testing differences between more and less independent variables. Therefore, although initial descriptive statistics had shown promising results, any formal scientific conclusions cannot be made with the data analysed.

Table 5. Regression Results

Dependent variable: Accessibility to financial resources				
Variables	Odds ratios	Std. error	z	p-values
Constant	29,11	1,45	2,32	0,02 **
Female	0,74	1,28	-0,23	0,82
Age below 35	0,71	1,37	-0,25	0,81
Below BA degree	1,12	1,24	0,09	0,93
Student and other	1,10	1,32	0,18	0,79
Several times a week +	1,42	1,19	0,30	0,77
Less than 5 years	0,68	1,11	-0,35	0,73
N	101			
Adj. R squared	-0,346			

Note: *<0.1, **<0.05, ***<0.01

Source: Authors calculations

Due to the answers of the survey almost unanimously agreeing that technology has made financial management resources more accessible to them (97%), a proper regression could not show the results that would be optimal to analyse. The adjusted R squared being negative, any remotely scientifically accurate conclusions can be made, other than there being no significant difference between demographics. Additionally, a probit binary regression was ran, however successful results were not obtained that did not face the same obstacles as the logit binary regression. Therefore, the hypothesis H3: More active use of technology has a positive association with accessibility, is inconclusive.

Table 6. Regression Results

Dependent variable:				
Positive effect towards PFM				
Variables	Odds ratios	Std. error	z	p-values
Constant	29,11	1,45	2,32	0,02 **
Female	0,74	1,28	-0,23	0,82
Age below 35	0,71	1,37	-0,25	0,81
Below BA degree	1,12	1,24	0,09	0,93
Several times a week +	1,42	1,19	0,30	0,77
Less than 5 years	0,68	1,11	-0,35	0,73
N	101			
Adj. R squared	-0,346			

Note: *<0.1, **<0.05, ***<0.01

Source: Authors calculations

On question 15, if “In addition, has any aspect of personal finance become more difficult to manage, after using previously mentioned tools and technologies? (if yes, select all that apply)” also show unphasing results as seen on Table 6. As per the wording of the question, “No” was considered a positive answer. Once again the adjusted R squared could not obtain positive figures, showing that the regression is not effective, in either logit or probit regression. Similar to Tables 4 and 5, the hypothesis H4 cannot therefore be properly analysed and is inconclusive.

3.2. Limitations and future research

Although consisting of a wide enough demographic, it is imperative for the sake of accuracy to mention the potential biases and errors within the analysing process. The sample size, whilst being sufficient, could prove to show slightly different results should the size be e.g. 1000+ participants. Additionally, a self-selected approach to conducting a survey also needs a critical approach for

analysing as there is a potential room for error. With a larger timespan and resources, a wider and more comprehensive study could be made and possibly add more questions regarding PFM. Lastly, the survey was conducted in the English language, which for some, might result in slightly irregular answer patterns depending on their understanding of the language. With a larger sample, regression analysis could potentially bring more highlights to the relationships and associations of technology on financial literacy and other possible patterns. The author suggests a more in-depth research to be conducted, that would also include the income of participant, which would allow for a more extensive research to be done. Also recommended is to ask a wider range of questions within each individual subtopic that hovers around the research question. Future research can divide the research questions into more bite sized portions, surveying and analysing more specific phenomenons within the technological realm regarding PFM.

The qualitative portions of the survey could have been analysed thoroughly and provide metrics for the approach, in addition to the semi-open ended questions that regarded which types of platforms the participant uses and how has it made financial management easier. These qualitative points can be supported with, for example, interviews that would allow for a comprehensive approach if done with a considerable amount of resources and time.

CONCLUSION

The main goal of the study was to produce insight on what type of association and relationships new technological tools, such as mobile banking and investment apps has had in PFM, and whether the effect has been positive. This study produces background information for further and more extensive studies to be made. By analysing the opinions of survey participants and recognising potential patterns, certain notes can be made. A Study by Gustina et al. (2022) showed promising results on the influence of financial knowledge, financial skills, and financial attitudes towards financial behaviour in their study of MSME entrepreneurs in West Sumatra, which led the author to also expect significant results from regressions. The testing showed that financial knowledge, also interchangeable with financial literacy, showed significant effect on the financial behaviour of the participants. This however was not the main scope of this particular study, but sufficiently similar to expect somewhat interesting results.

The study can be seen to show a somewhat positive relationship of technology usage towards PFM and financial literacy within certain demographics, the subjective understanding of investment has improved according to the survey and also notably men seem to perceive their knowledge to be improved more than their female counterparts. Participants below the age of 35 can be seen to perceive their understanding of borrowing methods better with the use of PFM technologies, which follows logical thinking. Typically, under 35 year-olds do not carry as much knowledge regarding loans and credit as the older groups usually does, since most loan-needing ventures are more prevalent later in life. Also, more frequent users of PFM technologies perceived their understanding of budgeting and investing having grown more than other demographics. Hence, hypothesis 1 can be partially seen as accepted. This in itself was not surprising for the author as discussed within the empirical analysis section. The popularisation of mobile banking and the improvements made to similar applications show growing interest in more efficient investing and budgeting.

The largest criticism was from the age groups of 55 upwards, that according to the study tended to be more cautious towards potential security risks and the difficulties to learn new tools. "I often feel that old people are left out of the discussion of new technology; we do not share the same capabilities to

learn and understand as quickly as the younger generation” (Participant aged 65+). These points however could not be further analysed due to regression model not providing significant results when dividing age groups into three categories, but more of a potential insight and pattern noticed for future studies. Additionally, older participants (65+) did not belong into the “several times a week or over” category in the frequency of PFM technology usage, which further advocates towards further possibilities of comparative research.

The largest upside of technology usage occurring often in the survey results is definitely the easiness and accessibility, with many participants claiming that tracking their finances is substantially easier with the use of technology. “Investments have been easier to track, and my knowledge of my assets has grown” (Participant aged 18-24) and “Encouraged me to start investing. Made investing more approachable, less scary” (Participant aged 25-34) were opinions that resonated with countless other survey participant answers. In total, qualitative point from the open word section as 33 participants mentioned the easiness of financial handling as the main positive in some form and 20 mentioned accessibility, which is a notable figure considering not everyone is willing to write down their thoughts only for the sake of a survey. However, due to the nature of the analysis, no scientifically significant consensus can be made to H2: There is a notable relationship between demographic factors and PFM technology association with financial equality, H3: More active use of technology has a positive association with accessibility of financial resources, H4: More active use of technology has a positive association with convenience in PFM. This is due to the results not showing a positive adjusted R squared after several tries and adjustments that included adding and removing independent variables. The data collected partially failed to aim directly towards the hypotheses in a specific enough manner, and the hypotheses had to be adjusted slightly due to that. These results in itself are not surprising, however definitely dissapointing. The main concern with internet surveys is the reachability to all demographics, which resonates with the answers. The more tech-savvy participants are more likely to answer surveys regarding “The effect of technology in personal finance management“. Analysing the answers help us recognise the need for possible future assesment, which could then lead to new findings and results.

The main task was to collect as unbiased and random data from a sufficient enough demographic in Finland that would allow to draw conclusions from. This only partially succeeded, as certain demographics are much more difficult to reach with internet based surveys. The author is suggests future research to cut the sample into smaller bits, and e.g. only compare two different demographic groups at a time. Due to the actual usable sample size being only 101, it would be logical. The overall

conclusion of the author states that more frequent usage of PFM technologies has a partially positive relationship with with the subjective improvement in financial literacy, thus urges for people to implement PFM technology usage heavier in their handling of personal finances. The other three hypotheses developed for the study cannot be concluded in any way, hence the author suggests for future research to occur in the realm of accessibility, financial inequality and convenience. Whilst the use of new technologies in all fields of life grow more popular and not stopping any time soon, it is imperative to keep studying both the positives and negatives altogether in every aspect, not just personal finance.

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APPENDIX 1. A survey questionnaire

The effect of technology in personal finance management

Anonymous data collection regarding how the use of financial technologies and platforms have affected the general understanding and perceivance of financial literacy and equality.

Section 1: Demographic information

Q1: Nationality: (Insert)

Q2: Age:

Under 18 / 18-24 / 25-34 / 35-44 / 45-54 / 55-64 / 65+

Q3: Gender:

Male / Female / Other

Q4: Education level:

No high school diploma / High school graduate / Trade or vocational training / Bachelor's degree / Master's degree / Other

Q5: Employment status

Employed (full or part-time) / Unemployed / Student / Retired / Self-employed / Other

Section 2. Technology usage in personal finance management

Q6: Do you use any form of technology to manage your finances? (Mobile banking apps, budgeting apps etc.)

Yes / No

Q7: Which type of technologies do you use? (select all that apply)

Mobile banking apps / Online banking (Home PC, laptop etc.) / Investment platforms/ Online fund and stock brokerage (Nordnet etc.) / Budgeting apps / Other

Q8: Frequency of use

Daily / Multiple times a week / Weekly / Monthly / Less than monthly

Q9: How long have you used said tools to manage your finances?

Less than a year / 1-2 years / 3-5 years / 6-10 years / Over 10 years

Section 3. Impact on financial literacy

Q10-14: How has the use of personal finance technology affected your knowledge on the following topics:

Budgeting

N/A, already understood the topic / No change / Slightly improved / Moderately improved / Significantly improved

Investing

N/A, already understood the topic / No change / Slightly improved / Moderately improved / Significantly improved

Borrowing (Incl. credit, loans and other such instruments)

N/A, already understood the topic/ No change / Slightly improved / Moderately improved / Significantly improved

Saving

N/A, already understood the topic/ No change / Slightly improved / Moderately improved / Significantly improved

Q15: In addition, has any aspect of personal finance become more difficult to manage, after using previously mentioned tools and technologies? (If yes, select all that apply)

No / Budgeting / Investing / Borrowing / Saving / Other

Section 4: Inequality in personal finance management

Q16: Do you think technology has made financial management resources more accessible to you?

Yes / No / Not sure

Q17: If yes, in what ways has technology made financial management more accessible? (Select all that apply)

Lower costs / More available information / Personalized advice / Easier tracking of finances / Broader access to financial markets / Other

Q18: Do you believe financial management technologies have reduced financial inequalities?

Scale of 1-5, 1: Strongly disagree, 5: Strongly agree

Section 5. General feedback and individual thoughts

Q19: Any additional comments on how technology has impacted your personal finance management? Or other thoughts?

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