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# DIGITAL BANKING AND (IN)EQUALITY: A SYSTEMATIC OVERVIEW

## ABSTRACT

The rapid expansion of digital banking has revolutionised financial services globally and stipulated financial inclusion. Still, debates remain about the (in)equalities that digital banking can contribute to. Its impact varies significantly among different social groups, which is why this review will show how digital banking contributes to inequalities across them and what policy responses can be used to overcome challenges.

The study employs a systematic literature review of 27 articles from 1999 to September 2023. Firstly, the review highlights a significant research gap in digital banking and inequalities in low-income countries. Secondly, there is an obvious shift in the research time from high-income countries to upper-middle and lower-middle countries, which may indicate that the problem of inequality under digital banking in high-income countries is not under urgent question. However, the issue of inequality remains relevant in upper-middle and lower-middle countries despite the previous experience gained in high-income countries, which may indicate gaps in the implementation of policy decisions. Thirdly, the most attention in research papers to inequalities is paid to age (74.1%), gender (66.7%), education (40.7%), and income (25.9%). The age gap, in particular, remains pronounced, with the elderly being disproportionately affected. The analysed research highlights that policies place significant responsibility on banks, but there is a pressing need for collaborative efforts involving the state, financial regulators, and banks, especially with an emphasis on training initiatives to bridge gaps in digital financial literacy.

**Keywords:** online banking, internet banking, gender divide, age divide, income divide, financial literacy, financial inclusion

**JEL Classification:** G21, G29, D63, D69

## INTRODUCTION

Integrating new technologies is challenging for both individuals and society. Failure to respond to this challenge can result in a society lagging behind in development. The changes are more dramatic at the individual level: exclusion (restrictions) from processes that have changed due to technologisation, in case of refusal to study or retraining. Introducing disruptive technologies often encounters resistance due to misconceptions or distorted perceptions of their consequences (Juma, 2016).

Among the transformational technological achievements of recent decades, the Internet stands out, accelerating the processes of digitalisation (1991 can be considered the official year of the Internet's invention when HTML, HTTP, and URL were combined) (Perez-Amaral et al., 2021). A characteristic feature of the present is the widespread use of online financial services, including digital banking. Delving deeper into the field of digital banking, it becomes apparent that the financial inclusion of individuals has increased significantly in recent years, indicating changes in consumer behaviour and preferences. In 2023, the United Kingdom topped the ranking with an online banking penetration rate of 98.41%, followed by Norway and Iceland with rates of 95.77% and 95.43%, respectively (Statista, 2024). In general, the analysis of available statistics on individuals using the Internet for digital banking shows a tendency to increase their share: in 2012, this share in the European Union was 38.17%, and by 2023, it had increased to 63.87%, with nine countries exceeding 80% (Eurostat, 2024).

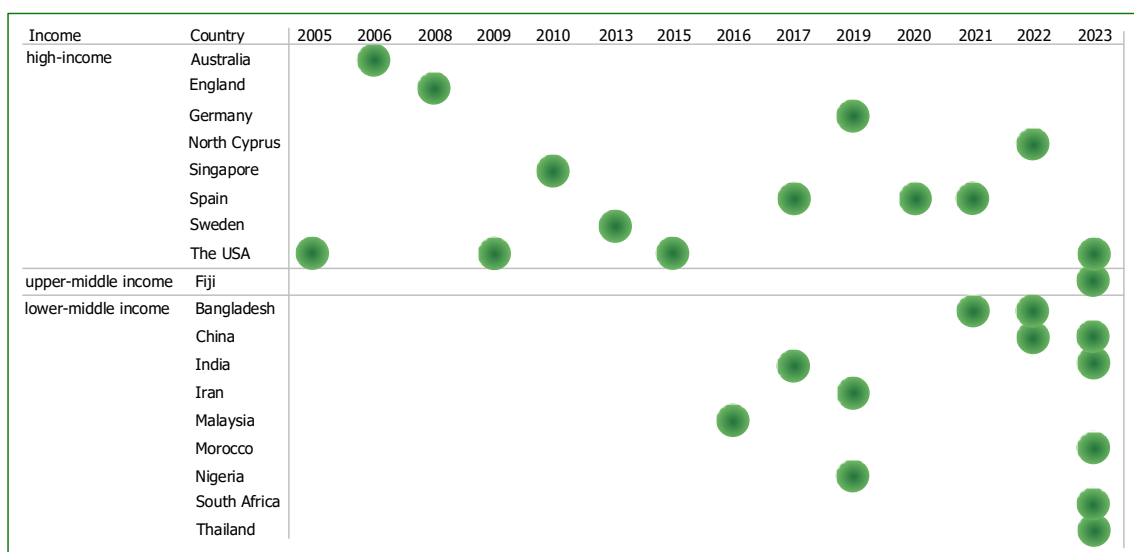
The peculiarity of digital banking is that mastering its tools is the responsibility of individuals to a greater extent and much less of banks. Our experience of using digital banking is self-learning. In addition, each digital banking has its own specifics: a set of services, restrictions, payment options, and, ultimately, an interface. This means that there are no special unified courses where you can learn how to use digital banking. And banks do not always offer special training materials for mastering such skills. Moreover, digital banking is constantly evolving, especially with the advent of smartphones.

## LITERATURE REVIEW

An analysis of the literature showed that scholars have paid attention mainly to the following groups of social differentiation: age (Banerjee et al., 2005; Williamson et al., 2006; Devins et al., 2008; Sølilen et al., 2013; Akhter, 2015; Tan & Leby, 2016; Marakarkandy et al., 2017; Garín-Muñoz et al., 2019; Mkpojiogu et al., 2019; Nouri & Soltani, 2019; Schehl et al., 2019; Peral-Peral et al., 2020; Perez-Amaral et al., 2021; Saka et al., 2022; Amin et al., 2022; Jenkins et al., 2022; Zhu et al., 2022; Bui & Luong, 2023; Chetioui et al., 2023; Zeng & Li, 2023), gender (Banerjee et al., 2005; Williamson et al., 2006; Devins et al., 2008; Haytko & Simmers, 2009; Riquelme & Rios, 2010; Sølilen et al., 2013; Akhter, 2015; Marakarkandy et al., 2017; Garín-Muñoz et al., 2019; Mkpojiogu et al., 2019; Nouri & Soltani, 2019; Schehl et al., 2019; Peral-Peral et al., 2020; Perez-Amaral et al., 2021; Zhu et al., 2022; Kumar & Chawla, 2023; Chetioui et al., 2023; Nel & Boshoff, 2023), education (Banerjee et al., 2005; Devins et al., 2008; Akhter, 2015; Marakarkandy et al., 2017; Garín-Muñoz et al., 2019; Mkpojiogu et al., 2019; Schehl et al., 2019; Perez-Amaral et al., 2021; Zhu et al., 2022; Jenkins et al., 2022; Chetioui et al., 2023), rural/urban (Williamson et al., 2006; Lee et al., 2021; Zhu et al., 2022; Bui & Luong, 2023; Zeng & Li, 2023), race/ethnicity (Banerjee et al., 2005; Devins et al., 2008), and income (Williamson et al., 2006; Devins et al., 2008; Akhter, 2015; Marakarkandy et al., 2017; Garín-Muñoz et al., 2019; Saka et al., 2022; Amin et al., 2022). To obtain more generalised results, we used the classification proposed by Perez-Amaral et al. (2021, p. 10). He identified three groups of dimensions of digital gaps: sociodemographics (gender, age, population size), individual skills (education, digital skills) and economic (income). During our analysis, we found that we need to add two more to the sociodemographics group: ethnicity and residence (rural/urban). Relevant study data (e.g., author, year, country, population characteristics, sample size, type of social differentiation (gender, age, education, rural/urban, other types), and policy recommendations) were extracted and presented in Appendix A, built according to applied methodology.

Figure 1 shows the distribution of studies by year and country of research based on their income level according to the World Bank methodology. Also, the study sample does not include low-income countries. This highlights a significant research gap on digital banking and inequalities in this group of countries. There is an obvious shift in the research time from high-income countries to upper-middle and lower-middle countries, which may indicate that the problem of inequality in the context of digital banking in high-income countries has been resolved or partially resolved.

The analysis of studies has shown that the problem of inequality remains relevant in upper-middle and lower-middle countries despite the previous experience gained in high-income countries, which may indicate a weak implementation of policy decisions (Figure 1).



**Figure 1. Distribution of studies among years and countries' income levels range.** Note: \*Saka et al. (2022) are not included in the sample in Figure 1 due to using research data from more than 140 countries. (Source: generalisation from Appendix 1)

Still, there is a growing interest in the study of digital banking in the context of inequality, as 3 papers were selected for analysis in the period 1999-2008 (first decade), 7 studies in the period 2009-2018 (second decade), and 17 studies in the period 2019-September 2023 (third period). Table 1 shows that over the entire period of the study, the following types of social differentiation received the most attention: age (74.1%), gender (66.7%), education (40.7%), and income (25.9%).

**Table 1. Frequency of mentioning the type of social differentiation in selected studies over the years.** Note: \* dark green highlight refers to the higher frequency of mentioning the type of social differentiation. (Source: generalisation from Appendix 1)

Type of social differentiation	Frequency of mentioning the type of social differentiation			
	1999-2008	2009-2018	2019-2023	1999-2023
Age	100.0%	71.4%	70.6%	74.1%
Education	66.7%	42.9%	35.3%	40.7%
Ethnicity	66.7%	0.0%	0.0%	7.4%
Gender	100.0%	85.7%	52.9%	66.7%
Rural issue	33.3%	0.0%	23.5%	18.5%
Income	66.7%	42.9%	11.8%	25.9%
Disability	33.3%	0.0%	5.9%	7.4%
Adults with children	33.3%	0.0%	0.0%	3.7%
Employment	33.3%	0.0%	5.9%	7.4%
PC skills	33.3%	14.3%	5.9%	11.1%
Internet skills	0.0%	14.3%	23.5%	18.5%
Internet trust	0.0%	0.0%	5.9%	3.7%
Experience of users using mobile banking apps	0.0%	0.0%	11.8%	7.4%
Cultural participation	0.0%	0.0%	5.9%	3.7%

So, the focus of research is being redistributed. There is a noticeable trend towards a decrease in the frequency of research focused on inequalities caused by age, gender, education, and income. Instead, in 2019-2023, the number of articles that focused on the impact of Internet skills, cultural participation, and Internet trust on the level of engagement in digital banking increased.

## AIMS AND OBJECTIVES

This paper will demonstrate whether the digitalisation of banking services (digital banking) contributes to inequality. To this end, we have conducted a systematic review to summarise the types of inequalities addressed in the context of digital banking, highlight the most common patterns of technology adoption, and identify the best policy solutions to cope with inequalities.

## METHODS

Our study employed a systematic review approach, a process of finding relevant articles based on keywords with inclusion and exclusion criteria, to identify relevant features or possible gaps (Mak & Thomas, 2022), ensuring the reliability of our findings.

This systematic review followed Arksey and O'Malley's (2005) methodology based on a five-step approach: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarising and reporting the results. At the outset, we employed the PICO methodology (Schardt et al., 2007) to craft the following research questions:

- **RQ1:** How does digital banking contribute to inequalities across different social groups?
- **RQ2:** What policy responses at the level of government, financial regulators, or banks were used to overcome inequalities in the implementation of digital banking?

The second and third steps involved identifying relevant studies and the study selection process for detailed review. For this purpose, we used the PRISMA table proposed by Tricco et al. (2018).

The search strategies were carefully designed to ensure the retrieval of accurate research articles for the presented systematic review.

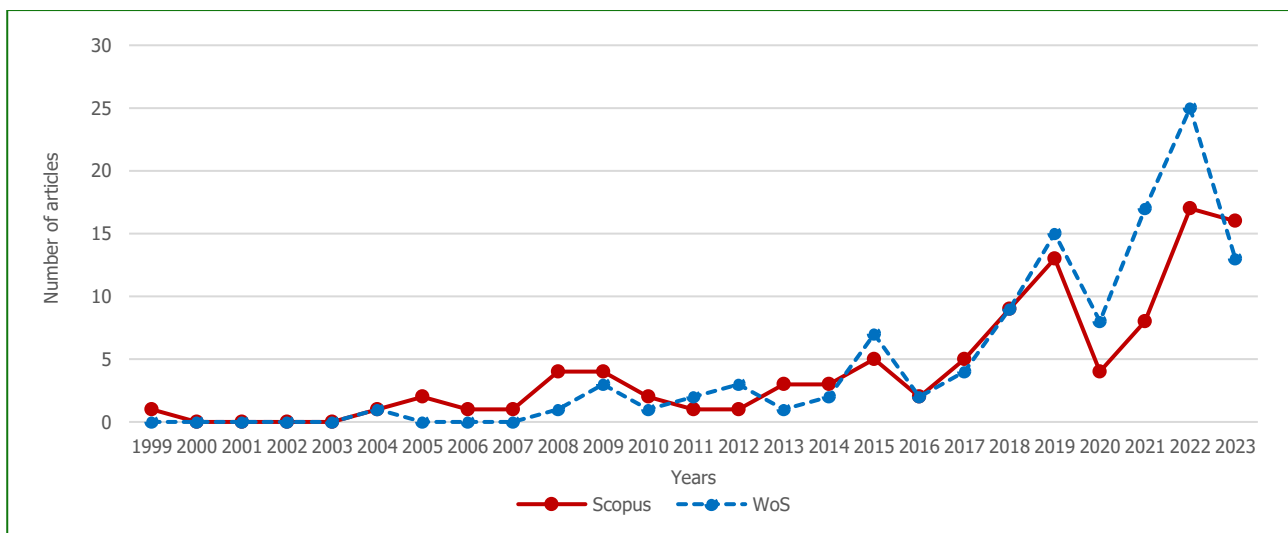
The search was conducted in Scopus and Web of Science (WoS) databases for three key reasons. Firstly, these databases host the most relevant scholarly research, particularly those subjected to rigorous peer review. Secondly, they allow for a uniform search approach, specifically using the Title-Abstract-Keywords method (TS – for WoS, TITLE-ABS-KEY – for Scopus). Thirdly, they utilise the same operators, such as "\*" for word ending variations, significantly enhancing the search capabilities.

A search query for each database consisted of two blocks: 1) digital banking with synonyms: e-banking, online banking, mobile banking, and internet banking; and 2) inequalities with synonyms: discrimination, disparity, bias, precarization, and divide.

Additionally, our inclusion criteria were defined as follows: "only Articles", "English Language", and a "search interval from January 1999 to September 2023". The selection of this specific timeframe was deliberate and methodical. Since the Internet is a relatively new technology in a historical context, emerging and expanding since 1991 (Perez-Amaral et al., 2021), internet-based banking followed suit later. Hence, we selected periods during which potentially relevant research for our systematic review would have been conducted. Then, two blocks and the above-mentioned criteria were combined using the "AND" operator, and our search queries were:

- **for Scopus:** (TITLE-ABS-KEY ("e-bank\*" OR "digital bank\*" OR "online bank\*" OR "mobile bank\*" OR "internet bank\*") AND TITLE-ABS-KEY ("inequalities\*" OR "discrimination\*" OR "disparity\*" OR "bias\*" OR "precarization\*" OR "divide\*")) AND PUBYEAR > 1998 AND PUBYEAR < 2024 AND PUBYEAR > 1998 AND PUBYEAR < 2024 AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English"));
- **for WoS:** TS = ("Inequalities\*" OR "Discrimination\*" OR "Disparity\*" OR "Bias\*" OR "Precarization\*" OR "Divide\*") AND TS = ("E-bank\*" OR "Digital bank\*" OR "Online bank\*" OR "Mobile bank\*" OR "Internet Bank\*") AND Article (Document Types) and 2004 or 2023 or 2022 or 2021 or 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2014 or 2013 or 2012 or 2011 or 2010 or 2009 or 2008 or 2007 or 2006 or 2004 (Publication Years) AND English (Languages).

The first publication in Scopus was in 1998, and in the WoS, it appeared in 2004, in line with our specific queries. Figure 2 illustrates the search outcomes.



**Figure 2. Numbers of articles by year published for chosen search strings in Scopus and Web of Science, 1999 – September 2023.**

After implementing the search strategy outlined in steps 2 and 3, we identified 217 articles, which were then imported into the reference management software Zotero. Through Zotero, we eliminated duplicate articles, resulting in a total of 162 unique articles. Subsequently, we evaluated the abstracts of these articles to determine their relevance to the research questions, excluding non-empirical studies in this process. Based on the reviewed abstracts, 27 articles were selected for full reading (Figure 3).

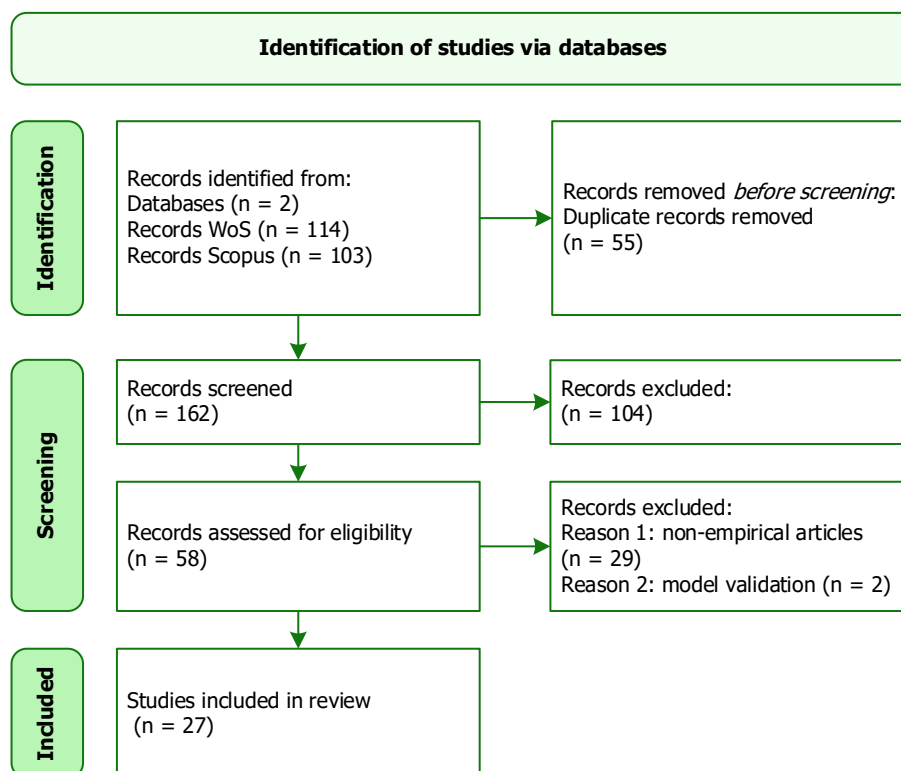


Figure 3. PRISMA Chart for systematic review.

In step 4, we identified the information blocks necessary to answer the search question. After that, we grouped the information in Appendix 1 with the following columns: authors, year of publication, country where the empirical study was conducted, population characteristics, sample size, type of inequalities (age, gender, education, rural/urban, other), causes of the inequalities, policy recommendations (if available).

Moving to step 5, which encompassed the collection, summarisation, and reporting of results, we followed the methodology proposed by Perez-Amaral et al. (2021). Accordingly, we categorised inequalities into sociodemographic, economic, and individual disparities.

## RESULTS

### *RQ1: How does digital banking contribute to (in)equalities across different social groups?*

The systematic analysis of sources in the context of this question should be divided into periods. This is closely related to the fact that access to online banking, at the initial stages of its promotion, depended on the availability of the Internet and access to computers. In fact, the first digital divide - lack of access to digital tools and Internet coverage - was indeed an obstacle, which was later replaced by the second digital divide - lack of digital skills, and eventually by the emergence of another - third level - the outcomes level of the digital divide (van Deursen et al., 2015). That is why the literature will be analysed in terms of time periods.

The first was **from 1999 to 2008**, in which the first three papers were published. Note that all three papers are empirical studies in developed countries: The United States, Australia, and England. These are developed countries that were the first to introduce digital banking. All three studies focus primarily on sociodemographic indicators.

The researchers focused on the gender gap in the use of online banking, along with an analysis of its use by age, education, race, and income. Banerjee et al. (2005) noted that "The result proves that the overall gender divide in the use of the Internet has diminished" (p. 35). At the same time, this paper emphasised that one of the explanations why women use the Internet less, for example, for online banking, is risk. In fact, they noted that women are more likely to use the Internet for less risky activities, such as information searches.

In Australia, the situation with gender inequality was worse, as Williamson found that 27.2% of women use online banking, as opposed to 70% of men. And they use it at home, not at work (Williamson et al., 2006). Even late at night, when

everyone is resting. The lack of awareness of inequality by women is striking. For example, one of the answers was: “[I can] just do it another time whenever I feel like it, late at night or something, when it is usually quieter” (Williamson et al., 2006, p. 27). On the one hand, online banking allows you to conduct transactions 24/7 without visiting the office, but women do it during “overtime”. And it’s not only about work but also about fulfilling household duties. Among the advantages of online banking were ease of access and time savings, which are considered even more important than minimising costs.

Two papers drew attention to racial differences. For example, in the United States, 43.5% of women and 45.1% of men used online banking among the white population, while among non-whites, 5.8% and 5.7% (Banerjee et al., 2005). Accordingly, in England, users of online services, including online banking, are “more likely to be male, white, and relatively affluent” (Devins et al., 2008, p. 53).

For older people, inequalities primarily lie in lower levels of digital skills but also in the devices they are offered. Age-related illnesses (poor eyesight and coordination) and insufficiently user-friendly interfaces cause problems in accessing online banking. However, there is one advantage: more free time, which means the opportunity to master digital skills. Once again, it is emphasised that this group has two types of gaps: the access gap and the skills gap. These two problems are also inherent in the rural population (Williamson et al., 2006).

People with higher incomes have more access to online banking than those with lower incomes. The authors speculate that perhaps the latter are not as interesting to bankers. We believe lower incomes may be responsible for the same two gaps as above: lack of access to a personal computer and Internet and insufficient digital skills (Williamson et al., 2006).

The second group of studies **from 2009 to 2018** is already represented by different countries by development, but the comparison groups remain the same: sociodemographic, economic, and individual skills. The peculiarity is that there are studies specifically focusing on gender (Riquelme & Rios, 2010) and age (Tan & Leby Lau, 2016). Age remains important: young people are adopting online banking, while older people remain outsiders. For example, Soilen et al. (2013) note that “The younger segments seem to rely more on Internet banking than the elderly segments” (p. 4). “The results indicate that segments containing elderly people perceive they lack information to a greater degree. Their concerns are mainly about safety/risks and usage” (p. 5). Garín-Muñoz et al. (2017) also show that as age increases, the use of online banking decreases, with a peak in the 35-44 age group. This is still explained by the “attitudes and behaviours” of older people, but other explanations also emerge: the frequency of using online transactions (if you don’t use them often, you forget the sequence of actions and need to recall constantly) (Akhter, 2015), higher risk tolerance on the part of young people (“...the innovation factor of risk” (Soilen et al., 2013). We also again encounter problems in developing countries: for example, in India, in a sample of 300 people, only 5 people were over the age of 51, which may indicate the exclusion of this age group from online banking (Marakarkandy et al., 2017).

Studies in developed countries show that there are no particular differences in terms of gender when it comes to inequalities. For example, Akhter (2015) notes that gender has no significant impact on the use of online banking. However, Garín-Muñoz et al. (2017) emphasise that gender does matter, as there is a gap in the use of online banking between women and men, but this gap cannot be said to be significant. A gender-focused study by Riquelme and Rios (2010) shows that it is not about inequalities but rather about factors that affect men and women differently when making a decision to use online banking. For example, it is noted that “Ease of use has a stronger impact on female respondents than male, whereas relative advantage has a stronger effect on the perception of usefulness on male respondents. Social norms (or the importance of others in the decision) also influence adoption more strongly among female respondents than male” (Riquelme & Rios, 2010, p. 328). At the same time, this is a problem in developing countries. For example, the study by Marakarkandy et al. (2017) openly states that India is a ‘male-dominated society’ and, therefore, the proportion of women respondents is much lower than men.

One paper notes that sociocultural characteristics regarding race should be taken into account, as they can also determine the level of online banking usage (Marakarkandy et al., 2017).

Economic indicators remain just as important. The same trend as in the early days of online banking adoption can be clearly seen: the higher the income, the higher the engagement with online banking (Akhter, 2015; Garín-Muñoz et al., 2017).

Education plays a crucial role, particularly in terms of Internet skills. Thus, Garín-Muñoz et al. (2017) note that “Respondents with very high-level skills had odds of adopting eBanking 26.52 times greater than people belonging to the reference group (low skills)” (p. 17).

The third period covers seventeen studies in **2019-2023**. Traditionally, there is still an age gap, which is emphasised in the works of Amin et al. (2022), Pérez-Amaral et al. (2021), and Saka et al. (2022). Bui & Luong (2023) once again emphasise that the elderly use online banking to a lesser extent due to insufficient skills and are less interested in having access to the Internet at all, in particular, due to the use of feature phones instead of smartphones. Jenkins et al. (2022) once again confirm the hypothesis that "Internet banking adoption rates" decrease with increasing age. At the same time, the author suggests that this may not be evidence of inequality but rather of a declining need to use online banking. However, the author also mentions a decline "in individuals' physical and cognitive abilities" (Jenkins et al., 2022, p. 6177).

Later studies show that the issue of gender can be considered from a different perspective. For example, Zhu et al. (2022) show that, on the contrary, women are more likely to use digital banking than men; according to Chinese tradition, they "...manage family income" (p. 6). Jenkins et al. (2022) argue that gender does not affect the use of online banking, and Pérez-Amaral et al. (2021) prove that the gender gap is shrinking. At the same time, in some countries, this is still an urgent problem. For example, Bui and Luong (2023) argue that in Thailand, gender issues remain, as some women do not know what the Internet is and how to use it. This problem is exacerbated when considering women living in rural areas. Kumar and Chawla (2023) also argue that a gender gap exists in India, emphasising that "men are more open to technology if they think it will be useful, while women tend to focus more on what needs to be done" (p. 16). Chetioui et al. (2023) show that for women, it is important that mobile banking apps are "enjoyable, frequently used, trusted and positively perceived" and "easy to use and fun" (p. 16). The same applies to young people and individuals with lower educational levels.

Opinions differ on income. Pérez-Amaral et al. (2021) point to a reduction in inequality. Jenkins et al. (2022) prove that income does not affect 'internet banking adoption', but Saka et al. (2022) show that individuals with high incomes use online banking more. Similarly, Bui & Luong (2023) indicate that the better-educated and wealthier are more likely to use digital banking.

As for education, education remains a relevant factor (Pérez-Amaral et al., 2021; Bui & Luong, 2023). Jenkins et al. (2022) note that the higher the level of education, the greater the ability to understand complex technologies, including online banking. Mkpojiogu et al. (2019) also argue that "the more educated the users are, the more satisfied they are with the usability of the interfaces of the apps" (p. 464).

Once again, the ease of use and technology familiarity are related (Amin et al., 2022; Nouri & Soltani, 2019). So, insufficient computer skills are a barrier to using digital banking (Zhu et al., 2022; Pérez-Amaral et al., 2021).

Online banking is also beginning to be considered from other perspectives, such as the use of visually impaired or blind and partially sighted people (Goundar & Sathye, 2023).

At the same time, Schehl et al. (2019) conclusion remains relevant: "...men and those who were younger, with higher education, and reported higher perceived behavioural control had greater odds for online banking and shopping" (p. 15).

## **RQ2: What policy responses at the government, financial regulators, or bank level were used to overcome inequalities in implementing digital banking?**

When addressing policies to reduce inequalities, it becomes apparent that in digital banking, existing recommendations predominantly emphasise the actions banks should undertake, while the roles of the state and financial regulators are largely overlooked. This focus is perhaps unsurprising, given that digital financial services often originate from the banking sector. However, certain factors critical to the adoption of digital banking, such as individuals' education and income levels, fall only partially within the sphere of influence of banks. It is essential to clearly delineate the spheres of responsibility within policymakers.

Education, in particular, has been consistently emphasised in policy recommendations across several studies (Tan & Leby, 2016; Garín-Muñoz et al., 2019; Peral-Peral et al., 2020; Perez-Amaral et al., 2021; Bui & Luong, 2023; Kumar & Chawla, 2023; Zeng & Li, 2023). These studies underscore that individuals' education levels, encompassing especially digital or financial literacy, are a crucial determinant in the adoption and effective use of digital banking services. This evidence underscores the need to broaden policy discussions to incorporate systemic educational interventions by the state and financial regulators aimed at enhancing financial and digital literacy.

The analysed studies show that financial literacy and inclusion have gained significant attention only in recent years. This shift has been facilitated by adopting a scientific approach to assessing them and developing comprehensive databases. Among the most widely used methodologies for evaluating financial literacy and inclusion are the OECD/INFE methodology (OECD, 2023) and the Findex database by the World Bank.

The findings on financial literacy, as measured by the OECD/INFE, indicate that certain aspects of fundamental financial knowledge remain notably weak in many countries. According to the 2023 report, these deficiencies have shown minimal or no improvement compared to earlier assessments conducted in 2016 and 2020 (OECD, 2023). The current levels of digital financial literacy appear inadequate to fully address the opportunities and risks associated with digital financial services. Data indicate that the average digital financial literacy score across participating countries and economies is 53 out of 100 points (OECD, 2023, p. 56).

In 2021, the European Union introduced the Digital Compass to foster digital education, marking the beginning of the Digital Decade. The Digital Compass outlines four essential pillars: the digitalisation of businesses, the transformation of government services, the enhancement of digital skills, and the development of secure digital infrastructure. As part of the Digital Decade, the Path to the Digital Decade policy programme was established, with progress measured using the Digital Economy and Society Index (DESI). The DESI focuses on several key dimensions, including human capital, connectivity, integration of digital technologies, and digital public services. Within the human capital dimension, particular attention is given to skills such as information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving, all of which are vital for navigating the digital era (European Commission, n.d.).

According to the DESI, data from 2023 highlights a disparity in digital skills proficiency among population groups in EU countries. On average, 28.24% of individuals in the EU possess basic overall digital skills. The gender gap is minimal, slightly favouring women, with 29.05% of women and 27.4% of men demonstrating basic digital skills. However, a considerable disparity persists across age groups: 31.91% of individuals aged 16–24 possess basic digital skills, compared to 30.82% in the 25–54 age group and only 22.84% among those aged 55–64 (Digital Decade DESI, 2023).

If financial literacy and digital literacy are combined into the framework of financial digital literacy, significant disparities can be observed across key socio-economic status indicators such as age, place of residence, and income. According to 2023 data, individuals under the age of 60 demonstrated an average financial digital literacy score of 54 out of 100, compared to 49 for individuals aged 60 and above, reflecting a 5-point gap. Regarding place of residence, urban residents achieved an average score of 55 points, while rural residents scored 50 points, also resulting in a 5-point disparity. The most pronounced gap is evident when considering income levels: low-income individuals scored 49 points, medium-income individuals scored 54 points, and high-income individuals scored 58 points, marking a maximum difference of 9 points (OECD, 2023).

Thus, the development of targeted policies aimed at enhancing financial and digital literacy - and consequently financial inclusion - can be realised by creating educational programs backed by the state and financial regulators. These programs should be tailored not only for younger generations but also for the elderly, as highlighted by Zeng & Li (2023), Bui & Luong (2023), and Peral-Peral et al. (2020), rural individuals (Bui & Luong, 2023; Garín-Muñoz et al., 2019; Kumar & Chawla, 2023), and income (Marakarkandy et al., 2017; Amin et al., 2022; Garín-Muñoz et al., 2019; Bui & Luong, 2023; Kumar & Chawla, 2023). These disparities can, in part, be attributed to insufficient access to smartphones with Internet connectivity among these population groups (Bui & Luong, 2023; Kumar & Chawla, 2023). To address these gaps, the development of targeted programs aimed at providing smartphones to vulnerable groups may prove effective. Additionally, the implementation of innovations by private telecommunications companies focused on expanding Internet coverage is likely to enhance digital inclusion.

It is essential to emphasise once again that age-related users of digital banking constitute a distinct and significant demographic group. However, it is emphasised that banks should tailor online services to meet the needs of older adults as a growing consumer group and organise training for them. Training for older adults should focus on improving digital skills, boosting confidence in performing tasks and reducing anxiety around digital banking. In addition, the government should get involved. For example, social workers and ageing-related practitioners should recognise older adults as active financial participants and involve them in the digital financial world.

Banks have a specific area of responsibility, which primarily involves focusing on providing clear consumer guidance and responsive interfaces, keeping banking apps easy to use, especially for vulnerable groups (Riquelme & Rios, 2010; Marakarkandy et al., 2017; Amin et al., 2022; Jenkins et al., 2022). Trial versions of mobile banking can offer customers new experiences with the technology. They should pay more attention to usability and convenience, which will result in a high performance-to-cost ratio for application users (Kumar & Chawla, 2023).

## DISCUSSION

The findings of this systematic review align with earlier research on the digital divide but also highlight underexplored dimensions. While much of the literature emphasises first-level (access) and second-level (skills) divides (van Deursen et al., 2015), our study underscores the growing importance of third-level divides - disparities in outcomes, such as digital banking usage. This perspective adds depth to the discussion, as many prior studies focus solely on the first two levels without addressing how these disparities manifest in practical financial inclusion.

Our work builds on earlier findings by Williamson et al. (2006), who identified gender and income disparities in the initial stages of digital banking adoption. However, unlike their emphasis on sociodemographic gaps in developed countries, our study expands the scope by analysing inequalities in a broader temporal and geographical context, including developing economies. This broader lens reveals that while gender gaps have diminished in some contexts (Pérez-Amaral et al., 2021; Bui & Luong, 2023), they persist in others, particularly in rural areas and male-dominated societies (Banerjee et al., 2005; Marakarkandy et al., 2017).

A key contribution of this study lies in linking digital and financial literacy as a unified framework for analysing inequalities. While previous work has addressed these domains separately (Garín-Muñoz et al., 2019; Jenkins et al., 2022), we argue that integrating financial digital literacy is essential to understanding disparities in banking access and usage. This approach provides a comprehensive view of barriers faced by older adults, rural residents, and low-income individuals, such as limited access to Internet-enabled devices and insufficient skills.

Our findings highlight the need for new avenues of research to address persistent gaps in digital banking access and usage. First, greater attention should be directed toward individuals in rural areas and those with low incomes. Despite the significant progress in bridging the first-level digital divide, these groups remain underrepresented in existing studies. Future research should focus on identifying tailored strategies for improving access to Internet-enabled devices, digital and financial literacy, and financial inclusion for these populations.

Second, while age remains the most studied factor in digital banking research, the persistent age-related gap warrants further exploration. It is crucial to investigate why this disparity remains unresolved and to develop targeted interventions that address the unique barriers older adults face. For example, research could explore the effectiveness of personalised training programs, user-friendly app designs, and government-supported initiatives aimed at enhancing digital and financial skills and confidence among the elderly.

Lastly, there is a pressing need for research beyond placing the responsibility for inclusivity solely on banks. Future studies should examine the impact of collaborative approaches involving governments, financial regulators, and banks. Understanding how these stakeholders can work together to create comprehensive policies and innovative solutions will be vital for fostering equitable digital banking.

## CONCLUSIONS

The findings of this systematic review provide critical insights into the evolving landscape of digital banking and its implications for inequality. While the rapid digitalisation of financial services has created new opportunities for financial inclusion, it has also exposed and, in some cases, exacerbated existing inequalities.

The geographical shift in research focus - from high-income to upper-middle and lower-middle-income countries - raises important questions. While high-income countries appear to have addressed many aspects of inequality associated with digital banking, it is unclear whether this success is due to effective policy implementation, better access to technology, or both. Conversely, the persistence of inequality in upper-middle and lower-middle-income countries, despite prior lessons from high-income regions, indicates a potential disconnect in the transfer of policy knowledge or an incompatibility of these policies with local socio-economic conditions.

The empirical studies from the analysed sample (1999–2023) focus on inequalities in areas such as age (74.1%), gender (66.7%), education (40.7%), income (25.9%), rural residency (18.5%), and internet skills (18.5%). Despite ongoing efforts to address these disparities, they continue to significantly influence the level of digital banking adoption. Among the factors examined, the pronounced gaps related to age and rural residency are particularly critical. Older adults, often less familiar with digital technologies, face substantial barriers to accessing digital banking services. This issue is exacerbated by the rapid pace of technological change, which disproportionately impacts individuals with low digital literacy. Similarly, individuals in rural areas encounter compounded challenges stemming from limited internet access and, frequently, low-income levels, which create additional physical and financial barriers to inclusion in the digital environment.

Policy responses to these challenges largely place the burden on banks to implement inclusive practices. While banks have a vital role in addressing these inequalities, the current reliance on them alone is insufficient. Promisingly, state-level initiatives focusing on financial and digital literacy have begun to emerge, highlighting the potential of collaborative approaches. To effectively reduce these disparities, coordinated efforts are needed among banks, governments, and financial regulators. These stakeholders must work together to create user-centric, inclusive, and accessible digital banking solutions.

## ADDITIONAL INFORMATION

### AUTHOR CONTRIBUTIONS

All authors have contributed equally.

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### CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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## ЦИФРОВИЙ БАНКІНГ ТА (НЕ)РІВНІСТЬ: СИСТЕМАТИЧНИЙ ОГЛЯД

Стрімке поширення цифрового банкінгу докорінно змінило царину фінансових послуг у всьому світі й прискорило фінансову інклюзію. Проте досі тривають дискусії щодо доступу до цифрового банкінгу та нерівності, яка може бути ним викликана або навпаки подолана. Цей огляд має на меті показати, як застосування цифрового банкінгу впливає на різні групи населення та які заходи можуть бути використані для подолання викликів, що виникають.

У дослідженні використано систематичний огляд літератури з 27 статей за період з 1999 по вересень 2023 року. По-перше, огляд підкреслює значну прогалину в дослідженнях цифрового банкінгу та нерівності в країнах із низьким рівнем доходу. По-друге, спостерігається очевидний зсув у часі досліджень від країн із високим рівнем доходу до країн із доходами, вищими за середній рівень і нижчими за середній рівень, що може свідчити про те, що проблема нерівності в умовах цифрового банкінгу в країнах із високим рівнем доходу не є нагальною. Однак питання нерівності залишається актуальним у країнах із доходами, вищими за середній рівень і нижчими за середній рівень, незважаючи на попередній досвід, набутий у країнах із високими доходами, що може свідчити про прогалини в імплементації політичних рішень. По-третє, найбільшу увагу в дослідницьких роботах звертають на нерівності за віком (74,1%), статтю (66,7%), освітою (40,7%) та доходами (25,9%). Зокрема, віковий розрив залишається помітним. Щодо політик, які імплементуються задля подолання згаданих нерівностей, то значну відповідальність покладають на банки. Водночас, на державному рівні існують ініціативи з акцентом на навчальні заходи. Отримані результати є важливими для фінансових регуляторів, банків і розробників цифрових банківських технологій для сприяння створенню більш інклюзивного фінансового середовища.

**Ключові слова:** онлайн-банкінг, інтернет-банкінг, гендерний розрив, віковий розрив, розрив у доходах, фінансова грамотність, фінансова інклюзія

**JEL Класифікація:** G21, G29, D63, D69

APPENDIX 1. Key characteristics of included studies.										
Author	Year	Country	Population characteristics	Sample size	Type of social differentiation					Policy recommendations
					Gender	Age	Education	Rural/Urban	Other	
Banerjee et al.	2005	The USA	Households and Individuals	50000 households and 157000 individuals	+	+	+	-	-	-
Williamson et al.	2006	Australia	Individuals	32	+	+	-	+	+	Banks have to support customers in overcoming skills divide.
Devins et al.	2008	England	Wired up Communities Project Participants	307	+	+	-	-	+	Future policies should explore alternative service delivery methods or remove access barriers.
Haytko & Simmers	2009	The USA	Undergraduate and graduate business classes	2 studies: first - 194 students who had bank checking accounts; second - 153 students	+	-	-	-	-	Banks should offer customers a choice between personal and digital services, which will contribute to increased satisfaction (this recommendation was provided under poor banks' digitalisation).
Riquelme & Rios	2010	Singapore	Individuals	681	+	-	-	-	-	Banks should develop different marketing strategies to promote mobile banking depending on gender. Mobile banking applications for women should be easy to use and emphasise the inclusiveness of using mobile banking.
Soilen et al.	2013	Halmstad, Sweden	Individuals	263	+	+	-	-	-	Banks should pay attention to the speed of adaptation to new technologies in different segments, especially in the age segment.
Akhter	2015	Minneapolis, The USA	Individuals	1503	+	+	+	-	+	-
Tan & Leby Lau	2016	Kuala Lumpur, Malaysia	students	347	-	+	-	-	-	Banks can convey information and educate consumers about mobile banking benefits through advertising, sales promotion and public relations. Establishing more mobile banking functions based on user suggestions to improve transaction performance. Keeping banking transaction ease of use. Providing clear guidance for consumers on using the mobile banking system.
Marakarkandy et al.	2017	India	Bank managers, bank employees and bank customers	300	+	+	+	-	+	Banks should develop different marketing strategies in promoting mobile banking depending on gender, age, income and education.
Garín-Muñoz et al.	2017	Spain	Individuals	16209	+	+	+	-	+	Policy must be diverse across individuals: sociodemographic and income strata. Improving computer and Internet skills can enhance the penetration of Internet services (this might be more reasonable than costly fiber laying in rural areas).
Nouri & Soltani	2019	Ardabil, Iran	Individuals	384	-	-	-	-	+	Bank managers should utilise mass media. Trial versions of mobile banking can offer customers new experiences with the technology.
Mkpjoigou et al.	2019	Nigeria	Individuals	150	+	+	+	-	+	Banks should improve their mobile applications, which will increase customer loyalty and boost bank revenues and competitiveness.
Schehl et al.	2019	Möchengladbach, Germany	Older adults	1222	+	+	+	-	+	Banks should tailor online services to meet the needs of older adults as a growing consumer group and organise training for them. Policy-makers should craft targeted legislation and interventions to ensure fair access to various online services for all demographic groups. Internet-based applications should enable responsive interfaces catering to individual needs, from device compatibility to user preferences.
Peral-Peral et al.	2020	Spain	Older adults	474	+	+	-	-	-	Training for older adults should focus on improving technical skills, boosting confidence in performing tasks and reducing anxiety around e-services. E-services can be made more user-friendly for older adults with intuitive designs and clear instructions. Banks should demonstrate the practicality of e-services through explanatory materials, ads, and positive word-of-mouth. Advertising featuring older adults as capable users can enhance self-efficacy. Social influences from family and friends can boost self-efficacy and reduce anxiety.
Pérez-Amaral et al.	2021	Spain	Individuals	97859	+	+	+	-	+	Enhancing the digital skills of vulnerable sociodemographic groups to mitigate the risk of digital exclusion.
Lee et al.	2021	Bangladesh	Rural households / migrants	813 / 809	-	-	-	+	-	-

Author	Year	Country	Population characteristics	Sample size	Type of social differentiation					Policy recommendations
					Gender	Age	Education	Rural/Urban	Other	
Saka et al.	2022	More than 140 countries	Individuals	250000	-	+	-	-	+	Banks may prioritise their interest in online and mobile platforms over opening new branch offices. Banks must pay attention to specialised agents providing guidance in digital banking services. Regulation and public policy must adjust to increased digital financial transactions and decreased cash usage, as evidenced by the introduction of a central bank digital currency (CBDC).
Zhu et al.	2022	China	Rural households	1291	+	+	+	+	+	Comprise increasing utilisation of communication channels, enhancing the interface experience of mobile banking for rural residents, and focusing targeting efforts.
Amin et al.	2022	Bangladesh	Individuals	366	-	+	-	-	+	Banks should prioritise ease of use and enhance customer service. Marketing strategies should include engaging videos showcasing how to use the app. Emphasise the technology's reliability to minimise perceived risks. Target specific age groups and income levels to expand market reach.
Jenkins et al.	2022	North Cyprus	Individuals	400	-	+	+	-	-	Banks can enhance marketing strategies by offering technical support and encouragement, especially to customers prejudiced against Internet banking and older adults lacking technical knowledge. Targeting younger, well-educated non-users with tailored advertising can boost Internet banking adoption. Ongoing improvements in online banking features can help banks enhance the satisfaction and retention of innovative clients.
Goundar & Sathye	2023	Fiji	Individuals with disabilities	21	-	-	-	-	+	Policymakers should implement measures to enhance access to banking and financial services for BPSF.
Bui & Luong	2023	Thailand	Individuals	1000	-	+	-	+	-	Digital devices can make elder-friendly financial training more convenient. Fintech innovations should not exclude vulnerable sectors like elderly rural populations, low-income households, elderly women, and remote communities. Promoting mobile internet access among the elderly can enhance financial inclusion, guiding policymakers in targeting inclusive policies. Increased internet and smartphone use for mobile banking should be coupled with efforts to promote financial and digital literacy among the elderly.
Kumar & Chawla	2023	India	Individuals	357	+	-	-	-	-	Service providers must address usage, value, and information barriers to increase digital payment adoption. Focus on usability and convenience, ensuring a high performance-to-cost ratio for users. Guide and educate consumers about digital payment benefits. Provide tools like smartphones with Internet access and guidance for deeper digital payment penetration, especially in remote areas. Communicate features, value, and novelty of mobile transactions to increase awareness. Consider gender differences in consumption habits when developing adoption strategies.
Chetioui et al.	2023	Morocco	Quota sampling	616	+	+	+	-	-	Promoting the savings and budget management features of M-banking over traditional banking methods is crucial, along with implementing fun and easy features to improve user experience. Tailoring mobile banking strategies to specific demographics is vital for reaching diverse customer segments effectively.
Peluso	2023	The USA	Individuals	12	-	-	-	-	+	Fostering a collective vision of a convenient technological future that acknowledges current and potential vulnerabilities and uncertainties is essential. Rather than ignoring these challenges, addressing them openly can pave the way for greater social inclusion.
Zeng & Li	2023	China	Urban older adults	268	-	+	-	+	-	Collaboration between aging-related practitioners and financial professionals is necessary. Social workers and aging-related practitioners should recognise older adults as active financial participants and involve them in the digital financial world. Promote projects to help older people, especially those with lower education, use digital financial tools. Policy-level regulations should ensure older people have choices like in-person services in an aging-friendly society.
Nel & Boshoff	2023	South Africa	Individuals	613	+	-	-	-	-	Digital banks need to reduce barriers compared to traditional banks.